Procedures in Modern Crown and Bridgework

Lee Walter Doxtater

PROCEDURES IN MODERN CROWN AND BRIDGEWORK

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The Principles and Technique of Stationary and Removable Bridges

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Illustrated with 577 Engravings

These Illustrations Present Sequentially Every Essential Detail of the Techniques Described, thus Creating a Practical Text-book for the Graduate Student as Well as the Undergraduate Student

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THIS BOOK IS DEDICATED TO THE MEMORY OF

HELEN LOUISE DOXTATER

my beloved wife

whose love and companionship was its chief inspiration

Preface

The developments in the field of crown and bridgework during the past twenty-five years have been so remarkable, such rapid strides have been made, so many new ideas have been brought out, that a real need seems to exist for a book in which these new developments may be described for the benefit of the dental student as well as the general practitioner. This book has therefore, been written with the principal idea in view of presenting practicable and modern techniques for the construction of bridges which will meet the various demands which occur in dental practice to-day. It is not expected that the subject has been exhausted, but it is the hope of the author that a variety of techniques have been described which will make it possible for the dentist to construct satisfactory restorations for his patients wherever bridgework is indicated. And it is furthermore hoped that mastery of these may prove a stepping stone toward the mastery of others which may be brought out in the future.

It remains only to acknowledge my indebtedness to those from whom help has been obtained. My thanks and appreciation are due to Drs. Charles F. Ash, James K. Burgess, A. L. King, Mendel Nevin, P. G. Puterbaugh, Fred A. Peeso and Julius Tandler from whose published works I have freely drawn.

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LEE W. DOXTATER.

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Part One

THE BASIC PRINCIPLES OF CROWN AND BRIDGEWORK

Introduction

To anyone familiar with dental literature and with the history of dentistry, especially as it has been developed on the North American continent, it would seem that a textbook on this subject would be superfluous. Bridgework has been practiced for many years; it has received as much, if not more, attention than any other branch of dentistry, yet we still find failures in bridge cases, although many successful cases indicate the essential possibilities of this type of restoration. Furthermore, we find advocacy of more than one type of bridgework, although the profession has failed as yet to reach a universal agreement as to the merits of and indications for the different types. It seems therefore, that clarification of the requirements for success is urgently needed, and this should also automatically serve as a means of determining the status of the various types of bridges which are now being made.

It has long been an axiom in this field, that bridges should only be placed on strong, healthy foundations. It will be unnecessary to urge the requirement that teeth which are to be used as abutments, shall be free from periapical and periodontal disease. But it is equally important that healthy teeth, both those to be used as abutments and others in the mouth as well, should remain healthy after the insertion of the bridge. It is here that criticism of bridgework is frequently justified. In fact we may state, that success in bridgework is to be judged fundamentally by the maintenance of health in the mouth, and we may accordingly state that, when further loss of teeth occurs following the placing of a bridge, the bridge has not succeeded, even though its own abutments have maintained their integrity, assuming that such loss is not directly traceable to negligence on the part of the patient.

Occlusion in Relation to Bridgework

Bridgeworkers in the past have talked much about occlusion, but examination of their work reveals a misconception of some of its fundamentals. It remained for the periodontists to introduce to the profession the theory of traumatic occlusion, as a cause of disease in the supporting tissues of the teeth. Bridgeworkers, after some scrutiny, accepted this theory and began to apply it in their practice. In the last few years, therefore, there has been much improvement in the matter of occlusion in bridge cases. There seems however, to be room for further improvement, and also a need for systematizing the available knowledge in this field.

When we study the causes of bridge failures, we find more often than not, that a faulty occlusion is responsible. It is often difficult to convince dentists of this fact, in specific cases. Possibly this point may best be illustrated by the similar situation which frequently comes to light in cases of periodontal disease. Such disease is frequently found in mouths in which the occlusion is apparently harmonious. In these cases the experienced periodontist will demonstrate incoördination of cusps, which, although seemingly trifling as compared with the gross malocclusions so frequently seen, will cause quite as much damage as the more obvious irregularities. Such minor deformities can frequently be demonstrated in bridge cases which are showing signs of giving way. Still greater refinement as to the requirements in occlusion are needed before bridge cases will be free from criticism on this ground.

One of the most important items in the occlusional requirements of bridge cases is the matter of securing functional occlusion. The term "functional occlusion" has been made familiar to us by Ottolengui and will be fully described later. It is not recognized as a requisite in bridgework, especially in those cases where but one or two teeth are to be restored. Experience has shown however, that the insertion of even a short bridge, in a mouth which lacks a functional, or at least a partial functional occlusion, may inaugurate the flaring up of a previously latent, and unsuspected periodontoclasia. The bridge in question may not even disturb the previous occlusal relations appreciably, but the presence of so artificial a structure serves to emphasize the traumatic occlusion which existed previously, and disease soon becomes manifest. Instances of such occurrence are to be found, in many variations, covering the range of bridge cases, from those supplying one tooth to the largest practicable restoration in this class. Even when the bridge itself does not violate the requirements of occlusion, there is often a definite need for adjusting the occlusion. In fact, this may be laid down as the first step in bridge construction; first, not only in importance, but first in sequence. That is to say, when a bridge case is undertaken, the occlusion in the mouth should be adjusted before beginning the actual construction of the bridge. This will serve two purposes. The first is as an aid in the treatment of periodontal disease, which is so often found at least in an incipient form in mouths requiring bridges. The second, is the establishment of the correct occlusion to which the bridge is to be adjusted. If the adjusting of the occlusion is postponed until after the completion of the bridge, it will frequently happen that so drastic a remodeling of occlusal surfaces may be required, as to involve the destruction of the just completed bridge. By adjusting the occlusion of the natural teeth first, embarrassments such as this will be avoided. The preliminary adjusting, and the study which it involves, will frequently influence the decision as to the type of bridge to be used, and will also influence important details of its construction.

Conservation of Tooth Tissue

One of the very important requirements in bridgework is the conservation of tooth tissue. Viewed in its extreme aspect, it is obvious that any method of construction which seriously impairs the strength of the abutment teeth, is to be condemned. The ideal method is always that which conserves the greatest possible amount of tooth substance, consonant with providing requisite strength in the restoration. This brings in also the consideration of pulp health and vitality, and of focal infection as well.

The bridgeworker, as his name implies, is primarily interested in an engineering problem. He is intent on the strength of the structure which he is building. It is but natural that he should regard abutment teeth as a means to an end, and not as vital constituents of the human body. This point of view has been carried to an extreme in past years, and it, more than any other one thing, has been responsible for the condemnation of bridgework in general, by the medical profession. The dental profession has made marked advances in this respect in recent years, but a word of warning is still in order. There is still a tendency to plan the desired bridge first, and then to try to treat, or otherwise manage, strategic but otherwise undesirable teeth, so that they may be utilized. Here, as in the case of adjusting the occlusion, the procedure should be the reverse of that ordinarily followed. Teeth should be studied as to their health, or the possibility of restoring their health, and only after this question has been satisfactorily answered, should the actual planning of the bridge be undertaken. Too often has physicial disability followed the placing of a much desired bridge on diseased abutments, when a partial, or even a full denture would better have served the ultimate interests of the patient.

Fixed and Removable Bridgework

Following the realization, that there was something wrong with many stationary bridges, came the introduction of the removable bridge. As so often happens in the dental profession, there was a pronounced swinging of the pendulum. The removable bridge was declared to be the final solution of all bridge problems. Experience has, however, been disappointing in this respect. Removable bridges have been known to produce periodontal disease, with resultant failure of the bridge. And even when this has not occurred, the removable bridge has been found to be unsatisfactory in certain types of cases. It has become evident, to all but the most ardent advocates of the removable bridge, that there is a place for both types and that where one is indicated the other will be less satisfactory. Even from the standpoint of pulp conservation, which became an issue at about the time when removable bridgework was introduced, this type of bridge has not been above criticism. Here again, careful preliminary study of the case may demonstrate the impossibility of safely constructing a much desired removable bridge, and may dictate the placing of a fixed bridge, or a partial denture. Further classification of cases is required in order that the indications for both fixed and removable bridgework may be made more definite.

Importance of Correct Construction

Many bridges, carefully planned and built on otherwise secure foundations, fail because of shortcomings in the carrying out of the various steps in construction. This is often more than a matter of individual failure in ability. The success of an intricate mechanical procedure is dependent on techniques which are capable of giving results of precision and of devising a correct sequence of steps, each of which shall in itself be precise. If at any point in a series of steps, a mechanical error creeps in, either through the shortcomings of the operator, or because of inherent faults in the process, this error is perpetuated and usually magnified in the succeeding steps. Deficiencies, such as those which are known to exist at the present time in the casting process, and in the impression processes, must be recognized, and must be suitably checked, and the necessary corrections made when these steps are a part of the procedure. All sources of error which can be avoided must be guarded against with the greatest of care, if the finished product is to be creditable. Mechanisms which are to be used in the course of bridge construction must be as accurate as can be attained. Because of this fact, economy in laboratory and operative equipment is of very questionable value.

The old saying that it is poor policy to change horses in midstream is applicable in bridgework. Failure may come from the decision to change from one type of bridge to another, after construction of the first type has been begun. In other words, if a bridge is undertaken with insufficient preliminary study, and it is later found that this bridge will not be practicable, the situation will seldom be improved by changing to another type of bridge, because of the work which has already been done in preparation for the first bridge. Careful preliminary study aided by study models, would be a prerequisite to success, if it were only for the aid which it gives in eliminating the unsuitable type of bridge and deciding upon the type of bridge which will best satisfy the requirements of the individual case.

Procedures in Modern Crown and Bridgework

The Principles and Technics of Stationary and Removable Bridges

CHAPTER I

Occlusion

The word occlusion, as applied to the teeth, either natural or artificial, means the contact which is brought about when the jaws are closed. If the teeth are so placed that they cannot be brought into contact with teeth in the opposite jaw, there is absence of occlusion. This also applies to any individual tooth. Because of the fact that the mandible is capable of assuming many different positions, there are many different occlusions, as for instance centric occlusion, protrusive occlusion, etc. In the natural dentition, irregularities in the position of the teeth may result in occlusal relations in which some teeth are subjected to greater stress than others. Since this has been found to be a frequent source of injury, it has been called "traumatic occlusion." When this uneven distribution of stress is found in full dentures it usually results in a disturbance of stability of the denture, and this relation of the artificial teeth is usually called an "unbalanced occlusion." All of these terms have reference to the contact relationships of the teeth of the mandible and maxillæ, when the jaws are closed, or are moved against each other in the performance of function.

Functional occlusion is a term which has come into use in recent years, having first been suggested by Ottolengui. He defined functional occlusion as being "Such arrangement of the teeth as will provide the highest efficiency during all the movements of the mandible necessary to the function of mastication." This is an excellent definition, particularly since it may suitably be applied to the natural dentition. Especially is this the case when we compare it with the term balanced occlusion, which is so frequently used in reference to full denture prosthesis. "Balanced occlusions are contact positions of masticatory surfaces having contact points so distributed that the forces simultaneously applied to these points of the denture will maintain equilibrium." (Sears). When this condition is found in the full natural dentition, there will be simultaneous contact of thirty-two teeth, pressure being evenly maintained in all of the positions which the mandible assumes during function.

As applied to the ideal natural dentition on one hand and the ideal artificial denture on the other, functional occlusion as defined by Ottolengui and balanced occlusion as defined by Sears will be synonymous. This condition is always to be sought by the dentist whether he is engaged in artificial denture construction, bridgework, or the treatment of the natural teeth. It frequently happens, however, that conditions in the natural dentition, or in cases requiring partial restoration are such that the attainment of full functional occlusion is impossible. In such cases a partial functional occlusion is usually attainable, and this may satisfy the requirements of both function and health. This would seem to be a functional occlusion, even though it fails to give the highest conceivable degree of efficiency. This may be called partial functional occlusion, and this has been defined by the author as "that arrangement of the occluding surfaces, which will bring the greatest practicable number of teeth into harmonious contact in the various movements of the mandible, without harmful sacrifice of tooth structure."

The occlusal requirements of different individuals will be found to vary as regards the health of the periodontal structure in their mouths. In one case a partial functional occlusion, which engages only eight anterior, and four posterior teeth in protrusive occlusion, will suffice for the maintenance of health; while in another individual the full functional occlusion of all of the natural teeth in protrusion is required. Careful study of each case, with painstaking evaluation of the radiographic and other evidence, is essential for success in the field of bridgework. The ideal in occlusion, as it concerns both the full natural dentition and that dentition in which bridgework is to have a place, is that there shall be such a contact relation of the masticating surfaces of the teeth at widely distributed multiple contact areas, bilaterally and anteroposteriorly, as will tend to maintain an equilibrium of force on the teeth and periodontal tissues.

Occlusal Requirement in Artificial Dentures

In full denture prosthesis it is necessary for the stability of the denture, that there shall be a fully balanced occlusion. In this type of work, balanced occlusion is obtainable. In partial restoration, whether by denture or bridgework, the need for this type of occlusion is less obvious. Here the artificial substitute may be stable, even when full functional occlusion is lacking. The need for functional occlusion in this type of work rests on a different foundation, namely the health requirement. The dental profession has come to recognize the fact that inharmonious occlusal contacts have a fundamental place in the etiology of periodontal disease. To this inharmonious relation Stillman has given the name "traumatic occlusion." He says:

"When there is lack of balance in the occlusal relationship of the teeth, whether natural or artificial, certain teeth receive an occlusal stress in excess of that which nature and the laws of mechanics decree. In the course of time, this produces an irritation of the entire periodontium, which may manifest itself in either vascular, or neural disturbances, or both. Through this disbalance of physiologic equilibrium, local nutrition is interfered with and infection is induced. It is for this reason that I have stressed so consistently the thought of the dental mechanism as an apparatus, together with the requirements of harmonious adjustment of its moving parts." *

The bridgeworker should study this statement carefully, because it will give the clue to many of the failures which have occurred in this field of dental practice.

The dental profession has been made acquainted with the idea that traumatic occlusion may cause failure in bridgework, and many practitioners are giving earnest attention to this phase of the subject in the construction of their cases. Two thoughts which may not be familiar to all should, however, be presented for consideration. The first is, that functional occlusion means not simply the relief of traumatic occlusion on the teeth involved in the bridge case, but on all the teeth in the mouth. The second thought is that adjustment of the occlusion throughout the mouth should be performed before construction of the bridge is begun.

It may not be obvious that an inharmonious occlusal relationship of teeth, not directly involved in the bridge case, would prejudice its success. But this may occur in one of two ways. Lack of harmonious occlusion may result in the imposition of undue strain on a bridge in certain positions of the mandible. Or, traumatic occlusion on the teeth other than those supporting, or occluding with the bridge, may result in an early loss of these teeth, thus necessitating the reconstruction of an otherwise satisfactory bridge.

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* *"Occlusion—The Fundamental Element in Dental Science."* *Dental Digest*, February, 1926.

An example of the first type would be a case of an anterior bridge which might be so constructed as to be in occlusal harmony in centric occlusion, but which would receive an undue stress in protrusive occlusion. Such a condition will almost invariably result in an early loss of the bridge. As an example of the second type, we might also cite an anterior bridge, supported by the cuspid teeth, this being in occlusal harmony in both centric and protrusive occlusion. If the first and second bicuspids have a traumatic occlusion, these teeth may ultimately be lost, with the result that the anterior bridge must be reconstructed. It may be stated in fact, that the loss of any teeth in the mouth through traumatic occlusion, following the insertion of a bridge, may be charged as a failure of the bridgework, because such a casualty is an indication that the dentist has failed to discover serious disease in the mouth before planning the bridge, or has failed to provide the conditions necessary for maintaining health. The responsibility of the bridgeworker is not limited to the teeth which support his restoration, nor to those which occlude with it.

Dentists will probably be satisfied to accept such responsibility and will accede to the requirements stated,—namely, that the entire dentition shall be put in full, or at least in partial functional occlusion whenever a bridge is inserted. Not all, however, are as yet convinced of the need for securing this harmonious occlusion previous to beginning the construction of the bridge. To perform this operation as the first step in the procedure is, however, a material aid in correct bridge construction, and in many cases it may be absolutely essential to success. Unless the occlusion is corrected before beginning the making of the bridge, the dentist will have no means for determining what alteration of the abutment teeth will be required during the subsequent adjustment of the occlusion. Teeth which may seem to be of correct length, or to have correct cusp inclination, upon study of the mandibular movements, may be found to be badly out of harmony with the other teeth. If a bridge is placed upon these teeth with their original length and shape remaining, or reproduced, the subsequent adjustment of the occlusion may necessitate the removal of material which is essential to the strength of the bridge.

An instance of this would be the placing of a three-quarter crown on a cuspid. For this restoration we desire to remove as little tooth structure as possible, and to replace this tooth tissue with as thin a veneer of gold as will provide the necessary strength. When such a piece has been finished, it is embarrassing to find that the tooth, as reconstructed, is out of harmony and must be perceptibly shortened to bring it into satisfactory relations with the other teeth. Other instances might be mentioned, but the lesson is the same. Furthermore, the adjustment of, or the effort to adjust the occlusion previous to the beginning of bridge construction will frequently reveal insurmountable difficulties, and will dictate the modification of the bridge as originally planned. Needless to say it is better to discover such difficulties before the bridge is made rather than after it has been completed.

CHAPTER II

Methods of Securing Full, or Partial Functional Occlusion

It may be well at this point to describe methods of securing functional occlusion in a case for which a bridge is to be constructed. The first step, after having eliminated hopeless teeth by means of radiographic study and examination for periodontal disease, is to determine whether the necessary relation can be attained by grinding, without undue destruction of tooth tissue. This may often be determined by mouth examination, but, in doubtful cases, study models, mounted on an adaptable articulator, may be required. The protrusive occlusion is first studied. If it is found that correct protrusive relationship is attainable, the right and left lateral occlusions are then studied. It will usually be found, however, that where functional relationship can be obtained in the protrusive position, it is also attainable in the lateral positions.

If it is decided that grinding is the method of choice, this is begun on the anterior teeth, grinding both upper and lower incisors as a rule. The full functional protrusive occlusion is one in which there is simultaneous edge to edge contact of the incisors and of the molars on both sides. This is an ideal which is not always attainable and which it is not always essential to attain. This point must be determined on the basis of the strength of the alveolar support of the anterior teeth, and of such teeth immediately posterior to them as may be called upon to obtain a functional occlusion. If a full functional protrusive occlusion cannot be obtained, it is usually essential that a partial functional occlusion of the six upper anterior teeth with the eight lower anterior teeth should be established. It is, of course, desirable to include more teeth in each arch.

Having secured a satisfactory protrusive relationship, attention is then given to the right and left lateral occlusions. The patient is directed to close in left lateral occlusion and the teeth are studied to determine whether a satisfactory occlusion can be obtained between the working side and the opposite side. This may not be possible, nor requisite. It is essential that a partial functional occlusion on the working side be obtained. This means that the functional relationship should be carried back to include the molars, or at least, to include the upper and lower first molars. The reason for this is that the strain produced by a working occlusion on the bicuspids and cuspids only, can rarely be tolerated for any considerable length of time, even when the alveolar support seems to be of the highest quality.

Having secured the required relationship in the left lateral occlusion, the same procedure is repeated for the right lateral occlusion. It will sometimes be found that functional contacts may be obtained in right lateral occlusion, and not in the left lateral occlusion, or vice versa. This condition may be satisfactory, provided that the teeth which are in functional occlusion only, have adequate alveolar support. When bilateral functional occlusions can be obtained, the alveolar support of the teeth involved need not be of the very highest quality.

Opening the Bite

When it has been found by the preliminary examination that a full, or partial, functional occlusion cannot be obtained, except at the sacrifice of an excessive amount of tooth structure, the only recourse is to open the bite. This is a procedure which has ordinarily been dreaded by dentists, in the past. One objection to it has been that it frequently causes considerable discomfort to the patient. Experience of the present day, however, indicates that this discomfort has been caused by a lack of functional contacts in the finished product, whether bridge or denture. When full, or even partial, functional occlusion is secured, there will seldom be any discomfort, and such as there may be will rapidly pass off.

Another reason for the desire of the dentist to avoid opening the bite is the difficulty involved. This difficulty can be surmounted by the painstaking execution of an orderly and definitely planned procedure.

Temporary Bite Opening Guide

The first step is to determine the extent to which the bite is to be opened. As a preliminary procedure, it will be most convenient to make a close fitting temporary gold band for one of the posterior teeth. This need not be one of the abutment teeth, but may be any tooth which, later on, is to be built up permanently; usually one of the lower molars. The band is placed in position and filled with modeling compound heated to 140 degrees F. The patient is instructed to bite into this, in centric occlusion, until he has reached the point to which it has been decided that the bite shall be opened. The compound is then chilled with ice water while in contact with the opposing teeth. The excess compound around the periphery of the band is removed. Abrasive paste is then placed on the occlusal surface of the compound and the patient is instructed to make right and left lateral excursions.

without using heavy pressure. This will develop such contours and grooves as may be suited to the condyle characteristics of the individual. The patient is next instructed to make protrusive movements, again without using undue pressure.

The reason for carrying out this procedure in the mouth, rather than on the articulator, is that under these circumstances the articulator will fail to reproduce the effect on the resilient interarticular tissues, and relationships established on the articulator may not be identical with those obtained in the mouth. This is especially apt to be true of the protrusive movement. Many individuals make a protrusive movement which is not directly forward; it may be slightly to the right or left, or may vary at different times. For this reason it is far safer to record the occlusion during these various movements, in the mouth itself.

Construction of Crowns and Inlays

Having obtained a guide in the manner described, the other teeth which are to be built up are approached. A tooth on the opposite side of the mouth is prepared for the proposed restoration whether crown or inlay, and the piece is constructed, its occlusal surface being developed in a manner similar to that already described, namely, a wax pattern, is placed in the mouth and the various occlusions are recorded, with the modeling compound bite guide in position. When this is finished the other teeth have restorations provided in a similar manner. When all of these restorations are complete, including the bridge abutments, all are cemented in, except the abutments. The impression and a bite are then taken and mounted on the articulator. The bridge is then constructed in the usual manner.

Typical Example of Bite Opening Technique

A typical example of this procedure will be a case requiring the replacement of the lower left first and second bicuspids and first molar. A suitable tooth on the right side is selected as the guide, and a band is constructed for it as already described. After the compound has been trimmed and milled in, an inlay cavity is prepared in the lower left second molar. The wax pattern is made and the occlusion registered in it in the mouth (with the modeling compound bite guide in position on the right side). This pattern is trimmed as described, and cast. The same procedure is repeated for the cuspid. When these abutments have been prepared and have had their occlusions properly adjusted, the tooth on the right side, which had served as the guide for opening the bite, is prepared for an inlay, or crown, as the case may be. This piece is constructed, using the completed inlays of the left side as a guide in establishing the occlusion. When this is finished, the next tooth on the right side is prepared and the same procedure repeated. When the restorations for all of the teeth on the right side have been completed, these restorations are cemented in at one time. The abutment inlays on the left side are then placed in the teeth and the impression and bite are taken. After the completion of the bridge the abutment inlays are cemented in, the removable bridge inserted and the final delicate correction of the occlusion is performed.

Variations From Curve of Spee

It will sometimes happen that the curve of Spee may be exaggerated, or the alignment of the upper or lower teeth may be out of harmony so that the curve of Spee is broken. In such cases it will usually be necessary to build down some of the upper teeth instead of performing all of the reconstruction operations on the lower teeth. The requirements for this will be indicated by inspection of the original study models.

Vulcanite Bite Block

When it is found that a considerable opening of the bite is needed it is usually advisable to make a temporary bite block of vulcanite. The patient is instructed to wear this for short periods of time, with a gradual lengthening of the time when it is left in the mouth. By this means the intermaxillary tissues gradually become accustomed to the relationship of the mandible, and the permanent restoration may then be placed without causing discomfort. The simplest form of such an appliance is constructed by taking impressions of the upper and lower teeth and mounting the casts on the adaptable articulator, with a facebow bite. The extent to which the bite is to be opened is determined, and modeling compound blocks are moulded over the lower plaster, or artificial stone teeth. These blocks extend well down over the lower bicuspids and molars, but their upper surfaces are trimmed, so that only the imprints of the cusps of the upper teeth are seen. It is very important that no deep imprints should be allowed to remain in the upper surface, since the locking of the upper cusps in these depressions would cause interference with lateral movements and produce a severe traumatic occlusion. These modeling compound blocks are taken to the patient's mouth and milled in gently with abrasive paste. They are then returned to the articulator and joined by a suitable lingual bar. The case is vulcanized, covering the plaster or stone lower teeth with tin foil to insure the easy insertion and removal of the appliance in the mouth. After completion, it is inserted and again milled with abrasive paste for both lateral and protrusive occlusions.

When such a temporary bite block is constructed, the permanent restorations for maintaining the opening of the bite may be conveniently constructed by cutting away the vulcanite of the bite block from an individual posterior tooth alternately on one side and then on the other, each time replacing the removed vulcanite with the appropriate onlays or crowns. These restorations may be cemented as soon as they are finished, the patient continuing to wear the bite blocks to maintain balance. As soon as one of the posterior teeth on each side has been so restored, the vulancite is cut away so as to expose the next tooth and the process is repeated. After four, or perhaps six, teeth have been so restored the bite block may be discarded, and the remaining restorations completed. This method is especially applicable where short bridges are to be made. It is also a convenient method to follow where no teeth are missing but where opening of the bite is required because of periodontal disease in the anterior teeth.*

Too much emphasis cannot be given to the question of occlusion in bridgework. Interference of cusps, whether of natural or artificial teeth, will surely lead to disaster. Partial functional occlusions may sometimes be tolerated in the natural dentition if resistance is high. But when artificial structures are placed in the mouth, the biologic balance is at once disturbed, and when this occurs, tolerance of imperfect occlusal relationships is at once diminished. Only the ideal in occlusal relations will then suffice for the maintenance of health. On this, bridgework will either stand or fall.

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* For a detailed description of this technique see Chapter XXIV.

CHAPTER III

Conservation of Tooth Structure and the Dental Pulp

The conservation of tooth structure and the maintenance of vital pulps should be the first thought in the mind of the practitioner whose intention it is to render the greatest service to his patients. The ideal of every dentist, whether he be concerned with the replacement of missing teeth, or the restoration of tooth structure in individual teeth, is to perform his operations with as little loss as possible of remaining sound tooth substance. No one will deny that nature's plan is the best one, nor that natural teeth and the natural tooth tissues are better than artificial substitutes for them. The realization that the pulpless tooth is a potential menace to health is not the only reason for making this statement. Starting, however, with the premise that conservation of the dental pulp is desirable, we may readily see that preservation of the health of this organ is equally important. In fact, the time may come when, with further perfection in the procedures for the management of pulpless teeth, we shall be more concerned over a low grade pulpitis than over the problem of satisfactorily replacing that pulp with a pulp canal filling. In other words, if it be found that a root of favorable formation can be so treated and filled as to be insured against infection, it would be a safer procedure to so treat that tooth, than to leave in it a pulp which is subject to a chronic low grade inflammation. It must be remembered that histological examination of vital teeth with deep fillings, or advanced periodontal disease, has often demonstrated well marked signs of inflammation of the pulp, even when these teeth had given no symptoms of pulpitis while in the mouth. It may be found, as the result of further investigation, that such teeth have a possible metastatic import.

Pulps in Abutment Teeth

Another important consideration is the question of the maintenance of pulp vitality and health after bridges have been placed. One of the most embarrassing casualties which can occur in dental practice, is to place in the mouth a carefully executed bridge, and to have the patient return later with a non-vital pulp, or an acute abscess, in one of the abutment teeth. This is not only a trying experience for the patient, but is an economic loss to both patient and dentist as regards time lost in repairing the damage. And in such circumstances it not infrequently happens that the tooth is eventually lost, when better judgment at the outset might have resulted in the execution of a satisfactory root canal operation. There will of course be cases in which, for various reasons, the performance of root canal operations may be inadvisable.

Dangers of Cutting Into Sound Teeth

Experience and histological evidence both teach us that when the enamel and dentin on any portion of the tooth crown is lost, there is a reflex disturbance in the pulp. It seems logical to expect that the more extensive the removal of enamel and dentin the more pronounced this disturbance will be. It is likely, although we cannot be sure, that the physical removal of tooth structure for deep seated inlays, has quite as much to do with the death of pulps under such restorations, as the possible introduction of bacteria into the dentinal tubuli during cavity preparation. Whatever the true explanation, it is a fact that many pulps have suffered as a result of this type of cavity preparation, especially when performed in previously sound teeth.

Whether we are to regard the preservation of sound tooth structure as an ideal from the standpoint of its inherent superiority over artificial substitutes, or whether we base our argument on the desirability of avoiding unfortunate accidents, the fact remains that we shall best serve our patients if we plan our operations so as to remove as little as possible of sound tooth substance. This means that where a proposed abutment tooth has suffered no previous encroachment by caries, we should, if possible, use some form of attachment which will involve only shallow cutting of the tooth. In many instances, where sound teeth are to be used as abutments, it may be better practice to use a clasp, even though this may later result in decalcification. When it is determined by a careful study, that the teeth, as a whole, are relatively immune to caries, and where there is evidence that the patient is conscientious in the care of his mouth, and where, also, it is reasonably certain that the case may be kept under periodic observation, this type of attachment may be used without fear of untoward consequences. If superficial decalcification occurs, the damage may readily be repaired by the insertion of shallow fillings, preferably gold inlays, on which the clasps may rest with but little fear of further damage. This process of decalcification, because of its usually slow progression, arouses what may possibly be considered a more natural, and certainly a less violent reaction in the pulp, than will the immediate deep cutting frequently required for inlays which house internal attachments.

Caries in Abutment Teeth

On the other hand, when it is found that the abutment teeth have already suffered from caries, either with or without the previous insertion of fillings, additional cutting of these teeth to receive inlays may usually be safely done. If in such cases the cavities are found to be extremely shallow, it may become advisable to modify the technique and to insert smaller inlays whose function shall be chiefly the reception of occlusal rests, which form an essential part of modern clasp technique.

Another form of preparation, whose object is to furnish a foundation for bridge attachments, is the preparation for a three-quarter crown. This is preferably made on a tooth which has previously suffered to some extent from caries, but may in some instances be used on sound teeth. The first consideration in planning any of these procedures, however, is the protection of the dental pulp from excessive and immediate irritation.

When a study of the radiograph makes it clear that root canal operations cannot be expected to succeed, the conservation of the pulp becomes doubly important. Instances will be found in second and third molars whose root canals are frequently much constricted, or which may present sharp curvatures. Teeth whose roots are deformed, although presenting sufficient bulk and adequate alveolar support are also to be placed in this same class. Here the unexpected necessity for removing a pulp which has lost its vitality under a large inlay may mean the immediate loss of the entire bridge. On the other hand it is frequently desirable to utilize, as abutments, vital teeth which have already been deeply attacked by caries. In these cases there may be no danger from fairly extensive cutting for cavity preparation, but the conservation of the pulp may dictate the utilization of all available means for protecting the plup from such irritations as that of thermal shock, as well as possible infection through the tubuli from a deep cavity. In such cases the cavity, after thorough excavation, is sterilized carefully with silver nitrate reduced with eugenol, and is then lined with a non-conductor, which in turn is reinforced with copper cement. This provides a sufficient bulk of protective material between the gold inlay and the pulp so that the latter is adequately safe-guarded against irritation.

This procedure is applied only to posterior teeth. In the anterior teeth there is seldom opportunity for building up an adequate layer of non-conducting material, without reducing the depth of the inlay to a point which will impair its usefulness as a retainer for an attachment. When the necessity for such treatment of a tooth arises, it is wise to postpone the beginning of bridge construction for several weeks, or until it has been determined that the pulp gives promise of responding favorably.

A special warning should be sounded in connection with the preparation of bicuspids and even molars, when previous caries has weakened one or more of the cusps. This will apply to vital teeth, but with even greater force to pulpless teeth. If the inlays are constructed in the usual manner, that is, with the usual cavity preparation, these weakened cusps may split off, either during construction of the bridge, or after it has been inserted. Such cusps should invariably be protected by including them in the preparation. This may be done by shortening the cusps so that the inlay may extend over them and thus receive such strains as may be involved. This practice should be followed even when it involves a slight display of metal over a buccal cusp.

CHAPTER IV

The Pulpless Tooth

The pulpless tooth has long been a topic of discussion. In the earlier days of root canal treatment, the attention of the dental profession was focused on the gross local manifestations of periapical disease. When the development of root canal treatment had reached a point where it was felt that such treatment was an assured success in a larger percentage of cases, the metastatic aspect was thrust upon the profession, with consequences only too well known.

Out of the maze of arguments, pro and con, certain concepts have emerged which seem to have very general acceptance. In the first place it is commonly believed that periapical infections, if allowed to persist, will, sooner or later, lead to a breaking down of the patient's general health. It is also generally accepted that the pulpless tooth is not a dead tooth in the sense that it becomes biologically a foreign body. It is believed furthermore, by a large percentage of the dental profession, that, under certain conditions, non-infected pulpless teeth may be so treated that they will be safe-guarded from infection, and may accordingly be looked upon as useful and innocuous units in the dental arch.

At this point, however, there appears a division in the dental profession. There is a difference of opinion as to the possibility of safely retaining infected pulpless teeth. One group believes that a certain amount of infection can be eradicated, and prevented from recurring, by appropriate treatment. Another group believes that where periapical infection has once become firmly established, it can only be temporarily overcome, if at all. They believe that the disturbance of the natural conditions at the apex, which occurs with pulp death, renders the periapical tissue permanently inferior in resistance. A very small group seems to persist in maintaining that almost any periapical infection, no matter how severe, or of how long standing, will respond to treatment. Needless to say, the views of this last group are unworthy of serious consideration.

To the bridgeworker, the question of the pulpless tooth is of prime importance from both the local and the systemic standpoints. When all the teeth are present in the mouth a certain extent of latitude may be permitted the dentist in his efforts to save an individual tooth. With due regard for the patient's health, he may quite properly experiment, using this word in its best sense, knowing that if the result is unfavorable the patient is at least no worse off than if the tooth had been extracted in the beginning. On the other hand when the subject of replacement is to the fore, the question of the pulpless tooth is of paramount importance. If this tooth is to be used as an abutment the necessity for assuring its permanent usefulness is obvious. No conscientious operator will place a bridge on an abutment which may require extraction, perhaps within a few months, because of discoverable periapical disease. Less obvious in importance is the status of pulpless teeth which may not be directly involved in the bridge case. The subsequent loss of such teeth may be quite as embarrassing as though they had served as abutments for the bridge. The responsibility of the bridgeworker in connection with pulpless teeth is no light one.

Periapical and Periodontal Disease

From the local standpoint, the pulpless tooth must be studied by the bridgeworker with a view to the possible effect of future stress on the periapical tissues. Students of periodontal disease have pointed out the fact that traumatic occlusion, which is merely an excessive stress, may produce periapical pathosis, even where the pulp has not become diseased through the encroachment of caries, nor by the deep extension of a pus pocket. Such damage may even progress to the point where the pulp loses its vitality. It is obvious then that the element of occlusal stress may have an important bearing on the health of the periapical tissues in the case of the pulpless tooth.

It is generally recognized by periodontists that a tooth which has both periapical infection and advanced periodontal disease, is unsatisfactory for both pulp canal and periodontal treatment. If this is true of a tooth which has only its own work to do, it will apply with even greater force to that tooth which is to be given the added burden of support, or retention of a bridge. Pulpless teeth which have suffered any appreciable loss of alveolar bone from periodontal disease are to be regarded as unsafe for bridge abutments, even though their periapical condition seems to be entirely satisfactory. The lamina dura should be unbroken from gingival crest to apex, and the pericemental space should show no abnormal width at any point around the root.

When it is proposed to utilize a pulpless tooth for a bridge abutment the periapical condition must be studied with the greatest care. If it be found that a good root filling has been placed and the periapical tissue is normal, as indicated in the radiograph, the tooth may be utilized as an abutment without misgiving, provided there is no marked periodontal disease, and provided also that the patient's health is good. The tooth should be radiographed from at least three different angles, before deciding that it is free from disease.

If on the other hand, it is found that there is radiographic evidence of periapical disease, the tooth is to be considered questionable to say the least, even though the periodontal condition is extremely satisfactory. All badly infected teeth should be removed, but under certain conditions pulpless teeth may be restored to health and usefulness. While a diseased pulpless tooth may respond to root canal treatment, however, with clearing up of the periapical infection, it is inevitable that the added stress involved in bridge support will provoke an irritation of this weakened tissue with probable subsequent reinfection. Where periapical disease is found on a tooth which it is desired to use as a bridge abutment, the tooth should be dismissed from consideration and recommended for extraction, with rare exceptions. Cases frequently are found in which the loss of such teeth may involve a considerable expansion of the original plan, or may even necessitate extraction of all remaining teeth in the same jaw, and the making of a full denture.

Retention of Doubtful Teeth

When the retention and utilization of such a tooth is the only means of avoiding such a calamity, and when the patient is regarded as a safe risk from the systemic standpoint, such a tooth may be retained.

The age, recuperative power and the present state of the patient's health are the factors that must be considered. In these cases the tooth, after the pulp canal has been sterilized, detoxicated and filled to the apex, is subjected to the operation of apicoectomy before beginning the construction of the bridge.

If the pulp canal has been filled, and regardless of the character of the pulp canal filling, as revealed by the radiograph, it is imperative that the pulp canal should be sterilized, detoxicated and refilled just previous to the operation of apicoectomy. Unless this procedure is followed, the source of the infection will not be eradicated and the operation will usually be a failure. Furthermore, if more than the apical third of the root is involved, extraction of the tooth is usually indicated.

In order to prevent exacerbations due to the lack of drainage from the involved periapical area following the hermetic sealing of the pulp canal, apicoectomy should be performed within six hours after filling the pulp canal.

The most satisfactory teeth for this procedure when they are to be used as bridge abutments are the upper cuspids, or upper central incisors.

The upper first bicuspids and lateral incisors, as well as the lower incisors respond favorably to this operation when they are not called upon to act as bridge abutments. Experience based on this principle has been most satisfactory. It should be borne in mind, however, that when such a tooth is to be retained, complete occlusal coördination is essential to success. Certainly no degree of traumatic occlusion can be tolerated.

Apicoectomy should be confined to the eight upper anterior teeth and the four lower incisors. The lower cuspids approach the anterior portions of the inferior dental canal so closely as to render this operation unsafe on these teeth. The lower bicuspids have their apices in such close proximity to the mental foramen that they are riskful. The upper second bicuspid, being naturally a weak tooth, is not to be regarded with favor for apicoectomy, nor are any of the molars, save in rare instances.

When the pulpless tooth which is to be used as a bridge abutment shows no discoverable sign of periapical disease, and has sound alveolar support, the only requirement is that the root filling shall extend to the apex, or at least to the presumptive dentocemental junction.

For the patient who has, or has had, any type of metastatic disease, the pulpless tooth is to be looked upon with disfavor. The indications for the retention of such teeth are poor, at best, in these cases. But when the pulpless tooth is to be subjected to the added stress involved in bridge retention or support, the risk becomes immensely increased. It must be borne in mind, that the problem of the pulpless tooth has not been solved as yet. We do not know positively that it is possible to protect such teeth from periapical disease, or to eradicate such disease when found. The ideal root filling is yet to be discovered. All of these considerations make it imperative that the bridgeworker, if he is to retain a place of honor in the eyes of the dental and medical profession, shall take no chances with the decidedly uncertain pulpless tooth in the cases of those who are susceptible to metastatic infection.

McCall has stated * "In considering the diagnosis of oral disease, we should first bear in mind that, because of the variations in resistance exhibited by different individuals, no hard and fast rule can be laid down that would be universal in its application. What may be safe for the young, healthy patient, may be very unsafe for the elderly, or for the patient having well developed indications of susceptibility to infection. The decision on the latter point can be properly made only after examination by a competent physician. We must be extremely careful, how-

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* *Oral Diagnosis.* John Oppie McCall, D.D.S., *Journal of Dental Research,* Vol. IV, No. 4, 1922, p. lxxi.

ever, that our attitude shall not be over lenient toward teeth with well defined regions of alveolar infection, even if the latter should be small. It is unwise to call upon the body defenses to contend with a continuing infection, even at an age when they seem entirely adequate to the task. It is impossible to forecast the period in life at which these defenses will fail.

"For the patient who is ill and who has been certified by his physician as suffering from a disease caused wholly or in part by focal infection, the case is quite different. Here we must be most critical of the condition of the mouth, regardless of conditions elsewhere in the body. We should see to it that recommendations are made which will, without question, free the mouth of foci of infection. Unfortunately for the dentist, as well as the patient, foci of infection in other parts of the body are frequently difficult to detect. When they are overlooked, a considerable burden of odium may be cast upon the dentist who has ordered the extraction of teeth without visible benefit to the patient. It is therefore impossible to promise a patient that he will be benefited by tooth extraction, yet this fact does not justify the retention of infected teeth. Neither does failure from such a cause invalidate our hypothesis."

More recently Hatton has presented histological evidence tending to show that a large percentage of pulpless teeth which are radiographically negative are free from periapical inflammation. He regards this evidence as being more trustworthy than the evidence of such bacteriologists as Rosenow and Hayden. The latter show a very high percentage of infection at the apices of radiographically negative teeth. Until this contradictory evidence is harmonized the bridgeworker must incline to the side of safety and condemn pulpless teeth as bridge abutments, in the mouths of susceptible individuals.

In conclusion it may be said that a thorough knowledge of the condition of the entire oral cavity is of vital importance if we are to hope for success in any restorative procedure. The history, physiology and pathology of all of the teeth and their surrounding tissues must be taken into consideration. The greater our knowledge of biological science and its application to dentistry, the greater will be the chances for success in any operation which we may undertake in this field.

CHAPTER V

The Influence of Bridgework on the Periodontal Tissues

When it is discovered that bridges might be used for the restoration of missing teeth, and that these bridges could be supported by natural teeth remaining in the mouth, there began what might be called the "Golden Age" of dentistry. The appeal which this type of reconstruction made to the average individual needing such restoration, is too well known to require comment. This type of work was introduced at a time when dentistry was regarded as being almost entirely a mechanical art. Teeth were looked upon merely as so many inanimate pegs upon which any structure, no matter how fantastic, might be suspended. The fixed bridge as a type of restoration got well under way, before it was discovered that the ultimate results were not invariably satisfactory.

Failures in bridgework were soon observed, however, and while it was frequently evident that the difficulty lay in an overloading of the bridge abutments, this factor was not always so obvious as to furnish a satisfactory explanation of the disaster. Dentists did, however, realize that the endurance of the supporting tissues of bridge abutments could be overtaxed, and the more thoughtful and conscientious operators voluntarily limited the length of the bridge spans which were to be inserted. In the effort to provide some of the desirable features of bridgework for their patients, they devised the removable bridge. When this was developed to a point which seemed to approach perfection, it was felt by many in the profession, that the bridgework problem had been solved.

All this time, however, the actual nature of the damage done by the bridge remained unknown. Hence some fairly extensive fixed bridges gave long years of satisfactory service, and on the other hand, many short removable bridges gave way, after being in the mouth but a brief time. It was of course realized that the factor which undermined bridge abutments, whether the bridge was fixed or removable, was periodontal disease of the suppurative type. Teeth which showed no signs of this disease before the bridge was placed, frequently developed it within a short time after the insertion of the bridge. This phenomenon did not always occur, however, and there seemed to be no reason for the success of one bridge and the failure of another.

The bridgeworker is largely indebted for the solution of this problem to the periodontists, and particularly to Stillman, who showed the influence of traumatic occlusion in bringing about periodontal disease.* It is this factor, which has so much to do with the causation of periodontoclasia in the natural denture, which also so frequently determines the incidence of this disease around bridge abutments.

Traumatic Occlusion

Traumatic occlusion is essentially a stress which is beyond the ability of the periodontal tissues to withstand. It tends to induce resorption of the bone around the tooth involved, and to reduce the resistance of the vascular tissues to infection. For the bridgeworker each of these phenomena has a serious significance. The resorption of bone reduces the amount of alveolar support and thus weakens the bridge in a mechanical way. The alteration of the resistance of the tissues, from a state of immunity to one of susceptibility, is still more serious, in that it leads to gingivitis and the destruction of the pericementum by pus pocket formation.

That periodontal disease does not invariably follow the placing of a bridge, is an indication that under favorable circumstances the periodontal tissues may withstand the added stress which the bridge imposes. It is that fact alone which makes satisfactory work in this field possible. It is known that function, properly regulated, stimulates the periodontal tissues in such a way as to improve their strength and resistance. The bridgeworker who is able to visualize his cases and to so apportion the work of his bridge abutments as to induce a physiologic stimulus, will be rewarded with success. This requires a consideration of the condition of the bone and gingivæ around the abutment teeth, the state of the occlussion before the insertion of the bridge, and the general immunity or susceptibility in the patient's mouth. Success will then depend on the ability of the bridgeworker to provide harmonious occlusal relations in the piece which he is to construct.

Gingival Irritation

Another factor in this problem has to do with the effect of crown bands and overhanging inlay margins on the gingival tissues. It was for many years believed that the matter of gingival irritation was the paramount problem in crown and bridgework. It is of course obvious that irritation from such a source is a matter of grave import. Study of this

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***Traumatism Due to Faulty Coördinating Bridgework.* Paul R. Stillman, The *Dental Cosmos,* Vol. LX, 1918.

problem has resulted in the development of such attachments as the cast gold inlay, and the three-quarter crown, in which gingival irritation can be entirely eliminated if a correct technique is followed. Careful study and comparison of the relative influence of gingival irritation from the bands of crowns, and the effects of traumatic occlusion have definitely demonstrated that the latter is the more serious pathogenic agency. However, there is no thought of minimizing the importance of the factor of gingival irritation. No pains should be spared to so construct the mechanical restorations which are to serve as abutments, that they shall induce no irritation of the marginal gingivæ.

When considering the item of possible traumatic occlusion in the planning of a restoration, it is necessary to determine the relative degree of stress which will be imposed on the abutment teeth by the finished restoration. Removable bridgework does not relieve abutment teeth entirely of the burden of the bridge simply because it is removable. Extensive restorations of this type may produce so severe a traumatic occlusion as to induce serious periodontal disease, and may thus be as definitely contraindicated as the fixed bridge, in such cases. Where a considerable number of teeth are to be replaced, it is often advisable to insert a denture whose chief support will be furnished by the vascular tissues, rather than to place a bridge of any type.

Particularly is it desirable that the bridgeworker shall be skilled, not only in this field and in the field of partial denture construction, but also in the field of full denture work. Many cases are presented for restoration which may be unsatisfactory for bridgework, and even for a partial denture, and in which a full denture presents the only satisfactory solution of the problem. Many dentists hesitate to recommend the latter, through fear that their efforts may not be successful. They accordingly recommend and construct a partial denture, usually with the active approval of the patient, only to find that the piece is short lived. In such cases, if the operator had complete confidence in his ability to make a good full denture, he would recommend this restoration in the beginning, and save the patient and himself severe disappointment.

Consideration of the Future

Another aspect of this problem has to do with the ultimate condition of the mouth, as regards its possibilities for full denture restoration. When teeth are lost from periodontal disease, a considerable area of the supporting bone is resorbed, with the result that the ridge which is formed after extraction, is meager and frequently so malformed as to present serious difficulties to the full denture worker. Study of prospective bridge, or partial denture cases must always take into account this factor. The interests of the patient will often be best served by advising the extraction of all remaining teeth before extensive bone resorption from periodontal disease has taken place. This constitutes one of the most important responsibilities of the bridgeworker.

When a bridge is to be placed and the circumstances are such that it is considered possible that the bridge may be lost at some future date, it is important to take suitable steps for insuring the health of other teeth in the mouth which may ultimately be needed as abutments. This will apply particularly to molars which are sometimes needlessly sacrificed because their importance is underrated at the time of construction of the original bridge. Special attention should be given to preserving the vitality of teeth not directly concerned in the original bridge case, but which eventually may be called upon to support or retain a restoration. Such teeth, if they have been deeply attacked by caries may frequently be preserved, with maintenance of pulp vitality, by the use of extensive restorations such as three-quarter crowns. Devitalization is never a satisfactory solution of the problem of restoring lost tooth structure, but it is especially to be avoided where there is any possibility that the tooth may later be called upon to support a bridge.

CHAPTER VI

Stationary and Removable Bridges:

General Consideration

In making a choice between a stationary and a removable bridge, for any given case, the following points should receive consideration. First the magnitude of the stress which will be imposed on the abutment teeth; second, the ability of the patient to maintain a hygienic condition; third, the matter of esthetics. Another point which may sometimes enter into the situation where the elements of stress, hygiene and esthetics, may be equally served by either type, is the wishes of the patient. Many people have acquired a disinclination toward removable bridgework, which amounts to an obsession. This psychologic factor is not to be lightly regarded, since it frequently involves the future happiness of the patient. Where the fixed bridge, for instance, is not definitely contraindicated, it may properly be placed, if it is found that the patient is strongly desirous of having this type of restoration.

Stress Defined

The element of stress is usually the most important factor in bridgework. It is to be understood that stress, as discussed in this connection, is related directly to traumatic occlusion. This factor may be as readily induced by a short removable bridge, as by a long fixed bridge, since it is invoked by both lateral and vertical occlusal pressure. It should be understood then, that where occlusal harmony cannot be obtained, the removable bridge, as well as the fixed bridge, is contraindicated. In other words, it is taken for granted that the preliminary study of the case has demonstrated the possibility of constructing a bridge which shall have satisfactory occlusal relations. The matter of stress then, when deciding between a fixed and a removable case, has reference to the magnitude of the vertical force which will be applied to the abutment teeth when the bridge is in place. From this standpoint, cases requiring the replacement of one or two teeth may quite properly be restored by a fixed bridge. The regions in which this is most suitable are the labial, both upper and lower, and the bicuspid regions. Where the cuspids have sufficient strength, it may even be satisfactory to place stationary bridges supplying the four incisors, either upper or lower. It should, of course, be kept in mind that the requirements of occlusal balance are increasingly severe as the number of teeth to be supplied increases. In other words, if the four incisors are to be supplied, the fullest occlusal balance must be attained, in both protrusive and lateral movement, in order that there shall be no occlusal trauma. In these cases the element of esthetics frequently plays a compelling part. Also, in considering the feasibility of a removable bridge, it should be kept in mind that it is usually impossible to prepare either upper or lower cuspids, for the insertion of inlays carrying internal attachments without endangering the vitality of the pulp. Anterior fixed bridges, because of the relatively slight labiolingual dimension of the pontics, are readily cleaned by the patient. It will thus be seen that fixed bridgework, even when fairly extensive, may often be properly placed in this part of the mouth.

When the case presents with teeth missing in both the bicuspid and the labial region, the fixed bridge may also be employed. Because of the different type of function of the teeth involved, however, it will usually be necessary to construct the bridge so that a movable joint is provided in the cuspid region. This will permit the independent movement of either segment according to the use to which the patient puts the supplied teeth.

Where the posterior teeth in the maxillæ are to be supplied, the buccolingual width of the pontics complicates the question of maintaining cleanliness in the mouth. The pontics should present a highly glazed porcelain surface to the mucous membrane, since it has been found that even the most highly polished gold has sufficient porosity to absorb toxic material which may produce irritation. Sufficient space should be provided at the cervix of the abutment teeth, so that cleansing of these teeth by toothbrush and floss is facilitated. Frequently the space required for cleansing cannot be provided in a fixed bridge without impairing its esthetic qualities to such a degree as to make it objectionable. Here it may be necessary to use a removable bridge in which cleanliness can be maintained without making such spaces.

Rebasing

Those who have had experience in the construction of partial and full dentures are well aware of the fact that rebasing is sometimes necessary.

If care is taken when placing a saddle for a removable bridge, the tissue will remain healthy for a number of years; yet slight absorption may take place. Many cases of fixed bridgework when properly planned, have endured for twenty or thirty years. If the removable bridge is to compete with the fixed bridge, it should endure for an equal number of years. If we are to secure this degree of efficiency it may be necessary to make some alteration after the lapse of a few years. If the removable bridge has been constructed to remove undue strain from the abutment teeth, by utilizing tissue support, it is of vital importance that this tissue support should be maintained. If after a period of six or eight years, there is an indication of a loss of this support, rebasing is indicated and is very easily accomplished.

Cleansable Bridges

When a fixed bridge, supplying one or two teeth, is to be placed in the posterior part of the mandible, a cleansable bridge is indicated, the missing teeth being supplied by a properly carved cast span, using no pontic and leaving the under surface of the span slightly convex for ready cleansing by the toothbrush. If it is desired for esthetic reasons to avoid the display of gold on the occlusal surface of the span, it will be necessary to make a removable bridge, on whose saddle, porcelain teeth of sufficient bulk to give strength may be placed.

Porcelain Roots on Pontics

In recent years, many dentists have advocated the placing of an anterior bridge immediately after extraction, the pontic having a glazed porcelain projection which extends into the tooth socket. It has been said that when these cases are so constructed and inserted, the original contour of the vascular tissues is maintained, and the appearance of the finished case is thus improved. While this latter point is true to a certain extent, the consideration of health and cleanliness contraindicates the use of this type of restoration. When such bridges are removed, it will invariably be found that the tissue around the porcelain tip is inflamed, and frequently presents a preceptible and significant odor. The esthetic requirements can be met in other ways and the use of a porcelain pontic of this type is thus rendered unnecessary.

Neglected Edentulous Areas

Cases are often seen in which the molars are missing on one side only, the opposing molars being in place. Since there is no posterior abutment, and because the case would then necessitate the use of a complicated removable bridge, it is often allowed to go indefinitely without restoration. This is a poor policy. In the first place, opposing teeth invariably elongate and may interfere with successful restoration later on. Furthermore, the patient is compelled to resort to unilateral mastication with consequent abnormal wear and traumatic occlusion on the teeth which are used.

Another type of case which is frequently allowed to go without restoration is where a single posterior tooth has been lost, as for instance the first molar. In such cases masticating efficiency seems not to be seriously impaired, and both patient and dentist are satisfied to leave the space unfilled. When this is done the second and third molars invariably drift, tipping as this migration goes on. If the extraction has been done before the bicuspids and second molars are fully erupted, the bite will be perceptibly closed. Either of these conditions leads directly to traumatic occlusion and periodontal disease. It is therefore an important prophylactic measure to restore such missing teeth promptly in order to stabilize the occlusion.

CHAPTER VII

Abutments for Bridge Cases

The selection of teeth which are to serve as abutments for bridges, or as the principal retention of partial dentures, is a matter of the greatest importance. It is obvious that such teeth should have adequate alveolar support, and that their environmental tissues should be in a healthy condition. Traumatic occlusion, if it has existed before the construction of the bridge is undertaken, must be relieved by the preliminary adjustment of the occlusion. Another factor which requires careful consideration, is the position of the tooth in the arch. Malpositions of any description are unfortunate, although not invariably a barrier to success. If, however, the tooth is appreciably tipped from its normal position, its usefulness as an abutment is impaired.

The most serious malposition of this type is a mesial tipping of the bicuspids, both upper and lower, as well as a mesial tipping of the lower cuspids. When, in addition, these teeth are tipped buccally the difficulty becomes still more pronounced. It is safe to say that when such a condition is found, the teeth so affected are contraindicated as bridge abutments, and are of doubtful value for the retention of partial dentures.

Another serious malposition is the lingual tipping of a lower molar, even when the condition is not complicated by mesial tipping of the tooth. Such molars will commonly be found to have suffered from absorption of the alveolar bone, from the traumatic occlusion which invariably accompanies this condition.

When the tooth is tipped lingually, even slightly, and is found to be somewhat loose, or to have suffered slight loss of the supporting bone, it should not be used as a bridge abutment. The additional burden imposed by the bridge, whether fixed or removable, will accelerate the rate of the bone absorption and the loss of the bridge is a foregone conclusion. When a molar has drifted forward and has become tipped mesially following an extraction, the situation is less serious, provided that the movement has not been extensive, and if the condition of the alveolar bone is satisfactory. The direction in which the tooth is tipped is such that stress induced by the bridge does not necessarily induce further tipping, and it is this factor which so frequently causes the loss of abutment teeth which are tipped. If such a molar is to be used, however, it is imperative that the further drifting of the tooth should be prevented by suitable technique in the construction of the bridge.

Teeth which are to be used as abutments must be studied most carefully by means of the radiograph to determine the length and development of their roots. Teeth with short, underdeveloped roots, cannot be expected to give satisfactory service as bridge abutments, no matter how firm they may be before the bridge is inserted. Special care should be taken to determine the possible beginning of root absorption, since this condition tends to be progressive, especially when additional stress is put upon the tooth.

Hypercementosis

Hypercementosis is a condition which, through the enlargement of the root provides increased alveolar support. Teeth which exhibit this condition may therefore be considered satisfactory as bridge abutments, provided there is no indication of other pathological disturbance at the apex. It not infrequently happens that hypercementosis is to be observed on pulpless teeth, and when this is found to be the case, there is always a possibility of periapical infection, even when no rarefaction is demonstrated in the radiograph. Such teeth, if selected for bridge abutments, should be used only with the full statement to the patient of the possibility of infection.

Choice of Attachments

Having selected the teeth which are to serve as abutments, the next step is the choice of the attachment. The first consideration at this point is the conservation of tooth structure. That attachment should be selected which can be placed in, or upon the abutment tooth, with the least amount of cutting of this tooth. This consideration has the greatest weight when the tooth is free from caries, or other enamel defects at the time when the case is begun. When the tooth has been attacked by caries, it is usually found that a slow, but progressive change has occurred in the pulp, which makes it less apt to respond unfavorably to additional cutting. In such teeth there is a wider latitude of choice as regards the type of attachment to be used.

Internal Attachments

The attachment which encroaches most severely upon the deeper tooth structure, is the internal attachment, consisting of male and female parts. This type of attachment should seldom be used in teeth which have not suffered from caries, unless the esthetic consideration is of great importance. There are two arguments in favor of the internal attachment which have comparatively slight application in such cases. The first is that the internal attachment is less apt to cause caries than a clasp, which would be the other alternative. The second argument is that this form of attachment provides opportunities for more satisfactory cleansing by the patient. When the tooth to be used as the abutment, and also the other teeth in the mouth, are fairly free from caries, it will usually be found that the clasp is relatively harmless, if given adequate care by the patient. This same consideration holds true with regard to the matter of cleanliness.

On the other hand, teeth which have suffered from caries and have been filled more or less extensively, will readily tolerate the cutting required for the proper placement of the internal attachment, as well as the retention of the inlay which carries this attachment. It also happens that these teeth, being more subject to caries will be more apt to be injured by clasps. The internal attachment therefore, becomes the choice in the mouth which is subject to caries, both because of pulp tolerance and because of the consideration for the future welfare of the tooth. It will be understood that the choice of the internal attachment will also depend on the position of the tooth and the ability of the operator to secure parallelism of the attachments, without excessive cutting of tooth substance.

Clasps

The choice of a clasp as an attachment will depend largely on the conditions just enumerated. Where the internal attachment is contraindicated the clasp will be the choice. The clasp should always be so constructed as to have the least bearing on the enamel which will provide for adequate retention. It should also be so made that when the bridge is in place, there shall be no movement of the clasp on the enamel. Occlusal rests are also important to prevent gradual movement of the clasp toward the gum line, with possible impingement on that tissue. The occlusal rest also prevents settling of the bridge with consequent loss of occlusal contact.

Attachments for Fixed Bridges

Attachments for fixed bridges may be considered under two headings. The first is the attachment to which the bridge is solidly attached. The other is the attachment which provides support without solid attachment. For the first of these, the crown, either full or three quarter, is frequently used, although the m.o.d. inlay in properly selected cases may be indicated. For the so-called "movable joint" attachment, the inlay is most commonly selected; this may be either m.o.d. or approximo-occlusal, according to whether caries has involved both approximal surfaces of the tooth.

For the solid attachment, strength is the prime requirement. It is for this reason that the crown has enjoyed such a wide usage, and this, in spite of the disadvantage commonly presented by the band, which must ordinarily be carried under the free margin of the gum. If an anterior tooth is so broken down, or is so weak from any cause, that a three-quarter crown cannot be used, a dowel crown with a band may be employed in suitable cases. If possible, however, its use should be avoided.

When possible the three-quarter crown should be used since it provides strength, freedom from gingival irritation and satisfaction of the esthetic requirements. When the position, or shape of the tooth is such that the construction of a three-quarter crown would require excessive cutting of the tooth, the m.o.d. inlay should be preferred. This type of attachment has the disadvantage of being more readily dislodged under stress, and should not be used except under the conditions specified. Where it must be employed, great care must be taken in the preparation of the cavity, to insure the retention of the inlay. If an m.o.d. inlay is to be placed in an upper bicuspid, or any tooth presenting weak walls, it is best to cut away the enamel over the cusps and restore the enamel so removed, by an extension of the inlay, in order to avoid the possibility of splitting off one or more of the cusps.

When the attachment is to serve as a support for the lug of a bridge of the movable joint type, the displacement of the inlay is not so likely to occur. An approximo-occlusal inlay is ordinarily used. Porcelain jacket crowns may also serve as a support for a lug, a recess being provided in the porcelain to receive this extension. Under no circumstances should a lug be allowed to rest on the enamel of the abutment tooth of a fixed bridge, since this will eventually lead to caries.

Individual Crowns

Individual crowns are indicated wherever the tooth substance is so deeply attacked by caries, or is so defective in structure that it cannot be properly restored by other means. The porcelain jacket crown is the ideal restoration in any part of the mouth, but is especially indicated for the anterior teeth. It has the unique quality of providing the most satisfactory protection for the dental pulp and the greatest possible avoidance of gingival irritation. It is of course the most satisfactory from the esthetic standpoint. It furthermore has been found to provide the greatest possible protection against caries. Even where the pulp has been lost, and where a dowel crown would therefore be a possibility, it is now considered that the porcelain jacket crown, placed over a properly reinforced tooth stump, is the most desirable restoration.

When the buccal, or labial surface of the tooth is sound and the pulp is vital, a three-quarter crown may provide an entirely satisfactory restoration. The full gold crown is seldom indicated, but may be used where the tooth is so short that a porcelain jacket crown of sufficient strength cannot be constructed.

The requirements for a crown are that it shall provide proper occlusal relations, restore function, provide correct approximal contacts and satisfy the esthetic demands. In addition, it should protect the tooth against fracture and future caries and should not cause irritation of the marginal gingivæ.

Traumatic occlusion may be produced by crowns as well as by bridges. Inharmonious cusp relations are a common source of periodontal disease in this type of restoration. The study of the occlusal relations throughout the mouth is just as important when a single crown is to be placed as in the case of an extensive bridge. A preliminary correction of the occlusion is advisable, to be followed by a final adjustment after the crown is completed. The most careful attention must be paid to the contact points since a shortcoming of this nature will surely lead to disease and cause a failure of the case.

The greatest care must be taken with regard to reproducing the anatomical characteristics of the tooth, as regards the occlusal surface as well as the approximal, buccal and lingual surfaces. Occlusal form should provide for proper interdigitation of the cusps with the opposing teeth without such extreme interlocking as would tend to produce occlusal trauma. The contour of the buccal and lingual surfaces are important from the standpoint of providing a guidance for food during mastication so that it shall not impinge forceably against the gum margin. Much harm has resulted from neglect of this feature of the construction of crowns.

When a jacket crown is to be utilized as an abutment, special technics will be demanded, which will be described later in this work.

Part Two

THE TECHNICS OF STATIONARY BRIDGEWORK

CHAPTER VIII

Conduction and Infiltration Anesthesia

Conduction, or infiltration anesthesia is recommended by the author as the most satisfactory method for removing vital, or partially vital pulps. Pressure anesthesia while efficient, is considered dangerous by some authorities for the reason that it may force infection from the pulp into the periapical tissue.

Sufficient anesthesia for cavity preparation, or root canal operations can be secured by infiltration anesthesia when such operations are confined to the upper bicuspids, cuspids, central and lateral incisors and the lower incisors. The cancellous structure of the maxillæ and mandible, and the numerous foramina in these areas permit the anesthetic solution to permeate through the alveolar bone and the pericementum to the apical foramen and into the pulp.

For the upper molars, lower molars, bicuspids and frequently the lower cuspids, better results can be secured by conduction anesthesia, as the alveolar process of both the maxillæ and mandible in these areas is very dense.

Conduction, or infiltration anesthesia will be of inestimable assistance to the practitioner who desires to perform his operations with the minimum of discomfort to his patients.

Blocking the Maxillary Nerve and its Branches *

Surgery has brought out, to a high degree, the inventive faculty of those who practice it. This is well exemplified in the field of local anesthesia in which it has been necessary for the surgeon to devise systematic techniques for blocking the various nerves with whose terminal branches he is concerned. In the region supplied by the fifth cranial nerve there are numerous difficulties to be overcome, but fortunately none of these has proven insuperable. The operator will localize the various foramina and

* The author wishes to express his appreciation for the consent given by Dr. Nevin and Dr. Puterbaugh for the use of illustrations No. 1, and Nos. 8 to 20 inclusive.

landmarks and utilize these anatomical features for the attainment of his object. There are certain anatomical structures which, because of their nature, must not be penetrated by the needle. This is particularly true of

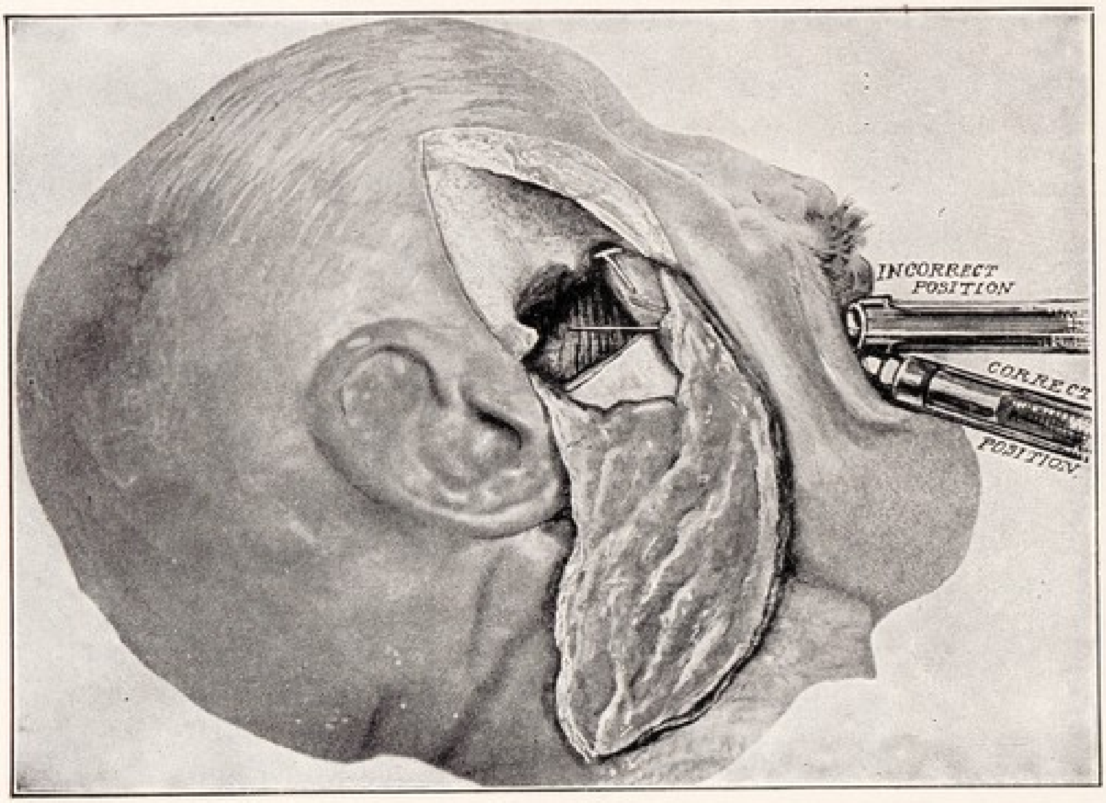


Fig. 1. Correct and incorrect position of syringe in a tuberosity injection on the right side. The syringe must swing externally as far as the angle of the mouth will permit in order to be in contact with the tuberosity. When it is directed parallel with the alveolar plate, the needle will miss the tuberosity and enter the external pterygoid muscle and the pterygoid plexus of veins

muscles. Anesthesia of a muscle is never called for in oral surgery, and, for that reason is superfluous. The anesthetic solution is absorbed very slowly from a muscle and it therefore causes prolonged discomfort, and often trismus. Finally, injection of a muscle is to be avoided because of the possibility of anesthetizing the motor nerve, thus interferring with the motor control, and resulting in a loss of normal function.

The structure of the external plate of the alveolar processes in the upper molar region is often sufficiently porous to permit absorption of the anesthetic solution into the more highly cancellous structure beneath. In certain cases, therefore, the upper molars may be successfully anesthetized by infiltration. When this is found to be impracticable, block anesthesia must be resorted to.

The three upper molar teeth, their alveoli and overlying gum tissue are supplied by two nerves, the posterior superior alveolar, and the anterior palatine. These nerves are derived from the outer and inner loops,

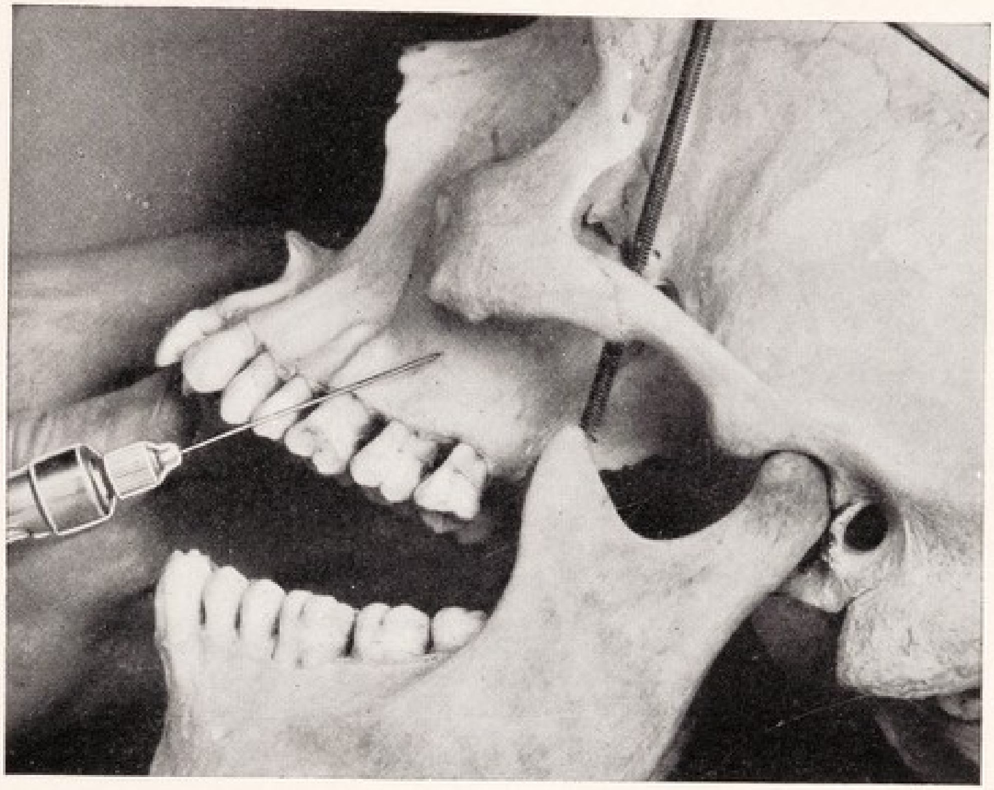


Fig. 2. Insertion of needle opposite the second molar in a left tuberosity injection. The syringe is held in close apposition with the alveolar plate and at an angle of approximately 45 degrees with the occlusal plane of the upper molar and bicuspid teeth

respectively, of the second division of the fifth cranial nerve, or the trifacial nerve.

Anesthesia for Upper Molars

When an operation on the upper molar teeth, not involving the palatal alveolar plate, or mucous membrane, is to be performed, it is only necessary to block the posterior superior alveolar nerve. This procedure will suffice, for instance, for the preparation of cavities, the preparation of the molars for three-quarter or jacket crowns, and for pulp extirpation. Extraction and alveolectomy, with which the crown and bridgeworker is not primarily interested, will of course require, in addition, the anesthetization of the anterior palatine nerve.

The posterior superior alveolar nerve is anesthetized by means of the tuberosity, or zygomatic injection. In order to reach the posterior superior alveolar foramen the needle must be kept in contact with the bone, as it advances, because of the fact that the surface over which it is carried is convex. The point of the needle must be directed internally and super-

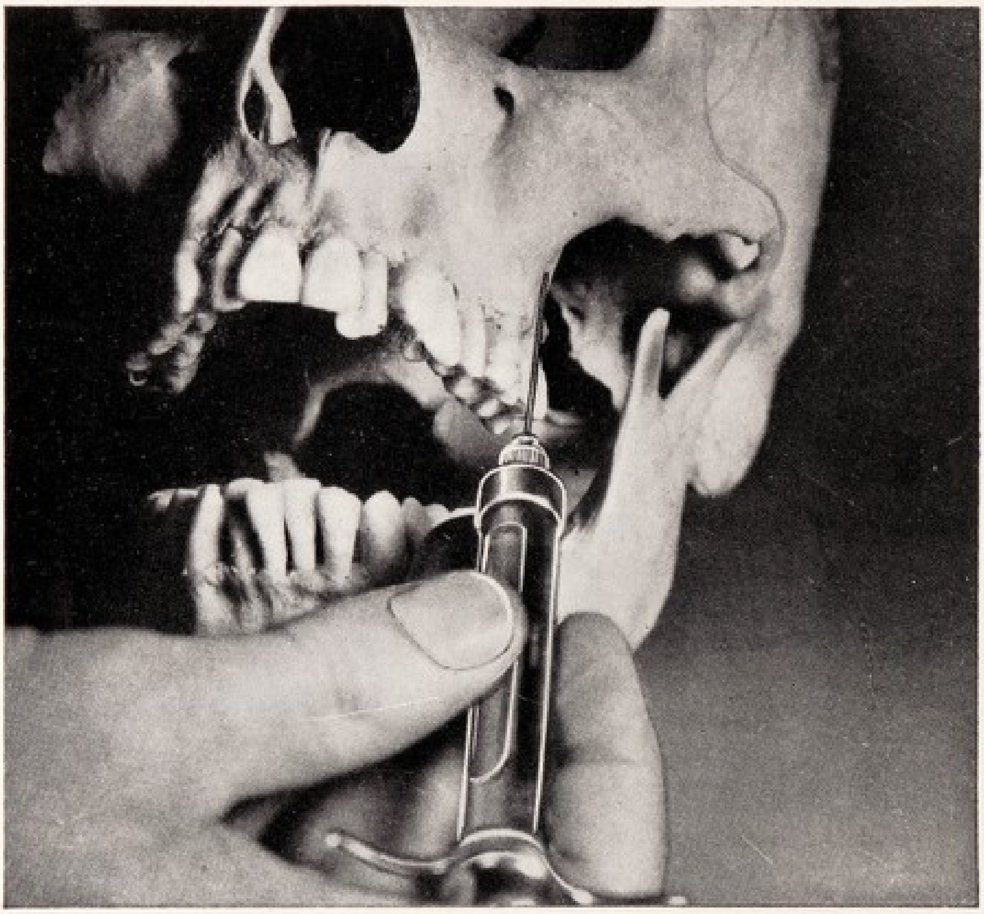


Fig. 3. Anterior view showing same position of needle as shown in Fig. 2

iorly, which is accomplished by holding the syringe as far externally as the angle of the patient's mouth will permit.

The external pterygoid muscle, and the pterygoid plexus of veins, must be carefully avoided in this injection; this is best accomplished by keeping the point of the needle in contact with the bone as it is being passed through the tissue to the point where the solution is to be deposited.

The operator must visualize the position of the external pterygoid muscle in its course from the external pterygoid plate toward the neck of the condyle. If the needle should be inserted too far posteriorly, it would enter this muscle. Should the needle be directed parallel with the alveolar plate, without swinging the syringe externally, it would enter

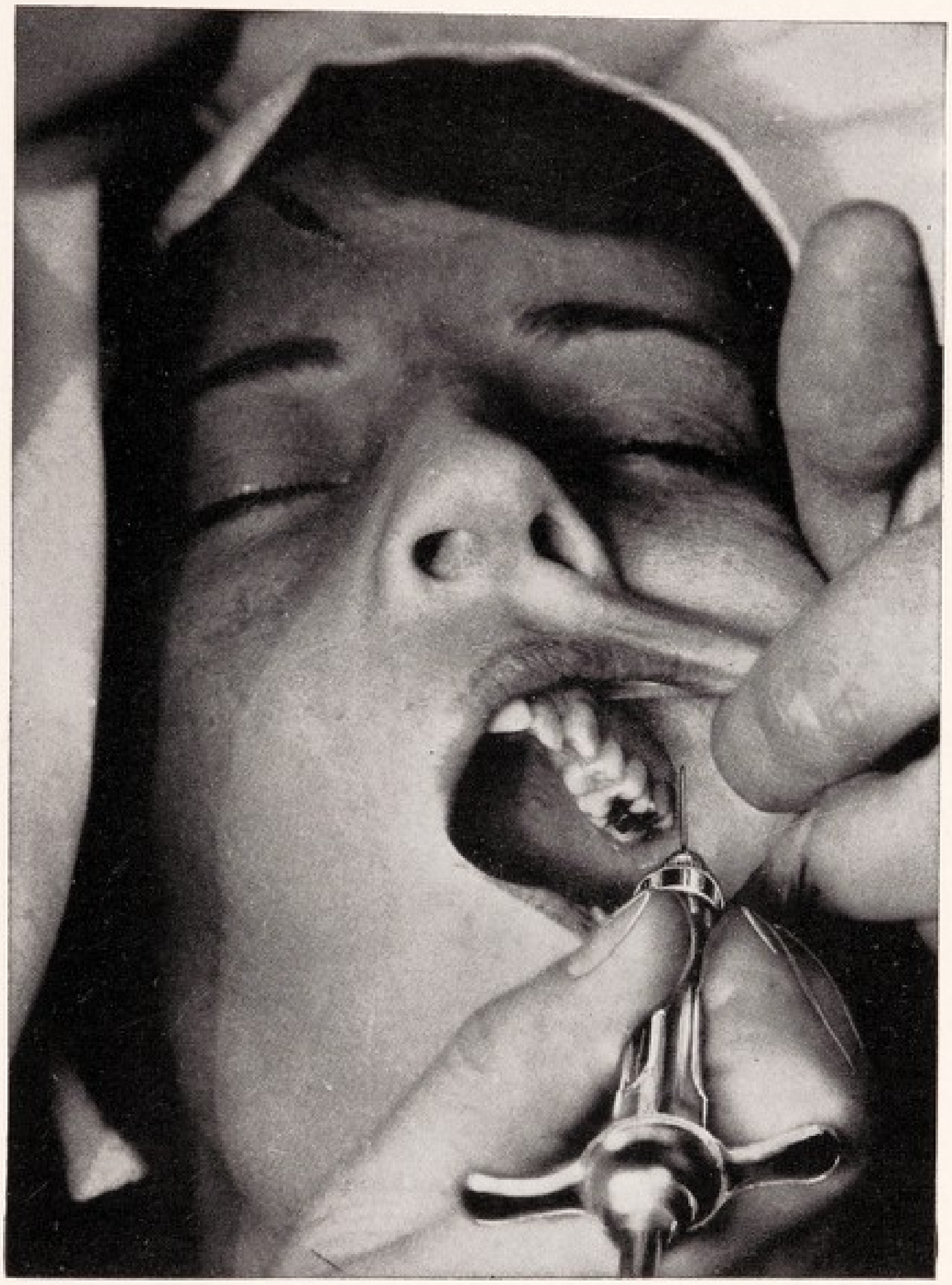


Fig. 4. Correct position for insertion of needle in a left tuberosity injection on patient

the pterygoid plexus of veins, and also the external pterygoid muscle. (Fig. 1.) In either case edema, or even hematoma may result. This last condition is accompanied by an immediate and usually large swelling. This is undoubtedly due to an accumulation of venous blood from the pterygoid plexus, which has been entered by the needle. The swelling generally disappears in a few days. However, an accompanying ecchymosis frequently causes a discoloration of the skin over this area.

The technique of this injection is therefore planned with special ref-

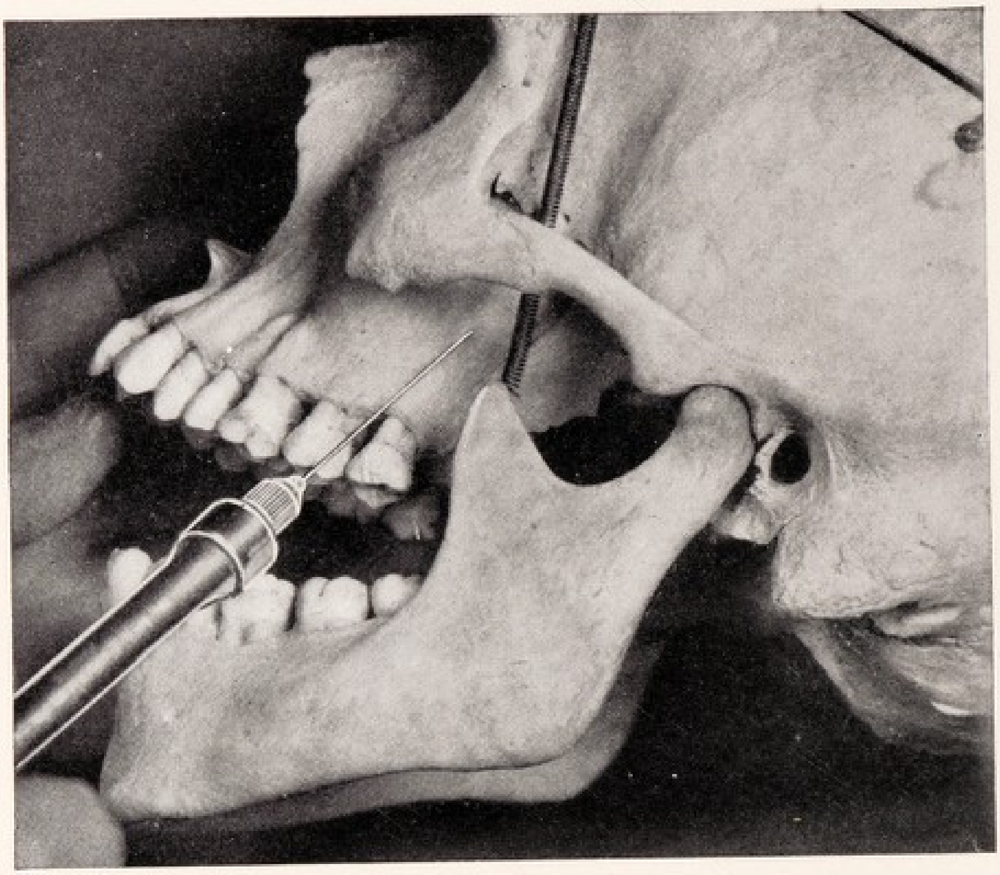


Fig. 5. Correct final position for the tuberosity injection. The needle point has been advanced to the posterior superior alveolar foramen

erence to avoiding the external pterygoid muscle and the venous plexus. This may be accomplished in the following manner:

A point between the last two upper teeth to erupt, is taken as a guide. Which teeth these last two may be will vary according to the age of the patient. In an adult, with the third molar erupted, the second and third molars are taken as a guide. When the third molar has not erupted, the first and second molars are used as guides. Before eruption of the second permanent molar, the second bicuspid and first permanent molar furnish the landmark. These teeth at the various ages point to the location of the posterior superior alveolar foramen on the tuberosity, and the tuberosity itself develops as the teeth erupt. In a child of ten the tuberosity is just back of the first permanent molar. At the age of fifteen the tuberosity will be back of the second molar. In the adult the tuberosity will be back of the third molar, while the first permanent molar will have a position corresponding to the point of origin of the malar process.

Fig. 6. Correct final position for the tuberosity injection, anterior view. Note the angle of the needle to permit apposition of its point with the posterior superior alveolar foramen

For this injection a 42 mm., 21 gauge needle of iridioplatinum, or rustless steel, is recommended. A heavy gauge needle will enable the operator to keep it as much as possible in contact with the tuberosity of the maxilla.

The injection on the left side for an adult with the third molar in place is as follows:

Standing in front of the patient, raise the lip with the thumb and the index finger, until the mucous fold is exposed. The mucous membrane at the point of insertion is painted with a 5% solution of iodin crystals in alcohol. The syringe and the needle are sterilized, etc. 2 c.c. of a recently prepared 2% procain solution are drawn into the syringe. Some operators find it more convenient to place the left arm around the patient's head when making a tuberosity injection on the left side. The syringe is held in a pen grasp and the needle is inserted as high as possible into the reflexion

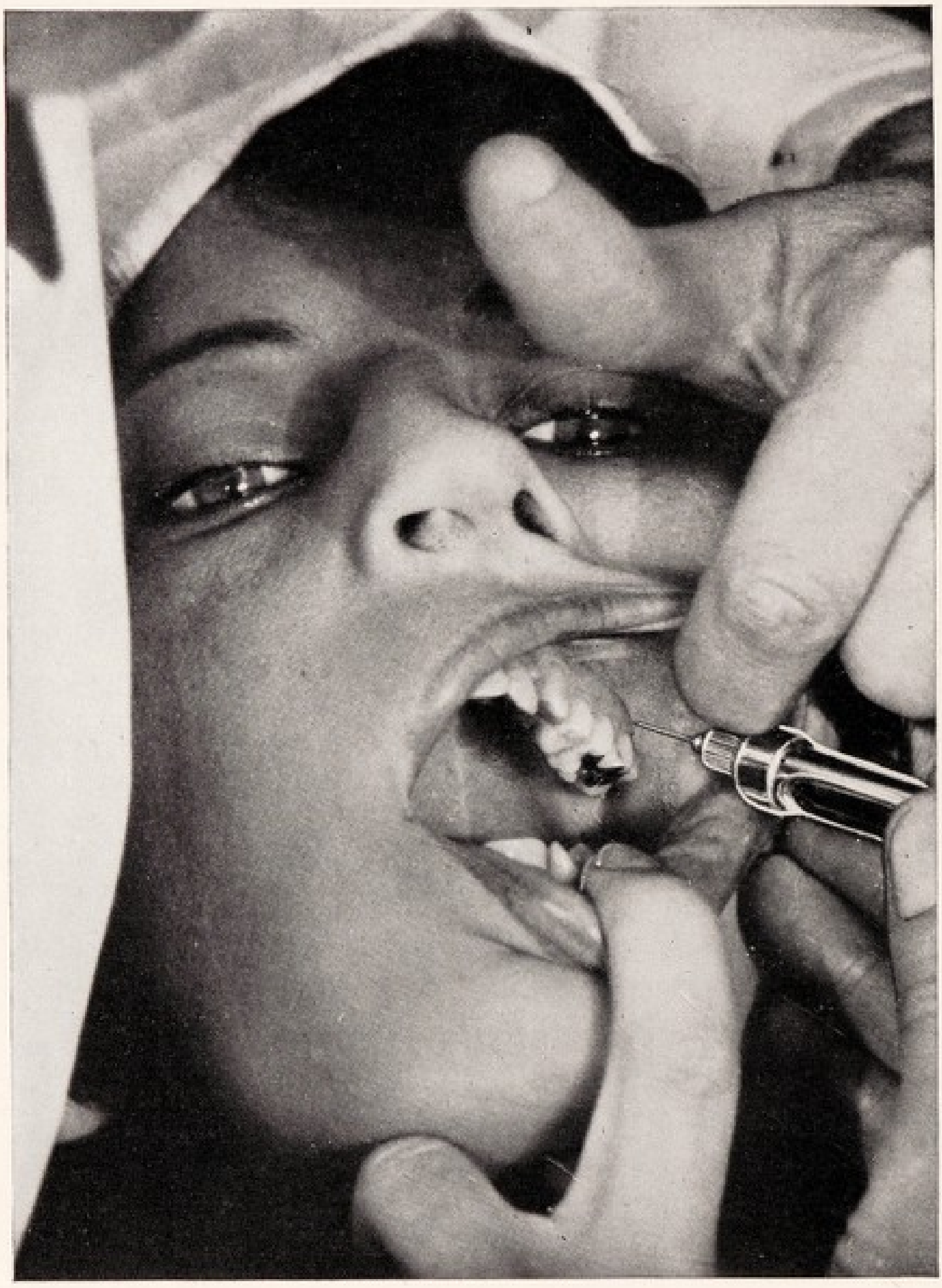


Fig. 7. Correct final position of needle on patient for the tuberosity injection. The syringe is turned outward and the needle advanced inward to the posterior superior alveolar foramen

of the mucous membrane, opposite the second molar tooth. (Figs. 2, 3, 4.) The needle is then passed over the distobuccal root of the second molar, holding the syringe vertically, parallel with the alveolar plate, and pointing posteriorally at an angle of about 45 degrees with the occlusal plane of the upper molar and bicuspid teeth. The needle is passed through the buccinator muscle, and directed over the root apices of the third molar, care being taken not to engage the periosteum. A few drops of the anesthetic solution are here injected. At this point, in order to

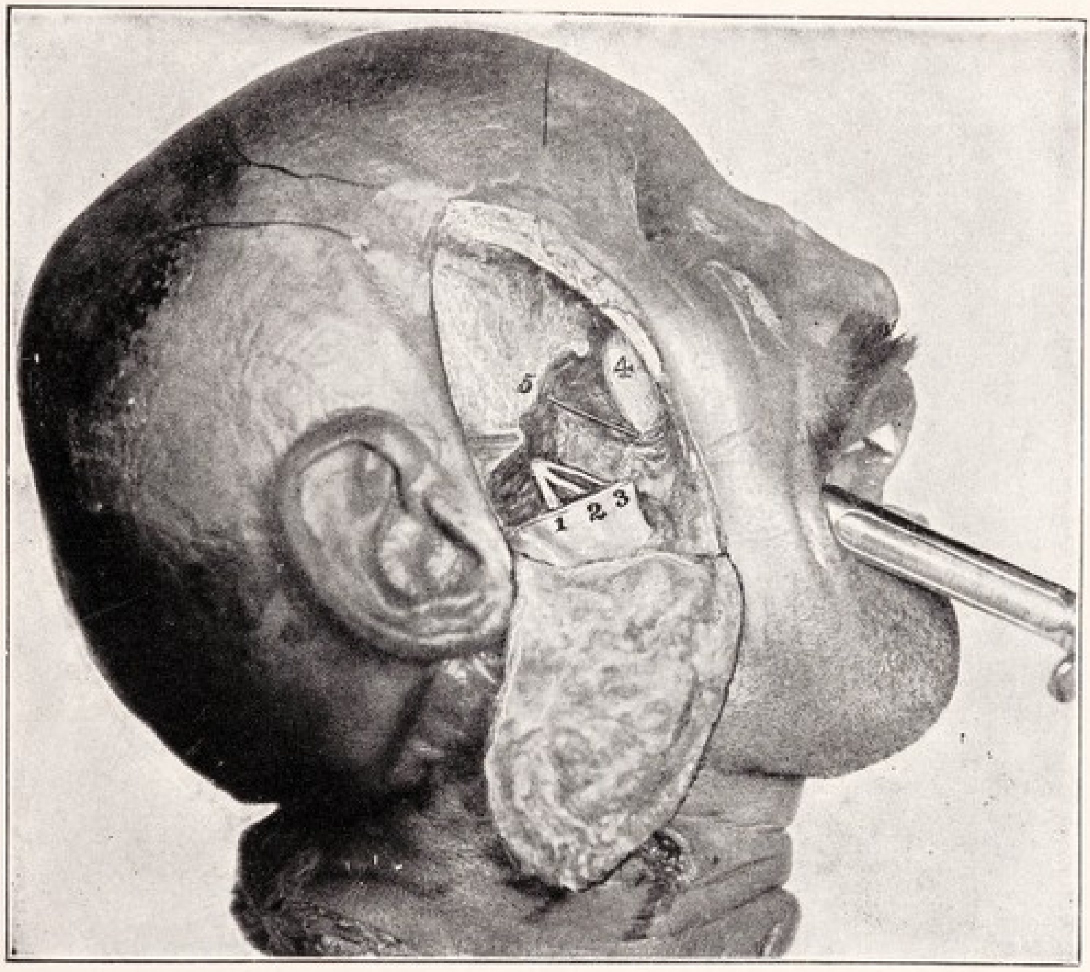


Fig. 8. Incorrect tuberosity injection on the right side. Needle is inserted too far posteriorly and would enter the external pterygoid muscle, which has been removed from this specimen. Note that the needle is away from the tuberosity. 1. Inferior dental nerve. 2. Lingual nerve. 3. Long buccal nerve. 4. Tuberosity. 5. Under surface of greater wing of sphenoid

reach the tuberosity and thence the posterior superior alveolar foramen, the needle is directed inward by turning the syringe outward as far as the angle of the mouth will permit. The needle is carried superiorly and internally, making an effort, as far as possible, to keep it in contact with the tuberosity. The needle is slowly and cautiously advanced, a few drops being deposited as it progresses, in order to establish a painless path, until about one inch of the needle has disappeared. The major part of the anesthetic solution is then slowly injected at the tuberosity. (Figs. 5, 6 and 7.) Not more than one inch of the needle should be inserted into the tissues. If the needle is inserted more than one inch, it will become embedded in the external petrygoid muscle and frequently will even strike the under surface of the greater wing of the sphenoid, or the external pterygoid plate. (Fig. 8.) The internal maxillary artery and the numerous anastomosing veins around the external pterygoid muscle may be invaded, resulting in hematoma. In this event also, the solution will be injected so far away from the posterior superior alveolar nerve that anesthesia may be very superficial, or entirely absent. Unless the anesthetic solution is deposited at the tuberosity, the only other possibility of securing anesthesia is by diffusion, and as this is usually accompanied by a venous exudation, care should be exercised to carry the needle in the right direction, and to the proper depth.

The mesiobuccal root of the first molar tooth is not always anesthetized by the tuberosity injection. This is due to the anastomosis of the middle superior alveolar nerve with the posterior superior alveolar nerve. Sensation in this manner is carried from the middle superior alveolar nerve to the first molar tooth. This nerve is given off in the infraorbital canal, and is not always reached by the tuberosity injection. About ten drops of the anesthetic solution are injected subperiosteally over the mesiobuccal root of the first molar, in order to produce complete anesthesia.

If the anesthetic solution is deposited at the tuberosity, profound anesthesia of the posterior superior alveolar nerve will take place within a few minutes, and will last for about one hour. The area anesthetized will include the first, second and third molar teeth, their buccal alveolar plate, periosteum and mucous membrane and subjacent tissue.

As was stated before, the tuberosity injection will suffice for those dental operations on the three upper molar teeth, which do not involve their palatal investment: such operations as extirpation of pulps, preparation of cavities, grinding teeth, etc. The inner nerve loop must also be anesthetized for the extraction of these teeth, or for any operation which involves the palatal alveolar plate and the soft structures covering the same.

Pterygomandibular Anesthesia

The mandibular injection is the most difficult of all the nerve blocking injections, and the one of most importance to the dentist.

A very low percentage of success will be attained by attempting to anesthetize the lower molars by infiltration. Examination of a mandible shows the great density and thickness of the alveolar plates in that region; because of this, diffusion of the anesthetic solution into the alveolus is very difficult, and sometimes impossible. With one mandibular injection, however, it is possible to anesthetize all the teeth to the median line, on the side of the injection.

The philosophy and technique of this injection have been very beautifully presented by Nevin and Puterbaugh in their text-book, *"Conduction, Infiltration and General Anesthesia in Dentistry."* This work is so admirable that it seems difficult to do better than to quote from the chapter describing this particular injection:

"The results obtained from this injection fully justify the expenditure of time and patience in mastering its proper technique. With but one injection at the sulcus mandibularis, the anesthetist is enabled to operate painlessly on that side of the mandible, having the added advantage of the patient's coöperation. Pulps may be extirpated, sensitive cavities prepared, roots extracted, abutments prepared: in short, any dental operation may be painlessly performed.

"The landmarks are positive, and therefore the percentage of success with this injection is greater than with any other. Yet no other nerve blocking injection is productive of so many post-anesthetic complications as the mandibular: not because these complications are unavoidable but because the injections are frequently made without proper understanding of the surrounding anatomical structures, and the needle is allowed to enter areas which one should carefully avoid.

Pterygomandibular Injection

"Let us suppose that we are to make a mandibular injection on the right side. The writer employs for this injection a 42mm. (1⅝") 21 gauge needle in steel or iridio-platinum, soldered to the hub. It is taken for granted that the solution has been properly prepared and that the needle has been properly sterilized. The operator stands in front of the patient and a little to the right. Holding the syringe in the right hand in the pen grasp, he palpates the landmarks with the index finger of the left hand. The finger is placed in the patient's mouth between the buccal surfaces of the lower teeth and the cheek and pushed gently backward until the anterior border of the ramus is encountered. The muscle band representing the anterior border of the masseter muscle is recognized, care being taken not to confuse it with the hard long ridge of the external oblique line nor with the anterior border of the ramus. The bulb of the index finger is passed along the external oblique line until its depression is located. (Figs.

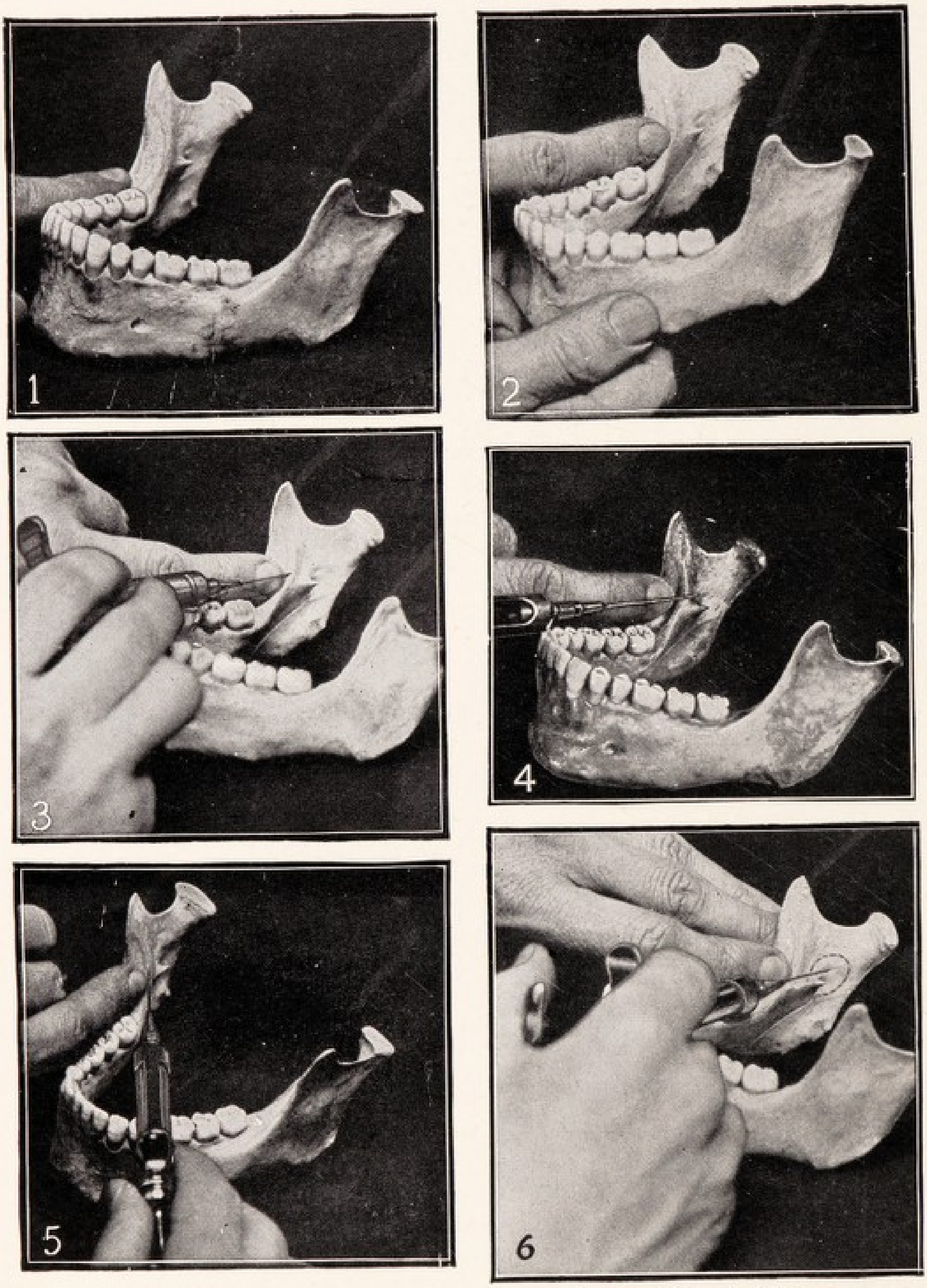


Fig. 9. Pterygomandibular injection shown on the mandible. 1. Palpating external oblique line (anterior border of ramus). 2. Bulb of index finger in depression of anterior border. 3. Insertion of needle. 4. Injection for lingual nerve. 5. Moving the syringe to the opposite side of the jaw. 6. Injection into the mandibular sulcus

Fig. 10. Palpating the external oblique line on patient

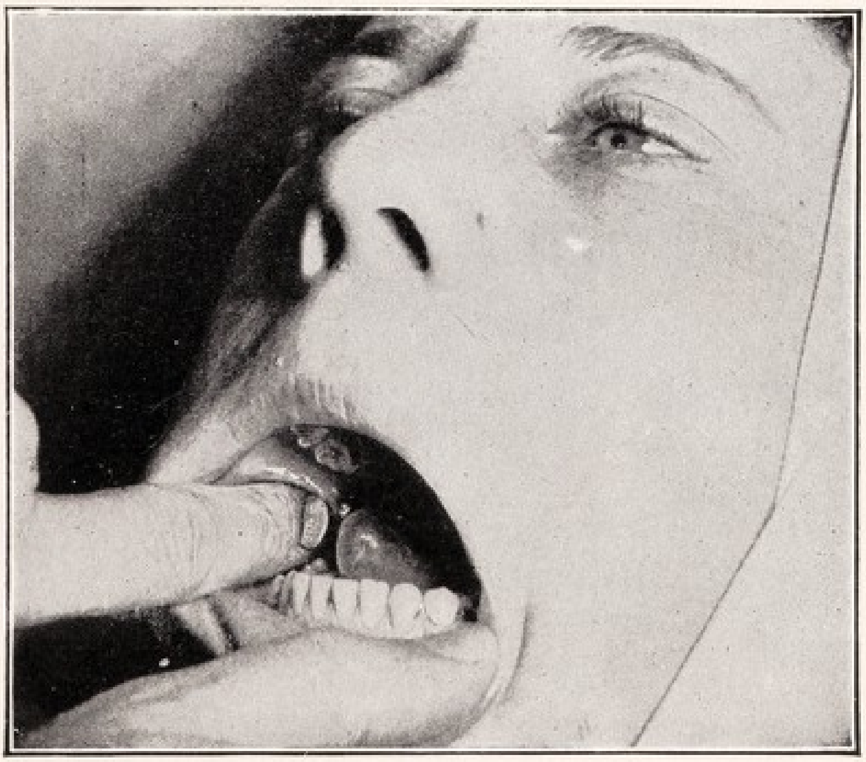


Fig. 11. Position of index finger for a mandibular injection. The bulb of the finger is in the depression of the anterior border

9-1 and 10.) With the bulb in the depression, the palpating finger is turned externally, the radial side of the finger being parallel with the occlusal surfaces of the lower molars and bicuspids, but not resting against those teeth. (Figs. 9-2 and 11.) Emphasis is particularly laid on the word 'parallel' because so many men, after locating the depression on the an-

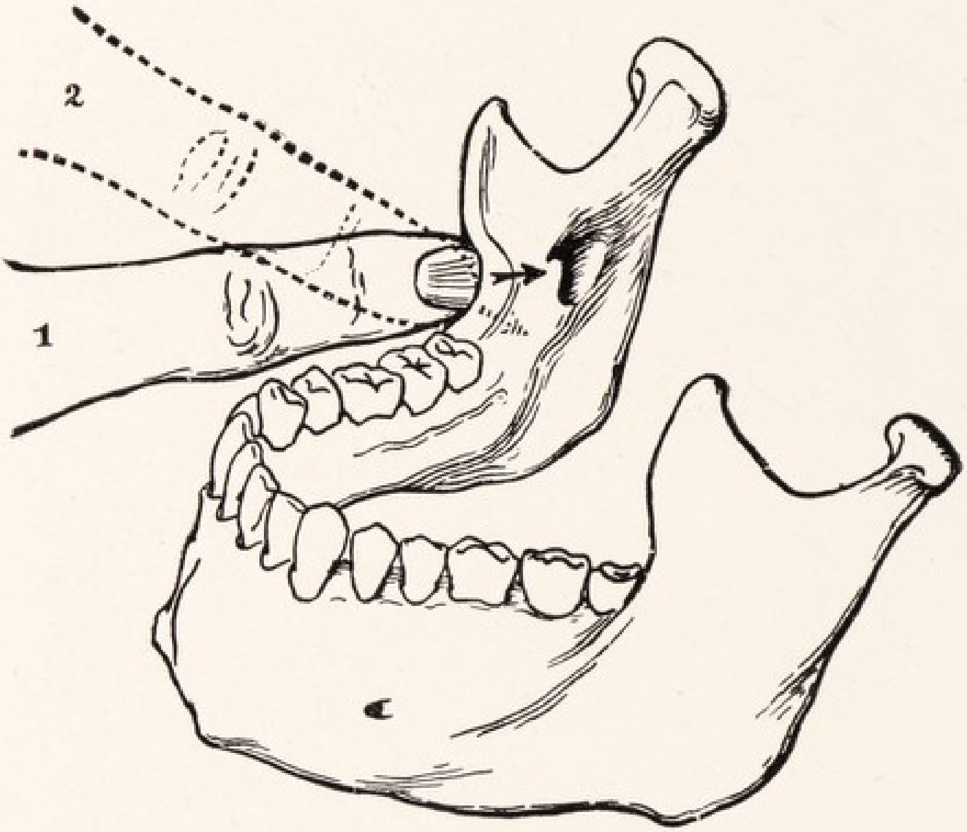


Fig. 12. Correct and incorrect position of the finger for a mandibular injection. 1. Correct position. Finger parallel to the occlusal surfaces of the lower teeth, but not resting upon these teeth. 2. Incorrect position. Finger not parallel to the occlusal plane of the teeth. Needle directed from the center of finger-nail will enter the insertion of the internal pterygoid muscle

terior border and placing the bulb of the index finger therein, will direct the finger in a distinctly downward direction, with the result that when the center of the finger-nail is taken as a guide, the needle will be inserted too low. (Fig. 12.) By resting the finger on the occlusal plane, the anesthetist's view of his field of operation is unnecessarily obstructed. In cases where the lower molars and bicuspids are in normal position and occlusion, the radial side of the index finger may be placed on a line parallel with the occlusal plane of those teeth, and the bulb of the finger resting upon the external oblique line may be used as a guide as to the proper height for the insertion of the needle. The depression in the anterior border of the ramus, in such cases, may be disregarded, or used only as an additional landmark. The bulb of the index finger is placed on the external oblique line and not in the postmolar fossa, nor on the internal oblique line. The mistake should not be made of placing the

Fig. 13. Insertion of needle in a mandibular injection on patient

finger too far internally, thus covering the internal oblique line. This would prevent us from striking bone with the needle.

"The bulb of the finger is slightly withdrawn and the mucosa painted with tincture of iodin. The syringe, with an attached sterile needle, is held in the pen grasp and the needle inserted at the height of the center of the finger-nail, striking bone. Either the internal oblique line or the postmolar fossa may be encountered. (Figs. 9-3 and 13.) The syringe is held parallel to the teeth on the side of the injection. Some operators prefer inserting their needle from the opposite side. The writer's objection to this procedure is that in so doing, the operator may engage some of the fibers of the internal pterygoid muscle, and when bringing the syringe parallel to the side of the injection, some of the fibers of the internal pterygoid muscle may be engaged and unnecessarily traumatized. By inserting the needle parallel to the teeth on the side of the injection, only the gum tissue covering the internal oblique line and a few fibers of the buccinator muscle are penetrated, giving the patient very little, if any, pain. If the needle has been correctly inserted and bone encountered,

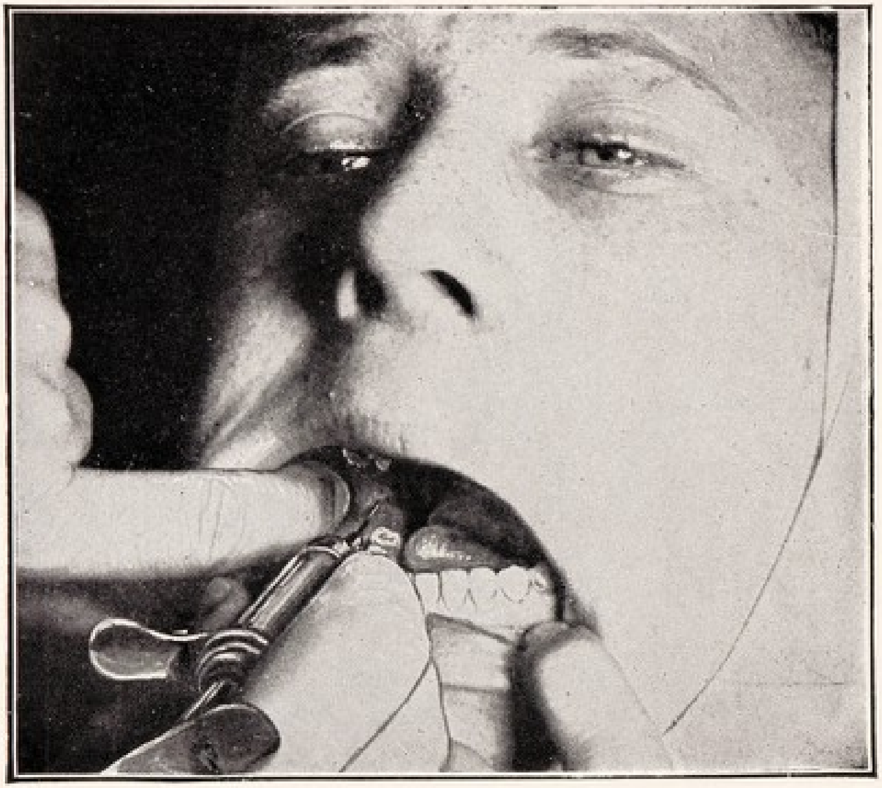


Fig. 14. Position for injection for lingual nerve

the syringe and needle will be on a line with the buccal surface of the molars and bicuspids, for it will be remembered that the internal oblique line will be found on that plane. The needle wil! be about one centimeter (a little less than half an inch) above the occlusal plane of the teeth in a normal case.

"The needle strikes bone for but a fraction of a second. This is only to assure ourselves that we are not entering too far toward the median line, in this manner engaging the internal pterygoid muscle. By maintaining the proper plane, namely the center of the finger-nail as it rests in the depression on the anterior border of the ramus, we are reasonably certain that the insertion of the internal pterygoid muscle will be cleared. In other words, we are beginning correctly, which is so essential to the successful termination of any undertaking.

"The needle is now disengaged from the periosteum, but not withdrawn, and is advanced about 6 mm. (¼in.), clearing the internal oblique line, yet holding the needle in lateral contact with the internal oblique

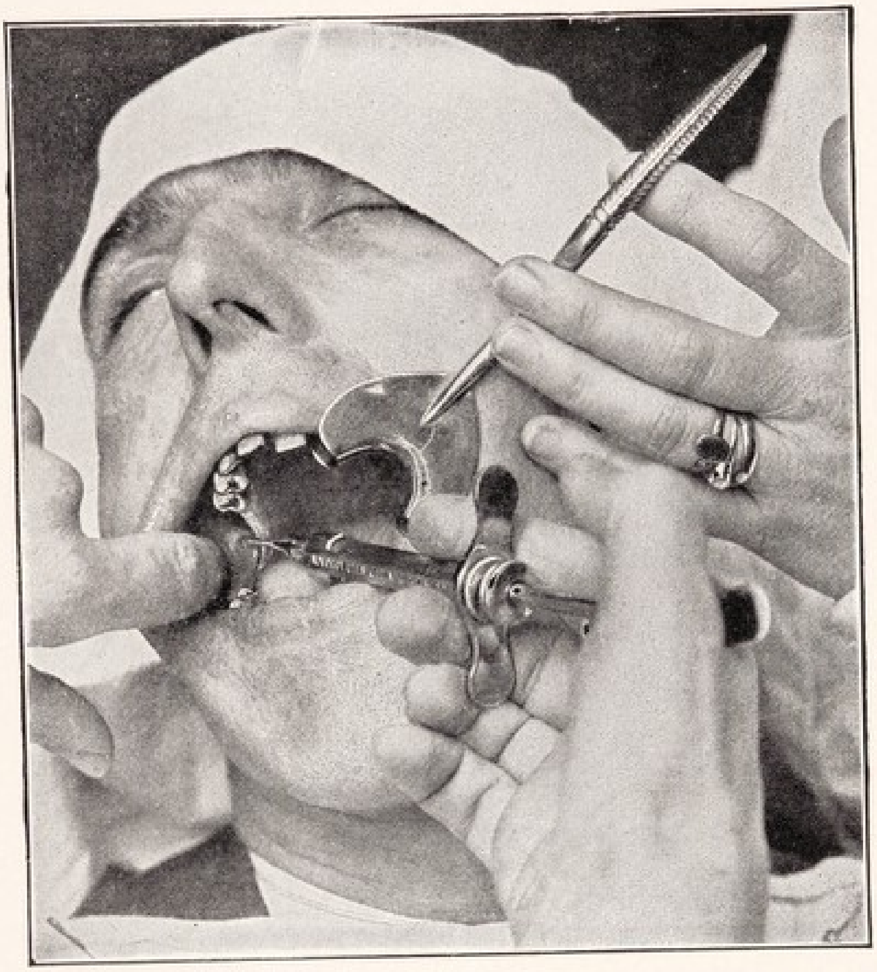


Fig. 15. Final position of needle in a mandibular injection. Solution being deposited in the mandibular sulcus

line. (Figs. 9-4 and 14.) This is very important. The writer has seen many operators, who, after striking the internal oblique line, will carry the needle quite a distance away from it, enter the internal pterygoid muscle and in this manner entirely destroy the advantages gained by the precautions taken at the initial puncture. It is important to release the needle from the periosteum; otherwise it will be held tightly against the internal oblique line, thus interfering with the free movements of the syringe during the injection and sometimes causing the needle to break. Occasionally, considerable resistance to the penetration of the needle may be experienced. This is due to the temporal tendon, which in many cases may be inserted as low down as the lower third molar. When these cases are met, sufficient force should be used to penetrate the tendon and to proceed with the injection. The needle is now in the pterygomandibular space between the

Fig. 16. Insertion of needle in a mandibular injection on the left side

lingual nerve and the inner surface of the ramus. About 8 to 10 minims of the solution are injected to anesthetize the lingual nerve. This will anesthetize the mucous membrane, subjacent tissues of the floor of the mouth and mandible. Quite frequently the long buccal nerve will be anesthetized by this injection also.

"The inferior dental nerve remains to be anesthetized. It must be remembered that the ramus diverges externally from the body of the mandible. In order to avoid entering the internal pterygoid muscle and still keep the needle in the pterygomandibular space, the syringe at this point is swung to the opposite side (Fig. 9-5), advancing the needle posteriorly and externally, endeavoring to keep the needle in close proximity to bone until the point of the needle gently encounters the posterior wall of the sulcus mandibularis. (Figs. 9-6 and 15.)

"The exact position of the syringe on the opposite side is of secondary consideration, our aim being primarily to be in contact with the ascending ramus, so as to enter the mandibular sulcus and encounter its posterior

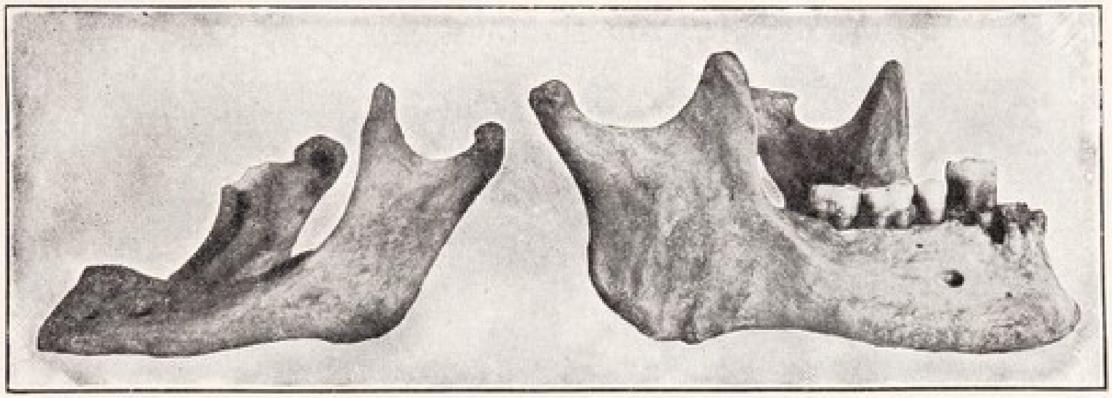


Fig. 17. One ramus is twice as wide as the other

wall. Examining the topographical anatomy of the ascending ramus, we cannot fail to note that if the needle is progressed above the lingula, in constant contact with bone, it must of necessity finally stop at the posterior boundary of the sulcus. When the needle is in contact with bone at this point, it is slightly withdrawn and the remaining anesthetic solution of the 2 c.c. syringeful slowly injected. Care should be exercised not to strike bone too forcefully and repeatedly, as this would tend to produce periosteal inflammation and after pain.

Injection on the Left Side

"The technique of injection on the left side of the mandible is the same as on the right except the manner of palpating the structures. This, however, is a question of convenience to the operator. Those operators who are able to manipulate the syringe with their left hand may palpate with their right index finger and inject with their left hand. The writer being unable to inject easily with his left hand, palpates the external oblique line with the left hand, placing the bulb of his left index finger in the proper position. He then proceeds with the insertion of the needle with the right hand, crossing arms. After beginning the injection the left hand is removed. Some operators find it convenient to place the left arm around the patient's head, palpate in this manner with the left index finger, injecting with the right hand. (Fig. 16.)

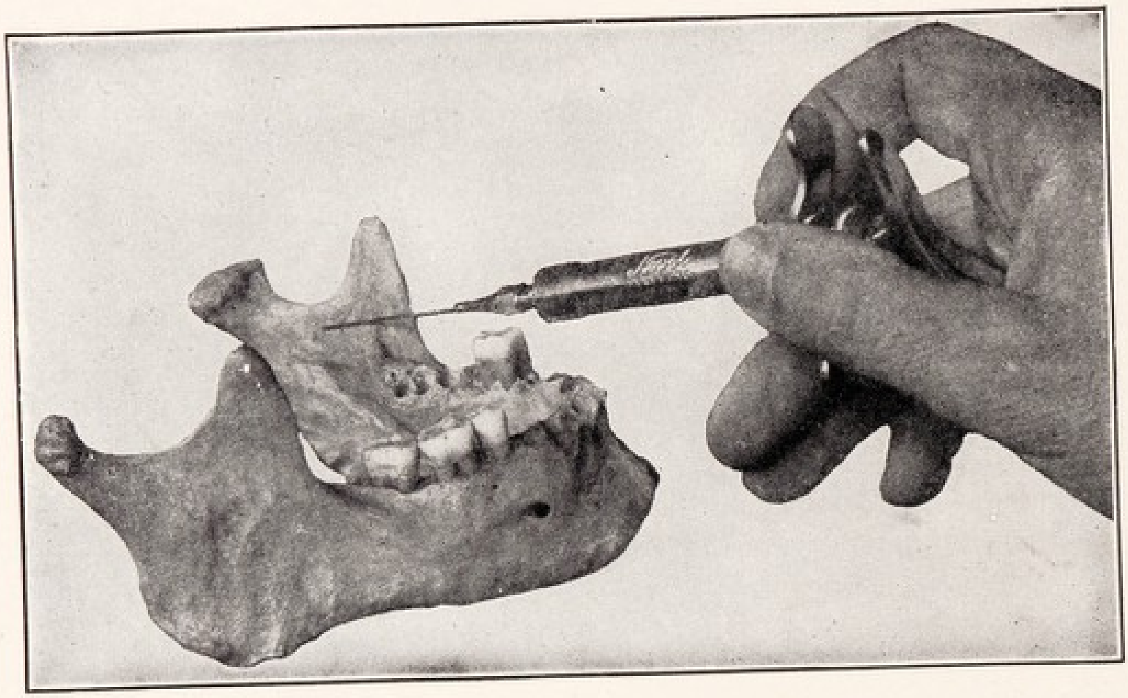


Fig. 18. In this mandible one inch insertion of the needle from the soft tissues will not reach the inferior dental nerve

Average Length of the Insertion of Needle

"While it may be true that in many cases a one inch insertion of the needle may produce satisfactory results, nevertheless in an almost equal number of cases this rule would fail to produce anesthesia. In the writer's clinical experience the depth of the insertion of the needle in a mandibular injection has varied from less than one half inch, in a child of 6 years, to more than one and one half inches in an adult, entirely depending upon the width of the ramus and therefore upon the corresponding distance of the mandibular sulcus and from the point of insertion. Fig. 17 illustrates the comparative width of two mandibles, one being 20 mm., while the other is 43 mm. wide. One-inch insertion from the soft tissues in one will not carry the needle far enough to reach the sulcus, and therefore no anesthesia will be produced; again one inch insertion from the soft tissues in the other mandible may carry the needle too far back, past the posterior border of the ramus and into the parotid gland. (Figs. 18 and 19.) It is quite evident therefore that the only safe and certain guide as to the length of insertion of the needle is to find the posterior wall of the sulcus and then make the injection.

Symptoms and Tests

"The first symptoms of anesthesia will be manifested at the lips. The patient will complain of a peculiar feeling, either at the median line, or at the corner of the mouth. This sensation will gradually become more

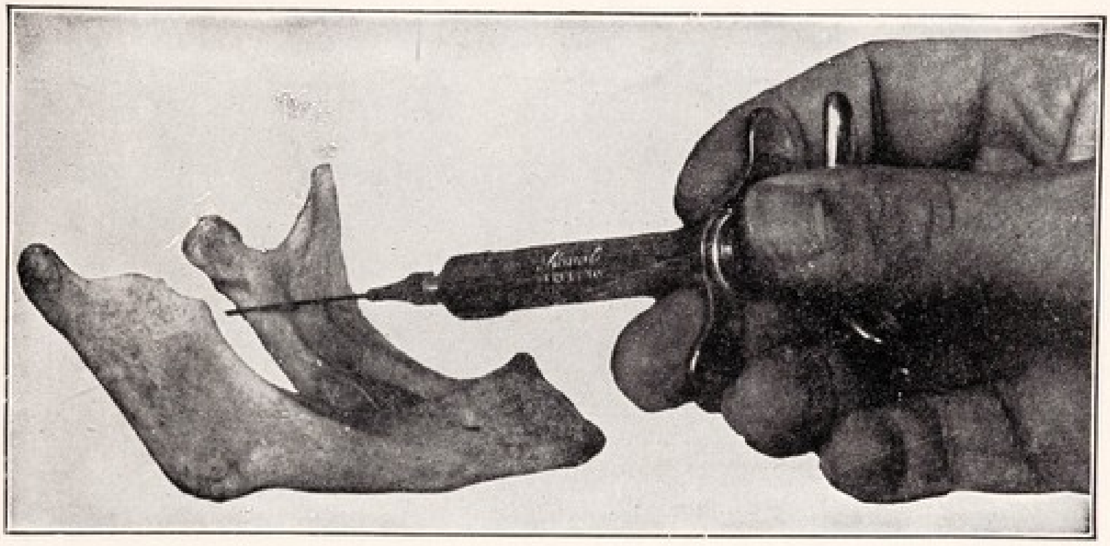


Fig. 19. One inch insertion from the soft tissues in this case would carry the needle past the posterior border of the ramus

intense. If the injection has been correctly performed, profound anesthesia will be obtained in from five to ten minutes. The patient is first aware of the anesthesia in the lip because this structure is more responsive to the blocking of the afferent impulses at the mandibular sulcus than is the mandible itself. Anesthesia does not take place at first in the lips, as some anesthetists believe. Anesthesia, once established, will last from one to three hours.

"After the injection has been made and symptoms observed, the mucous membrane must be tested for the extent of anesthesia obtained. The symptoms alone are not sufficient, for the patient is often unable to analyze his own sensations because of the psychic effect of the impending operation.

"The mucous membrane is tested lingually to determine whether the lingual nerve has been anesthetized. Pressure is exerted by the points of a pair of cotton tweezers, or other suitable instrument. Next, the buccal mucous membrane of the molar region is tested. If there is no pain, it would indicate that the long buccal nerve has been anesthetized and nothing else. The inferior dental nerve may have been anesthetized and, on the other hand, it may not have been reached by the solution. The writer has had many cases in his clinical experience where the long buccal nerve has been anesthetized while the inferior dental nerve has not. Anesthesia of the long buccal nerve is necessary only when the lower molar teeth are to be extracted. We next test the anesthesia of the buccal mucous membrane between the bicuspid teeth, or between the cuspid and first bicuspid. When there is no response to this test we know that the inferior dental nerve has been blocked. It must be remembered that the buccal mucous membrane of the bicuspids is supplied by the mental nerve and if this nerve does not respond to stimulation, it naturally follows that the inferior dental nerve has also been anesthetized by the injection, since the mental nerve is a branch of the inferior dental.

"The numbness of the tongue, of course, does indicate that the lingual nerve has been anesthetized. The dryness of the mouth after a mandibular injection is due to the blocking of the chorda tympani, a secretory nerve and a branch of the facial. This nerve joins the lingual and they run together to the tongue and to the submaxillary gland, controlling the secretion of the saliva as well as providing the sense of taste to the tip of the tongue. When the lingual nerve is anesthetized, the chorda tympani is also frequently blocked, with the resultant interference of salivary secretion. Hence dryness of the mouth.

Anesthesia of the Long Buccal Nerve

"It has never been satisfactorily explained why the long buccal nerve is often anesthetized by a mandibular injection, nor why it remains unanesthetized just as often. Some maintain that this phenomenon is due to the fact that the long buccal nerve may sometimes be given off at the inferior dental foramen and is therefore anesthetized by a mandibular injection together with the inferior dental. It is the writer's opinion that the long buccal nerve is constant in so far as its origin is concerned, namely, it is given off from the anterior root of the mandibular nerve almost as soon as it leaves the cranium by the foramen ovale. Its course, however, toward the cheek is not constant. Sometimes the long buccal nerve may run along the anterior border of the ramus, or just slightly internally to it. In such cases the nerve will be anesthetized by the injecting solution intended for the lingual nerve. At other times the course of the long buccal nerve is more internally, along the tuberosity of the superior maxillary bone, before its ramification into the buccinator muscle. In such cases a lingual or mandibular injection will fail to reach it and therefore anesthesia of the buccal mucous membrane of the lower molar region will not be obtained.

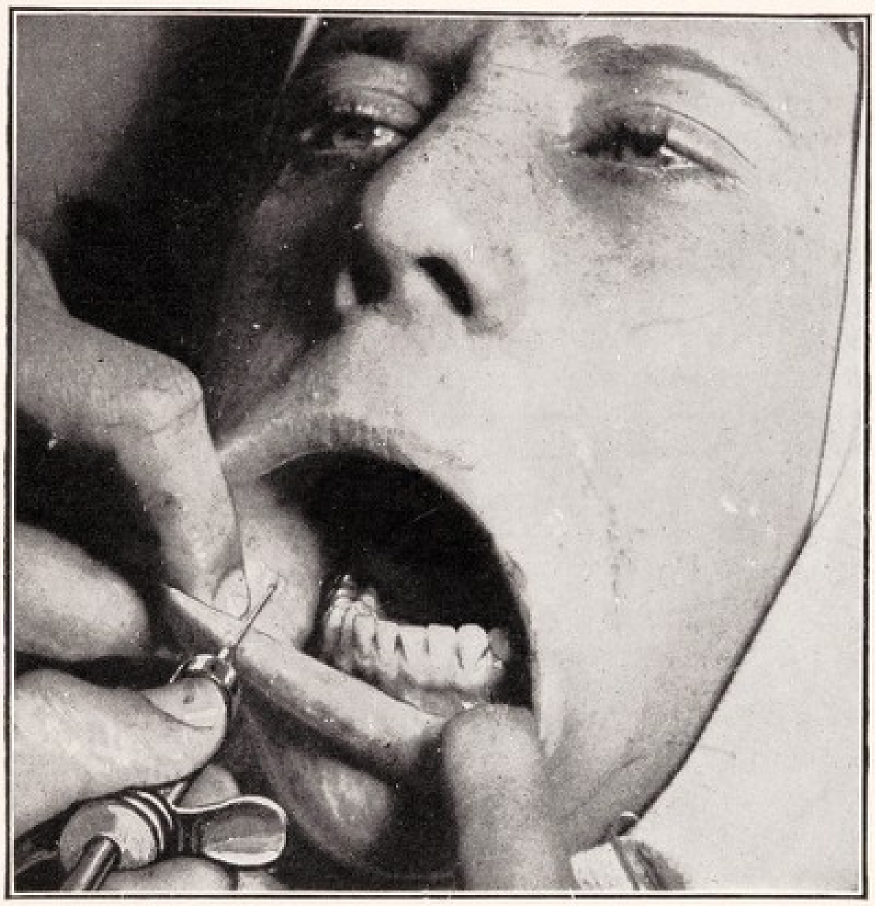


Fig. 20. Blocking the long buccal nerve

"If the long buccal nerve remains unanesthetized, the anesthesia of the molar teeth may be completed, in the absence of infection, by a submucous injection of the buccal mucous membrane of the area to be operated on. But in cases of infection, infiltration into the inflamed and infected area is contraindicated. The long buccal nerve is then anesthetized in the following manner. A long, 42 mm. (1⅝") 23 gauge needle is inserted just beneath the mucous membrane of the buccinator muscle, beginning at the first molar tooth on a plane of the occlusal surfaces of the lower molar and bicuspid teeth. The needle is then advanced posteriorly, injecting the solution as the needle progresses until the postmolar fossa is encountered, where about 1 c.c. of the anesthetizing solution is deposited.

This will generally anesthetize the terminal branches of the long buccal nerve or it may block the main branch of the nerve which supplies the buccal mucous membrane of the lower region. In this injection care must be taken not to insert the needle deeply into the muscle fibers of the buccinator muscle. Also not to insert the needle at too high a plane, for fear of entering Stenson's duct and discharging a solution therein. About 1 c.c. of a 2% procain solution is deposited in this injection. (Fig. 20.)*"

Infiltration Anesthesia

This method of producing anesthesia is sometimes referred to as peripheral or terminal anesthesia, because the peripheral or terminal nerve filaments of a certain area are anesthetized by injecting the anesthetic solution into, or around that area.

Infiltration anesthesia was the first type of local anesthesia by injection. Probably because of the long familiarity of the profession with this method of securing anesthesia it has remained the most popular. The direct avenue of approach of the needle to the area to be anesthetized offers a simplicity of technique which also makes its appeal.

This method has great value where the anatomical characteristics are favorable, but should be excluded in regions where the anatomy of the tissues militates against success. It is most effective where there are numerous small foramina in the bony structure overlying the tooth root. Where these are lacking this method will seldom be successful.

Infiltration anesthesia is usually effective in young patients, the reason being the relatively greater porosity of the alveolar bone in the young. As age advances the bone becomes denser and absorption of anesthetic fluid is correspondingly slower.

In the superior maxillary bones there are numerous small foramina, especially around the anterior teeth. The palatal process and also the canine and incisive fossæ present numerous small foramina.

The alveolar bone around the six lower anterior teeth contains numerous foramina also. For this reason most of the upper teeth and the six lower anterior teeth are suitable for infiltration anesthesia.

The alveolar processes of the maxillæ and mandible consist of a dense outer cortical layer of compact bone, which covers an inner cancellous structure. The cortical layer of the mandible is much denser and thicker than that of the maxillæ. The thick outer cortical layer of the mandible

* Text and illustrations relating to pterygomandibular injections, etc., to this point, quoted from Nevin and Puterbaugh, by permission.

has very few formina in the bicuspid and molar region. Here the walls of the alveoli are unusually thick and dense, rendering the diffusion of the anesthetic solution very difficult. For this reason the lower bicuspids and molars are not suitable for infiltration anesthesia. The mandibular injection must be used to secure satisfactory anesthesia in this region.

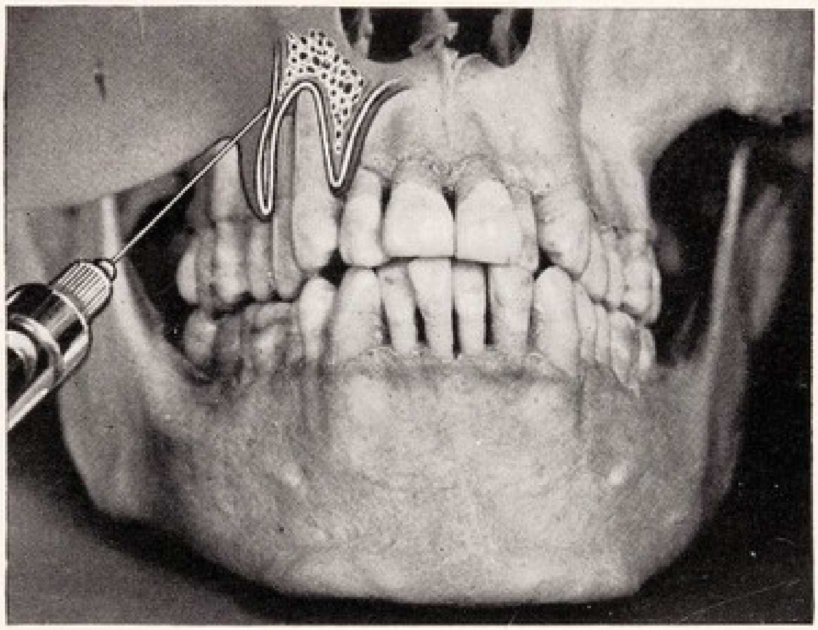


Fig. 21. Diagrammatic representation of the lip as drawn out to locate the muco-buccal fold. The insertion of the needle into this fold and its angle to the alveolar mucosa is shown

The average patient is reluctant to submit to either infiltration, or conduction anesthesia, through fear of the pain which is usually produced by the insertion of the needle into the tissues. Others refuse this method because of unfortunate experiences in the way of postoperative pain. When it is considered that procain is non-toxic and non-protoplasmic it would be logical to assume that most of the postoperative pain and most of the pain produced by the introduction of the needle is to be charged to faulty technique. If several punctures are made close together, or if an injection is made into the dense fibrous tissue, traumatism is bound to occur. Not only does this cause pain at the time of injection, but postoperative pain will result and there may even be ulceration and sloughing of tissue. In like manner if the needle is inserted midway between the gingival margin and the region of the apex, and forced diagonally toward the apex, the connective tissue fibres will be torn, resulting in severe postoperative pain. If the correct technique is employed, in a properly selected case, one injection made by the infiltration method will usually suffice for such operations as cavity preparation, or pulp extirpation.

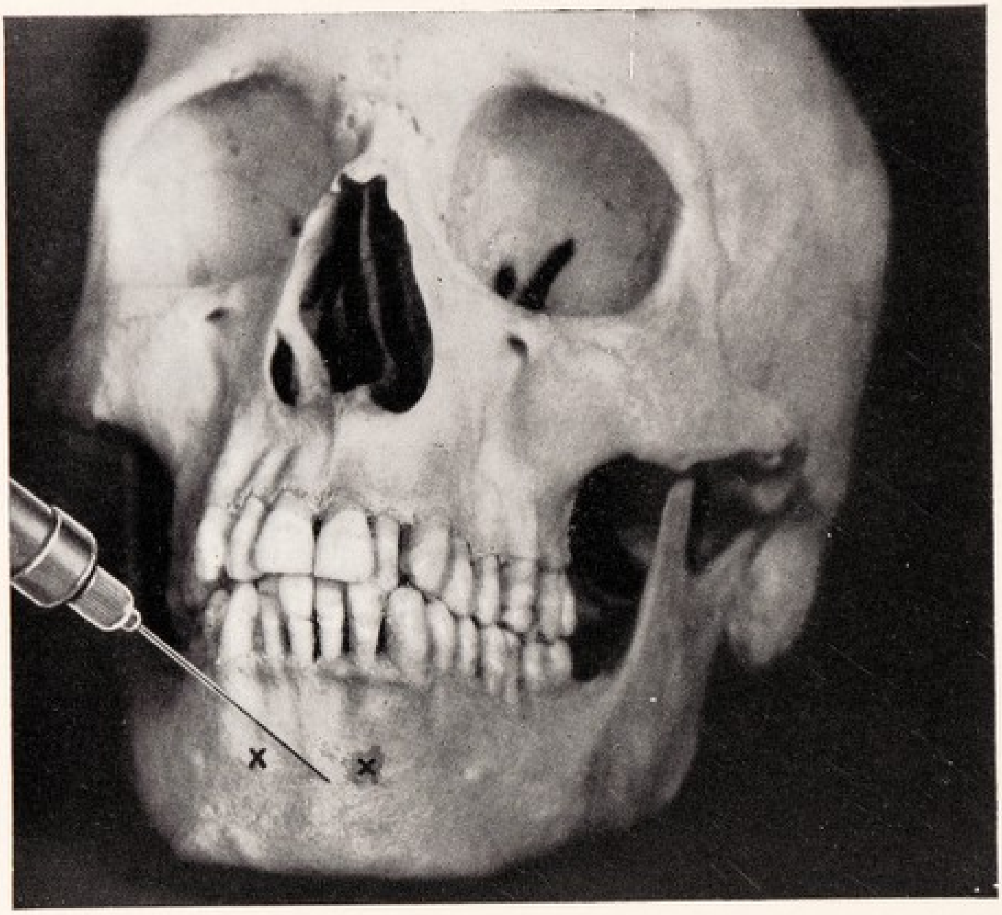


Fig. 22. Position of needle point for anesthesia of lower left central incisor. If the needle is inserted in the incisive fossæ (x-x) anesthesia of the six lower anterior teeth may be obtained

The first consideration and technique is the selection of the needle. For infiltration anesthesia it is possible to use a needle of very fine gauge. No. 26, or even smaller. This needle should have a short bevel. The smaller the needle the less pain it will produce when it penetrates the soft tissues. Heavier needles are sometimes needed in conduction anesthesia, where it is necessary to keep the needle in close proximity to the bone in order to deposit the solution at a definite, predetermined spot. Even when the heavier needle must be used, much of the pain of injection can be avoided if the initial puncture and preliminary deposit of anesthetic solution be made with a fine gauge, short bevel, needle. After the technique for conduction anesthesia has been mastered, a needle of as small a gauge as possible should be used.

Anesthesia of Upper Bicuspid

The technique for infiltration injection of an upper bicuspid is as follows:

Request the patient to close the jaws and to relax the cheeks and lips. Grasp the upper lip at the corner of the mouth with the thumb and index finger of the left hand and pull the lip down, out and away from the teeth. When in this position an angle will be formed by the lip and the gums which is known as the mucobuccal fold. The mucosa of this fold is painted with tincture of iodin at the point where the needle is to be inserted, which is at the apex of the angle, and opposite the tooth which is to be anesthetized.

The needle is inserted at the apex of the mucobuccal fold, its insertion being facilitated by the fact that when the lip is pulled down and away from the teeth, the mucous membrane lining the mucobuccal fold is stretched until it becomes taut. This also largely eliminates pain when the puncture is made. Furthermore the areolar connective tissue of this region, and the mucous membrane lining the mucobuccal fold have very little sensory innervation. For making the puncture the syringe is held with a pen grasp and it is directed through the apex of the mucobuccal fold at an angle of approximately forty-five degrees to the cortical plate. (Fig. 21.)

After the needle has passed through the mucous membrane a few drops of the anesthetic solution are deposited. A brief pause is made to permit anesthesia at the point of this deposit. The needle is then slowly advanced toward the alveolar process, opposite the apex of the tooth, depositing solution en route as required. At the apical region approximately 1 1/2 c.c. of the anesthetic solution is slowly expelled from the syringe. The cortical bone in this region is usually very thin and the anesthetic solution will quickly reach the apex of the tooth by permeating through the alveolar bone and periosteum, finally reaching the tooth pulp by a process of absorption and diffusion.

About five or ten minutes should suffice to give adequate anesthesia for operation. During this time the rubber dam may be adjusted, instruments laid out, etc. For such operations as cavity preparation, the preparation of teeth for three-quarter crowns, or pulp extirpation, blocking of the outer nerve loop, as described, will give sufficient anesthesia. In rare cases it may be necessary to inject 1/4 c.c. of the anesthetic solution on the palatal side of the alveolar process opposite the apex of the tooth. The needle should be introduced midway between the gingival border and the median line of the palate, as the connective tissue is less dense in this region. Less solution is required here because the palatal alveolar plate contains a large number of small foramina which greatly facilitate absorption.

When the technique described here for buccal and palatal infiltration is used, the anesthetic solution is deposited in the areolar tissue instead of in the dense fibrous tissue which is found nearer the neck of the tooth. The areolar tissue accommodates the solution with less traumatism and the result is an entire freedom from postoperative pain at the side of the injection.

Lower Anterior Teeth

On the lower jaw this technique is used, as stated before, for the six anterior teeth only. The preliminary technique is the same as for the upper jaw as regards the location of the angle of the mucobuccal fold. When the needle is inserted it is carried below the apical region of the teeth rather than just opposite the apex as in the upper jaw. (Fig. 22.) It is at this region, namely, in the incisive fossæ that the penetrating foramina are most numerous. Here it is frequently found that three teeth may be anesthetized with one injection, or anesthesia of the six lower anterior teeth may be obtained with two injections. (See x-x, Fig. 22.)

CHAPTER IX

The Pulp Canal

There are certain general principles underlying the mechanical aspects of the treatment of pulp canals which are fundamental in successful case management. These have to do with the matters of obtaining access, clearing away overhanging dentin and the enlargement of canals. This statement is trite, but observation in clinics and postgraduate courses, indicates a general tendency on the part of dentists to allow their attention to be distracted from these mechanical fundamentals, with resultant failure in treatment.

Treatment with drugs, or other therapeutic agents is futile unless the mechanical procedures have been properly carried out.

The dentist's first consideration then is to understand the shape, position and size of the pulp chamber and the number of canals, together with their size and point of entrance into the pulp chamber. It should be unnecessary to remind dentists who have undoubtedly studied these details during their undergraduate days, as well as during years of practice, of the anatomy of the pulp canals in the various teeth. Again, observation forces one to the belief that many important and commonly occurring anatomical features of these structures are often overlooked. Furthermore it is well to bear in mind that many pulp canals present minute irregularities of form, which may be difficult to detect by vision or exploration, but which may have a profound influence on the success of treatment. In attempting so important a procedure as the construction of a bridge, utilizing a pulpless tooth as an abutment, it is of the first importance that the pulp canal work shall be carried out with full attention to all the factors which may influence its success.

The first requisite in treatment is the opening of the pulp chamber, whether previously exposed by caries or not, in such a manner that no overhanging dentin is left at any point in its periphery. Included in this operation is the matter of establishing not only access but convenience of approach to the pulp canal or canals. This includes the cutting away of dentin and enamel wherever this is found to present an interference to an approach to the canal in line with its lumen. The canal itself should nearly always be enlarged to an appreciable degree, especially if it is at all constricted through natural anatomical form, as in the buccal roots of the upper molars, or by deposition of secondary dentin which is so often encountered. This enlargement, which should produce a lumen nearly

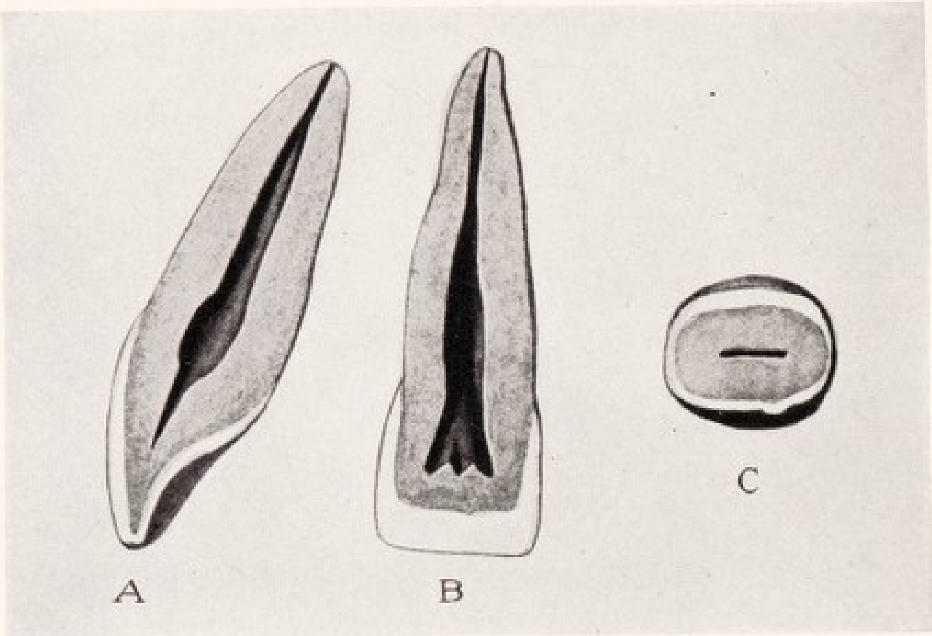


Fig. 23. Upper central incisor. (A) labiolingual cross section. (B) mesiodistal cross section. (C) cross section through crown. (This and the following illustrations of the anatomy of the pulp canals are reproduced from *Anatomie fur Zahnarzte*: Julius Tandler, through the courtesy of the author)

circular in cross section, has two objects. One is to facilitate medicinal treatment and the subsequent filling of the canal. The other object is to clear away the tiny irregularities so frequently found along the canal wall and which render impossible proper cleansing and filling of the canal.

Upper Central Incisor

In the upper central incisor the pulp chamber, as found in the adult, is usually somewhat spindle shaped and is virtually an enlargement of the coronal end of the pulp canal. Its incisal end may terminate in a rounded point, but it more often flattens out to a thin wedge, as in C Fig. 23. In the latter case enlargement of the incisal portion is indicated as a part of the mechanical operation. The canal is usually quite large and straight. It is nearly round in cross section and therefore requires but little enlargement in the average case.

Access to the pulp chamber and the canal must be in line with the root. This requires opening through the lingual surface, unless caries, or accident,

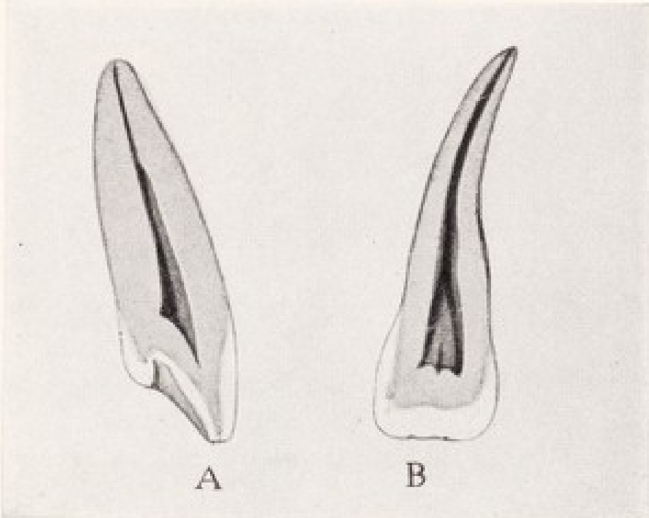


Fig. 24. Upper lateral incisor. (A) labiolingual cross section. (B) mesiodistal cross section

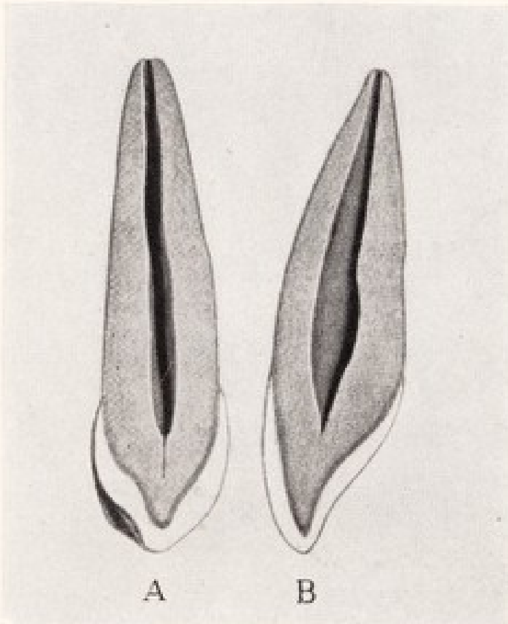


Fig. 25. Upper cuspid. (A) mesiodistal cross section. (B) labiolingual cross section

has provided a direct access through extreme loss of mesial or distal tooth substance. Even in the latter case overextension is preferable to lack of direct line access.

Upper Lateral Incisor

In the upper lateral incisor the pulp chamber resembles that of the central incisor. The canal tends to be relatively smaller and is more subject to constriction, especially in its mesiodistal diameter. Enlargement of the canal of the upper lateral incisor is practically always indicated.

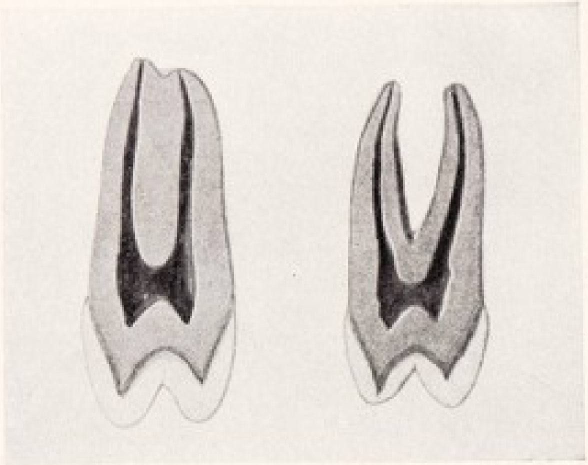


Fig. 26

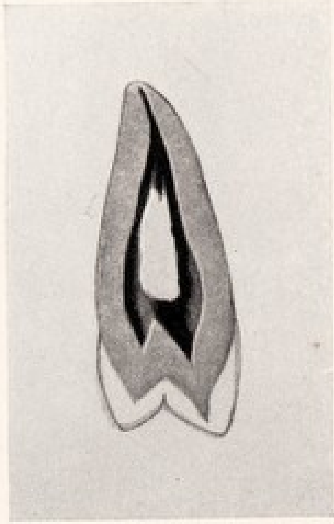


Fig. 27

Fig. 26. Buccolingual cross sections of typical upper first bicuspids
Fig. 27. Buccolingual cross section of upper second bicuspid showing a common anomaly, namely division of the root canal

The access to the canal is obtained in the same manner as for the upper central incisor.

The Upper Cuspid

The upper cuspid has a larger pulp chamber than the upper central incisor, and its canal also is usually somewhat larger than that of the central incisor. The canal is quite regular in shape, and enlargement is seldom necessary for complete cleansing. The great length of the cuspid root, however, renders difficult the insertion of a root filling to the apex. Enlargement of the coronal portion of the canal is usually indicated to facilitate this procedure.

Upper First Bicuspid

In the upper first bicuspid the pulp chamber in cross section is ovoid, corresponding to the points of exit of the two canals. The occurrence of two canals in this tooth is fairly constant. Unless completely obliterated by secondary dentin each canal must be opened and filled. It is surprising to note the number of upper first bicuspids which, when examined radiographically, show but one pulp canal filling. These canals are often constricted and exhibit a curvature, in many instances, amounting almost to a right angle turn.

Where the curvature is less abrupt, the canals may be opened to the apex, if sufficient enlargement is provided in the coronal third of their length.

Access should be through the occlusal surface. The opening should be extended sufficiently toward the buccal and lingual sides to permit access in the direct line of the pulp canals. To work around a curve at the entrance of a canal is to invite failure.

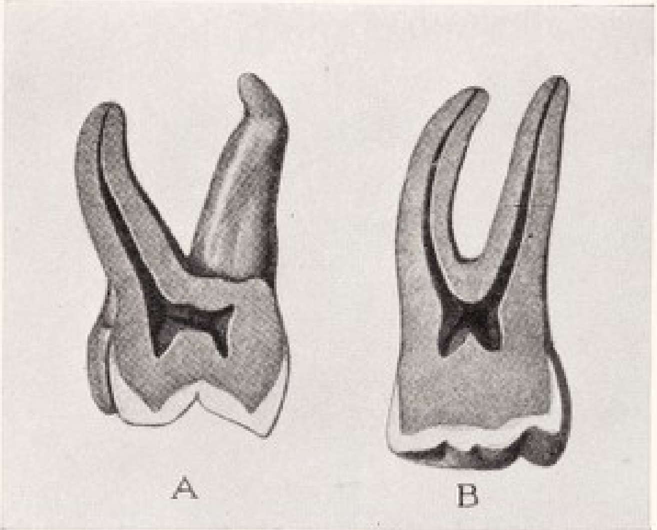


Fig. 28. Upper first molar. (A) cross section through mesiobuccal root. (B) cross section through lingual and distobuccal roots

Upper Second Bicuspid

The upper second bicuspid has a pulp chamber resembling that of the first bicuspid, except that it is slightly smaller in its buccolingual diameter. It usually has one root and therefore normally has one pulp canal. Occasionally, two canals are found, which, however, tend to unite at the apex. (See Fig. 27.) The entrance to the canal is in the center of the pulp chamber, this being the case even when two canals are found. It is therefore, only necessary to open the pulp chamber sufficiently to eliminate undercuts. The possible presence of two canals, and the frequent curvature found in the root of this tooth, tend to complicate pulp canal procedures.

Upper First Molar

The upper first molar has a large pulp chamber, roughly triangular, corresponding to the points of exit of the three canals. Of these the palatal, or lingual, is the largest and most accessible. In spite of this fact, numerous cases are found in which it has been incompletely filled, which of course is an inexcusable error.

The entrance to the mesiobuccal canal is usually situated at the extreme mesiobuccal portion of the pulp chamber. The mesiobuccal root commonly has a mesial inclination as it leaves the crown of the tooth, and at its middle third usually begins to curve distally, continuing this course until

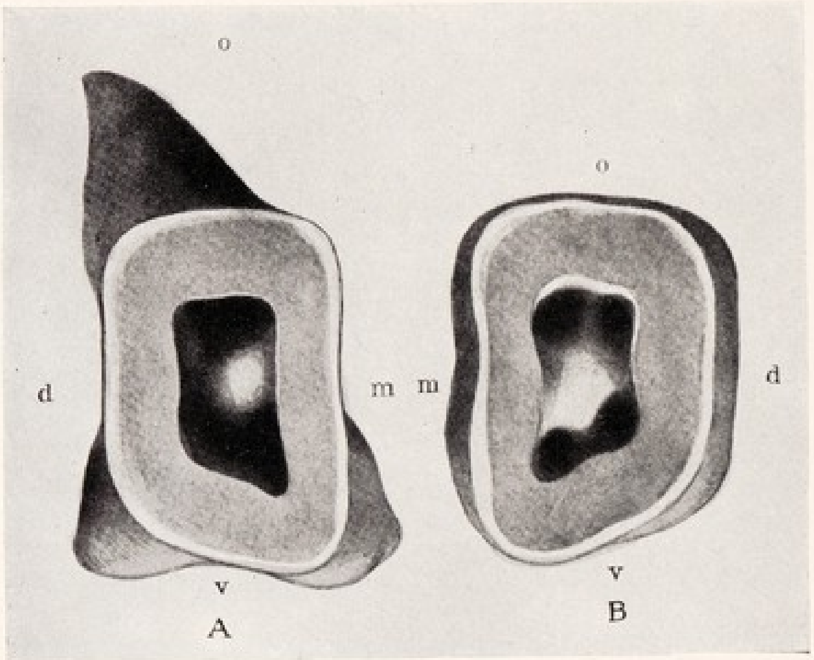


Fig. 29. Horizontal section through crown of the upper first molar. (A) floor of pulp chamber showing entrance to canals. (B) vault of pulp chamber showing cornua of pulp. m. mesial, d. distal, o. lingual, v. buccal

the apex is reached. This fact renders the cleansing and filling of the mesiobuccal pulp canal extremely difficult. It is therefore of the utmost importance that adequate access to the canal should be obtained. This requires marked extension of the pulp chamber in a mesiobuccal direction and not infrequently requires cutting away the mesiobuccal cusp of the tooth.

The entrance to the distobuccal canal is usually very close to the entrance to the mesiobuccal canal and is situated distolingually of its orifice. This point is situated mesially of the entrance to the palatal canal, so that a line drawn from the mesiobuccal to the palatal canal will nearly pass through the entrance of the distobuccal canal. The distobuccal canal is usually constricted, as is also the mesiobuccal, and in spite of its greater accessibility it is frequently difficult to enlarge and cleanse.

The upper first molar is sometimes found to have two roots, due to

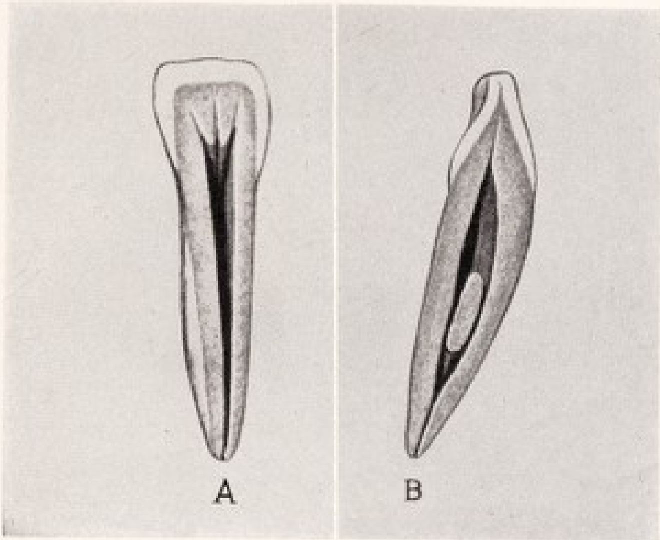


Fig. 30

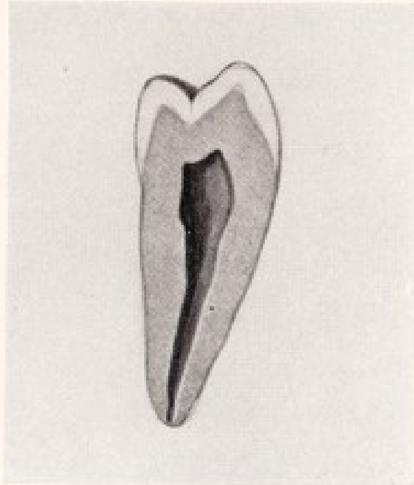


Fig. 31

Fig. 30. Lower central incisor. (A) mesiodistal cross section. (B) labiolingual cross section. Note divided canal

Fig. 31. Lower second bicuspid. Buccolingual cross section

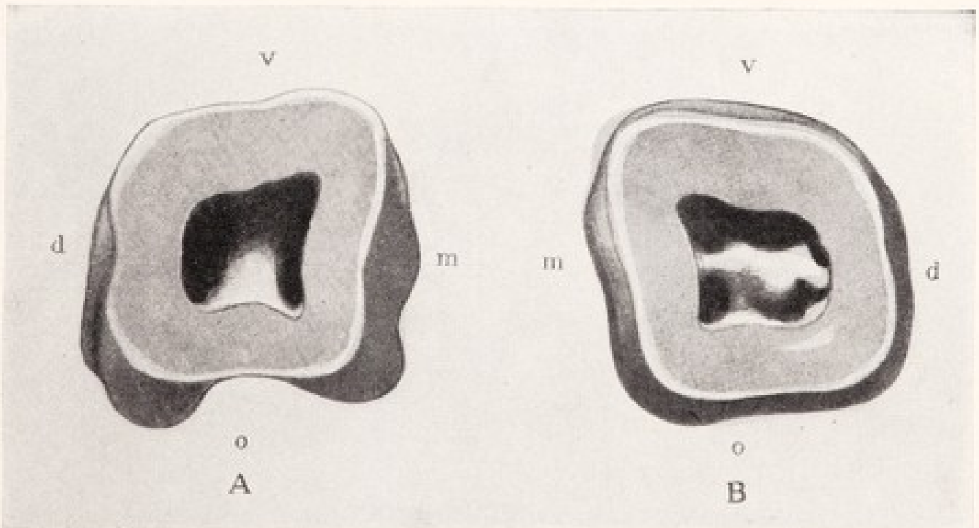


Fig. 32. Horizontal section through crown of lower first molar. (A) floor of pulp chamber showing entrance to canals. (B) vault of pulp chamber showing cornua of pulp. m. mesial, d. distal, o. lingual, v. buccal

the fusion of the buccal roots. Even in this case three canals will be found. A much rarer occurrence is the finding of four roots with a corresponding number of canals.

Upper Second Molar The upper second molar has a pulp chamber and canals closely resembling those of the first molar in shape and distribution. This tooth is more apt to show a variation in the

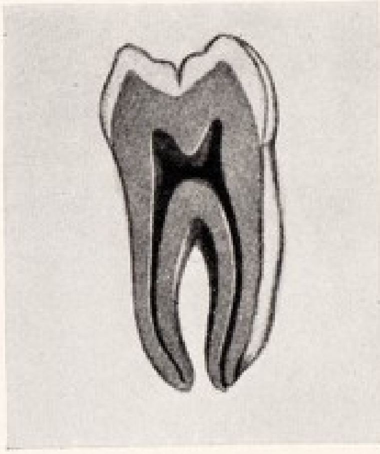


Fig. 33. Lower second molar. Mesiodistal cross section

number of roots, this ranging from one to four, or even more. If one root is found there will be but one root canal, which will be large and irregularly shaped.

Upper Third Molar The upper third molar, because of the usual shortness of both crown and root, is seldom suitable for bridgework. The inaccessibility of the canals, due largely to the position of the tooth, make pulp canal work an extremely hazardous procedure. Its anatomy corresponds approximately to that of the first and second molars.

Lower Central Incisor The pulp chamber and canal of the lower central incisor resemble the pulp chamber and canal of the upper lateral incisor except that they are usually smaller in size. The canal of the lower incisor is usually quite thin, and ribbon shaped, labiolingually. This tendency frequently proceeds to the point of producing a fusion of the pulp canal walls at about the middle third of the root, resulting in the formation of a branching canal. (See Fig. 30, B.) These branches unite before they reach the apex. Needless to say, both branches must be opened, cleansed, and filled.

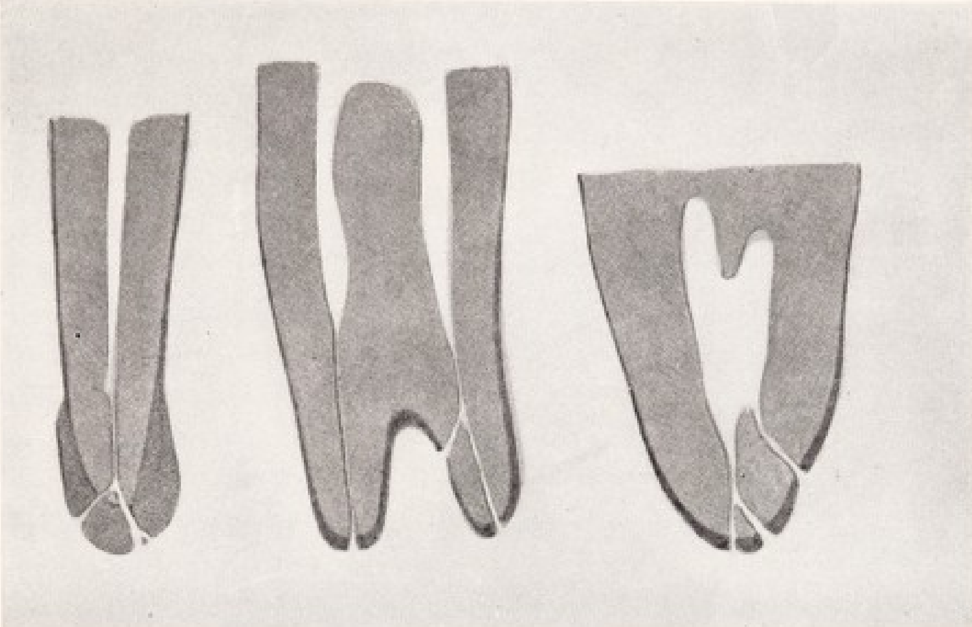


Fig. 34. Sections showing accessory canals as often found in upper and lower bicuspids. The presence of these canals very seldom show in the radiograph

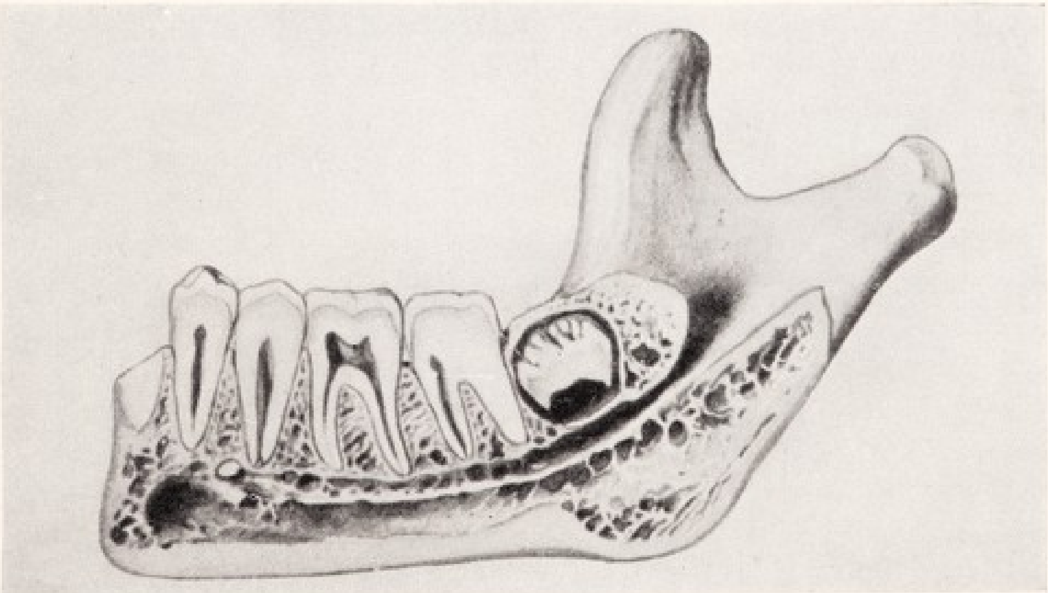


Fig. 35. Relationship of apices of the lower posterior teeth to the inferior dental canal

Lower Lateral Incisor

The anatomy of the pulp canal in the lower lateral incisor is practically indentical with that of the lower central incisor.

Lower Cuspid

The pulp chamber and canal of the lower cuspid resemble those of the upper cuspid so closely that no separate description is needed.

Lower First Bicuspid

While the lower first bicuspid presents a different anatomical form from that of the lower cuspid, its pulp chamber and canal resemble those of the lower cuspid very strongly, except that the root is shorter. Like the cuspid, it is single rooted, but, like the cuspid, sometimes shows a division of the root near the apex.

Lower Second Bicuspid

The lower second bicuspid has a crown with two, or frequently three, cusps, and hence the pulp chamber will have a greater diameter than that of the lower first bicuspid. More extensive opening is therefore required, in order to eliminate all undercuts. It has one root. The canal is frequently of rather large diameter at the coronal end, but may be quite constricted at the apex. The root of this tooth has a tendency to develop a distal curvature at its apex, which may complicate the cleansing and filling of the canal.

Lower First Molar

The lower first molar has a quadrangular shaped pulp chamber, although, normally, but three canals enter it. Full opening to eliminate undercuts, may require the sacrifice of considerable occlusal enamel. This tooth usually has two roots. The mesial root contains two canals. The anatomy and relationship of these canals, however, make it seem reasonable to speak of them as one canal, divided by virtue of its extreme constriction. The mesial root curves distally, giving to the canals a direction which makes it difficult to enter them. Adequate access is frequently only attained by cutting away the mesial wall of the tooth, nearly or quite to the gum line. Because of the ribbon shape characteristic of the mesial canals, considerable enlargement is needed for successful cleansing and filling. The distal canal is large, circular, or ovoid in shape, and therefore readily located and entered. This root may curve distally, or mesially, near the apex, but this curvature is seldom so sharp as to interfere with a successful pulp canal operation.

Lower Second Molar

The lower second molar bears a general resemblance to the lower first molar (see Fig. 33), but its roots lie close together and are usually straighter. The number and distribution of canals is similar to that of the lower first molar and the slope of the canals is also similar to that of the lower first molar. In this tooth, as in the case of the lower first molar, it is necessary to open the pulp chamber radically towards the mesial surface to gain adequate access to the mesial canals.

Lower Third Molar

The lower third molar is frequently a very valuable abutment for bridgework, but the irregularity of its roots and root canals makes successful filling operations extremely difficult. The majority of lower third molars have two roots and three canals, resembling in that respect, the lower first and second molars. The most common variation from this is toward the single rooted tooth, with corresponding coalescence of the canals into a single one. When this latter condition is found, the pulp canal cleansing and filling is a comparatively simple operation. Often, however, this tooth has more than two roots and may have four or more canals, in which case the enlargement and cleansing of these canals present great difficulty.

CHAPTER X

Pulp Canal Therapy

The treatment and filling of pulp canals has been a subject of controversy for many years. The debate is still going on, and at the present time it seems impossible to state what the outcome will be. In this chapter there will be described a technique which has given very satisfactory results for many years, together with a newer technique which has still to stand the test of time, but which, by virtue of its rationale, as well as by the high repute of its sponsor, gives promise of becoming the outstanding method of managing pulpless teeth.

Diagnosis

Before proceeding to the details of treatment, it is essential to consider the subject of diagnosis. The most careful discrimination must be employed in the selection of teeth which are to be treated and filled. While not directly concerned in the construction of the bridge, the pulpless tooth nevertheless has a determining influence on the life of the bridge. No bridgeworker can afford to jeopardize the success of his restoration by placing it upon a doubtful pulpless tooth, or on teeth of uncertain health. Most patients, if informed that a given tooth has too poor a prospect of continued health, will cheerfully assume responsibility for its use as a bridge abutment. Later when, as sometimes happens, the tooth must be extracted and the bridge discarded, the patient is rather apt to disclaim his former acceptance of responsibility. It therefore behooves the dentist to be extremely cautious about placing bridges on dubious abutments.

One of the important considerations in diagnosis is the age and health history of the patient. It is generally accepted by pulp canal workers that the chances of successful pulp canal therapy diminish as age advances. While it is not possible to set a definite age limit on the initiation of pulp canal treatment, it seems probable that the dividing line is approximately at the age of fifty. This age limit should certainly be applied to teeth which have had previous and unsatisfactory pulp canal operations. Such teeth should be recommended for extraction. On the other hand, if the health history is satisfactory, it may be permissible to devitalize a vital tooth which has been deeply attacked by caries, even if the age is beyond fifty.

The patient's health is an even more important consideration. A patient who is in chronic poor health is to be regarded as having an inferior resistance and is therefore a poor subject for pulp canal therapy, at any age. The same restriction is to be applied to the patient who has a history of poor health even though apparently well at the time when the bridge is constructed. It is easy, in the present state of knowledge regarding focal infection, for the dentist to absolve himself of responsibility for chronic invalidism if it occurs in the patients he has treated. Too many of these patients either continue in poor health, or in order to regain their health, are compelled to sacrifice important restorations which have been placed on infected teeth. Dentistry cannot be called a "health service" if infected, or even suspicious teeth continue to be used as bridge abutments.

The outstanding and important conditions which are recognized as being directly related to infections of the teeth are endocarditis and other heart infections, nephritis, arthritis, iritis and other diseases of the eye, and some forms of gastro-intestinal disease. There are many other types of disease, however, which may be associated with focal infection. The dentist therefore, in studying his cases, should not limit himself to the consideration of the disorders mentioned. Any obscure chronic invalidism, in the health history of his patient, should make him very cautious in his attitude toward pulpless teeth in the mouth.

Any tooth which is to be used as a bridge abutment, and which requires pulp canal treatment, should be carefully examined to determine whether any pathologic condition exists at the root end. Clinical evidence, such as tenderness to percussion, response to thermal change, loss of translucency, and evidence afforded by the radiograph, are all needed in establishing the local diagnosis. Teeth which show root end disturbances such as granuloma, acute abscess or liquefaction necrosis, are not suitable for use as bridge abutments. This is especially true of upper bicuspids and molars, as secondary infection of the maxillary sinus is frequently the result of an attempt to utilize such teeth as abutments for bridgework. The patient's general health should be the first consideration and all teeth not favorable for thorough root canal treatment should be eliminated, when planning the construction of a bridge.

Where the ravages of decay have progressed to a point where devitalization is necessary, a bacteriological culture will usually show an infected root canal, even though the pulp is apparently vital and the radiograph shows no evidence of periapical disturbance.

Technics of Root Canal Therapy

The first step, in treatment, is to see that the tooth is not in traumatic occlusion with the opposing teeth. This is done in order to prevent post-operative pericementitis. The area adjoining the tooth to be operated on should be painted with tincture of iodin. The rubber dam is then placed, and the exposed teeth and rubber dam are painted with tincture of iodin. All carious material is removed from the cavity and the pulp tissue is removed from the pulp chamber. To avoid forcing infectious material through the foramen into the surrounding tissue no attempt is made to enter the canals at this time. A pellet of cotton moistened with cresol, U.S.P., is placed in the pulp chamber and the tooth is sealed with cement for twenty-four hours. At the next sitting the rubber dam is placed, and the entrances to the canals are located with a Rhein root canal pick, and an attempt is made to reach the apical constriction with a pathfinder. The contents of the canals are then removed with sterile barbed broaches and small files. The orifice of each canal should be enlarged with a small Gates Glidden drill in the right angle handpiece. This operation should be confined to the orifice of the canal and no attempt should be made to enlarge the canal itself with drills, or burs.

Asepsis must be maintained in every stage of the operation to insure success.

All root canal instruments must be boiled for at least fifteen minutes and placed in a shallow dish of alcohol. Napkins, cotton pellets, absorbent points, etc., should be wrapped in packages and sterilized by steam under pressure previous to use. The operator's fingers must not touch any of these materials previous to their insertion in the canal; sterile tweezers serve this purpose. To thoroughly remove all the disorganized organic matter, and enlarge and open the canals to the end, the author has found the Callahan method very satisfactory. Fifty percent sulphuric acid is pumped into the canals, using small files. The canals are enlarged by using "Antalum" files, beginning with the smallest in size. The file is passed along the side of the canal to the apical constriction and then withdrawn to remove the debris. This action will tend to cut the sides of the canal and thus enlarge the canal. Considerable care should be exercised to prevent the canal from becoming clogged. The canal should be filled with the acid when using the files, and then flushed with a solution of sodium bicarbonate (one teaspoonful of sodium bicarbonate to one ounce of boiling water) from time to time, to remove the debris.

If the canal becomes clogged, toxic material may be forced through the apical foramen in the course of the cleansing operation. After using the smallest size "Antalum" file, the next files in sequence as to size, are used, until the canal is sufficiently enlarged to permit the easy passage of a gutta-percha point to the apical constriction. Great care should be exercised not to pass the instruments through the apical foramen. The canals should not be opened beyond the dento-cemental junction until all debris has been removed from the canals, and then only in the infected cases.

The canals are then flushed several times with one of the chlorin bearing solutions, or a one percent solution of iodin in physiologic sodium chlorid solution. Small, sterile, measuring wires, are then placed in the canals and a radiograph taken to determine the length of the tooth and the point to which the canals have been opened. The rubber dam holder may be removed, but the rubber dam should be retained in position, to avoid infection of the canals while taking the radiograph.

The ideal root canal filling is one that extends to the apical foramen; however, to fill a root canal just to the apical foramen and not force the root canal filling beyond this point is a very difficult operation and such an ideal result is usually obtained only under the most favorable conditions. Where strict attention has been given to asepsis in every stage of the operation, it is the author's opinion that a previously vital tooth, with canals filled to the dento-cemental junction, with a thoroughly condensed root filling, may be retained as a useful and innocuous member of the arch. In vital teeth the foramina are lined with a vital membrane.

Treatment of Infected Teeth

Under favorable conditions, in the presence of infection, the tooth may be opened from the dento-cemental junction to the apex. This is accomplished at the second sitting, using a very fine "Antalum" rat tail file. This is made necessary because the foraminal lining has been destroyed and the peri-dental membrane injured. Accordingly it is requisite to fill to the end to obliterate the dead foraminal pocket.

Electrolytic Medication

As an aid in the sterilization of the root canal, electrolytic medication is applied at this time. While this process has many loyal friends, the author is well aware of the fact that many men of good standing in the profession have condemned it. In spite of the controversy, which has raged back and forth regarding the merits of electrolytic medication, the author still has faith in the process. When properly used, it is undoubtedly an aid in sterilizing root canals.

For this operation, the rubber dam is placed and an electrode of suitable size for the canal is selected. Iridioplatinum, copper or zinc are the metals most suitable for this purpose. Twenty to thirty gauge wire may be used. The portion of the wire that is to be placed in the canal should be flattened on the anvil and tapered to a point. A round wire should never be used as it may establish a close contact with the sides of the canal and prevent proper diffusion of the iodin in the larger part of the canal, to replace that driven out of the solution beyond the electrode end by the electric current. The electrode need not extend to the apex of the root. Indeed it is preferable that it should not do so, because that would require that the wire should be sharpened at the foraminal end, and the best authorities agree that the electrode should be as thick as feasible, with a blunt terminal. In fact, the broader the cross diameter of the wire at the point of exit of the current, the better, and the less painful will be the application.

It has been advised by some operators that multirooted teeth may be treated with an electrode that passes down into two or more canals. This is an error, and the advocates overlook the well known postulate that electricity will pass along the road of least resistance. Consequently the current will find exit only along one electrode. However, if three roots are to be treated, whilst each must be treated separately, it should be remembered that there is but a single external area, and consequently the time of application may be shortened accordingly. For example, if thirty minutes is used for a single rooted tooth, three ten minute applications accomplish the same result where there are three canals.

After shaping and fitting the electrode wire, the canal is filled with the stronger (Churchill's) tincture of iodin, which contains 16 percent of free iodin and 2.5 percent potassium iodid. The electrode wire is then placed in the canal with the negative pole in the solution and the positive pole on the cheek. One electrolytic treatment of 30 minutes, using one milliampere of current is usually sufficient. The solution should be renewed several times during the treatment. When the level of the solution sinks below the floor of the pulp chamber fresh solution should be added. At the expiration of 30 minutes, all the solution is absorbed with cotton points and the canal flushed several times with 95 percent alcohol, to remove the iodin.

The Callahan Technique for Filling Canals

Filling The canals are then flooded with 95 percent alcohol, which is thoroughly pumped into the canals for five minutes. The excess alcohol is then removed with absorbent points. Hot air should never be used at this stage in the operation, nor, in fact, at any stage of pulp canal treatment. It is desirable to have the tubuli filled with alcohol to aid in the diffusion of chloroform and rosin, with which the canals are now flooded. This solution is prepared by dissolving 12 grams of water-white rosin in three fluid-drams of chloroform. The rosin should be immersed in a chlorin solution for several hours before preparing the chloro-rosin solution. The solution is pumped into the canals from three to five minutes, adding fresh chloro-rosin as the chloroform is taken up by the tubuli. If the solution becomes heavy, due to evaporation of the chloroform, pure chloroform may be added just before inserting the gutta-percha point. The canals should be enlarged sufficiently to allow a gutta-percha point to pass nearly to the apex. The diagnostic wires may be used to select points of suitable length. In multirooted teeth one canal should be filled at a time. To prevent the solution entering the other canals absorbent points of suitable size are placed in these canals to seal them temporarily. A gutta-percha point of suitable shape and size, which has been immersed in 40 percent formaldehyd for 30 minutes, is dipped in alcohol and dried, and then placed in the canal and forced gently with a pumping motion toward the apex of the tooth, using a small sized plugger point.

The chloro-rosin solution will dissolve the gutta-percha point very slowly. Care should be exercised not to force the point toward the apex with direct pressure as this procedure may force the gutta-percha into the apical space. Lateral pressure should be used to condense the gutta-percha into a homogeneous mass. A radiograph is taken at this time, to ascertain the position of the gutta-percha point in the canal. In the event that the gutta-percha has not been forced to the apex, a larger plugger is used to force the chloro-rosin-gutta-percha mass toward the apex. Another radiograph is taken and this operation is repeated until the canal is properly filled. If the foramen is large, very little pressure should be used at first to prevent forcing the chloro-rosin-gutta-percha through the foramen.

Chloro-rosin-gutta-percha, in hardening, shrinks from the center and clings to the walls of the canal, due to the strong adhesive qualities of the rosin. After the gutta-percha has been thoroughly condensed with the root canal pluggers, a sharp, tapering plugger, is passed through the center of the filling at least half the length of the canal to break up the central cohesion. This opening, as well as the pulp chamber, is quickly filled with copper cement to prevent the external evaporation of the chloroform and to eliminate the possibility of peripheral shrinkage. The technique above described, is popularly known as "the Callahan method."

Re-treating Canals Teeth with improperly filled root canals may sometimes be used as bridge abutments, provided that the radiograph shows no evidence of root-end disturbance and if the age and health of the patient are satisfactory. If the canals of such teeth have been filled with gutta-percha, the canals may be opened by placing the rubber dam and softening the gutta-percha with a hot instrument such as a root canal plugger. The pulp chamber is then flooded with xylol which will quickly dissolve the gutta-percha. The mass is then broken up with broaches and the liquefied contents of the canal are removed with broaches wrapped with cotton. No attempt should be made, at this time, to open the canal beyond the point of the old filling. A small piece of sterile cotton, saturated with cresol is sealed into the canal for 24 hours, at which time the canal is enlarged and cleansed as previously described.

While the Callahan technique, just described, has given great satisfaction in the hands of many operators, it is generally recognized that it does not meet all the requirements of a successful pulp canal technique. Among those who have recently made outstanding contributions in this field is U. G. Rickert, D.D.S., Ph. B. Dr. Rickert's technique, developed in the dental school of the University of Michigan has received very favorable comment and has given excellent results since its presentation to the profession. Through the courtesy of Dr. Rickert his technique is presented in the following pages of this chapter in his own words.

Dr. U. G. Rickert's Technique for Filling Canals

"There are two things we have learned in our experimental work, which must be met in the treatment of those teeth through which diffusion has taken place, and which need root fillings, and which the dental profession still fails to appreciate. The organic matter from the circulatory elements, which diffuses through a tooth, becomes toxic by stasis when retained for months and years, even in the absence of infection. Many of the acute inflammatory reactions, that follow attempted re-treatment of inadeqately treated pulpless teeth, are first due to intoxicational trauma, which, in many cases, may become infected and go into the acute stage.

But the toxic content (split protein products) of the canal itself, may be detoxicated, or chemically changed, so that it is no longer toxic; this is essential to the re-treatment of teeth that have seemingly never given any trouble, but which the operator thinks should be re-treated, and more adequately filled. Intoxication usually precedes infection so that bacteria may be only incidents in the affection. This is one fundamental generally misunderstood. The secret of success, then, is complete sealing to the end of the root, after sterilization and detoxication of the root canal, in the infected cases, and complete sealing alone, under aseptic conditions, to the dentocemental junction only, in freshly devitalized teeth.

"It is remarkable what success one may have with the majority of pulpless teeth, if these conditions are kept in mind. Sidestepping them, however, spells failure in a large majority of cases.

The Technical Management of Pulp-Involved Teeth

"There are three distinct classes of teeth where root surgery is indicated: (1) that of vital pulps with deep caries, or accidental exposures; (2) some dead pulps, untreated or previously treated; (3) a combination of the above two—degenerating but still vital pulps.

"The uninfected, vital pulps are by far the easier ones to manage. These cases when treated, meeting the fundamental requirements to be outlined in our technical procedure, should reward the operator with a percentage of success at least equivalent to that gained by general surgery.

"Single rooted teeth, especially, are usually easy to manage. The multirooted teeth of children with still accessible canals are also less difficult to manage by our method. The mesial roots of molars in middle-aged patients at the present time offer an almost insurmountable barrier, because one is always less certain of accomplishing the above mentioned fundamentals with the techniques now in use. It is hoped that the diffusion method of filling may eventually simplify the latter procedure. There are then eighteen to twenty out of the twenty-eight major teeth (eliminating third molars) that should be operable.

"The experimental and clinical experiences supporting the following procedures have been reported elsewhere in the dental literature.

Vital Pulp Removal

"For vital pulp removal the method of choice is either conduction, or infiltration anesthesia. The pulp chamber is opened with sterile spade burs, removed from alcohol and flamed. The lingual, or occlusal area, through which the tooth is opened, should be sterilized with tincture of iodin. If the pulp chamber must be opened through caries, eugenol should be sealed in for a period of twenty-four hours. The pulp chamber is opened with an orifice of adequate diameter, so that the opening does not obstruct the ready removal of the pulp, intact. Nearly all mature roots offer slight resistance to selected root canal instruments at the (ill-defined) dento-cemental junction, or slightly curved end of mature roots. The size of the canal determines the size of the barbed broach that must be introduced for complete removal of the pulp. The radiograph usually gives some assistance in approximating both the length and diameter of the canal, because one can determine at least whether the canal is large or small. Pass the barbed broach gently through the pulp to a point near the dento-cemental junction, being sure that it falls a little short of the end, rather than passing beyond this junction. Careful rotation of the barbed broach entangles the pulp, which now can be removed intact by withdrawing the instrument. Should the operator have failed in accomplishing intact removal, the control of hemorrhage and the cleansing of the canal becomes more difficult; nevertheless, with adequate curettement with root files, the canal may be cleansed sufficiently for the root filling. The difficulty encountered, (subsequent soreness and future failure), where the pulp is not completely removed in the first attempt, is frequently due to the organic material being forced beyond the dento-cemental junction during the process of root curettement. The trauma and subsequent decomposition of this organic material prepare that area for easy infection. Many failures are due to this occurrence and to over-instrumentation.

"Finding the location of the dento-cemental junction (or slightly curved main root-end canal) is not difficult in the majority of single-rooted teeth. Success depends upon, (1) a carefully made radiograph; and (2) suitable instruments. If too large an instrument is introduced into the canal, it wedges on the sides and the slight excess force required to perforate the root-end, or cemental junction will not be noticeable. Proceed as follows: Select the finest root file that will just pass into the canal the required distance as noted from the radiograph. This distance is marked on the instrument, in any way convenient to the operator. A small piece of rubber dam answers the purpose quite well. This will permit approximate location of the junction, and also avoid probable perforation in that region. When this measurement is approached with the instrument, it is advanced *very gently* to the point of *first slight resistance*. Beyond this point never go with an instrument when preparing the pulp chamber, following vital pulp extirpation.

"If infiltration anesthesia has been used, accompanied with suitable hemostatics, hemorrhage may usually be controlled. (The exceptions are usually found following extirpation necessitated by violent trauma—athletic and automobile accidents. This is especially true a day, or more, after the accident. The inflammatory reactions following these conditions frequently make the control of hemorrhages at the first sitting impossible.) The filling of the canal may be undertaken at the same sitting, if the hemorrhage can be controlled to the dento-cemental junction; otherwise it is impossible to seal the canal completely at that point. Our filling material is only adhesive on the comparatively dry surfaces. A small blood clot between the filling material and the vital foraminal remnants is conducive of the most successful results. Histories of a large number of root fillings by our methods, immediately following pulp extirpation show extremely gratifying results. The time necessary to remove the pulp and fill the average canal of a single-rooted tooth, when it can be done at one sitting, requires from 40 to 60 minutes. (This includes anesthesia, pulp removal, and adequate cleansing of the canal walls.)

"Successful root canal surgery requires adequate enlargement. This can only be accomplished with suitable instruments. If one begins with the smaller sizes, and gradually increases the regular sizes, it is not a difficult operation. By slightly bending the tip ends, one can pass around curves with amazing ease, and the newer files have many advantages over the old twist broaches.

Management of Acute, and Chronic Alveolar Abscess

"For a little more than a year, we have been trying to standardize our technique for managing the several forms of alveolar abscess. We realize that the dentist does not have the laboratory facilities to determine certain conditions; what agents are best suited for this work; how long treatment should be continued; how to know when a pulp canal is sterile and ready for filling; whether it is best to treat with rather potent drugs for a short period, or milder drugs with more treatments over a longer period of time, etc. These are questions that we are trying to answer in a standardized technique, which will be given to the profession as soon as possible. However, since this work is still incomplete we are giving the older method that we have used for a long time, and which does reward the operator with a reasonably high degree of success.

"If there is swelling and severe pain at the first sitting, the tooth is opened and permitted to remain open for drainage. Usually in two or three days the pain subsides and then treatment may be begun. Unless there is a great deal of periapical destruction, a cyst, or a fistula, treatment is indicated without resection.

"At the first sitting, after complete aspiration, if there is considerable involvement of periapical tissue, we use a rather potent drug. Formocresol, or beechwood creosote may be used for this treatment. It is introduced into the canal with a Johnson and Johnson point, taking care not to have the point approach the end of the canal within two or three millimeters. This dressing is not sealed in with a tight seal, and should not remain longer than over night. For this seal, we use sandarac varnish and cotton. This is placed rather loosely to permit the escape of gases, and to prevent internal pressure, but does at the same time exclude the free access of food and saliva. It should never be used where the dressing must remain more than twenty-four hours. Morning patients are seen late in the afternoon, and late afternoon patients early in the morning for the removal of the first dressing.

"At our second sitting, if the tooth is still comfortable, we aspirate with dry Johnson and Johnson points, getting rid of as much of the secretion as possible, washing it out with trichlor, or any dilute available chlorin solution, and then do the necessary curetting. Great care must be taken not to force the toxic pulp canal contents beyond the tooth apex. Next we seal in a milder drug. If the case is rather severe one may seal in beechwood creosote and eugenol. The second treatment should not remain over twenty-four hours. At the next sitting, if there has been continued disturbance, the canal should again be dried and treated with the proper dilution of chlorin, beechwood creosote, eugenol or iodin. If not, one may skip a day and finally two or three days; if the tooth is quiet, clean and free from seepage, it can then be washed with a chlorin solution and filled with any suitable root canal filling material. In cases where the seepage cannot be stopped, and where none of the above therapeutic measures bring relief from pain when the pulp chambers are sealed, there is nothing else to do, at the present time, but resection or extraction. Single rooted teeth of strategic importance requiring more than five to seven adequate or suitable treatments should be managed by root resection. We are also having phenomenal results with electro-sterilization, using water solutions of iodin. The physical explanation and experimental data will soon be published.

The Management of Infected Degenerating Pulps

"The technique is quite identical with that of the non-infected vital pulps. One should avoid pressure anesthesia and be extremely cautious in not forcing pulp contents beyond the root end. Our first dressing has always been eugenol and beechwood creosote. There may be other drugs that will do equally well, but the rapidity with which some of the extreme cases of myositis and acute arthritis and certain eye involvements have disappeared when such pulps were located, removed, and the canals treated with this drug, has made us hesitate to experiment with other drugs. It is remarkable how severe cases of secondary involvement of months standing will improve in 24 to 48 hours when the offending tooth is located. These vital infective degenerations may continue for many months.

"The filling technique is identical with that outlined following vital extirpation.

Root End Resection

"This operation resolves itself into three stages: *first,* the proper sterilization and detoxication with phenolsulphonic acid and reducing silver solution; *second,* complete filling of the canal with some non-shrinkable filling material; *third,* the adequate surgery required to remove the toxic and critical end of the tooth, accompanied with the removal of all necrotic bone. If this operation is properly carried out, it is rewarded with as high a percentage of success as any root-canal surgery of the present time. It is not suitable for bridge attachments, but when undue stresses are relieved, it will carry the tooth, or an artificial crown, for many years, if successfully achieved. This operation can all be accomplished in one day, unless the infection is in the acute stage, at which time the operation is contraindicated. Exacerbating cases are opened and permitted to drain, until all soreness has been relieved, when the canal is prepared and filled.

"In our Clinic the pulp chamber is opened and the contents examined by direct smears and cultures. The canals are enlarged, the putrescent walls curetted with suitable root canal files, aided, when necessary, by the use of sodium and potassium, or phenolsulphonic acid. These agents are used for enlargement and dehydration only, previous to resection. The canals are then thoroughly dried after which ammoniacal silver is introduced, preferably freshly prepared.

"The silver solution is made in some transparent glass vessel. We use the concave end of a dappan dish. To two drops of chemically pure 28 per cent. ammonia, just enough pulverized silver nitrate is added to give it a faint, and slightly cloudy appearance, and just carried to the point of solution where the ammoniacal odor disappears. Great care must be taken not to have an excess precipitate. If this does occur, the addition of a little more ammonia will be required. This solution, if properly prepared, carries a maximum content of silver. With a little experience the dental assistant can prepare it in from one to two minutes. This silver solution is allowed to remain in the tooth for about ten minutes, before it is subjected to the reducing action of a 15 or 20 percent formalin solution. The reducing agent is allowed to remain for about two or three minutes and the canal is again flooded with the silver solution and this time it may be reduced with eugenol. The walls are now carefully dried and are ready for filling by the methods outlined herewith.

The Technique of Filling Roots

"When the canal, following painstaking curettement, is ready for filling, the following technique is used: After the canal is thoroughly dry, Kerr's root canal sealer is carried to a point near the apex of the tooth on a smooth broach. Introduce a sufficient quantity to cover the wall entirely. It is very adhesive, and of about the consistency of the ordinary dental cement when spatulated. When withdrawing the broach, some of the sealer will be withdrawn on the instrument. For this reason it is necessary to use a filling agent that will carry in the quantity that is withdrawn and remain in the canal as a permanent filler. A gutta-percha point previously prepared and approximately filling the canal, serves the purpose. *Cover this* with the sealer and slowly force to place in the canal. The plastic nature of the sealer, under slight pressure, forces it into all irregular spaces of the pulp canal. The consistency of the cementing substance is such that in nearly all mature roots where live pulps have been carefully removed to the dento-cemental junction (never beyond it) the sealer will not be forced through the ends of the roots by the above method. In the immature roots of children and where there has been marked destruction of the periapical and foraminal tissues, in one form or another of alveolar infection, and if there has been over-instrumentation, the opening is larger and the control is much more difficult by any method. Under these conditions we prefer slight over-filling to under-filling because the plastic consistency of the sealer is so adaptable and so kind to the vital tissues that the adaptation over the end of the tooth is quite favorable to success, provided the gutta-percha point is not also forced through.

"In cases where the canals and apical openings are very large, use a root plugger of a diameter that approaches the end to within about 3 millimeters. After carrying a small quantity of the sealer on a smooth broach near the apical end of the canal, a short section of a gutta-percha point, of approximately the diameter of the canal near the dento-cemental junction is attached to a heated plugger, gently warmed, rolled in the sealer, and carried almost to the end. This position is marked on the plugger, the plugger removed and a radiograph taken. The setting time of the sealer permits sufficient time before hardening to develop the film from which it may now be determined how much further the section of the root canal point must be forced to just reach the end. After forcing the short section the required distance, with a size smaller plugger, the remainder of the canal can now be filled, without forcing an excess of the sealer beyond the root. This is accomplished by flooding it with the sealer and the introduction of a gutta-percha point, after which smaller root-canal pluggers, or spreaders, are again passed along the side of the points for the introduction of more points and sealer, until the canal is thoroughly filled.

"For filling material we personally prefer Kerr's root canal sealer, made according to my own formula, which is not presented as a finished product, but which we believe to be one of the most suitable materials available at the present time. This sealer is manufactured by the Detroit Dental Manufacturing Company of Detroit. (I have no financial interest in this preparation whatever.) I wish to acknowledge that this manufacturer has supplied me with the necessary instruments for the experimental work.

"The composition of the set mass is:

Silver	24.74%
Zinc oxid	34.00%
Dithymol diiodid	10.55%
Oleoresins	30.72%

"The rationale of each ingredient has been published elsewhere.

"The filling is so thorough and the volume change so negligible that these sections may lie around in the laboratory for weeks and months and still successfully adhere to the walls, which is, indeed, a severe test.

"The root filling method for teeth *previously treated for infection,* when such infection has been successfully controlled, is identical with that outlined for the filling of canals *following vital pulp extirpation,* with the exception that in the former case it is preferable to fill completely to the end, even a trifle beyond, rather than to fall short of the end. The reason for this is that in the latter cases the foramina are still lined with vital enveloping membrane, (provided the operator has not used caustic drugs nor resorted to over-instrumentation). Many of the foramina are later closed with cementum by the receding membrane, provided the foraminal tissue is not destroyed by drugs or instruments. *In the infected* *cases,* however, this foraminal lining has been destroyed with some attendant injury to the periapical membrane so that the ideal filling for this condition requires that we fill to the very end of the tooth, thus avoiding the dead foraminal pocket. Quite contrary to the general conception, much of the favorable results accompanying reducing silver solutions is due to the detoxication of split protein products within the dentin. These silver combinations are both non-toxic and practically insoluble, so that they do not diffuse into the periapical tissues. This property of the silver solutions is of even greater importance than its germicidal value.

"The filling of the canals, in cases in which root resection is to be performed, is quite like the filling of other infected types, except that even greater care should be taken to condense the filling, especially at the expected site of resection. Over-filling is not so serious in these cases because the excess will be removed during the operation. Resection should be completed within five hours after root filling to prevent exacerbations due to lack of drainage from the involved periapical area following the hermetic sealing of the canal.

"Our failures in root surgery have been due, first, to the diffusion of toxic matter and the spreading of infection from the traumatized involved periapical tissue; and secondly, to deficiencies due to the universal failure to seal the apical third, or critical end of the root. There is only one condition under which there are some apparently successful root fillings that fall a number of millimeters short of the end, and that has come when the uncauterized remaining vital pulp was left at the apical end and was permitted to recede over a long period of time. In some cases, at least, the foramina have been automatically sealed by deposition of cementum during the atrophic changes. It is wonderful what a high degree of success can be accomplished if the apical third is filled perfectly without trauma to the vital tissues in the periapical areas. If, however, tissue is allowed to putrify in the apical end of the canal, the final results, from a health standpoint, will depend on the inherent ability of the individual to develop suitable quarantines about such involved roots. If the operator will do a little experimenting on laboratory teeth, and follow carefully the principles outlined in these directions, there is every reason to believe that he will be more favorably impressed with the possibilities of root surgery."

CHAPTER XI

The Cast Gold Crown

Previous to the advent of the casting process, the most important means of restoring a tooth deeply involved by caries, or for providing a means of support for a bridge, or a partial denture was the gold shell crown, or "gold cap," as popularly designated. Dentists of today can visualize, only with difficulty, the many uses as well as abuses of the old fashioned, gold shell crown. It was originally made as a two piece crown, and, in the early days of its use, some pretension of obtaining a snug fit at the gingival margin was made by the more reputable dentists. Fair adaptation of the occlusion was possible, although, few dentists actually carried this out to the extent which is now considered desirable. Then came the seamless crown, with the possibilities of adaptation at the gingival line and of respectable occlusion very much reduced by the inherent limitations of the device. It was, however, seized upon by the charlatan as an outstanding means of cutting corners and was possibly the most conspicuous blot on the dentistry of a generation ago. So serious were the injuries directly traceable to the gold shell crown, and especially the seamless gold crown of the "gold tooth era," that this type of restoration was given a condemnation which it did not entirely deserve. It was simply another example of a method being condemned because of its improper application. The cast gold inlay, and the three-quarter crown, have of course superseded the gold shell crown in many places where formerly it was appropriately used. But the gold crown as now made, with a cast occlusal surface, has a place in dental practice and, when indicated, no other structure will quite take its place.

Technique of Gold Shell Crown

In the earlier days of the use of the gold shell crown, the technique followed was to fit a band to the root, then strike up an occlusal surface in a mould, of approximately the proper form and size, from a brass, or steel die plate. The cusp so swaged was fitted to the band, tried in the mouth and finally soldered to the band and reinforced with solder. The occlusal form, so developed, was seldom satisfactory, and this lead to the development of a technique wherein a special die was constructed by making a carving from an imprint of the opposing teeth. Even here, considerable difficulty was experienced in seating the swaged cusp on the band, so that it would have the correct relations with the opposing teeth

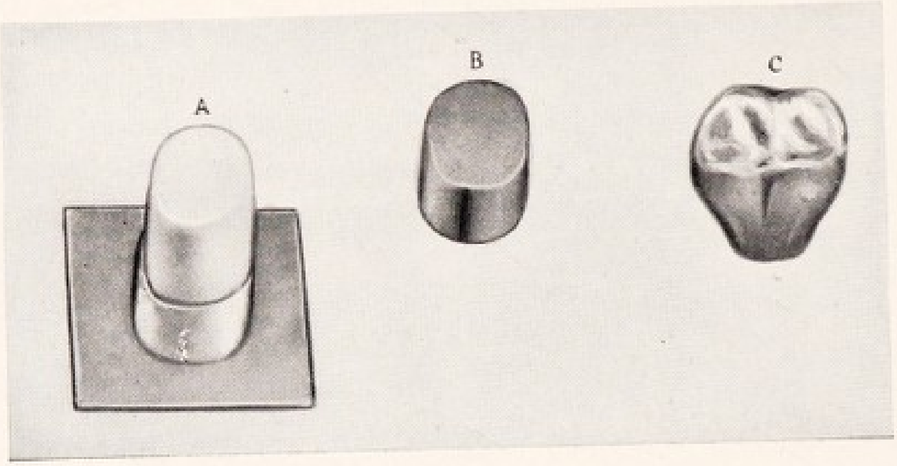


Fig. 36. A. This represents a right upper molar prepared for a cast gold crown. B. Gold band fitted to the root, trimmed to follow the gum margin and with a gold floor sweated to it. C. Finished crown made by casting gold over the coping, B. Note the development of approximal, buccal and occlusal contours made possible by this method

when finally inserted. The introduction of the casting process has eliminated nearly all of these difficulties. The casting of the occlusal surface represents the modern development, since the band is still fitted to the root in essentially the same manner as when the gold shell crown was first made.

At the present time the cast gold crown, as it is commonly called, is made by fitting and contouring a gold band to the prepared tooth, and developing the occlusal surface by placing softened inlay wax in the occlusal area, into which the patient is then instructed to bite. With this imprint as a foundation, the details of the occlusal surface are worked up with suitable carving instruments. A modification of this technique will be described later. Fig. 36 represents the stages in the construction of a cast gold crown in which a coping is used as the foundation for the piece.

Uses of the Cast Gold Crown

The cast gold crown may be used as a restoration upon a single tooth, or as an abutment for a bridge, or a partial denture. It is to be understood that this is only recommended when the tooth is very much broken down. Occasionally it may be used on a vital tooth, but will ordinarily be indicated only on pulpless teeth. If used on a vital tooth it must be kept in mind that, unlike porcelain, gold is a good conductor of thermal changes. This will serve as a word of caution in deciding upon the use of the gold crown, and also as a warning to provide such protection as may be possible in the way of non-conductive material as a lining, for any deep cavities which may have developed in the tooth. By this means, it may be possible to avert the development of untoward pulp disturbances, which might ensue from repeated thermal shock.

The lower bicuspids and molars, and the upper second molars, are the teeth most suitable for restoration by this method. Occasionally it may be acceptable for use on an upper first molar, but the requirements of esthetics forbid its use elsewhere in the mouth.

Technique for Cast Gold Crown

The primary requirement in the construction of the cast gold crown is an accurate fit at the gingival line. This demands first the correct preparation of the tooth. All excessive contour must be removed so that no diameter of the tooth shall be greater than its diameter at the point where the gingival border of the band terminates. The point to which the band is to be carried requires careful consideration. It should be brought slightly beneath the gum margin, for protection against caries, and against the development of sensitive spots at the gum line.

The gingival edge of a cast gold crown should never encroach upon the investing tissue, nor pass more than 1/2 mm. beneath the free margin of the gingiva. This rule applies to any crown requiring the use of a metal band in its construction. One reason for not carrying the band farther, is the increasing difficulty of maintaining close adaptation of the band to the tooth when the metal is carried farther apically. Any protrusion of metal into the gingival tissue at this point will bring about a constant irritation and inflammation.

In the preparation of the tooth, the reduction of contour is carried on with the thought in mind as to this slight extension of the gold beneath the free margin of the gingiva. It will be seen therefore, that not all of the enamel is removed from the tooth at its cervix. The enamel remaining below the gum margin preserves the normal contour at this point. This is very important since it is nearly impossible to reproduce these contours with gold.

A difficulty, which is of frequent occurrence during the construction and fitting of the full gold crown, is an overhang where the root contour develops an unexpected dip just below the gum line. A radiograph taken during the fitting of the band, with the band in place, will serve to disclose this condition, if it is on an approximal surface. Overhangs of crown bands are also frequently found at margins which are not readily reached by the explorer. This may occur on buccal and lingual surfaces, as well as approximal, if the marginal gingiva, under which the crown band is usually carried, is dense and firm. If the band is carried to, or nearly to, the point of attachment of the marginal gingiva this tissue is momentarily blanched by the pressure of the band. This blanching was formerly considered to be a satisfactory test of the fit of the band. But since the gingiva may be blanched by firm pressure, at points other than its attachment, and since pressure of the band against the gingival tissue is undesirable in any event, this test, is of course, worthless. Dependence must be placed on the explorer, and no band, nor other metallic edge, should be carried so near the base of the gingival crevice that the operator is barred from passing a fine pointed explorer along the edge of the metal margin to ascertain that the metal tightly hugs the tooth at all points.

Caries at Crown Margins

One of the serious faults of the full gold crown is the fairly frequent occurrence of caries under the band. This can nearly always be traced to a failure to secure close adaptation of the band to the tooth, at the margin of the band. If the fit of the band is tested both by the x-ray and by the explorer, as previously outlined, there need be little fear of the future occurrence of caries.

Crowns in Traumatic Occlusion

In the past it has usually been accepted, that if gingival inflammation develops, subsequent to the placing of a full gold crown, the fault lies in the adaptation of the band. This is not invariably the case. Traumatic occlusion, due to improper occlusal relations, is a very prominent factor in gingivitis, and has very often been the most important cause of this disturbance on crowned teeth. This point has been stressed by periodontists, but its significance is still disregarded by many crown and bridge workers. In checking up those cases which may show gingivitis after the placing of a full gold crown, it is necessary to examine the occlusion as well as the fit of the band.

Height of Contour

On the mesial and distal surfaces of the teeth, the greatest diameter will be found at the level of the contact points. On the buccal and lingual surfaces the contour is prominent near the occlusal surface, but is carried more or less uniformly to a point where the gum tissue normally rests. It is this contour which protects the marginal gingiva from injury by the crowding of the food bolus during mastication. On the approximal surfaces, on the other hand, there is comparatively little contouring at the region of the cemento-enamel line. Preparation of the tooth must be planned with these variations in mind. On the approximal surfaces the major portion of the cutting will be done near the occlusal surface, while on the buccal and lingual surfaces the crown is reduced more uniformly from the occlusal to the gingival line.

The difference in the anatomy of the upper and lower molars, and of the lower bicuspids should receive careful attention when these teeth are prepared for the reception of gold crowns. The greatest diameter of the tooth must be considered, and the band must be contoured to conform to this diameter, in order that the finished crown may harmonize in its outline with that of the adjoining teeth.

The greatest diameter of the occlusal surface of the upper molars is from the anterobuccal to the distopalatal. The band should be made to conform to this outline to enable the operator to shape and contour the casting wax in such manner that the finished crown will have the necessary thickness and proper contour at all points. The greatest contour of this tooth will usually be found on the mesial side. This contour is removed by using a carborundum disk in a Smith Universal Grinding Attachment. (Fig. 208). Good results cannot be attained with a straight handpiece. Make a slice cut and exercise care not to cut too far into the tooth. Avoid producing a shoulder at the gingival margin. To remove the bulk of the contour with a straight handpiece would necessitate cutting toward the center of the tooth, thus destroying sound tooth structure and leaving a decided slope to the mesial surface of the tooth, while on the distal surface, though the contour is not so great, there is always the possibility of producing a ledge which would make the fitting of a band very difficult. The same difficulty will be encountered if a straight handpiece is used in reducing the mesial and distal contours of the lower molars and bicuspids.

After reducing the mesial and distal contours of the tooth with a carborundum disk in a Smith Universal Grinding Attachment, the buccal and lingual surfaces are reduced with Miller Stones Nos. 226½, 227, 228½, 269, 326½, 327, 328½, 369. The tooth should be trimmed until these surfaces taper slightly from the parallel. Coarse sandpaper disks are then used to round the corners of the tooth, giving the handpiece a rotary motion.

Exercise great care to avoid, as far as possible, any laceration or traumatism of the investing tissue. The recuperative power of the gingivæ in a healthy case is very marked, but too severe an injury may result in a permanent recession of the marginal gingiva, always an embarrassing incident when occurring as the result of bridge construction.

The general outline of the occlusal surface of the lower molars is oblong, and the mesial side is usually slightly broader than the distal. The contour of these teeth is usually very great, hence the mesial, distal and lingual surfaces may require considerable trimming. However, it is usually not necessary to reduce the enamel to any great extent on the buccal surface, as the natural inclination of this tooth is toward the lingual. On the other hand, the enamel on the lingual surface may require considerable trimming, in order to parallel the tooth with an anterior abutment. The same disks and right angle points are used in reducing the lower molars and bicuspids, as were used in the preparation of the upper molars.

In preparing the lower bicuspids it is usually advisable to use a safe-sided disk, and to cut between the teeth very carefully, gradually removing the contour of the tooth on the mesial and distal surfaces. The buccal and lingual surfaces are reduced with small Miller stones of the same shape as those used in the preparation of the molars. And, as in the lower molars, the greatest contour will usually be found on the lingual surface.

The shape of the tooth on the buccal side is such that it provides protection for the marginal gingiva from the impact of food during mastication. The fact that the normal buccal overbite of the upper posterior teeth over the lower tends to crush food forcibly against the buccal gum tissue of the lower teeth makes this anatomical feature very important. In preparing the tooth, and in shaping the gold band, it is of great importance, first, to preserve the enamel beneath the gum margin and, second, to contour the gold so as to reproduce the original protective features of the anatomy of the tooth. The same condition is found on the lingual side, but is not accentuated so much. This is because there is relatively less crushing of food against the lingual gum tissue.

Enough of the tooth structure should be removed from the occlusal surface, so that a gold cusp, of at least 2 mm. thickness over the entire surface, may be constructed. The removal of sufficient tooth substance should be carefully checked, both by inspection with the jaws closed in the various functional positions, and by means of a bite taken in wax. In the case of vital teeth there is a tendency to stop short of the desired point because of sensitiveness of the tooth. Shortcomings at this time will mean either too thin a gold cusp, with the probability that it will soon wear through, or the stress on too high a cusp will cause traumatic occlusion with resultant disease.

The Technique for the Construction of a Cast Gold Crown for a Right Lower First Molar

In the construction of a cast gold crown for a right lower first molar, the first step is the preparation of the distal surface. A slice cut is made with a Joe Dandy disk, in a Smith Universal Grinding Attachment. The greatest care is taken to avoid leaving a shoulder at the gingival line. It is frequently found that the root of the tooth dips in, just below the

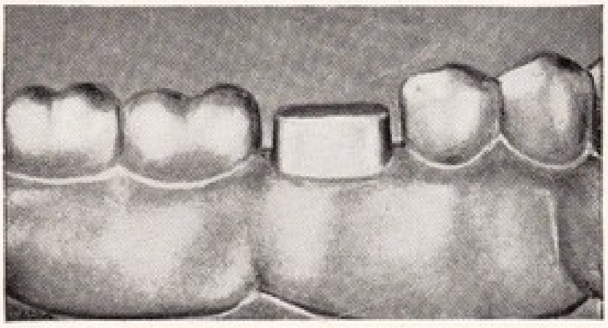


Fig. 37. A lower right first molar, devitalized, prepared for a cast gold crown. Notice that the greatest circumference is at the gum line

gum line, on either mesial or distal surface, or on both. The preparation of these surfaces requires the inclusion of such a depression in the preparation of the surface involved, down to that point below the gum margin to which it is intended to carry the gold band. By so doing, it will be possible to avoid one of the commonest errors in the construction of gold crowns, namely, the production of an overhanging margin beneath the gum line at this point.

The mesial surface is next prepared in a similar manner, observing the same precautions as with the distal surface. The buccal and lingual contours are next reduced with stones as previously described, until the greatest diameter is at the gum line. The occlusal surface is next reduced sufficiently to provide for the proper cusp height, and the corners at the approximal, buccal and lingual angles are rounded with sandpaper disks. (Fig. 37.)

Two measurements of the prepared tooth stump are taken. The first is taken straight around the neck of the tooth at the gum line. No attempt is made to follow the curvature of the gum line, as this would result in a measurement greater than the actual diameter of the stump. The second measurement is taken in a similar manner at a point about 1/3 the length

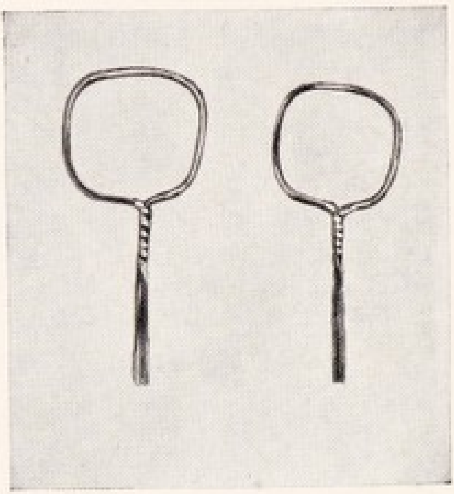


Fig. 38. Two measurement wires as removed from the tooth. The larger loop is the measurement of the tooth at the gum line; the smaller loop represents the diameter at a point about one third of the length of the stump below its occlusal surface

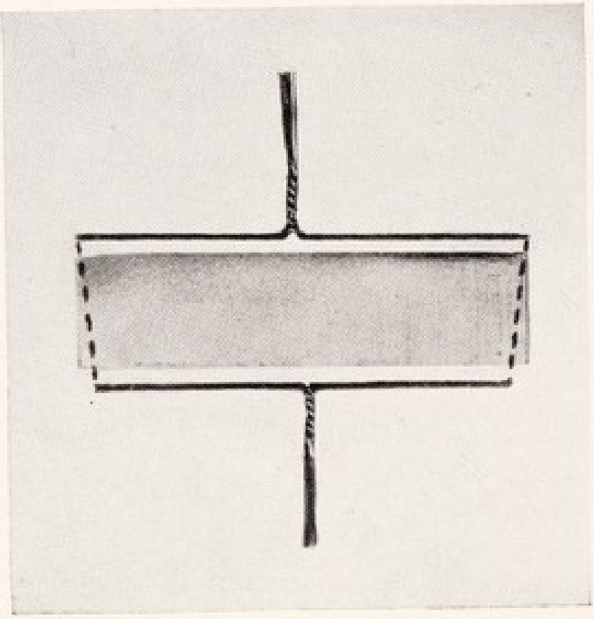


Fig. 39

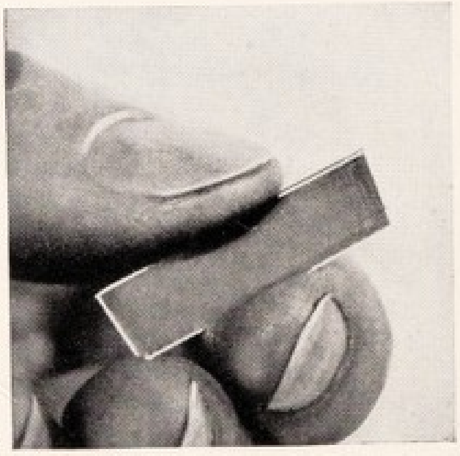


Fig. 40

Fig. 39. This represents a piece of 22 K., 30 gauge, gold, with the measurement wires shown in Fig. 38, straightened out and laid on either side of it. The gold band which is slightly wider than the length of the stump is cut to the length of the longer wire measurement on one side. The smaller wire is placed so that its ends are equidistant from the ends of the gold band on the opposite side. The band is to be cut as indicated in the dotted lines, allowance being made of 1/2 mm. extra length for beveling

Fig. 40. The gold band cut and ready for beveling

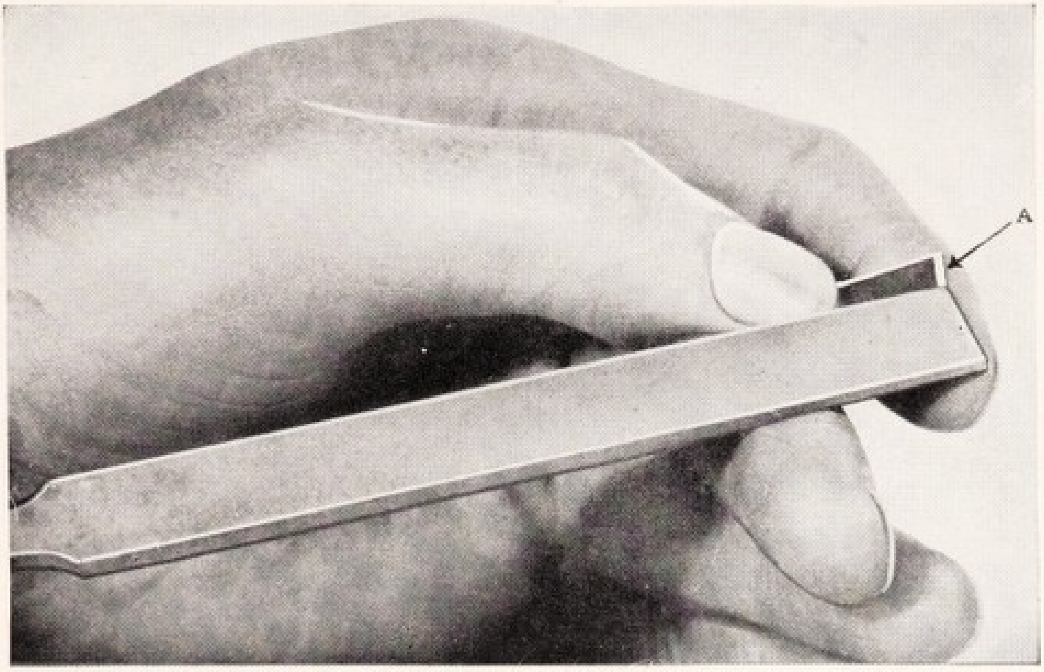


Fig. 41. Gold band held in correct position for beveling. A fine flat gold file is passed over the end of the band, producing approximately a 45 degree bevel, which must be uniform

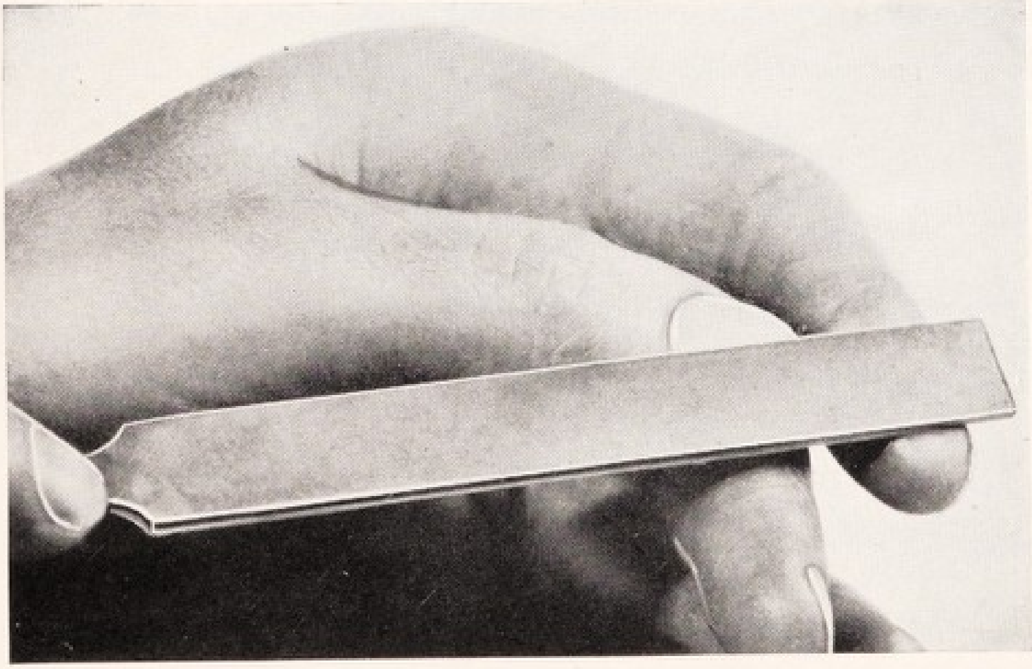


Fig. 42. The file is passed forward in one direction only, as shown in the figure. The stroke is repeated until the bevel as shown in Fig. 41 at A, is produced

of the stump from the occlusal surface. These two measurements are illustrated in Fig. 38. The measurement wires are now cut and straightened out as in Fig. 39. A piece of 22 K., 30 gauge, gold plate, is cut slightly wider than the length of the tooth stump. Its length is that of the

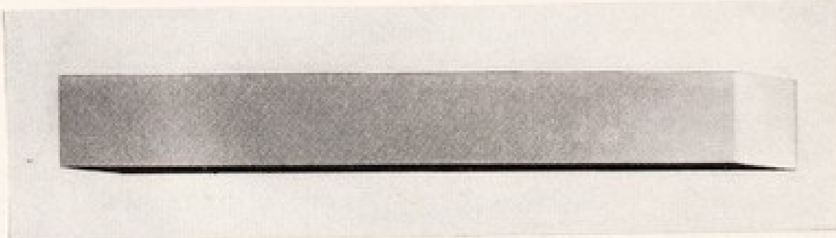


Fig. 43. The other end of the band is beveled on the opposite side. This produces the effect shown in Fig. 44. (In Figs. 43 and 44 the gold band appears thicker than it really is. This has been necessary in order to properly illustrate the bevels. Ed.)

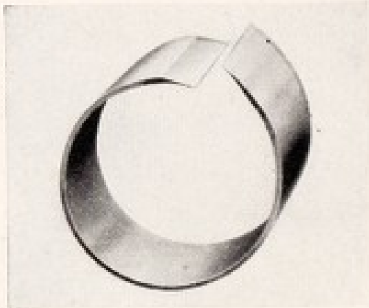


Fig. 44. A wash drawing representing the bending of the band so that the ends overlap. After this is done, the ends are pulled back and sprung one under the other. The tension thus produced will maintain contact during the sweating of the band

longer measurement wire to which is added 1/2 mm. to provide for beveling. The shorter wire is now placed along the lower edge of the gold plate, equidistant from the ends, and its length is marked on the gold with a sharp instrument. This measurement is also increased 1/2 mm. and the gold is cut as represented by the dotted lines in Fig. 39. This will provide for the tapering of the band which is requisite for correct fitting at the gum line and will also cause it to hug the tooth stump more closely. (Fig. 40.)

The gold band is next beveled at each end at an angle of about 45 degrees, using a flat file, of fine cut as shown in Fig. 41. The file is passed over the gold in one direction only in order that a smooth true bevel may be produced. (Fig. 42.) A bevel is placed on the opposite side at the other end of the plate, (Fig. 43) so that when the gold is curved into band form the two beveled surfaces will overlap.

Autogenous Soldering

The best method for uniting gold bands, or uniting pieces of gold of the same karat is the "sweating process," or autogenous soldering. By this means the parts are melted, or welded together, without the use of solder. This

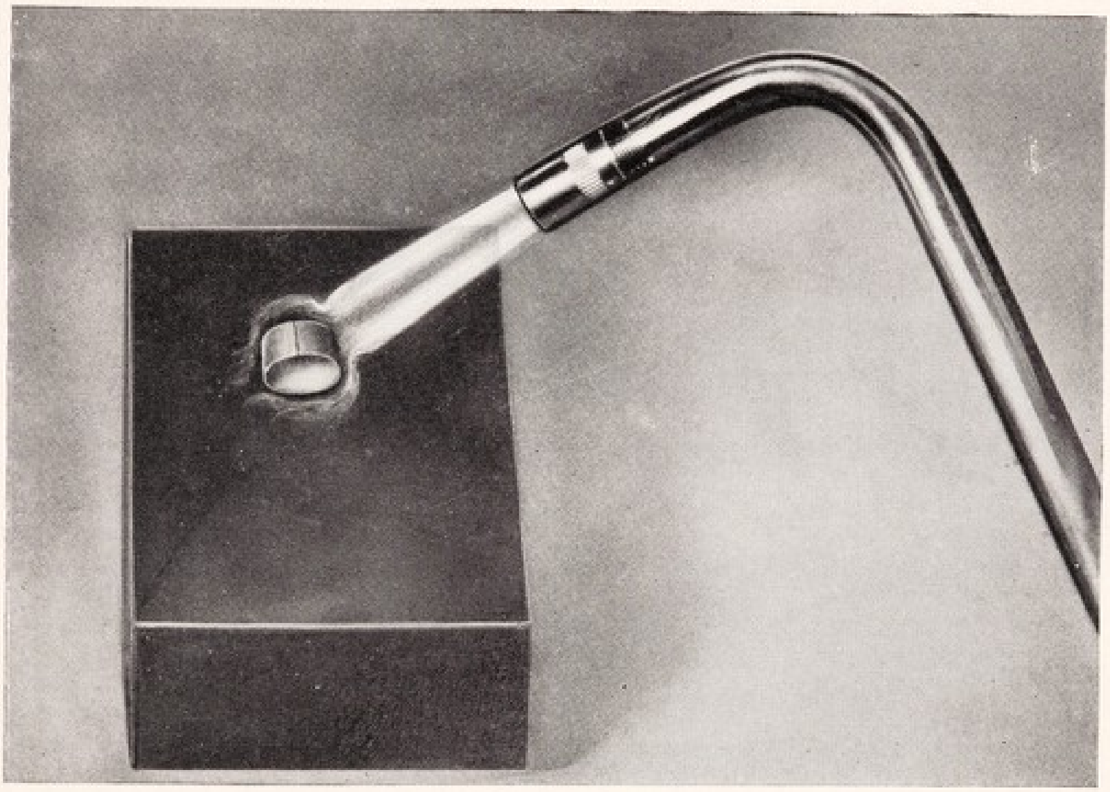


Fig. 45. The gold band laid on a charcoal block and the blowpipe used to sweat the edges of the band

method makes the strongest union and has the advantage of not being re-fused in subsequent solderings. To master this technique requires considerable practice and patience, but once the skill has been acquired, the dentist who aspires to efficiency in the finer mechanical procedures will seldom resort to the use of alloys for uniting gold bands. By this method the metal surfaces to be united are heated, while in close contact, until they are fused together. The edges must be fused while the metal is near, but not actually at its melting point. When the proper degree of heat has been applied there will be a molecular attraction between the fused sur-

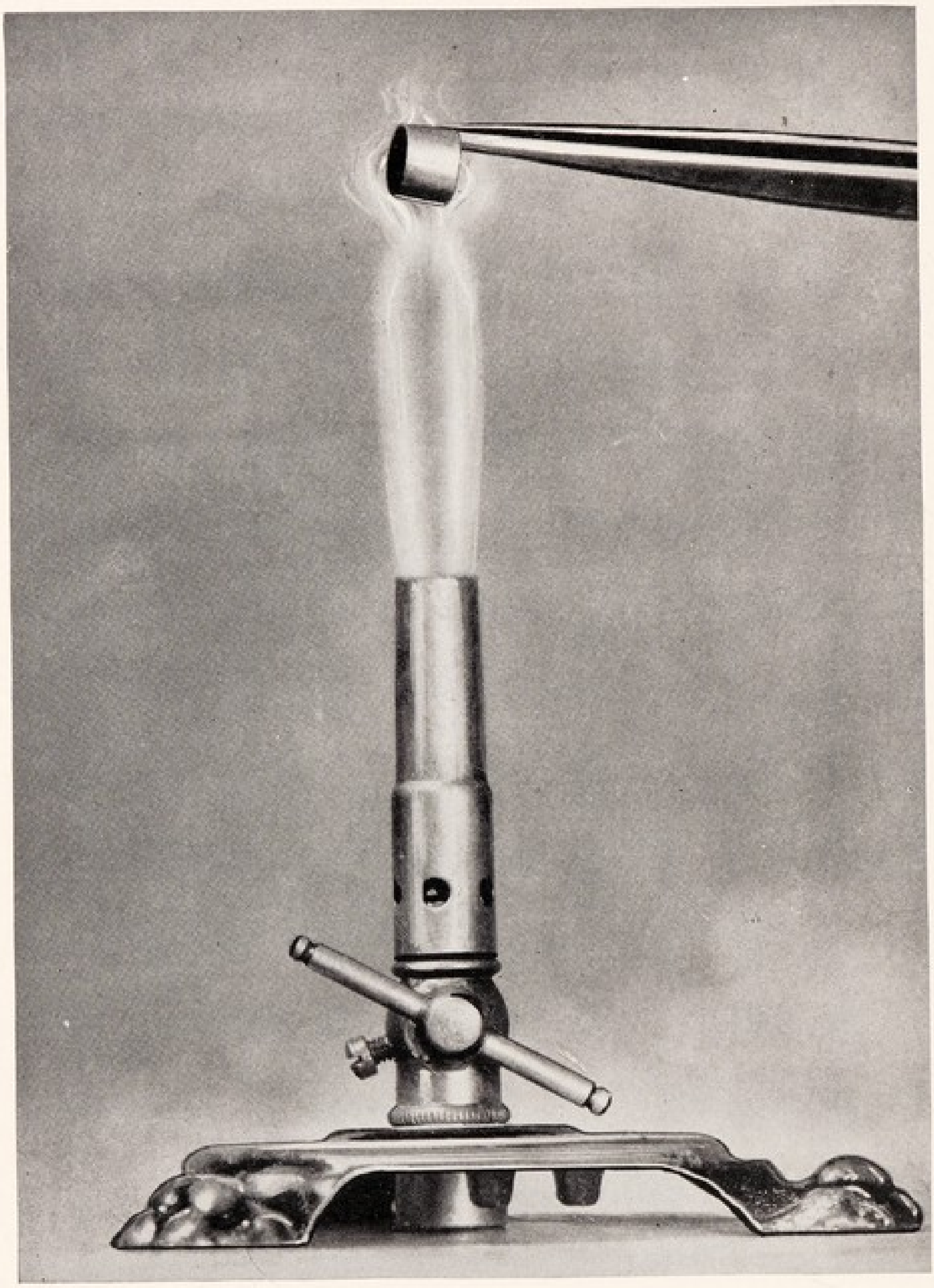


Fig. 46. This illustrates the method of sweating the band in the Bunsen flame. Note that the seam is down, and that the pliers grasp the band opposite the seam

faces causing them to flow together and unite. Bands are more quickly and easily united by this method and with less liability of burning than where solder is used.

To unite a band by the "sweating process," bevel both ends of the band on opposite sides. The beveled ends are then bent around, and under each other, until the ends overlap, as in Fig. 44. The overlapping ends are then pulled back and allowed to spring together upon each other. The overlapping ends will then be pressed together in their proper position by the elasticity of the metal. Continuous contact of the beveled edges is essential to insure perfect union when the band is sweated together. By first overlapping and bending under the ends of the band, as just described, and then restoring the ends to their original position, this contact will be maintained. This manipulation of the metal acts upon the molecules in such a way as to overcome expansion when the band is heated.

After the beveled ends of the band have been placed in continuous contact, the joint is fluxed with a saturated solution of borax and boric acid. The band is then placed on a piece of charcoal with the lapped edges uppermost as shown in Fig. 45. When the blowpipe is used in the sweating process, start with a small brush flame, and continue to apply heat until the band is brought to a red heat. When the gold begins to glisten, the surface is nearly ready to fuse. The flame must be quickly removed as soon as the parts are united.

Another, and undoubtedly the easiest method is to sweat the band together in the Bunsen flame Fig. 46. The band is held with the seam downward in a pair of light, soldering pliers, and placed in the Bunsen flame until the gold begins to melt, when it is quickly withdrawn.

Uniting a band by this method produces a molecular condition in the metal similar to that obtained in cast gold. To bring about a rearrangement of the molecules, place the band, with the seam uppermost, over the beckhorn of an anvil and hammer the seam until it is of the same thickness as the rest of the band. Condensing the gold in this manner restores its tenacity, and makes the band as strong where it has been joined, as at any other point.

For those who maintain a predilection for the use of solder in such places as this, it may be said that this method is acceptable. But if solder is to be used it is necessary to have as little as possible, and at the same time secure union of the joint. A piece of solder half the size of a small pin head, will be ample to solder a band one half inch in width. To use more than this, will produce a stiff joint of objectionable bulk. Twenty-

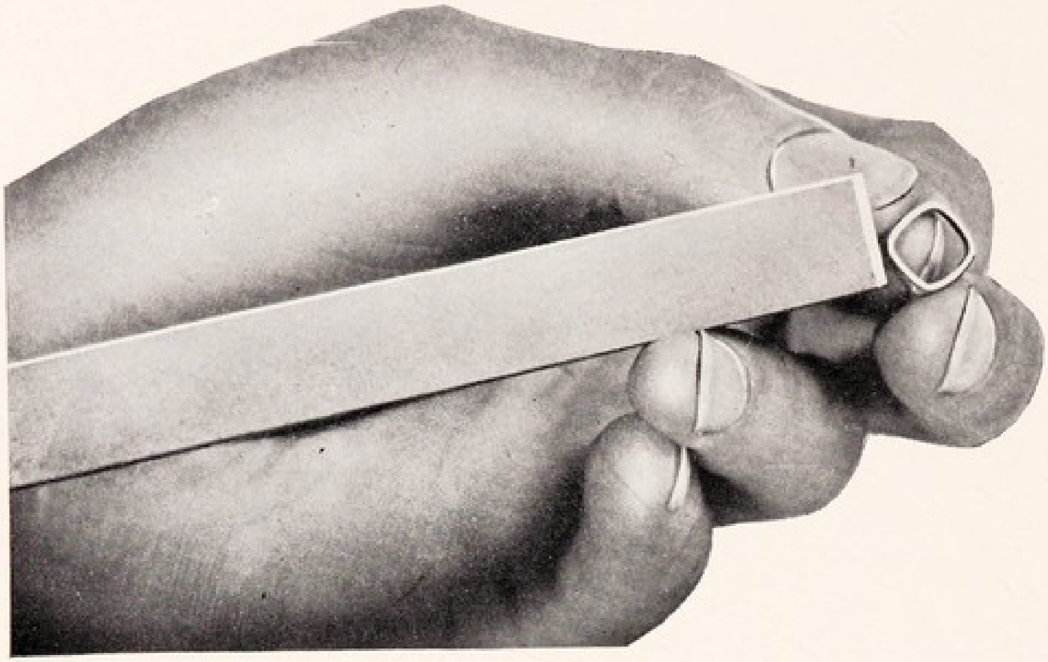


Fig. 47. After the sweating of the band the occlusal end is filed flat

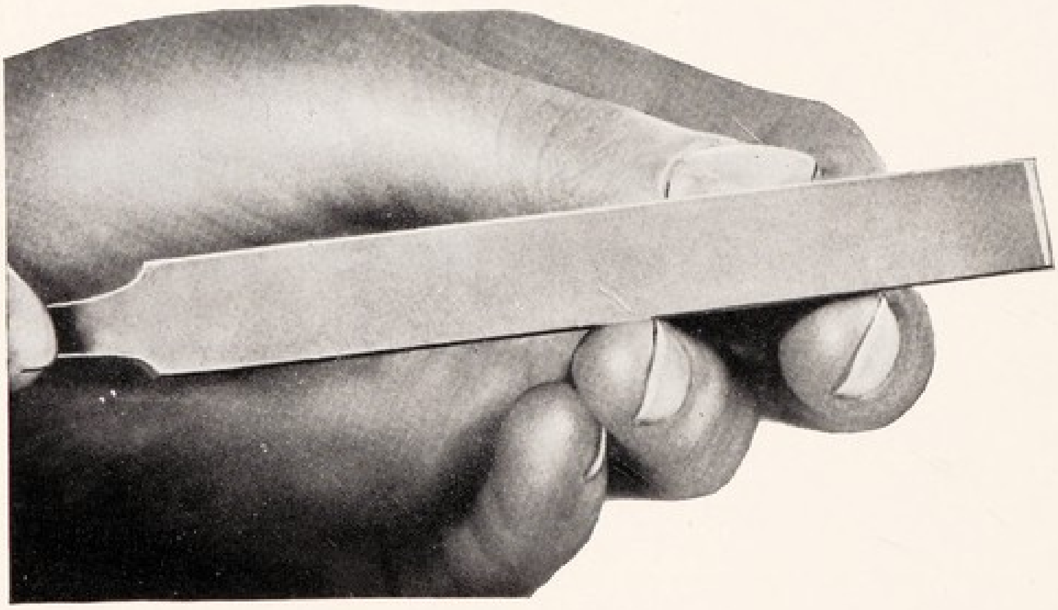


Fig. 48. In filing the band, the file is passed forward, in one direction only

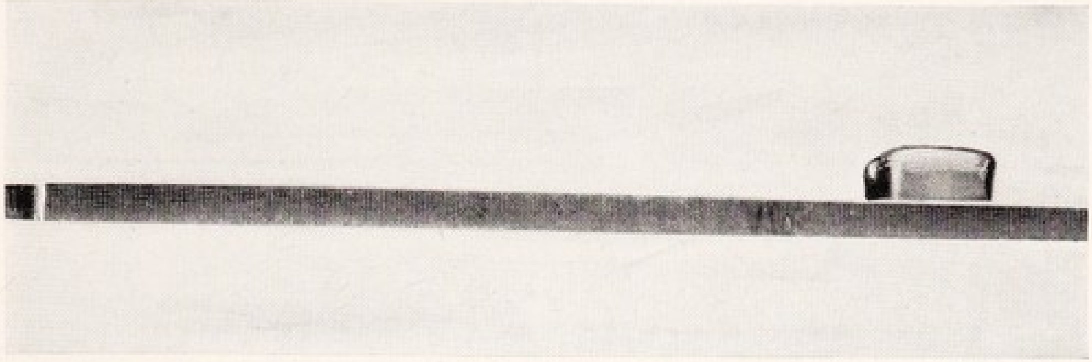


Fig. 49. The band is laid on the file and held to the light to determine any inaccuracy in the filing of the occlusal end

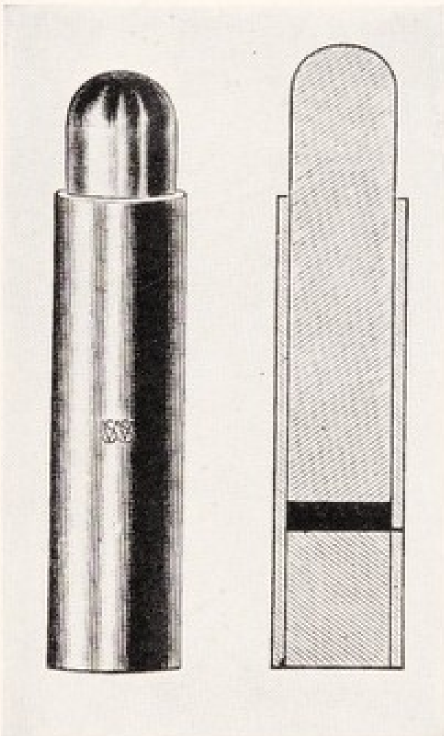


Fig. 50. This illustrates the Peeso swager used to flatten a piece of plate gold to form the floor of the coping

two K. solder should be used in uniting the band and its floor. It will then be necessary to use a lower karat solder for later soldering.

Fitting the Band

After uniting the band it is then carried to the mouth, trimmed and fitted to the gum line of the tooth. The band should be carried not more than 1/2 mm. beneath the gum margin. A sharp instrument is used to mark

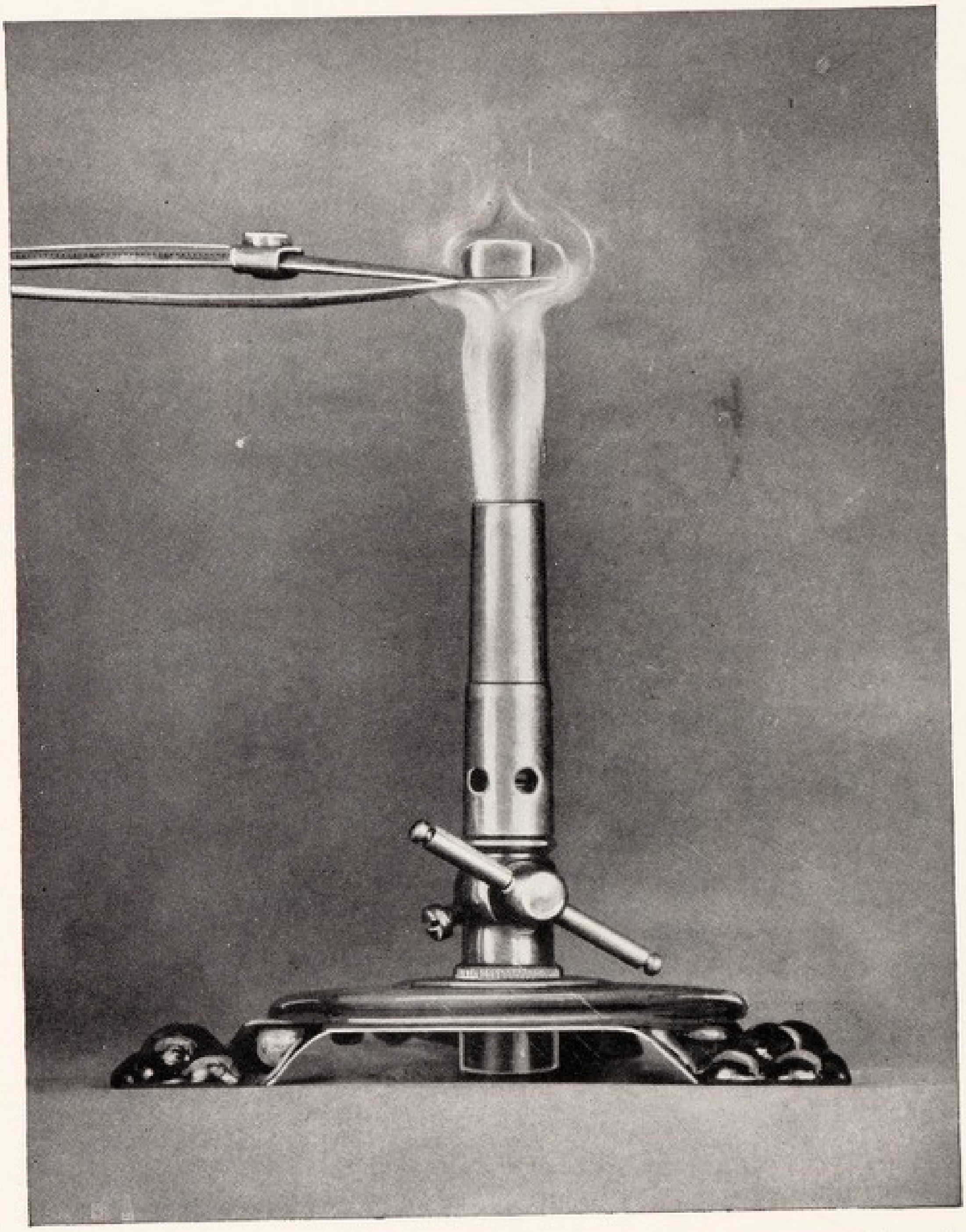


Fig. 51. The gold band placed on the flat floor and held in the Bunsen flame for sweating

the level of the occlusal surface of the tooth stump on the inside of the band, which is then cut to this line, leaving a slight excess for the subsequent filing.

The band is next held between the thumb and fingers of the left hand and is filed flat at the occlusal end. The file is passed over the band in one

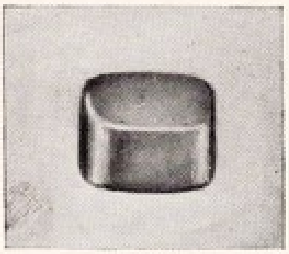


Fig. 52. This illustrates the finished coping after the excess gold of the floor has been trimmed away

direction only, as shown in Figs. 47 and 48. The band is filed until the file makes contact at all points. This may be tested by placing the band on the file and holding it up to the light as shown in Fig. 49.

Constructing Floor of Band

A piece of 22 K. 30 gauge gold plate of a size large enough to cover the occlusal end of the band is then selected, annealed and placed in a Peeso swager (Fig. 50) and swaged until perfectly flat. The gold plate is then cleansed in acid and one side is painted with a solution of borax and boric acid. The gold band is then placed on the gold plate and they are held in the Bunsen flame until the band is sweated to the gold plate. (Fig. 51.) In doing this the gold plate is first held low in the flame until the band is thoroughly heated. It is then gradually raised until the plate reaches the hottest part of the flame, at which point the gold plate will begin to fuse. When it is withdrawn it will usually be found that the side of the plate toward the tweezers which have held it, has failed to unite with the band, due to the reduction of heat by the tweezers. If this happens, the plate and band are cleansed in acid and grasped on the opposite side by the tweezers. Another application of borax and boric acid is made, and the gold is again placed in the flame to complete the sweating of the band to the plate.

The excess gold of the floor, is now cut away as shown in Fig. 52. This coping is now tried on the tooth, at which time it may be found that a slight additional grinding of the occlusal portion of the tooth may be required in order to permit correct seating. This is permissible because this type of coping, with a gold floor, is only used on pulpless teeth. The technique for the vital tooth will be described later.

A wax bite and plaster impression are taken at this time, with the gold

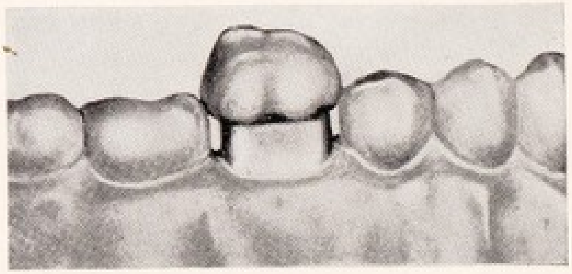


Fig. 53

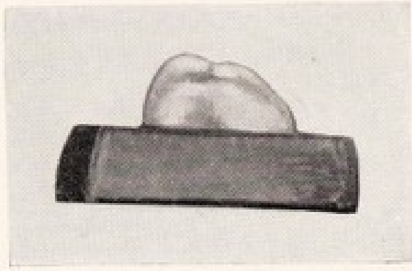


Fig. 54

Fig. 53. A porcelain tooth of suitable mold selected as to its mesiodistal diameter to fill the space between the second bicuspid and second molar

Fig. 54. Porcelain tooth selected as in Fig. 53 pressed into a block of softened modeling compound

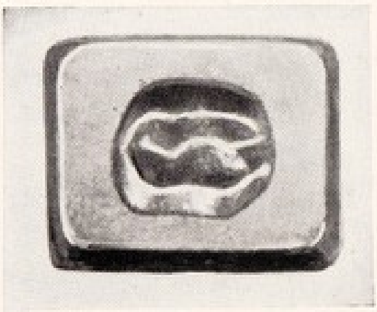


Fig. 55

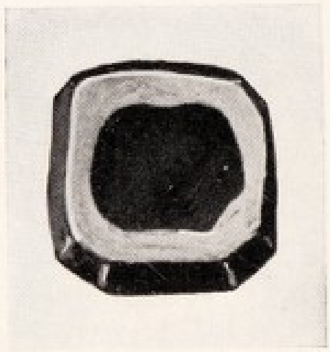


Fig. 56

Fig. 55. Modeling compound block showing imprint of porcelain tooth

Fig. 56. Softened inlay wax pressed into the impression in the chilled modeling compound block

coping in place, in order to prepare a cast for the proper contouring of the occlusal and approximal surfaces. The impression and bite however, may be taken at the same time with modeling compound as illustrated in Fig. 65.

Construction of Cast Cusps

The next step is the selection of a porcelain tooth having a well developed occlusal anatomy, and of a width which will fill the space formerly occupied by the natural tooth. (Fig. 53.) In selecting the tooth the buccolingual diameter is to be considered, as well as the mesiodistal diameter. If it is found that the tooth is slightly deficient in the buccolingual diameter this

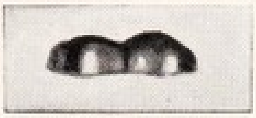


Fig. 57

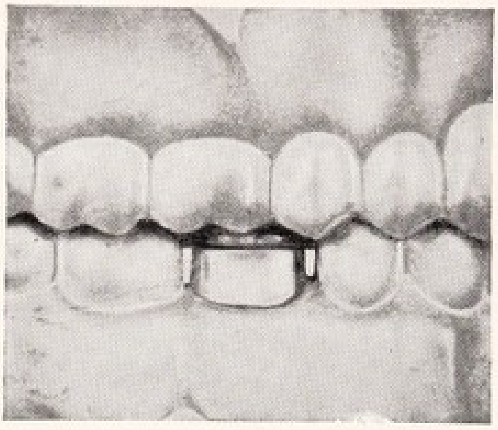


Fig. 58

Fig. 57. Inlay wax form removed from modeling compound block

Fig. 58. Gold coping in place on the cast with wax form placed in position for adjustment of occlusion with opposing teeth

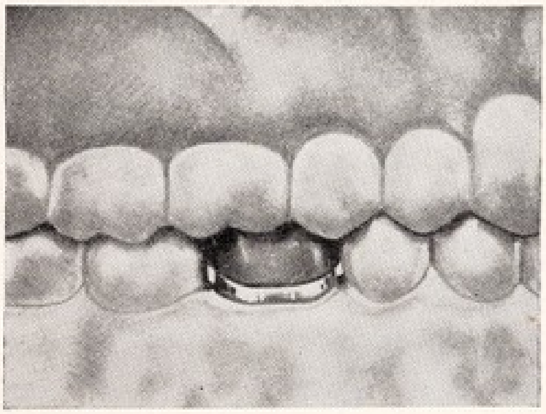


Fig. 59. Inlay wax added to the gold coping to bring out the approximal, lingual and labial contours of the crown

may be made up later on by adding wax to the occlusal wax pattern which is to be prepared.

The occlusal surface of the porcelain tooth is covered with a thin coating of oil, and the tooth is forced into a small block of modeling compound, the surface of which has been softened in the open flame. (Fig 54.) The porcelain tooth should be forced into the compound a sufficient distance to secure an impression that will enable the operator to produce a wax cusp form of adequate height. The modeling compound is then chilled and the porcelain tooth is removed. The imprint of the porcelain tooth is shown in Fig. 55. The surface of the imprint is then covered with a thin coating of oil, and inlay wax, which has been softened in warm

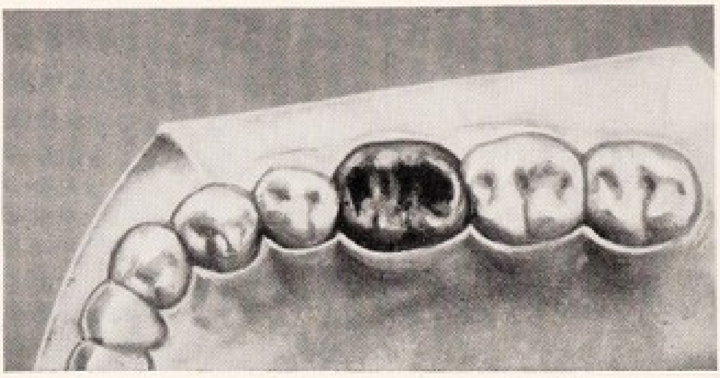


Fig. 60. Occlusal view of the crown shown in Fig. 59

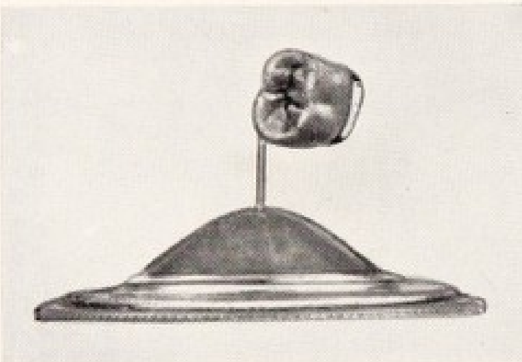


Fig. 61

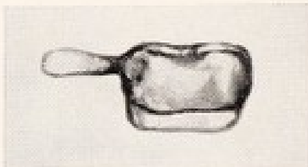


Fig. 62

Fig. 61. Sprue wire attached to the wax and mounted on crucible former. Note that the sprue wire is so placed that it does not involve the approximal surface, so that the gold, when cast, will not be forced in a right angle direction against the coping

Fig. 62. After casting, the gold nugget is cut off from the sprue which is then flattened to facilitate holding for final finishing of margin, with solder

water, is forced into the impression. (Fig. 56.) The inlay wax is chilled; it is trimmed flat and level with the modeling compound block, and is then removed from it. The inlay wax form is illustrated in Fig. 57.

The gold coping is next placed in position on the cast and the wax occlusal form is placed in contact and adjusted to conform to the occlusion of the opposing teeth. It may be necessary to reduce the cusps of the wax form, or the addition of more inlay wax may be required in order to secure a harmonious occlusal relationship with the opposing teeth. (Fig. 58.) After the proper occlusal relationship has been secured, inlay wax is

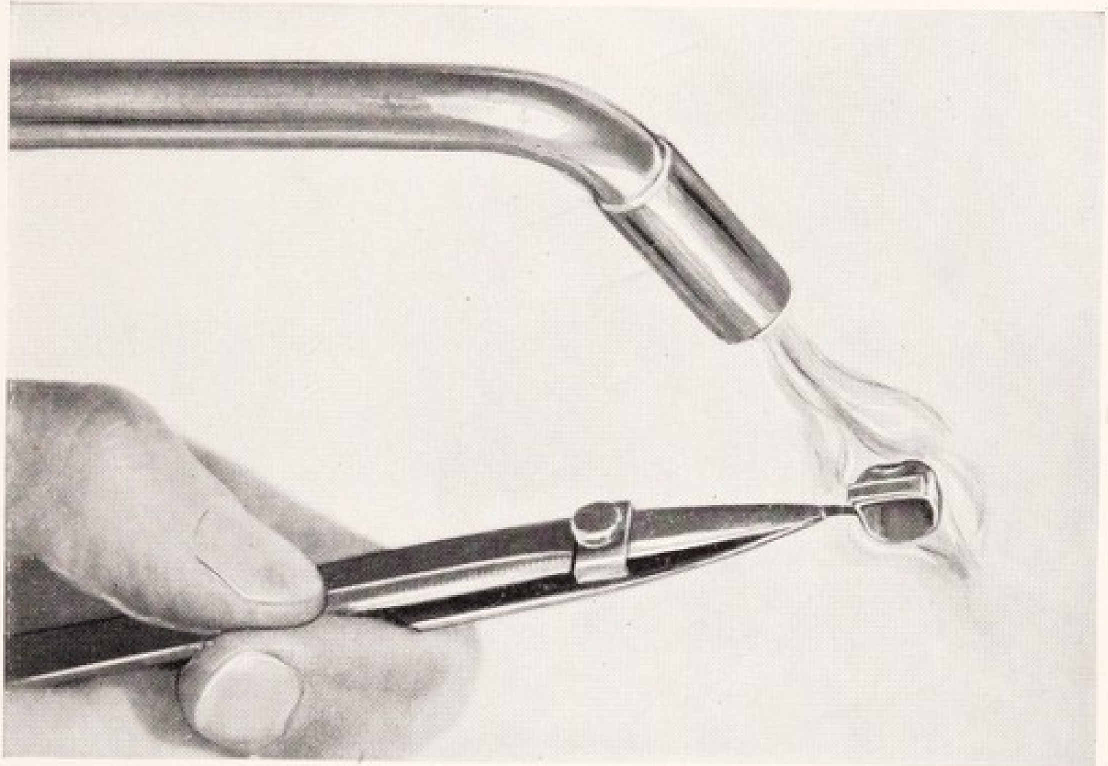


Fig. 63. 22 K. solder is flowed over the exposed band in the open blowpipe flame, to perfect the contour towards the gingival margin.

added to the approximal, lingual and buccal surfaces of the gold coping, and these surfaces are carved to the proper contours. About 1 mm. of the gold band should be left exposed at the gingival margin. (Fig. 59.) This precaution is taken to avoid the possibility of the cast gold extending beyond the gingival edge of the gold band, thus destroying the accurate fit of the band to the tooth stump. Carelessness in investing the crown previous to casting might cause such an error.

When constructing this type of crown, every possible source of error should be guarded against. Under no circumstances should the crown be cast, until the wax form has been tried in the mouth. It is imperative that the finest possible occlusal adjustment, approximal contact, surface relationship and contour should be obtained. These relationships cannot be secured unless the final adjustment of the wax form is made in the mouth. With the wax form in position in the mouth, the patient is instructed to make the right, left and protrusive bite several times. It will usually be found that the opposing teeth make excessive contact with the wax form, necessitating some alteration and recarving of the wax pattern. Had the precaution of trying the wax pattern in the mouth not been taken, this would result in excessive stress and would produce traumatic occlusion

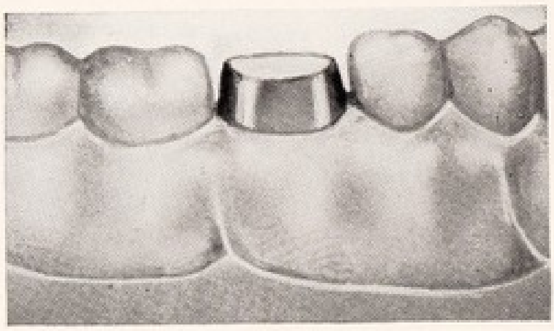


Fig. 64. Gold band in place on a vital tooth. Note that the occlusal height is greater than for the devitalized tooth, and that no gold floor is used. This obviates any difficulty of adaptation which might come from irregularity of the occlusal surface of the tooth

unless relieved on the finished crown. Making this relief on the inlay wax is much easier and a great saving of time. Also, possible deficiencies in cusp height may be remedied at this time, by the addition of inlay wax. Contact points are also of great importance and cannot be easily reproduced if found to be faulty on the finished crown. The same contact relationships, as well as other contours should be reproduced on the crown as found elsewhere in the mouth. (Fig. 60.)

When the crown is invested for casting, the sprue wire should be placed at one corner of the crown (as illustrated in Fig. 61) in order to avoid deforming the contact points. When placed in this position the molten metal will flow around the gold coping and not be forced directly against the gold coping as would be the case if the sprue wire were placed at a right angle with the surface of the coping; this would cause the gold to strike the coping and spatter in opposite directions, and possibly solidify before it could fill the mold.

After casting, the nugget is cut off, leaving a long sprue attached to the crown; the sprue is then flattened with a small hammer on the beckhorn of the anvil. (Fig. 62.) The cast crown is then cleansed in boiling acid and the flattened sprue is grasped in the jeweler's soldering pliers.

(Fig. 63.) Twenty-two K. solder is flowed over the exposed band with the blowpipe, to perfect the contour towards the gingival margin of the crown.

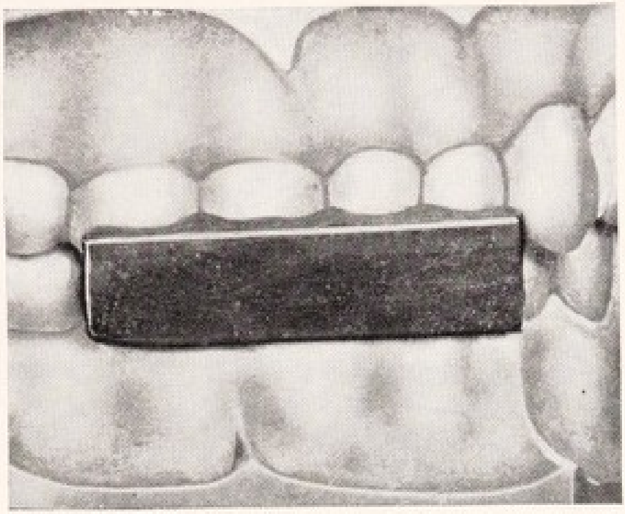


Fig. 65. Impression and bite taken simultaneously in modeling compound

Fig. 66. Gold band removed from the tooth stump and placed in the modeling compound impression

In the event that the band and floor were united by solder instead of by sweating, the step just described must be carried out in a slightly different manner, in order to avoid disturbing the joints previously soldered. First paint the inside of the crown with antiflux. The joint between the cast gold and the band may then be soldered as described before, using 20 K. solder, instead of 22 K. After the exposed portion of the band has been covered with solder the gingival margin of the crown is reduced to a very fine edge with a fine cut gold file. No rough edges or irregularities should be allowed to remain at this portion of the crown. The crown is then polished to a high degree of smoothness.

Perfecting Final Occlusions

After the finished crown has been cemented to place the final occlusal adjustment is made. If care has been exercised in the preliminary steps the final adjustment can usually be made by placing abrasive paste on the occlusal surface of the crown and requesting the patient to perform the movements of mastication. This will reduce any slight irregularities not easily detected by articulating paper.

Cast Crown on Vital Tooth

When the cast gold crown is used on a vital tooth it is inadvisable to reduce the occlusal surface to any greater extent than is necessary to secure a cusp of adequate thickness. The encountering of sensitive tooth structure may necessitate the construction of a gold band that would have an irregular border at the occlusal surface. Under such conditions no attempt is made to place a gold floor on the band. After the gold band has been accurately fitted at the gum line, the occlusal surface of the band is reduced with stones until it is the same height as the occlusal surface of the tooth stump. (Fig. 64.) An impression and bite is then taken with modeling compound (Fig. 65). Considerable care should then be exercised in placing the gold band in the modeling compound impression. (Fig. 66.) Any discrepancy in the proper placing of the gold band will necessitate considerable occlusal adjustment in the wax pattern when the crown is transferred to the mouth for final adjustment.

From this bite-impression, articulated stone casts are prepared. This will provide accurate relationship of the prepared band with the antagonizing teeth. Wax cusps are built on and properly carved to occlusal adaptation, and the crown is then cast and finished, as already described.

CHAPTER XII

The Richmond Crown

The Richmond crown was one of the first responses of the dental profession, to the esthetic demands of restorative dentistry. Previous to the invention of this crown, the gold shell crown and the open-face gold shell crown had been used for anterior teeth. The open faced gold shell crown only partially met the esthetic demands and in many cases the tooth to be crowned was so seriously attacked by caries that it was impossible to make an open face crown that would satisfy the patient's desires. Even at its best, the open face crown was unsatisfactory, being especially likely to develop leakage and caries at the labial margins.

The Richmond crown was the first crown in which a porcelain facing was used. It was designed to combine the necessary strength with a pleasing appearance, and, when properly constructed, was and still is, a useful device in properly selected cases.

The early Richmond crown had a full gold band, a feature which is now regarded as unnecessary, in the majority of instances. The gold band extending under the gum margin is only justified by the demands of extreme stress. In the posterior teeth stress may be delivered from any angle, mesial, distal, buccal or lingual. The banded crown for the posterior teeth must therefore, completely encircle the tooth. On the upper anterior teeth, however, stress is delivered chiefly from the lingual side and, under normal conditions, never from the labial. This being the case there is no reason for using a band on the labial side of the upper anterior teeth, and it is particularly desirable that it be omitted at this point. The reason for this is that esthetics demands that no gold shall show on the labial side of the crown. If the band on the labial side is to be concealed it must, of course, be carried some distance under the gum margin, a procedure which will eventually result in irritation and inflammation. Since the band is not needed at this point for strength, it is obvious that it should be limited to the lingual portion of the tooth.

On the lower anterior teeth the direction of stress is, normally, from the labial toward the lingual. Here a band on the labial side is required, and it is therefore made to completely encircle the tooth. Very few patients show the gingival third of the lower anterior teeth in talking or laughing; hence there is no esthetic objection to placing the band at and above the gum line of these teeth.

Early Type of Facings

The earlier facings used for Richmond crowns were of the pin type. When these facings were used, a gold backing was adapted to the porcelain facing and fastened to it by bending over the pins which had been carried through holes punched in the gold backing. This means of course, that the porcelain facing must be carried through one or more soldering processes, during the course of completing the crown, with the danger each time of checking the porcelain. Furthermore, the facing, not infrequently, became fractured in the mouth, in which case, satisfactory repair was almost impossible. Needless to say, the modern interchangeable porcelain facing has eliminated both of these hazards.

The Richmond crown, because of its metal back, provided a simple and efficient means for union with bridge pontics. It therefore early became an established feature of fixed bridges, where anterior teeth were to be used as abutments. It can still be utilized for this purpose, provided the various requirements for health, which are now well recognized, are met.

The Richmond crown, like the gold shell crown, has suffered from abuses which are not inherent in the crown itself. The first to be mentioned is improper fitting of the band. Difficulties in this part of the operation may be overcome in a similar manner to the means described in the technique for making the cast gold crown. Another important error in maxillary teeth has been the tendency to flow too much solder on the lingual surface with the result that traumatic occlusion is created when the crown is inserted. Especial care must be used in the planning of the crown, to make sure that sufficient space will be left between the gold backing and the opposing teeth, to provide for sufficient gold solder to give the necessary strength, without disturbing the occlusion. Having provided this necessary space, which may properly be obtained, in most cases, by grinding the opposing teeth, the operator must then take pains to use no more than the necessary thickness of solder.

Inasmuch as the Richmond crown, as constructed today, is nearly always used as a bridge abutment, it is necessary to lighten the occlusion more than would be required for a single crown, when finished to final form. The most satisfactory test for this, is to place a piece of thin paper, such as that found between the carbon sheets in a book of articulating paper, between the crown and the opposing teeth. Have the patient close first in centric occlusion and then in the various eccentric occlusions. In all of these positions it should be impossible for the patient to grasp the paper so as to prevent its withdrawal. The same test should also be made later with reference to the bridge segment of anterior bridges.

Another serious error, often committed in the construction of the crown, is to make the facing overlong, with reference to its relation to the opposing teeth. This has usually been due to the esthetic requirement of matching the length of natural teeth adjacent to the crown. This is an important consideration, but if this matching for length leads to the production of an excessive over-bite, as often happens, the result will be a traumatic occlusion and probable periodontal disease.

This situation suggests two preliminary procedures to be carried out before beginning the actual construction of the crown. In the first place, the length of the adjacent teeth should be carefully studied, as also their occlusal relationship, to determine whether it might not be desirable to shorten them as an esthetic measure. Also, in a surprisingly large number of cases this examination will reveal a traumatic occlusion not previously suspected and, of course, if found, its correction will prove to be of benefit to these teeth as well as making it possible to avoid traumatic occlusion on the crowned tooth.

Next, the length of the opposing teeth should be studied with the thought of possibly shortening them in the interest of the general occlusal harmony. These studies should be made for both protrusive and lateral excursions of the mandible. And when the proper adjustments have been made, whether of teeth adjacent to the proposed crown, or of teeth opposite to it, it will be found that the crown may be constructed to give esthetic satisfaction without causing traumatic stresses.

The Technique for the Construction of a Richmond Crown

When the Richmond crown was first advocated the root end was given a decided slope in its preparation as illustrated in Figs. 67 and 68. The argument for this method advanced by some authorities was that this type of preparation would protect the root from fracture. When this type of crown is made with a band, this extreme bevel is unnecessary as the band protects the root from fracture. When pin facings were used in the construction this extreme bevel did not weaken the retentive qualities of the porcelain facing as the pins could be shortened and bent against the gold backing. The facing was also held in position by soldering the pins to the floor and band of the crown. However, when the modern interchangeable facing is used this preparation is contraindicated. To secure proper adaptation at the cervical margin, this extreme bevel would necessitate cutting away that part of the porcelain facing which has the greatest strength and retentive qualities, as illustrated in Fig. 69.

Fig. 67

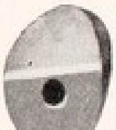


Fig. 68

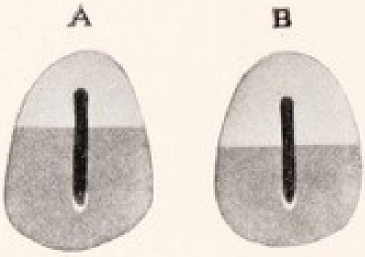


Fig. 69

Fig. 70

Fig. 67. Earlier method of preparing root end for Richmond crown. Note extreme bevel of labial side

Fig. 68. Occlusal view of preparation shown in Fig. 67

Fig. 69. A. Lingual surface of Steele's interchangeable porcelain facing as obtained from the manufacturers. B. View of same facing as it would be if ground to fit the root preparation shown in Fig. 67. Such grinding would dangerously weaken the retention groove in the porcelain

Fig. 70. Modification of preparation shown in Fig. 67 where the root has been attacked by caries, or where previous crowning has rendered ideal preparation impossible. Here a metal floor without band is used

Where the root end has been attacked by caries to such an extent that a band cannot be utilized, but where the remaining tooth structure will permit, a modification of the older type of preparation may be used, keeping in mind that the anterior bevel must be flattened out to accommodate the modern interchangeable facing, as illustrated in Fig. 70. Under such conditions a close fitting platinum floor, without a band, is adapted to the root end.

Due to extreme decay, or improper preparation at some previous time, it is sometimes necessary to construct a floor that is nearly flat as illustrated in Fig. 97.

When the marginal gingiva of the tooth is in a healthy condition the root end is reduced nearly to the gum line on the labial side with a flat bevel toward the lingual, allowing the root to extend slightly beyond the gum line on the labial side to facilitate fitting the band. About 2 mm. of the root end is left extending beyond the gum line on the lingual side. All enamel is stripped from the root end with suitable enamel cleavers. (See Figs. 71 and 72.) At this portion of the tooth only short enamel rods are found. The supporting structure of these rods has been largely re-

Fig. 71

Fig. 72

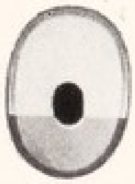


Fig. 73

Fig. 71. Author's preparation for a Richmond crown. Note the broad gently sloping bevel of the labial side to accommodate an interchangeable facing with the minimum of grinding. The tooth is allowed to extend about 2 mm. beyond the gum line on the lingual margin

Fig. 72. Occlusal view of preparation shown in Fig. 71. Compare with Fig. 68

Fig. 73. Occlusal view of root preparation showing gold band fitted

moved due to the reduction of the tooth in the course of preparation. It is therefore necessary to remove all remaining enamel rods to forestall their future loss at this point. The situation is therefore different from that obtaining in the preparation for a cast gold crown, where considerable of the original crown of the tooth remains. It will usually be found also, that the proper fitting of the band will be facilitated by first stripping off all the enamel. Protection for the gum margin can be given on the lingual side by developing a reproduction of the cingulum in solder. This should be carried on to the band so as to reproduce approximately the original contour of the tooth at the gum margin.

A measurement is taken, with a small gauge wire, straight across at the gum line and a 22 K., 30 gauge, gold band, about 3 mm. in width, is beveled and sweated together. The gold band is contoured and fitted to the gum line, allowing the band to extend about 1/2 mm. under the free margin of the gum on the lingual side, and slightly farther on the labial. The gold band is removed and the labial portion of the root end is then

Fig. 74

Fig. 75

Fig. 74. Cone of softened modeling compound pressed against the root end with the band in place, thus securing an impression into which the band is to be placed

Fig. 75. Modeling compound impression shown in Fig. 74, packed with cement

reduced to the gum line. The gold band is then replaced on the root and reduced with small stones until it conforms to the outline of the root end. (See Fig. 73.)

With the band in place, mark with a sharp instrument the level of the marginal gingiva on the labial portion of the mesial and distal sides. This portion of the gold band, as well as that directly on the labial surface is to be cut away after the floor has been soldered to the band. The marks will serve as a guide to indicate the point to which solder is to be carried.

One end of a small cone of modeling compound is then softened in the flame and an impression of the gold band on the root end is taken. (See Fig. 74.) The modeling compound is chilled and removed from the root end bringing away the gold band. The inner surface of the gold band is next covered with a thin coating of cocoanut oil, and cement is then packed

Fig. 76

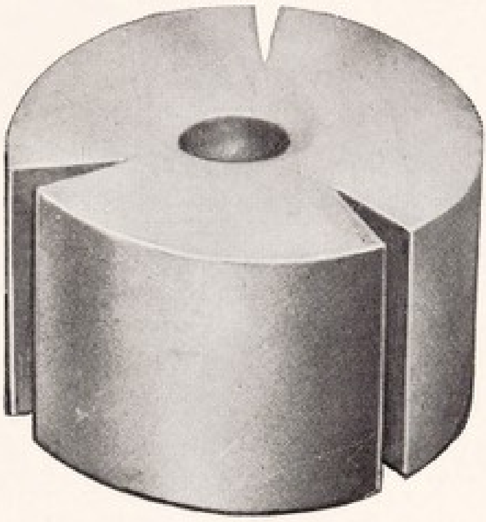


Fig. 77

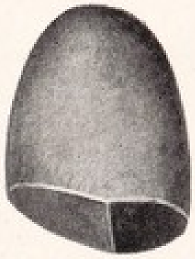


Fig. 78

Fig. 76. Cement cone with band in place after separation from the modeling compound

Fig. 77. Plaster impression of cement cone reassembled after the removal of the cement cone

Fig. 78. Metal die reproducing the cement cone shown in Fig. 76

into the impression, forming a cone. (See Fig. 75.) After the cement has set, the modeling compound is softened and removed. (See Fig. 76.) The cement cone, with gold band in place, is painted with cocoanut oil, and embedded with the gold band downward, in a metal or rubber ring filled with plaster. After the plaster has hardened the ring is removed and notches are cut in the side of the plaster with a sharp knife or metal saw, and the plaster is pried away from the cement cone with a sharp instrument. The cement cone is removed and the plaster segments are assembled in proper position, (See Fig. 77) and held together with sticky wax or a rubber band.

Dee low-fusing metal is then poured into the recess in the plaster to secure a metal die for swaging the gold floor. This metal will harden in about two minutes, after which the plaster is removed. The metal die is illustrated in Fig. 78.

A small piece of 30 gauge, 24 K. gold, or 36 gauge platinum, is then selected and swaged over the end of the metal die. After swaging it is cleansed in boiling acid and transferred to the gold band on the cement cone and burnished until it is in close adaptation with the band at all points. The gold band is next removed from the cement cone and placed on the gold floor. (See Fig. 79.) The band is soldered to the gold floor on the

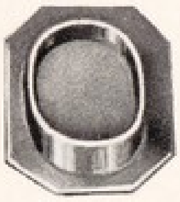


Fig. 79

Fig. 80

Fig. 81

Fig. 79. Gold floor which has been swaged to the face of the metal die and adapted to the gold band

Fig. 80. Root end showing over-large opening of canal due to the removal of a previously cemented pin, or other operative procedure

Fig. 81. Pin which is to be used in the root shown in Fig. 80 covered with a thin layer of sticky wax

lingual side in the open flame using a piece of 22 K. solder about half the size of a small pin head. The labial portion of the band which is completely covered by the gum margin, is painted with antiflux to prevent the solder from extending to that part, as this is later to be cut away. The band and floor are taken to the mouth and tested for accuracy of fit. It is essential that this precaution be taken to overcome any possible error in impression taking, etc. When the band is properly seated over the root end the floor is burnished with suitable instruments until it is in close contact with the end of the root. If the approximal portion of the floor is found to be unattached it is now soldered to the band with 22 K. solder.

At this stage the pin is to be attached to the gold floor. When constructing this type of Richmond crown it is of paramount importance that the pin shall be in close contact with the sides of the root canal throughout, in order to hold the half band on the lingual side of the tooth in close contact after the labial portion of the band has been cut away. Carelessness at this time may destroy the final fit of the crown. If the root canal has been enlarged for any reason (See Fig. 80) this excessive opening must be closed at this time. The canal is opened with a round bur about two-thirds of the distance toward the apex, being careful to follow the lumen of the canal. The diameter of this portion of the canal is then made uniform by drilling to the same distance apically, with a 16 gauge, cross cut, fissure bur. A bur of this size may be selected by using a wire gauge (Fig. 363).

Fig. 82

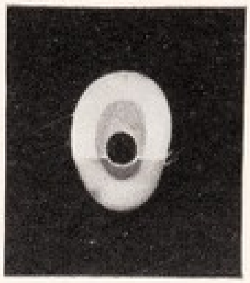


Fig. 83

Fig. 84

Fig. 82. Pin shown in Fig. 81, placed in the root canal which is then packed with amalgam

Fig. 83. Pin removed from amalgam. Note the added stability provided by this technique

Fig. 84. Small pellet of soft wax placed on the floor of the coping to locate the entrance to the canal

A piece of 16 gauge, Ney-Oro No. 4, wire is then selected and rounded slightly on one end and fitted to the canal. The pin should never be tapered, as this reduces the retentive qualities of the pin. If the root is small, a smaller gauge wire should be used, and a correspondingly smaller fissure bur will have been used in the preceding step. The pin must have straight sides. After the pin has been seated to the proper depth in the canal, it is removed, and that portion that extended into the root canal is covered with a thin coating of sticky wax. This is accomplished by heating the pin and rolling it over a piece of sticky wax. The pin is then rolled between the thumb and finger, while the wax is still soft, to give it a fairly uniform thickness. (See Fig. 81.) To prevent the wax sticking to the thumb and finger, lubricate them with a little oil.

When the pin is placed in position in the root canal, endeavor to carry it as far toward the lingual side as possible, to avoid interference with the proper placing of the porcelain facing. At the same time, in bridge cases, it must be kept in mind that the pin must be parallel with the other abutment. The Bridgemeter will be a help in establishing this relationship. (See Fig. 311.) When the pin has been placed in the proper position, soft amalgam is packed around it. (See Fig. 82.) The pin may be allowed to extend several millimeters beyond the root end. This extension may be used to retain a celluloid tooth form filled with a silicate cement of appropriate shade. This will serve as a temporary crown until the individual crown, or the bridge, is completed. The following day the pin may be removed by applying a hot instrument to the end of the pin. This will soften the wax and permit the easy withdrawal of the pin. (See Fig. 83.)

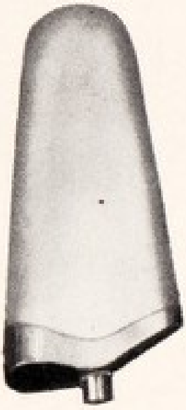


Fig. 85

Fig. 86

Fig. 87

Fig. 85. Pin soldered to the coping and placed on root

Fig. 86. Labial portion of band which extends under the gum margin cut away

Fig. 87. Coping and post assembly removed from the root

To make an opening through the floor of the coping directly opposite the hole in the root canal, place a small mass of soft wax on the inside of the coping and force to position over the root end. The soft wax will be forced into the opening in the root canal. (See Fig. 84.) The floor of the coping is then perforated with a round bur, at the point indicated by the wax extension on the inside of the coping.

The pin is passed through the opening and attached to the coping with sticky wax. To secure a tenacious union between the coping and the pin heat the coping in the open flame and then smear some sticky wax around the opening in the floor. The coping is then placed in position over the root end. The pin is heated in the open flame and a small quantity of wax is placed on the pin at the point where it emerges through the opening in the floor of the coping. The pin is next placed in position in the root canal and the two sections of wax are united with a hot instrument. Additional sticky wax may be added if necessary. The sticky wax is then chilled and the pin and coping are removed, invested, and soldered with 20 K. solder. The pin and coping are placed in position on the root end (See Fig. 85) and the outline of the gum margin on the labial side, as previously marked, is verified. That portion of the band extending under the free margin of the gum on the labial side is then trimmed away until only the gold or platinum floor remains in the labial region. Suitable burnishing

Fig. 88

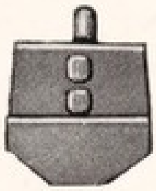


Fig. 89

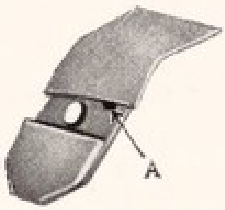


Fig. 90

Fig. 88. Porcelain facing ground to an accurate fit at the cervical margin

Fig. 89. Incisal tip of the gold backing reinforced with clasp metal

Fig. 90. 34 gauge 24 K gold or 40 gauge platinum soldered to the upper portion of the gold backing, to be burnished over the gingival end of the facing. Use a piece of 20 K solder half the size of a pin head as A

instruments are then used to establish a close contact of the metal floor with all parts of the root end. (See Figs. 86 and 87.)

A Steele's interchangeable, porcelain facing, of the proper size and shade is now selected and ground to establish close contact with the metal at the cervical margin. (See Fig. 88.)

As an aid in securing this adaptation, rub the graphite of a soft lead pencil over the surface of the metal floor. By placing the porcelain facing in position and rocking it gently, a graphite marking will be transferred to the porcelain. This section of the porcelain is reduced with a small fine cut, true running, stone and the operation repeated until the porcelain facing completely covers the metal on the labial surface, and the proper length of the facing has been established.

The porcelain facing is then placed in position on the gold backing and the gingival, mesial and distal surfaces of the metal backing are trimmed to fit the porcelain facing. The metal backings for interchangeable teeth are longer than the porcelain facings, at the incisal end; therefore adequate protection will be provided for the porcelain facing if this extension is not destroyed before soldering, by trimming the backing too short in this region, or by improper finishing after soldering. The incisal end of the back-

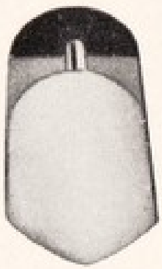


Fig. 91

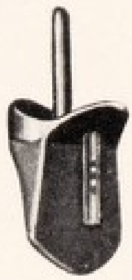


Fig. 92

Fig. 91. Porcelain facing partly seated showing pure gold backing which has been trimmed and burnished to accurately fit the gingival end of the porcelain facing

Fig. 92. Backing waxed to the coping with porcelain facing removed. The labial side of the backing is coated with antiflux

ing should extend about 1 mm. beyond the porcelain facing at the incisal end. To avoid chipping of the porcelain when grinding the backing to conform to the outline of the facing, see that the facing is securely seated on the backing and hold both in a firm grip to prevent movement of the facing while grinding. Steele's grinding pliers may be used for this purpose.

The facing is then removed from the backing and the backing is reinforced on the back at the incisal end. A piece of 26 gauge clasp metal is cut to conform in outline with the incisal end of the metal backing and soldered to position in the open flame. (See Fig. 89.) This will provide a stronger and more uniform protection for the facing than would be accomplished if solder alone was used on this area when soldering the facing to the coping. To cover the gingival end of the porcelain facing on the lingual side, where it is exposed between the gingival end of the backing and the coping, solder should be flowed into this area. To facilitate this, a strip of 34 gauge 24 K. gold or 40 gauge platinum is soldered to the gingival end of the backing with 20 K. solder. (See Fig. 90.)

The backing, with pure gold extension, is then cleansed in acid and the porcelain facing placed in position. If the facing does not go to place easily, locate and file away the obstruction. With the facing in place, the

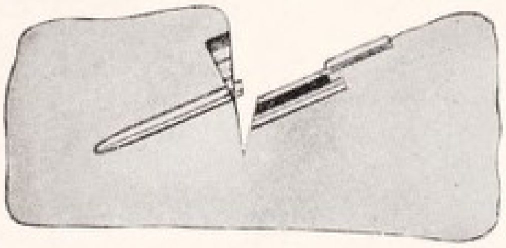


Fig. 93. Cross section view of Richmond crown assembly invested and ready for soldering

Fig. 94

Fig. 95

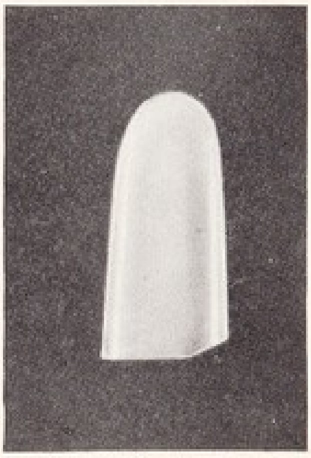


Fig. 96

Fig. 94. Approximal view of the completed crown

Fig. 95. Labial view of the completed crown

Fig. 96. Approximal view of preparation of upper first bicuspid tooth for Richmond crown where previous decay or extensive dental operation makes it necessary to trim the tooth to the gum line

gold extension is burnished to fit the gingival end and the excess gold is trimmed away. (See Fig. 91.) The backing, with facing in place, is then waxed to position on the coping and final adjustment is made. The facing is removed and all surfaces having contact with the facing are painted with antiflux. (See Fig. 92.) This precaution should always be taken, to prevent solder or borax from adhering to that surface of the backing which makes contact with the facing, in order to avoid any obstructions after the final soldering.

The crown is then invested, using a small quantity of investment material. After the investment has set the wax is removed with boiling water. (See Fig. 93.) The investment should be cut away so that there is no obstruction to the opening between the gold backing and the coping which is to be filled with solder. If the investment is left standing high over

Fig. 97

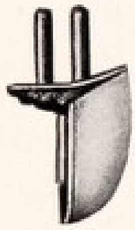


Fig. 98

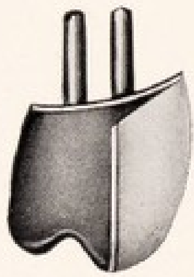


Fig. 99

Fig. 97. Floor adapted to preparation shown in Fig. 96, with posts assembled which have previously been fitted to the canals

Fig. 98. Porcelain facing and backing adapted to the floor and post assembly

Fig. 99. First bicuspid crown completed by casting

the invested crown, the heat from the blowpipe cannot readily reach the solder, being deflected by the investment. This complicates soldering. Furthermore the investment should be thoroughly heated throughout, before attempting to flow solder into the open space.

In finishing the incisal edge, use a small gold file of fine cut, and file obliquely across the incisal edge from gold to porcelain, with the file pointing gingivally. The incisal end of the facing should not be altered in any way. Grinding this portion of the facing causes an unsightly appearance. Approximal and labial views of the finished crown are shown in Figs. 94 and 95.

Technique for Badly Decayed Roots

Teeth are sometimes so severely attacked by caries that there is no healthy tooth structure remaining at the marginal gingiva. Previous operative procedure sometimes leaves the tooth structure reduced to the gum line. In these cases it may be necessary to construct a Richmond crown with a floor that is nearly flat. Such a case for an upper first bicuspid is illustrated in Fig. 96. Here no attempt should be made to use a band. A floor of 36 gauge platinum is swaged to fit the root end and pins are inserted into the root canals as previously described and soldered to the floor. (See Fig. 97.) Thirty-four gauge, 24 K. gold is attached to the gingival portion of the backing and burnished to place over the facing. After proper adjustment the backing is attached to the platinum floor with sticky wax. (See Fig. 98.) The facing is removed and the parts invested. The backing is soldered to the platinum floor with 20 K. solder.

A thin layer of the solder is flowed over the lingual surface of the backing, and the space between the platinum floor and the gold extension is filled with solder. The lingual contour for a bicuspid is best obtained by casting. After soldering the backing to the floor, cleanse the piece by heating in a 20% solution of sulphuric acid. An impression and bite are taken and a cast prepared. Flux the lingual side of the backing with a solution of boric acid and borax. All moisture is driven off and inlay wax is attached to the backing and floor. The lingual contour is reproduced with suitable carving instruments. It is unnecessary to solder the metal reinforcement across the occlusal end of the backing for protection, as the cast metal will give adequate security. The backing is left slightly longer than the facing, and the inlay wax is carried to this point. This extension is later reduced, until only a slight edge of gold is exposed at the occlusal end. The casting ring and investment material should be heated to a higher degree than for an inlay, to insure union of the cast metal with the gold backing and floor. It is good practice to cut a slight groove in the inlay wax where it makes contact with the platinum floor to prevent encroachment of the cast metal on this area. This groove is filled with solder after casting, using antiflux on the upper surface of the floor. The finished crown is illustrated in Fig. 99.

CHAPTER XIII

The Porcelain Jacket Crown

By common consent the porcelain jacket crown is regarded as approaching more nearly than any other restoration, the ideal in function, comfort, preservation of essential dental and periodontal tissues as well as esthetics.

The porcelain jacket crown was devised by Land, to whom the greatest credit must be given for having developed the fundamental features of this restoration. Land's technique has undergone considerable improvement. Among the workers who contributed to the early improvements in technique, credit should be given to Spalding and Thompson. In fact this crown was known for a number of years as the "Spalding Jacket." Later the technique was still further improved by LeGro, director of Ceramic Art in the Detroit Clinic Club, who brought this restoration to what seems to be its ultimate possible refinement, and who originated the modification known as the "shoulderless" porcelain jacket crown. Among those who have distinguished themselves in this art, Dr. William A. Squires should be mentioned, because of his special contributions in the field of esthetics, and his excellent conception of the requirements of the porcelain jacket crown. The author presents Dr. Squire's technique herewith with grateful appreciation.

"The dental profession today is accustomed to thinking of porcelain as a material whose chief advantage is an esthetic one. Those who were in practice twenty-five years ago, when the porcelain inlay was being perfected and the porcelain jacket crown had just been developed to a practicable point will recall that, at that time, porcelain was extolled because of its value as a protective agent against caries. The tolerance of the soft tissues for porcelain was also recognized. Perfection of technique had added another feature, viz., the exactness with which contours may be restored. With reference to the porcelain jacket crown, which today is the center of interest in the field of dental ceramics, it may safely be stated that from the physiological, esthetic, and anatomical points of view, where indicated, it has no equal. Each of these items is of outstanding importance.

"It is obvious from the esthetic standpoint that the porcelain jacket crown cannot be surpassed, nor can it be equalled by any other restoration. However, it is unnecessary to urge the porcelain jacket crown from this view point. The unique quality possessed by this crown as a preservative of the health and vitality of the dental pulp, and also its benign influence upon the supporting structures of the teeth, would compel its adoption in practice, even if it were totally lacking in esthetic qualities.

"Modern dentistry demands conservation of the pulp, as well as of the investing tissues of the teeth, whatever the type of restoration required. No intelligent and conscientious practitioner will devitalize a healthy normal pulp, for the sole purpose of making a restoration. For the badly broken down vital tooth, whether anterior or posterior, the porcelain jacket crown, in nearly all cases, offers a means of avoiding this very dangerous operation.

"Another very important point in favor of the porcelain jacket crown, as well as of the porcelain inlay, is its protective power against the recurrence of caries. The porcelain jacket crown, properly constructed, is one of the most permanent restorations available to the dental profession. It will therefore be the restoration of choice in mouths where caries runs rampant, where rapidly recurrent caries is a constant source of worry to both patient and dentist. In such mouths the porcelain jacket crown is a boon.

Importance of Correct Tooth Form

"Because of the esthetic possibilities of the material, it is natural and fitting that much attention in porcelain work should be devoted to the question of color and form, because, on these appearance rests.

"In considering these subjects the beginner in porcelain work usually places the greater emphasis on color. He thinks that if he succeeds in matching the shade of the tooth perfectly, his crown will be a complete success from the esthetic standpoint. This may be far from the truth, because a tooth may look very unnatural even if the shade be perfect. From the esthetic standpoint, correct reproduction of form is just as important as the correct matching and harmonious blending of shades. Inharmonious and incorrect form may exert an unfavorable influence on appearance from another standpoint, that of a deleterious influence on the health of the surrounding tissues. For, while porcelain is second to no material in the tolerance displayed toward it by the vascular tissues, it may cause injury if used with a total lack of regard for anatomical requirements. For instance, the labial surface of a crown may be beautifully formed and the color may be perfect, but if the lingual and gingival contours are not correct, the investing issues will, in time, either discolor or recede, thus producing anything but an esthetic restoration. An example of this is a case of four upper anterior crowns which had been in the mouth about three years; their labial surfaces were beautifully formed and shaded. At the time they were made they undoubtedly seemed to be perfect reproductions. But after a period of only three years a recession of the gums had taken place and these restorations had become actually disfiguring. Furthermore, the surrounding tissues were rapidly being destroyed. Had the cervical contour and lingual anatomy been correct, these crowns would have continued to be beautiful reproductions, for an indefinite period.

The Problem of Correct Shading

"While much emphasis should be placed on form, correct shading is of course greatly to be desired. The first effort should be to so systematize the management of porcelain shades that the beginner may attain some measure of success in this part of the work. Reduced to essentials, there are three colors to be found in the natural tooth. First the enamel color; second, the dentin color; third, the color of the blood in the pulp. There is a fourth element that influences the shade of the tooth. It gives the quality which we speak of as 'translucency.' This quality seems to reside in the dentin and undoubtedly has its basis in the vitality of the fluid and semi-fluid contents of the dentinal tubuli. It is this which permits the transmission of light, as in transillumination. The lack of this quality in the pulpless tooth is of course well known and appropriate handling is required in cases where pulpless teeth are to be matched with a porcelain jacket crown.

"In porcelain jacket crown construction the dentin color is usually given by the first, or dentin bake, which is made of an orange colored porcelain. Orange colored porcelain is used, rather than yellow, because the color of the natural tooth is influenced by the color of the blood in the pulp. By combining yellow with red we get orange, which more nearly harmonizes with the tooth color. After this has been brought to a high biscuit, the crown is returned to the model and examined for contour. When necessary corrections have been made, the enamel bake may be applied, provided no special deep shading is to be employed. If deep shading is to be used, it must be applied before the enamel bake is put on. When this is done, and the enamel layer is placed over it, a more natural appearance is produced, in the majority of instances, than when the stain is applied over the enamel layer. For these effects Justi high fusing porcelain stains are used. The application of these stains for the production of the highest artistic effect requires close observation of the natural teeth in the mouth, and a study not only of the color effects, but also a study of the depth of the pigmentation which we desire to reproduce.

Surface Stains

"While deep staining is usually employed, there are often instances where a surface stain is required to give the desired effect.

"The color effect may be varied by suitable manipulation of the crown, after the completion of the baking. If a surface stain is used, this may be modified by a variable amount of dressing with rubber abrasive wheels so as to leave just the degree of color desired and also to produce an uneven, or mottled effect. The amount to be removed will be determined by trying the crown in the mouth, and instructing the patient to moisten the surface of the crown with saliva. Crowns always should be polished, or buffed on the lathe, after firing is completed, in order to remove the glassy surface produced by the final bake. As few human teeth have so high a gloss, this contributes to the natural appearance of the crown. Some operators have objected to this procedure, claiming that it leaves the surface porous, and may even weaken the crown. There seems to be no reason to expect a weakening of the crown, if the surface glaze is modified, or even removed by buffing, provided the operator avoids checking, through overheating the crown during this operation. As to the porosity of the unglazed porcelain, this contention may be answered by the statement that the surface produced by buffing is so dense in a properly constructed crown, that no perceptible deposit of mucin, or stain, will form on the relatively cleansable surfaces so treated.

"With reference to enamel shades it may be said, in a general way, that the thickness of the enamel layer influences to a considerable degree the shade which will be produced. By utilizing this properly, we may produce a considerable variety of shades from comparatively few enamel colors. The natural appearance of the tooth may be greatly enchanced by varying the color so that the effect of an even gradation of color from the incisal portion to the neck is interrupted. We find on examination of most natural teeth that the shade is not homogeneous over the entire surface. It is broken up in a way which suggests a minute mottling. In the jacket crown, this effect is produced chiefly by varying the thickness of the enamel layer, and this may be most readily accomplished by producing a slight irregularity in the surface of the dentin bake, before it goes into the oven. The shade may also be influenced by the surface markings. For example, if the labial surface of the crown were left smooth and highly glazed, it would appear much lighter than a crown

Fig. 100. Radiograph to determine the size of the pulp chamber

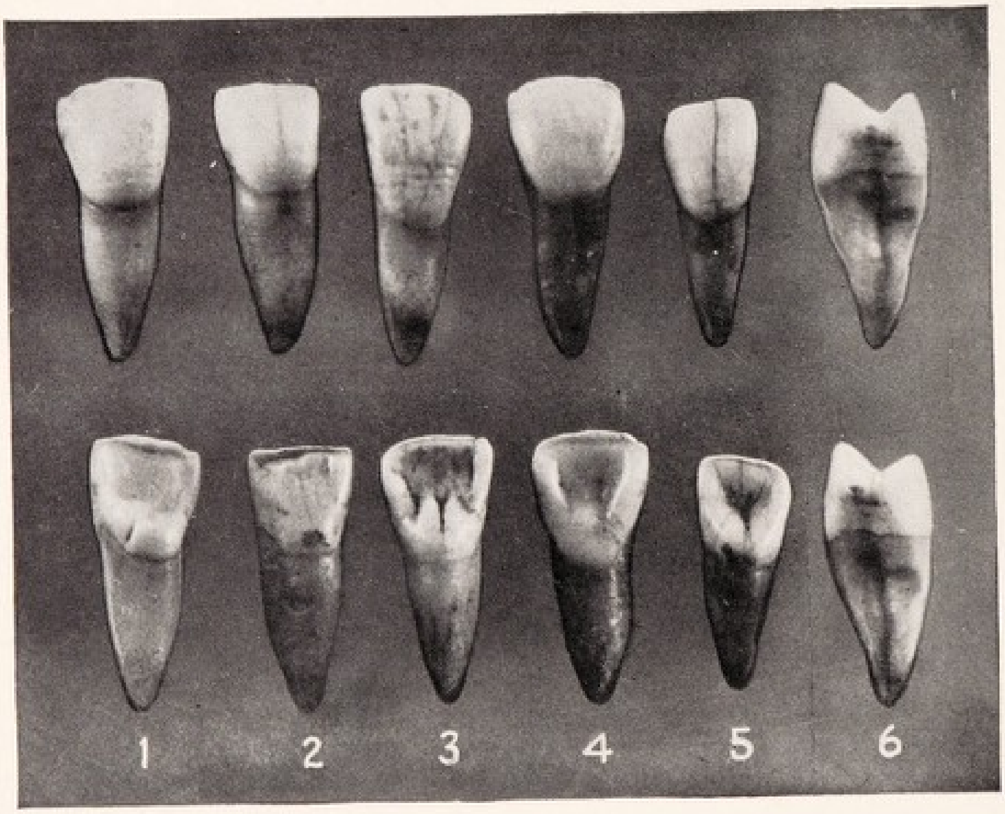


Fig. 101. Types of teeth

made of the same colored porcelain, but having facets, horizontal or vertical markings.

When are Jacket Crowns Needed

"One of the most important questions which the dentist who wishes to make porcelain jacket crowns is called upon to answer is; 'When is the jacket crown indicated? I will pass over those cases in

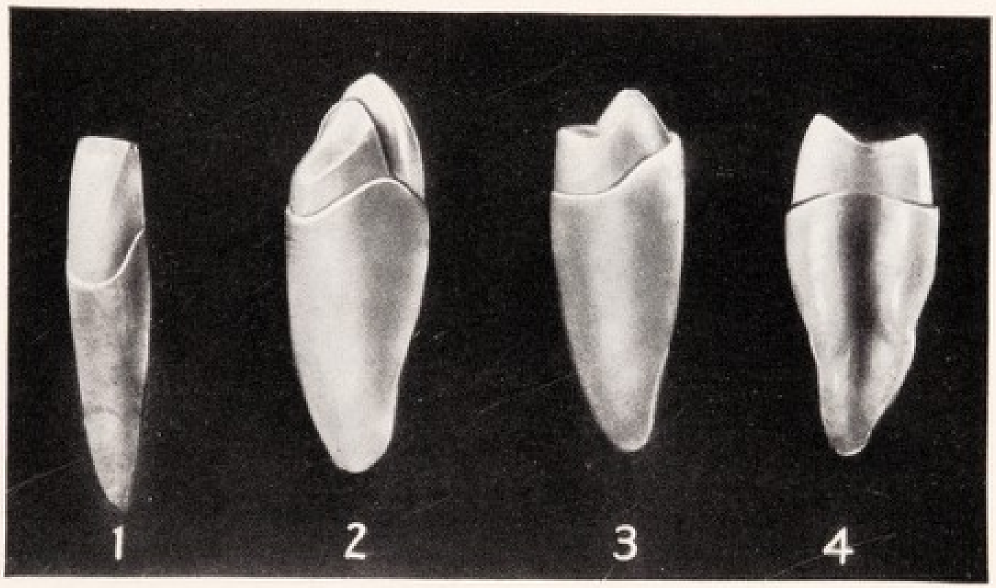


Fig. 102. Variation in the preparation according to type of tooth

which appearance is the only factor, as for instance mottled, pitted or discolored teeth. Such cases need no argument. What I would urge is the making of porcelain jacket crowns for teeth in which the insertion of metallic fillings, either foil or inlay, would involve a close approach to the pulp. Incisors, with only one incisal angle involved, will often fall into this category. When both angles are broken down, or badly weakened, the argument becomes still stronger. Even when the incisal angles are not broken however, deep approximal decay on both mesial and distal surfaces may point to the porcelain jacket crown as the most logical restoration. An important indication for the porcelain jacket crown is the tooth which may perhaps be capable of restoration by a gold inlay, but which, when so restored, may be subjected to the risk of fracture. This risk in itself, when present, points strongly to the porcelain jacket crown. But a still more important argument is this; the preparation to

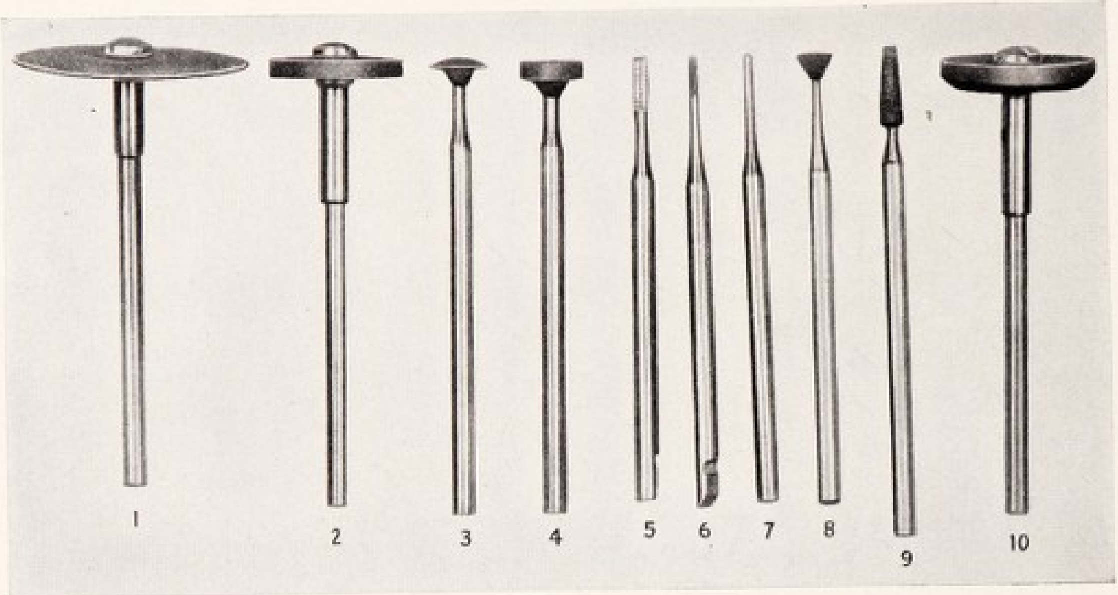


Fig. 103. Engine instruments used in jacket crown construction

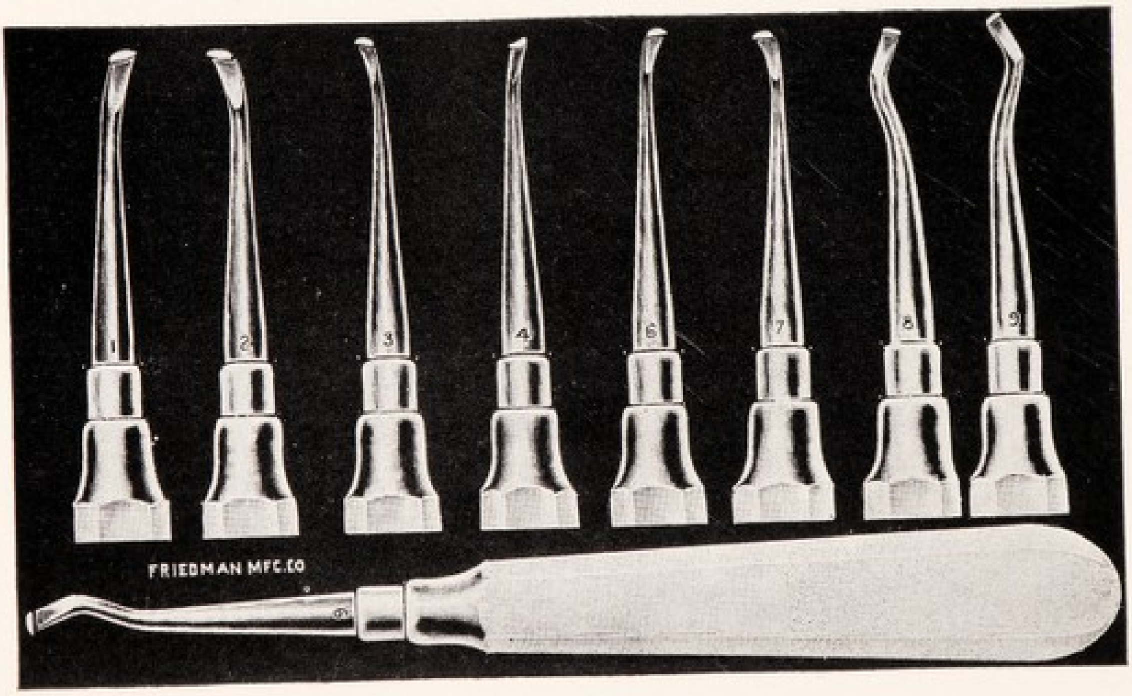


Fig. 104. Legro enamel cleavers

provide retention for the inlay usually involves so much sound tooth structure that when, and if, the subsequent fracture occurs, there will be too little tooth structure left for the preparation of a suitable stump for a

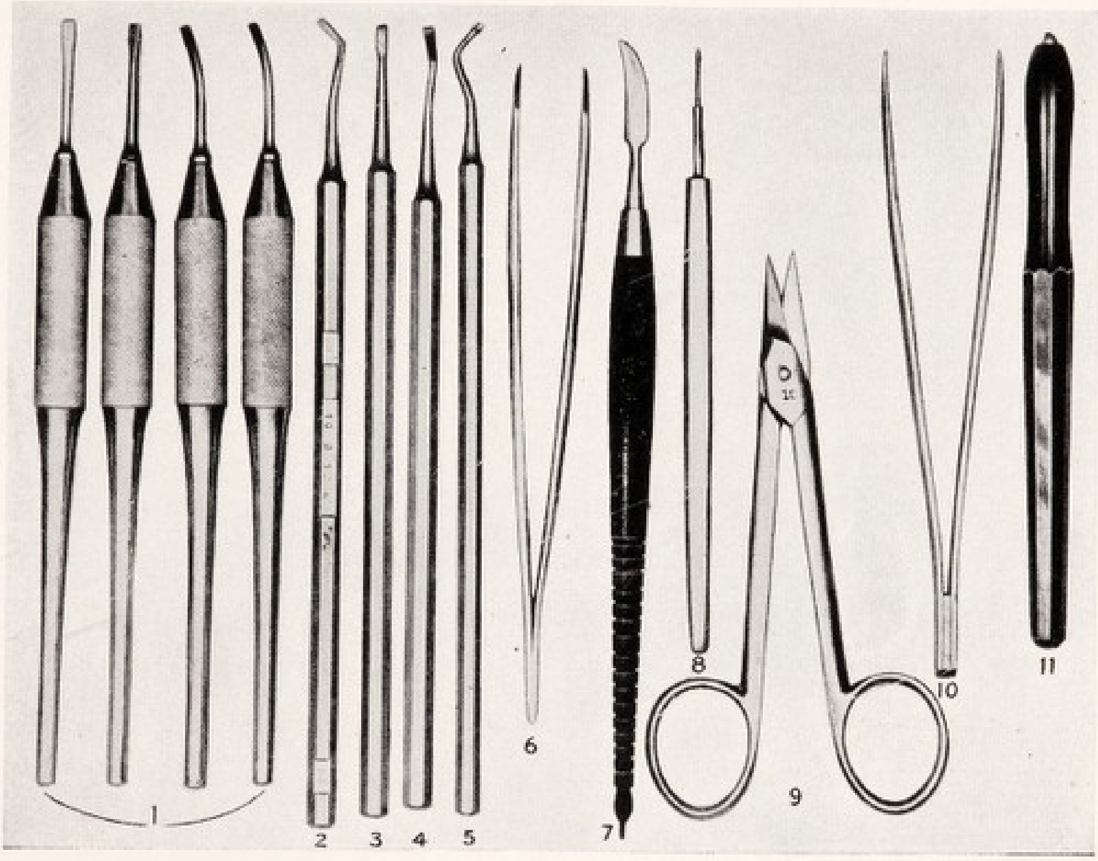


Fig. 105. Hand instruments used in jacket crown construction

porcelain jacket crown. The ensuing devitalization must then be charged to shortsightedness. In the posterior region, teeth requiring complicated preparations for inlays may frequently be best served from the standpoint of pulp preservation by the porcelain jacket crown.

Types of Teeth

"Make a careful study of the tooth on which you expect to place the jacket crown; also of the neighboring and opposing teeth. Then refer to the radiograph (Fig. 100) noting the size of the pulp and the condition of the investing tissues. Note carefully the type of tooth. A large ovoid tooth such as Fig. 101—No. 4, will require a modified preparation. It is often dangerous to cut this type of tooth for a shoulder crown. The age of the patient must also be considered, it being well known that the size of the pulp is larger in the younger patient. Different teeth in the same mouth may require a modified technique in their preparation, such as the upper first bicuspid, Fig. 101—No. 6, the lower first bicuspid and the

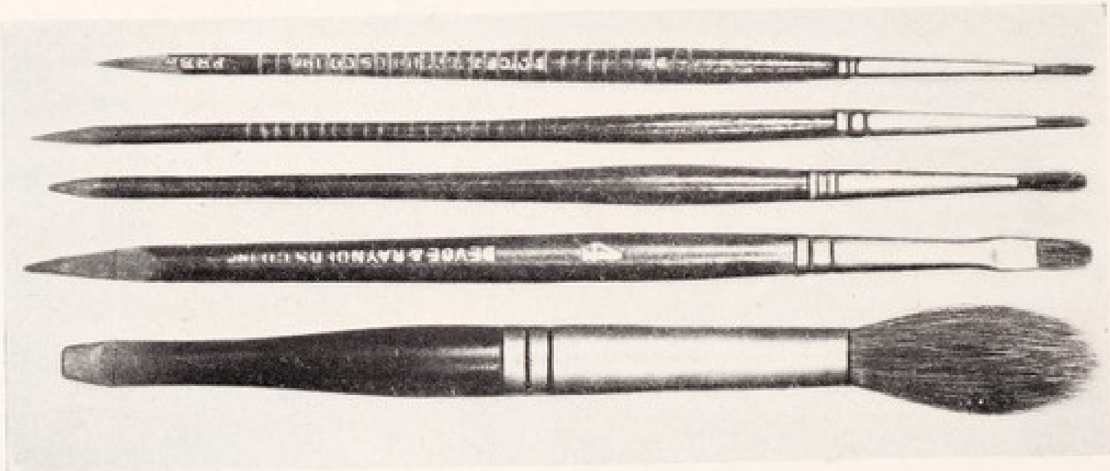


Fig. 106. Sable brushes used in porcelain work

lower incisors. It may be possible to prepare an upper central incisor for a shoulder crown, in a mouth where it would be necessary to modify this preparation for an upper first bicuspid. This tooth has a mesial groove as in Fig. 102—No. 4, which extends down on the side of the root as well as on the crown. It is seldom good policy to cut a shoulder at that particular location when preparing this tooth. A lower first bicuspid is a bell crowned tooth having an ample amount of enamel on the buccal side. Here it is customary to prepare a shoulder just at the most prominent point of the contour of the buccal surface, thereby making it unnecessary to remove all the enamel, as shown in Fig. 102—No. 3.

Instruments Used in Jacket Crown Work

"The instruments used in the preparation of the tooth and also in the construction of the crown are illustrated in Figs. 103, 104, 105 and 106. It is very important that the operator should know just what instruments are to be used in making this preparation, and also in constructing the crown, and to provide himself with the correct equipment. (Fig. 103.)

"In Fig. 103—No. 1 is a 7/8 inch separating disk which is used for making the mesial and distal cuts: No. 2, shows the flat sided carborundum stone, used to reduce the incisal edge: No. 3, the No. 37 Crystalon point, used for blocking out the enamel, on the labial and lingual surface: No. 4,

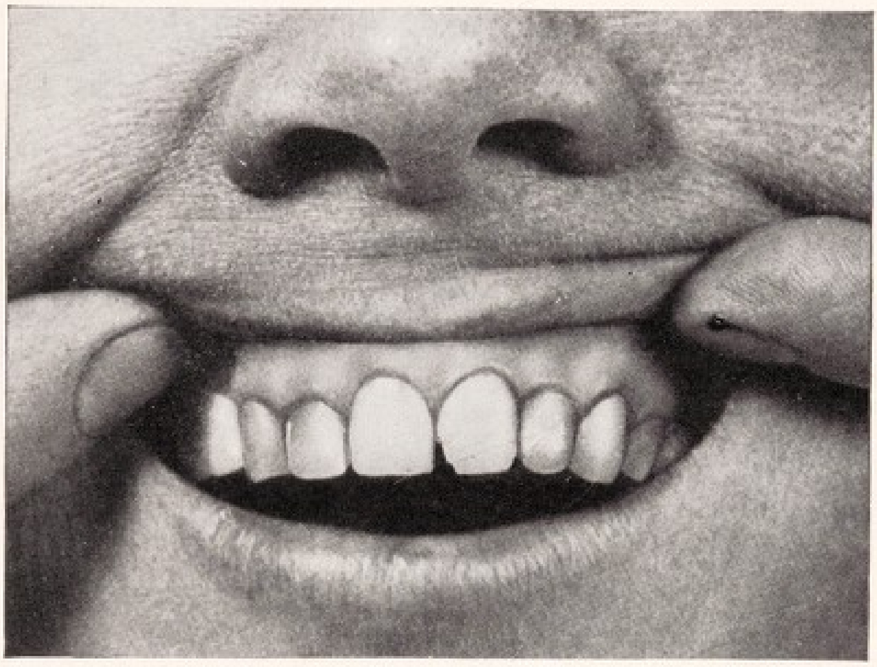


Fig. 107. Central incisor suitable for jacket crown restoration

the No. 4 Crystalon stone used to reduce the enamel, and to shape the lingual surface. No. 5, the cross-cut fissure bur which cuts effectively where some enamel still remains: No. 6, the No. 56 plain fissure bur used in cutting the shoulder: No. 7, the small, end-cutting bur used to reduce the shoulder 1 mm. under the free margin of the gum: No. 8, the No. 33 Crystalon inverted cone stone used to dress down the porcelain at the cervical margin and to remove the platinum apron: No. 9, tapering mounted point used in shaping the labial surface—also for finishing the shoulder where some enamel may remain: No. 10, a rubber abrasive wheel which is very useful in porcelain work, particularly where modification of a surface stain is required. When touched here and there to the surface of the crown, it will remove part of the stain, giving an uneven or mottled effect. Fig. 104 shows the Legro enamel cleavers. In Fig. 105, No. 1, are shown the Bastian files which are very useful in finishing the shoulder: No. 2, an enamel hatchet: No. 3, a small straight chisel: No. 4, small scaler used in removing the collar of enamel under the gum: No. 5, the Thompson burnisher used in matrix forming:

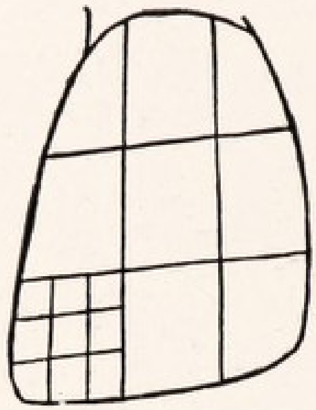


Fig. 108. Diagram to show landmarks for correct reproduction of the tooth to be replaced

No. 6, a useful pair of pliers, Caulk's Stellite No. 5, used in matrix work: No. 7, the Thompson carving spatula: No. 8, a small cataract knife, used for cutting out the porcelain around the gingival margin, before the first bake, and also for cutting fine lines and grooves, particularly in the occlusal surfaces of bicuspids and molars where stains are used: No. 9, a pair of S.S.W. scissors, No. 10, with the blades ground thin making them more suitable for cutting platinum: No. 10, a pair of S. S. White, K pliers with the lock removed: No. 11, the diamond graver, useful in making fine lines on the labial and buccal surfaces where a stain is to be used.

"Fig. 106, illustrates a set of five sable brushes, which should answer practically all needs in porcelain work.

"Fig. 107 represents a typical case requiring a porcelain jacket crown. The distal angle of the central incisor was so deeply decayed as to be about ready to fracture, thus making an involvment of both mesial and distal angles. The tooth was vital. Such cases may require deeper cutting to prepare them for metallic restorations, than they would for porcelain jacket crowns. Such a crown encroaches less on the pulp, than restorations depending upon undercuts for retention. However, cases involving only one angle, are also ideal for this type of restoration, since other methods fail to give good esthetic results.

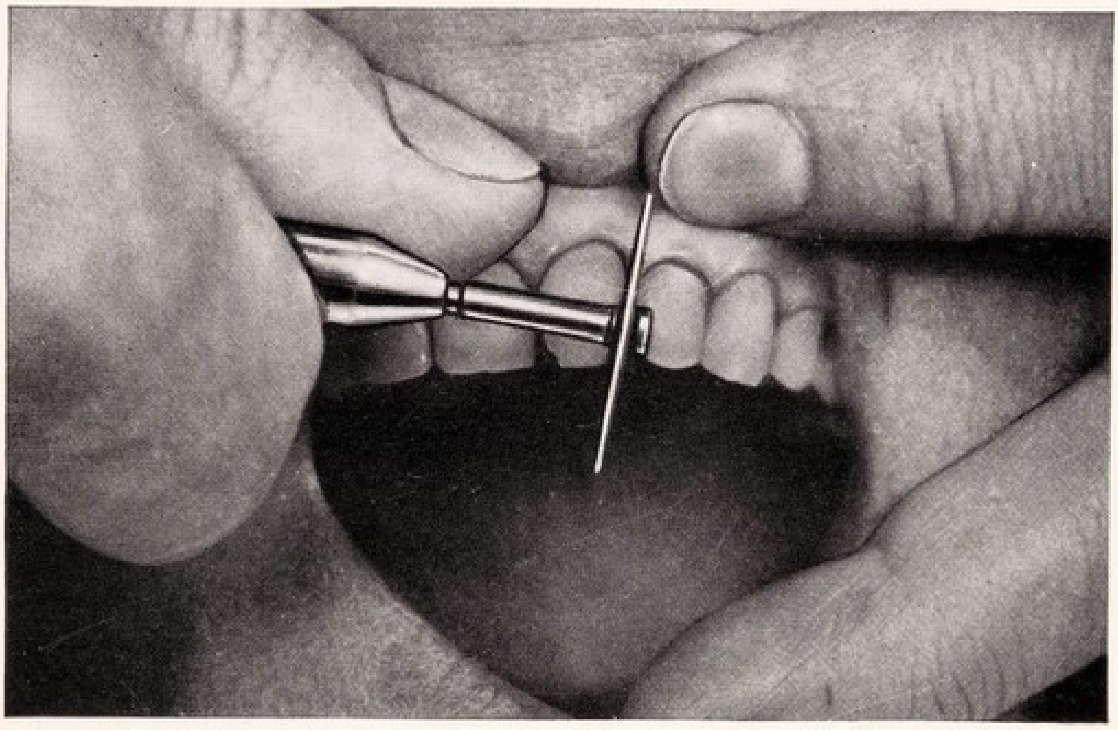


Fig. 109. Approximal surface removed with separating disk

"A means of providing for the proper placing of landmarks in building up the crown is to make a drawing of the tooth on which the jacket crown is to be placed as shown in Fig. 108. Divide this into thirds both horizontally and vertically by intersecting lines. By means of the squares thus produced, we may accurately chart the location of irregularities and surface markings, such as grooves, spots and stains. These may then be reproduced in their proper location on the jacket crown.

Technique of Preparation for Jacket Crown

"Make a line cut from incisal edge to the gingival region, approximately 1 mm. in width, with the 7/8 inch separating disk, (Fig. 109) which must be very thin and must run absolutely true; these points are essential. The inclination of the disk is important. It should be inclined slightly toward the center of the tooth, so that when both mesial and distal cuts

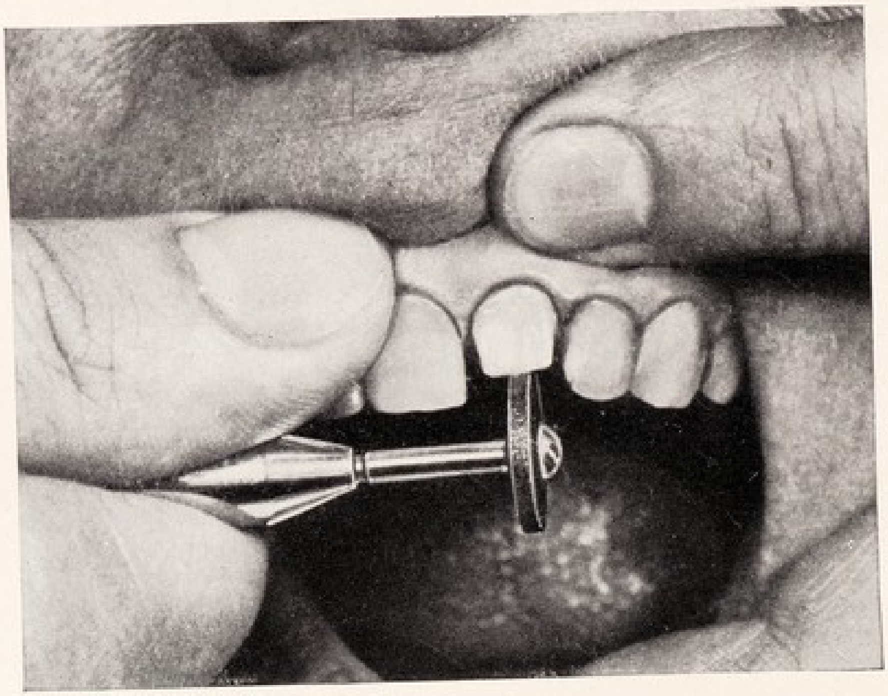


Fig. 110. The incisal edge is reduced with flat sided carborundum wheel

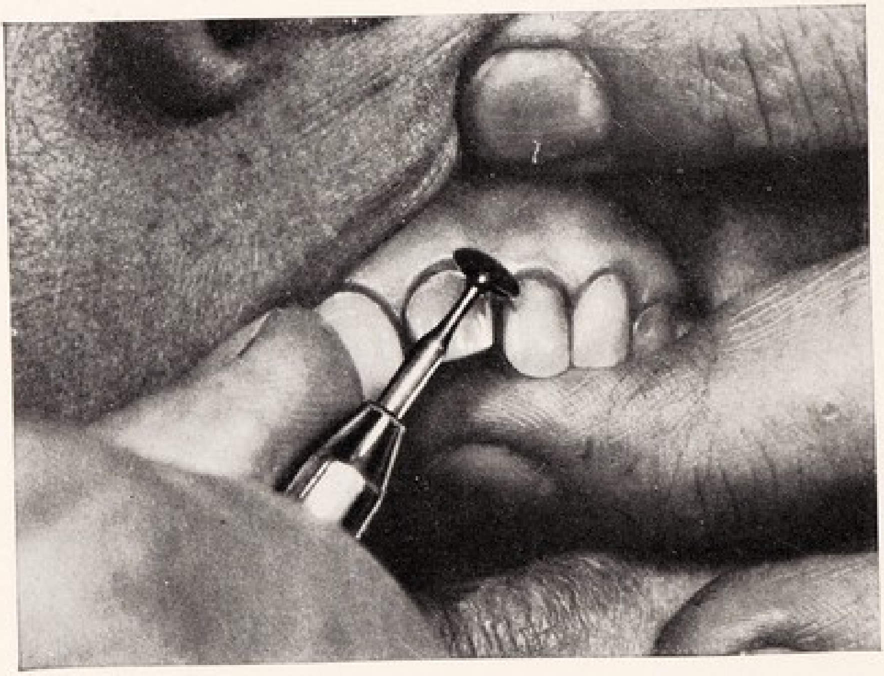


Fig. 111. The labial and lingual surfaces are grooved with a sharp edged Crystalon stone, No. 37

are made, the prepared surfaces will converge as they approach the incisal edge. The labiolingual inclination is such that the labial surface will be

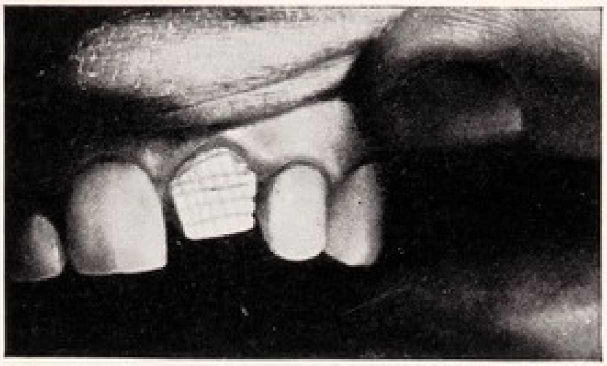


Fig. 112. The labial enamel cut into blocks

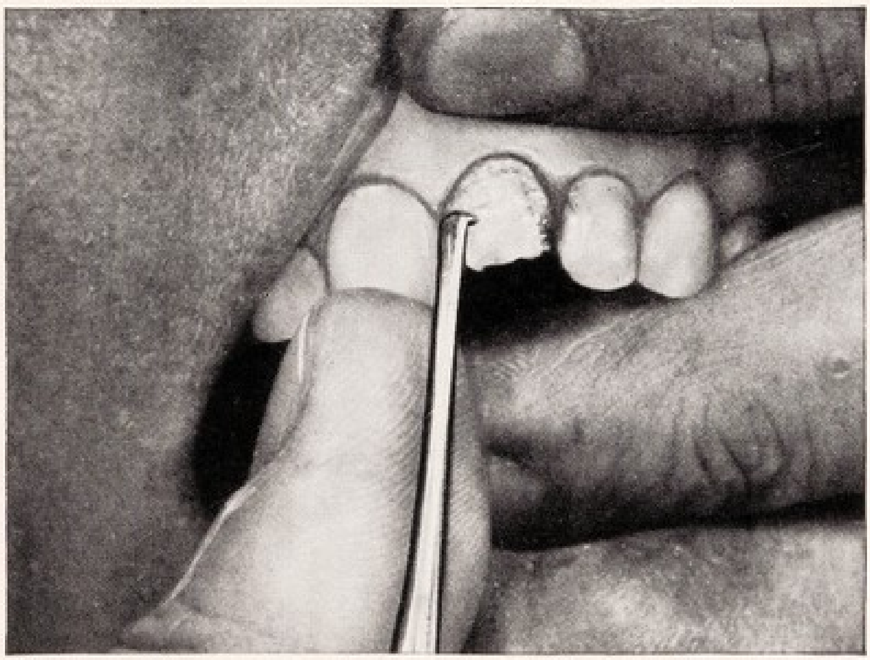


Fig. 113. Removing enamel with Legro enamel cleaver

slightly wider than the lingual after the cuts are made. Note the palm grasp and thumb rest to secure steadiness. (Fig. 109.)

"The incisal edge is reduced with a flat sided carborundum wheel. (Fig. 110.) It is very important that the prepared incisal edge shall be at a right angle to the direction of stress. The tooth stump should be left as long as possible, to give the greatest support against the leverage of forces which may be brought to bear on the porcelain. Usually a cut

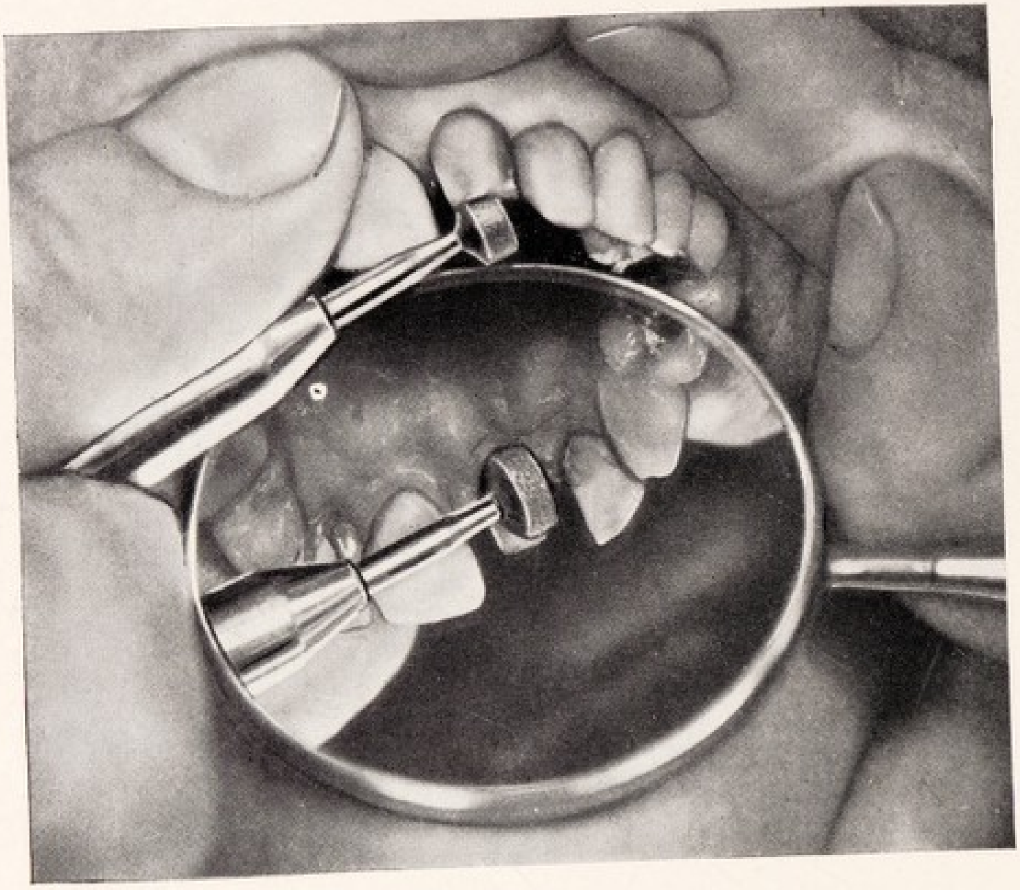


Fig. 114. Removing lingual enamel with small engine stones

of 1½ mm. is sufficient to make room for the porcelain. Extra strength may be gained in the incisal region by grooving the incisal edge transversely in close bite cases. (Fig. 102, No. 2.) In the past there has been too much tooth structure sacrificed in preparing teeth for jacket crowns. As a matter of fact these crowns seldom break through the central area. They usually break on the labial surface, near the gingival margin.

"The labial and lingual surfaces are prepared for the removal of the enamel by means of a series of vertical and transverse cuts made with a No. 37 Crystalon stone. (Fig. 111.) These cuts are carried through the enamel, but should not penetrate into the dentin, as this may necessitate too much cutting subsequently, to secure a smooth preparation.

"Fig. 112 shows the enamel on the labial surface cut into small blocks. These blocks should be less than 1 mm. in diameter. The enamel blocks cut as in Fig. 112 are readily removed with the enamel cleavers. (Fig. 113.)

"The lingual enamel is removed with small, mounted Crystalon stones,

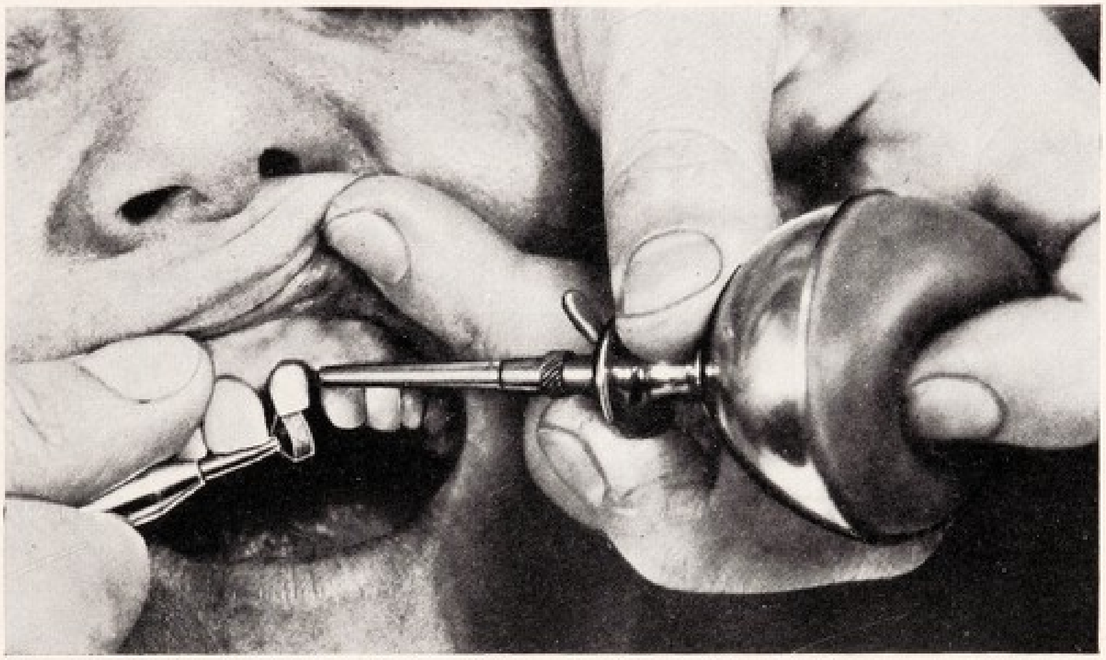


Fig. 115. Hot water is dropped on the stones during grinding to prevent heating the tooth by friction

No. 4, in the straight handpiece, (Fig. 114) and Nos. 38 and 34 in the right angle handpiece. This will not only remove the enamel on this surface, but should give the desired shape for the finished preparation. Care must be taken not to encroach on the pulp unduly, in an effort to provide space between the upper and the lower teeth for the necessary bulk of porcelain. Such space may usually be safely gained by a little shortening, and labial beveling, of the opposing lower incisors.

"During the various operations involving grinding of the tooth, a constant dropping of hot water on the tooth and stone is maintained (Fig. 115) to prevent undue heating of the tooth by friction, regardless of whether or not the tooth has been anesthetized. Infiltration, or block anesthesia is used in most instances. However, the use of hot water alone, seems to have almost an anesthetic effect, in many cases. In case the assistant is not available, the operator may manage very satisfactorily by using the type of syringe seen in the illustration, having shortened the nozzle; or one of the all-rubber ear syringes may be used.

Fig. 116. A copper band is first flamed and then dipped into alcohol

"After the enamel has been removed, two copper bands of the proper size are flamed, and then dipped in alcohol to remove the oxid. (Fig. 116.) This operation both softens and sterilizes the band material, making it more easily contoured; also it will not spring when the impression is removed. Two bands are fitted at this time, before cutting a shoulder, if a shoulder crown is to be made.

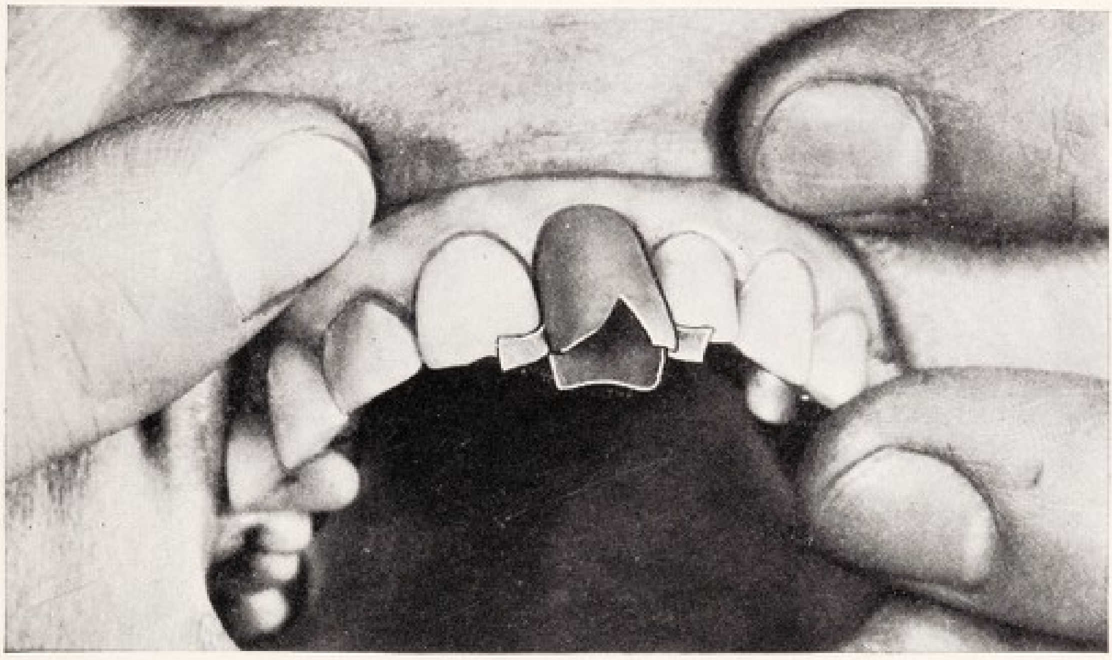


Fig. 117. Copper band fitted to tooth, and having wing resting on the adjacent teeth as guides in taking the impression

"The band is trimmed to match the gum contour. (Fig. 117.) It should extend about 1¼ mm. under the free margin of the gum, around the entire circumference of the tooth. At the incisal end, tongues are cut and turned back over the incisal edges of the adjoining teeth. These will act as a guide and a stop when the impression is being taken. Be sure that the band stands away from the tooth stump on all sides, to provide room for the impression material. Slit the labial side of the band a little at the incisal, and turn back the metal to identify this surface. Fill the band with compound and lay aside until the preparation of the tooth has been completed.

"The shoulder on both the mesial and distal sides can be defined with a thin 7/8 inch disk, which runs perfectly true. With a No. 56 square end, plain, fissure bur cut the shoulder on the labial surface. (Fig. 118.) Note the angle of the bur to the long axis of the tooth, and take care

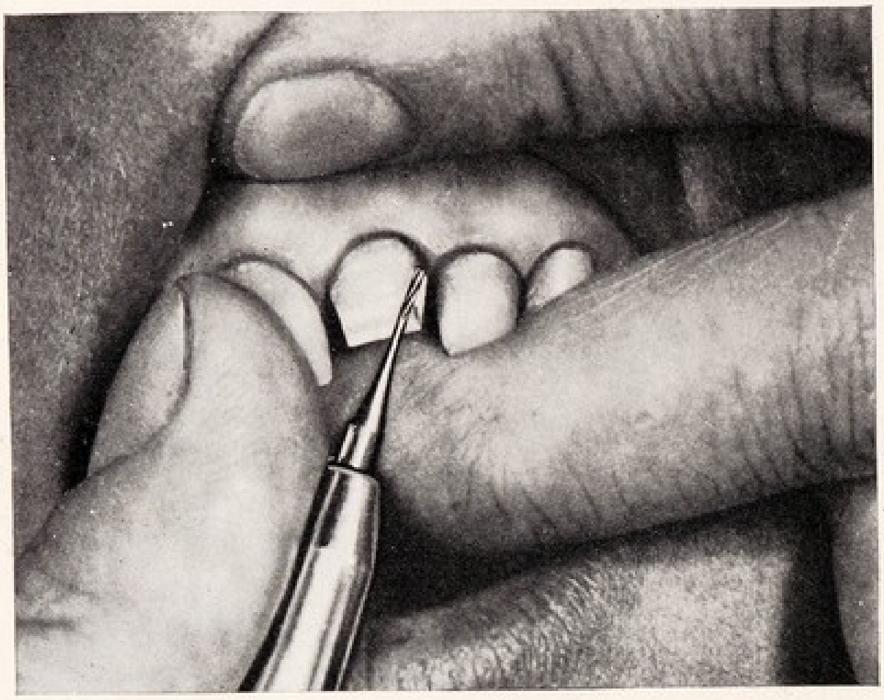


Fig. 118. The labial shoulder is cut with a plain fissure bur

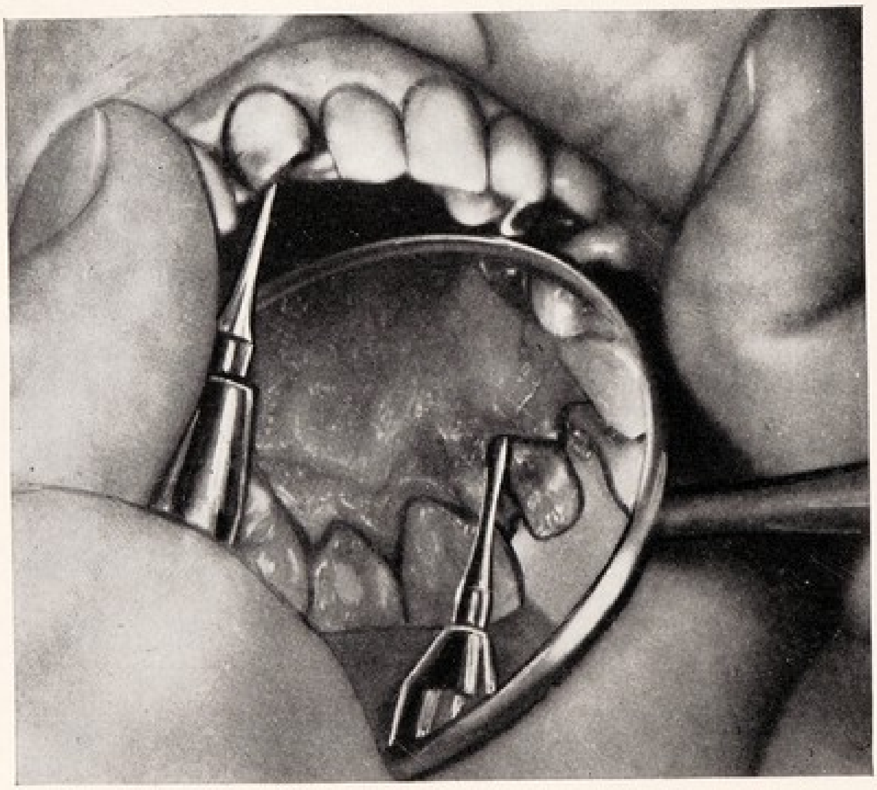


Fig. 119. The shoulder under the gum is squared and perfected with smooth sided, end cutting burs

that it lies as flat as possible on the tooth, so that it will not make an undercut. As the bur approaches the center of the tooth its position becomes parallel to the long axis. By keeping the bur always at a right angle to the arc of the gum outline, the proper shoulder will be provided and the bur will not spin off into the tissues.

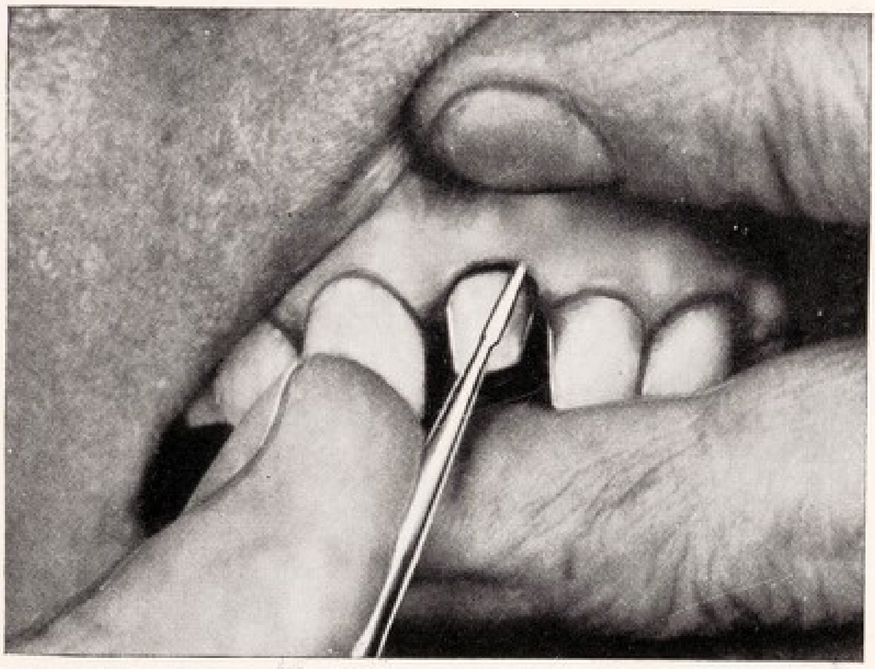


Fig. 120. The shoulder is trimmed and made smooth with straight chisels and Bastian files

"The shoulder on the lingual surface is made in the same manner as on the labial, starting in this case at the mesiolingual angle. When performing this operation on a right upper central incisor, the operator should start the shoulder at the distolingual angle. This is most conveniently accomplished when the operator stands directly back of the patient and, holding the handpiece as shown, operates by the reflection in a mirror. Use an end cutting bur of the same diameter as the No. 56 bur in reducing the shoulder to 1 mm. under the free margin of the gum. (Fig. 119.) Ordinarily the shoulder should not be cut more than 1/2 mm. in width.

"The shoulder is trimmed and made smooth with a narrow straight chisel and Bastian files. (Fig. 120.) Finish the toilet of the preparation with strips and disks lubricated with cocoa butter. Ordinarily any enamel which remains above the shoulder should be left in place, as it provides

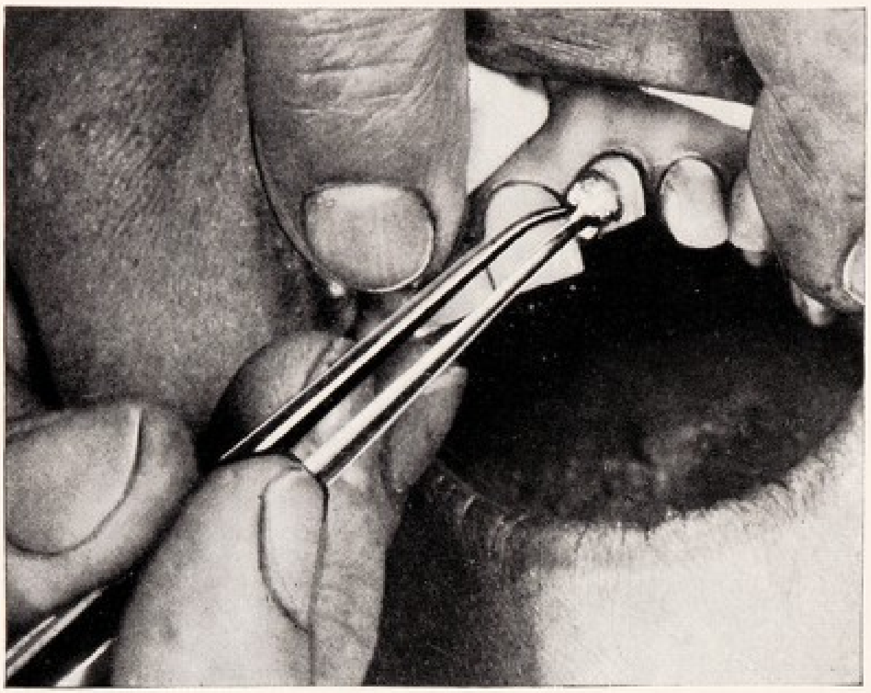


Fig. 121. The tooth stump is prepared for taking the impression

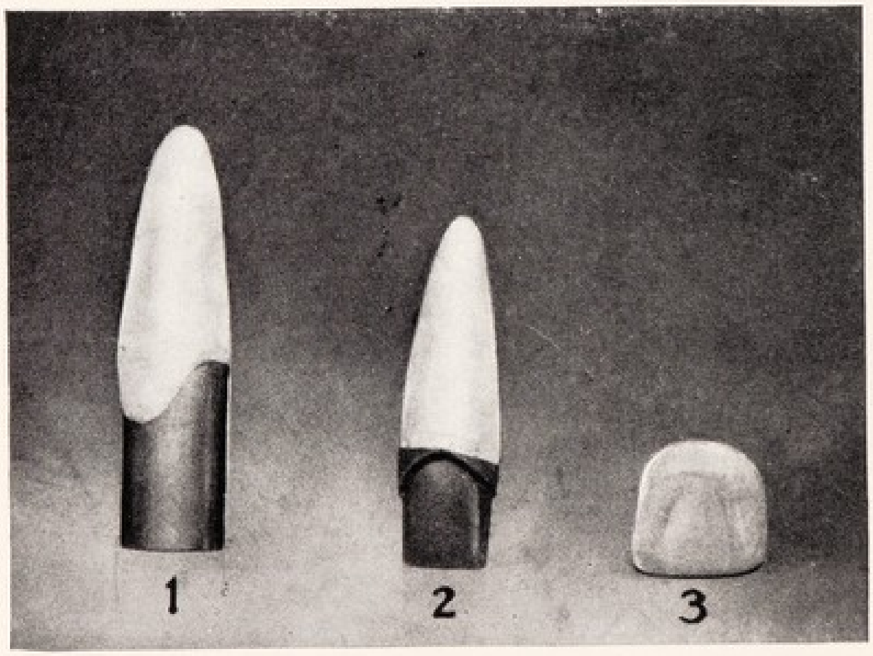


Fig. 122. Cement is packed into modeling compound impression, No. 1.—A matrix of tin foil is burnished over the cement die, No. 2.—And a cement crown is made, No. 3.

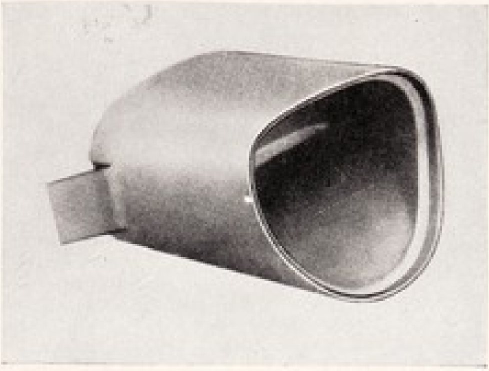


Fig. 123. Accurate modeling compound impression into which soft amalgam is packed to form the working die

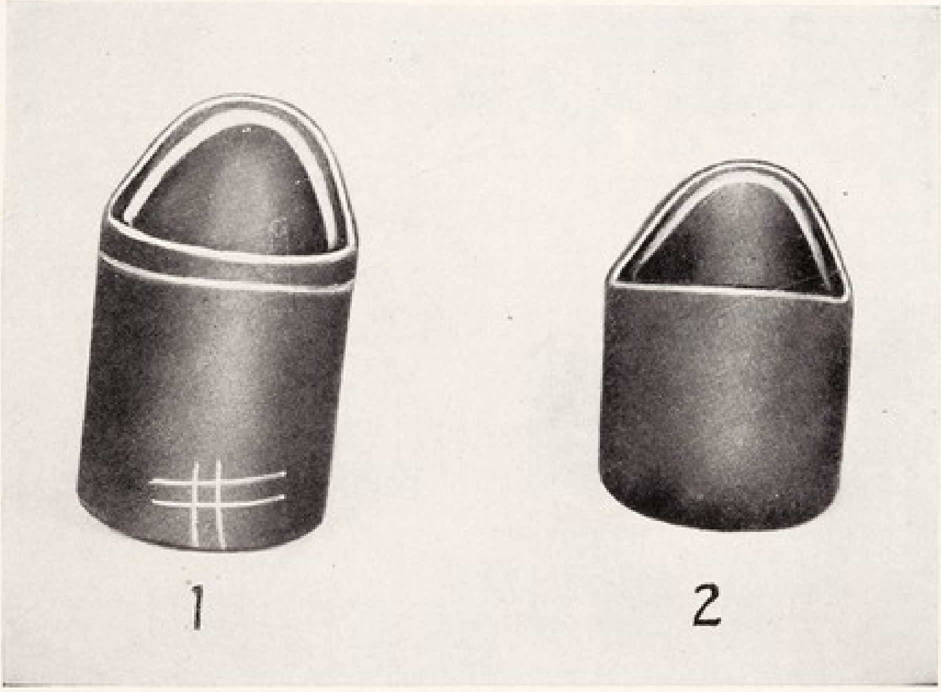


Fig. 124. Alternative methods. No. 1, Band filled with base plate wax to be fitted over the preparation while taking the impression. No. 2, Jacket made of modeling compound, to be used in similar manner

the natural contour required for the continued health of the gingiva. If the gingiva has receded, or if the tooth is pulpless, it is customary to remove all enamel.

"The tooth stump is now prepared for taking the impression. Dry the tooth carefully, isolating it by means of cotton rolls, and then paint

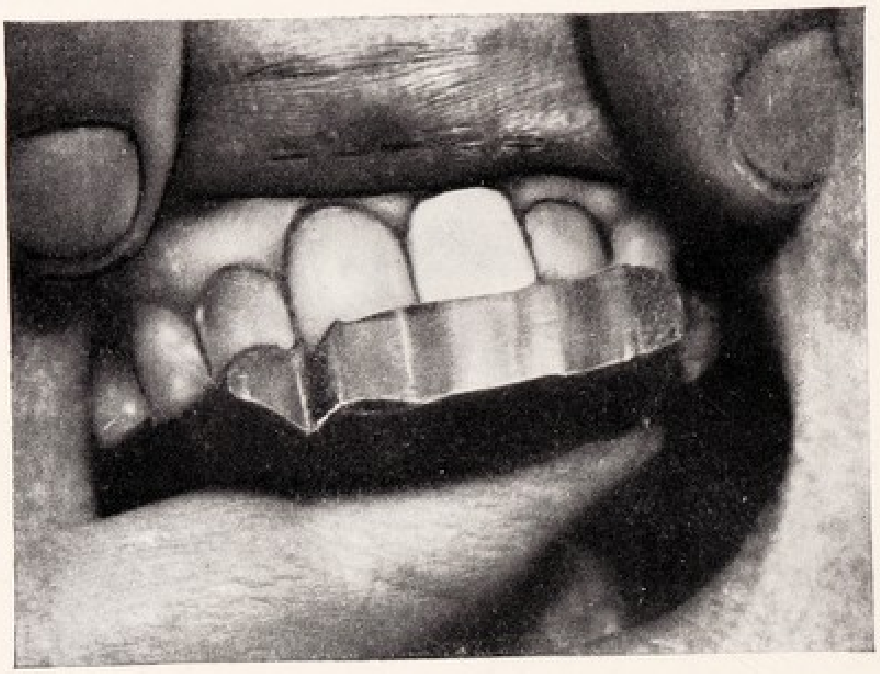


Fig. 125. Sectional impression in modeling compound. The lingual impression is taken first and trimmed as here shown

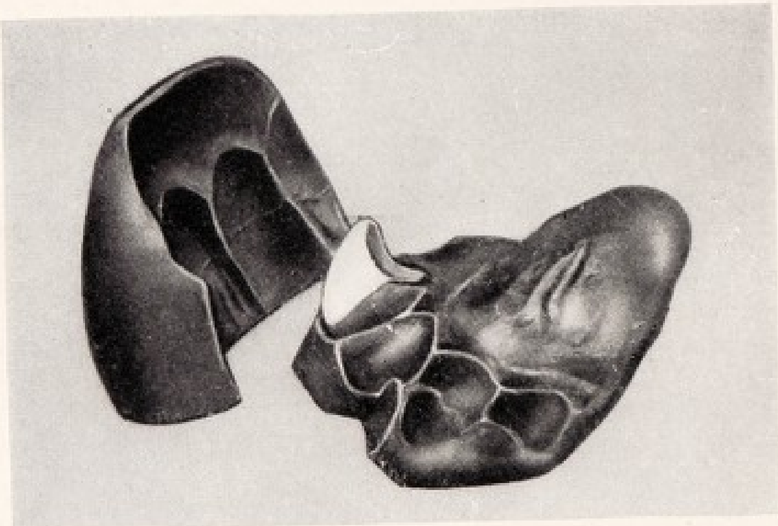


Fig. 126. The cement temporary crown removed from the preparation and placed in the impression

it with phenol. (Fig. 121.) Wash this off with warm alcohol and apply a thin solution of rosin and chloroform. To facilitate the removal of the impression, the tooth is next lubricated slightly with liquid petrolatum.

Many cases of pulpitis may be traced to carelessness at this stage of the operation.

"It is very important that accurate working casts be produced on which to build the crown. A few minutes more at this stage of the opera-

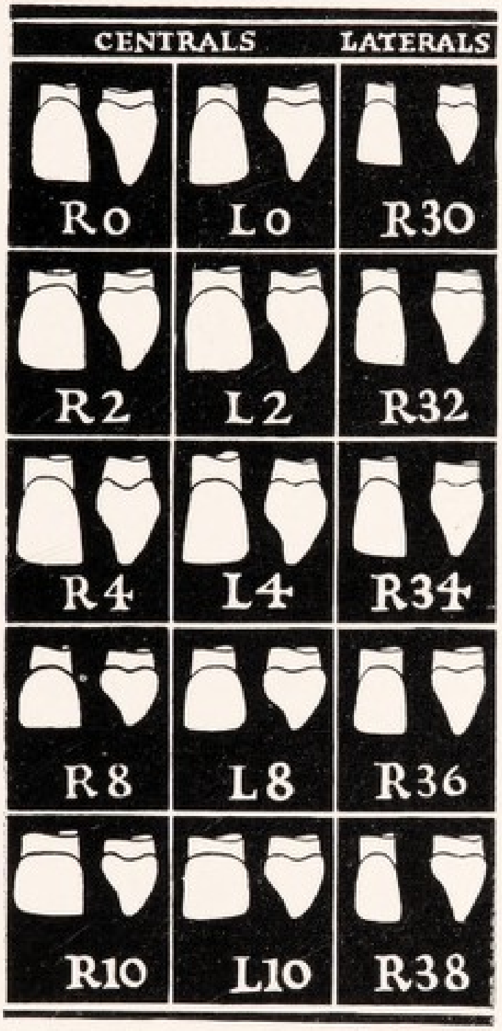


Fig. 127. Caulk's celluloid tooth forms

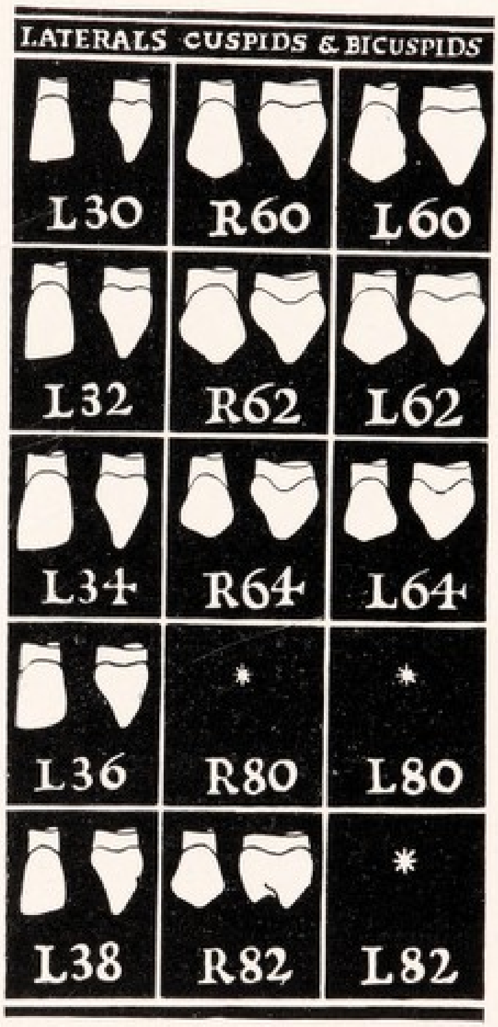


Fig. 128. Caulk's celluloid tooth forms

tion, may save considerable time and embarrassment later. The technique shown here is most exact and has given much satisfaction. Take an impression in one of the bands previously fitted. Pack with cement as No. 1, Fig. 122. While this is hardening take the second, a more accurate, impression as shown in Fig. 123. It is good practice to remove the impression for inspection, before it has been quite carried to place. Remove any excess compound from the gingival periphery. If found to be satisfactory otherwise, it is then reheated and carried to the proper position as indicated by the incisal guides. Chill with a few drops of ice water, from the syringe, and remove. This impression is later packed with amalgam in which is embedded a base metal wire for convenience in handling and

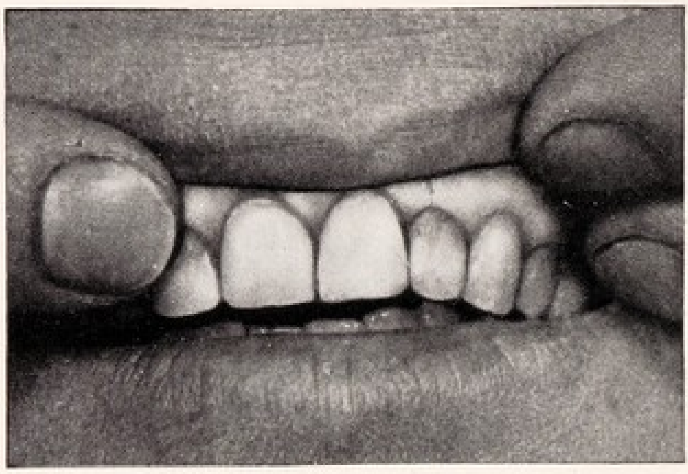


Fig. 129. Silicate cement temporary crown, in position

'vibrating' the porcelain. When the cement hardens in the first impression, No. 1, Fig. 122, flame the band and remove the band and compound. Wrap a matrix of No. 40 tin foil over the cement preparation, No. 2, Fig. 122, and over this, mold a crown of cement, No. 3, Fig. 122. Trim this so that it will not obscure the contours and contact points of the adjoining teeth.

"Another method sometimes used is to insert soft base plate wax in one of the previously fitted bands, No. 1, Fig. 124, place this band accurately on the tooth stump in the mouth and take the split modeling compound or plaster impression. Still another method is to mold a jacket of modeling compound, using a small part of a Kerr's tracing stick. This should also be fitted accurately over the preparation so that it does not obscure the contours and contact points of the adjoining teeth as No. 2, Fig. 124.

"The completed impression of the tooth is shown in Fig. 123. Note the carefully finished margin of the copper band, also the clean cut imprint of the shoulder of the tooth.

"The impression of adjoining teeth into which the die of the tooth stump is to be incorporated is taken either in modeling compound, or plaster, by the sectional method, Fig. 125, having placed the cement crown (Fig. 122, No. 3) on the tooth stump. When using compound, as shown here, take the lingual impression first. After chilling, trim away any compound which may overlap the incisal edges, or penetrate so far into approximal spaces as to cause distortion. Lubricate and take the labial impression, forcing the compound well up over the labial gum tissue. Chill,

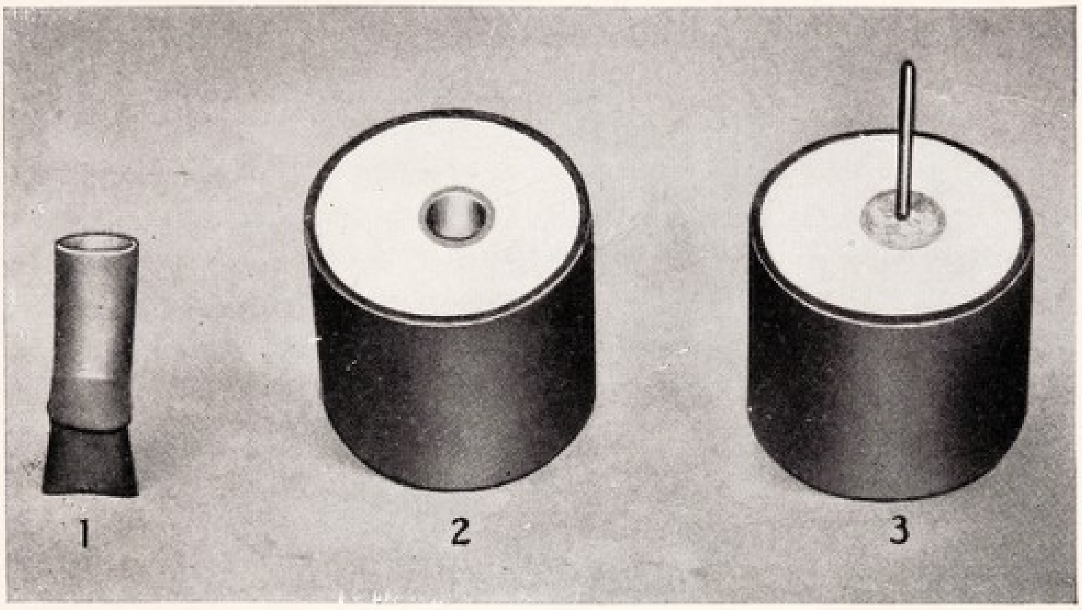


Fig. 130. No. 1, Impression of preparation wrapped with wax, preparatory to investment for making amalgam die. No. 2, Impression imbedded in plaster. No. 3, Impression filled with amalgam, and base metal wire inserted while amalgam is yet soft

remove both sections, and the cement crown. Assemble by placing the cement crown into whichever side of the compound impression it may be seated in most accurately as Fig. 126. A wax bite is taken at this time.

Selecting the Shade

"The shade guide to be used is that which the dentist would prefer to use for the selection of artificial teeth. For an upper central incisor, match the shade of the adjacent central incisor. For an upper lateral incisor, match the other lateral incisor. For the purpose of obtaining the desired shade the dentist should learn to divide the tooth to be matched, visually, into two parts, and preferably into three, the cervical, middle and incisal thirds. The color of the cervical third should be matched with the lip raised high. The color of the incisal third should be matched with the lip covering at least the cervical portion of the tooth, because if the color of the incisal third is matched with the lip all the way up, the incisal edge of the crown will usually be found to be of too light a shade. The color of the middle third of the tooth is usually a result of the blending of

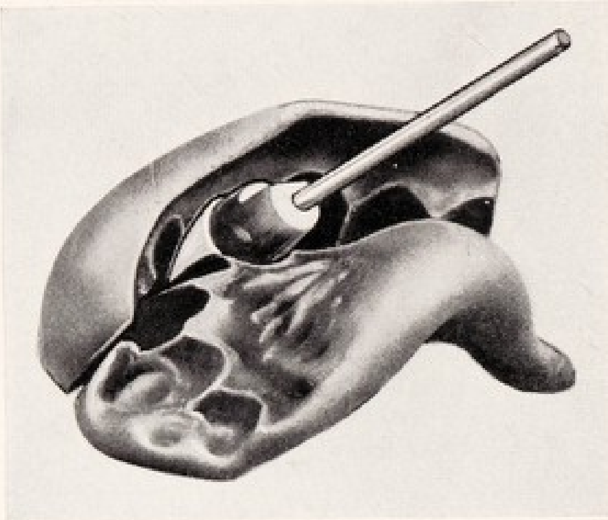


Fig. 131. Sectional impression assembled and amalgam die placed in position

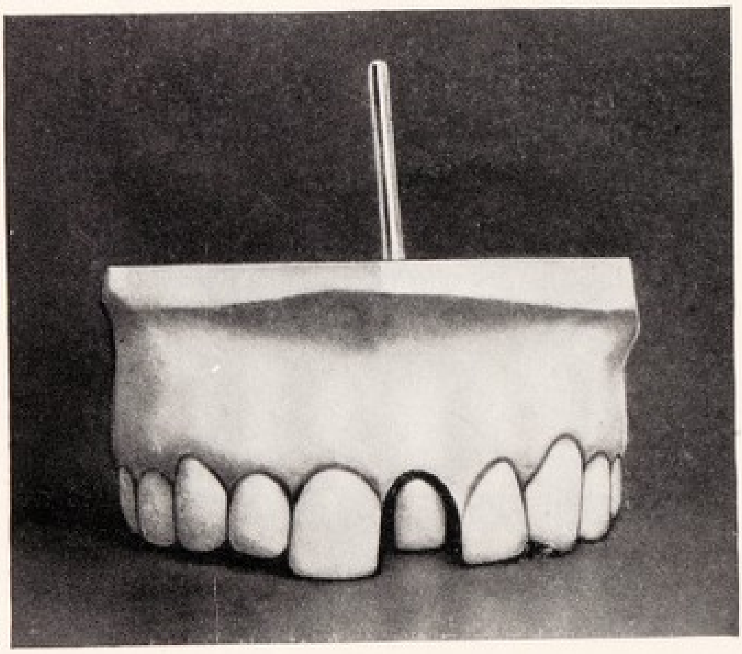


Fig. 132. Working cast with amalgam die in position

the dentin and enamel colors in that tooth. In some teeth the break between these colors is very distinct, in others it is very gradual. It is desirable to get different lights upon the tooth while matching. This may be done by matching the tooth with the patient facing the light, and again with the patient turned away from the light. If a sample tooth can be found which is satisfactory in all these positions, the crown that matches it will usually be found satisfactory.

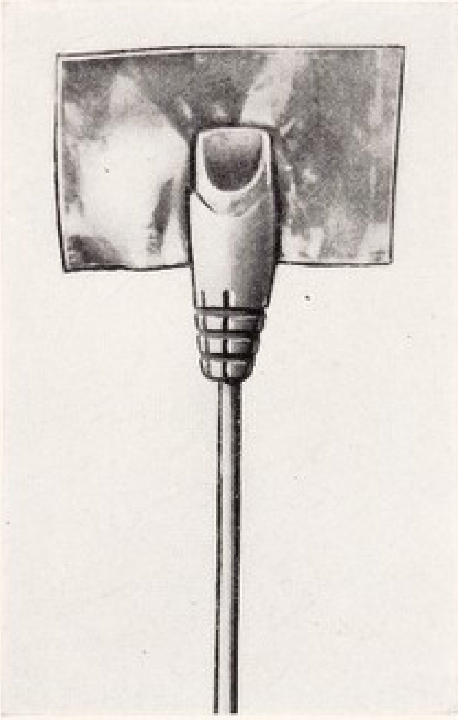


Fig. 133. First step in making platinum matrix

"The thickness of the porcelain necessarily influences the color. A sample shade guide tooth is about 2 mm. in thickness, whereas the labial thickness of a jacket crown is usually 3/4 of a mm. in thickness. A slightly darker pigment would be required in the jacket crown to reproduce the same color as the shade guide tooth.

Temporary Crowns

"A temporary crown of silicate cement is made. Use one of the Caulk celluloid forms as illustrated in Figs. 127-128. This is trimmed to the gum outline and perforated at the mesial and distal incisal angles for the escape of air and excess cement. Before placing this crown, bathe the tooth first with phenol, then with alcohol, and then varnish and lubricate as before taking the impression. This is extremely important. The celluloid form is filled with silicate cement of the proper shade, and is then forced into position on the tooth. Trim off the excess silicate around the gingival margin. Before the cement hardens, slip it off part way, two or three times. When completely hardened, it should be removed and set with Medi cement as illustrated in Fig. 129.

"Considerable care should be exercised in making the amalgam die, and

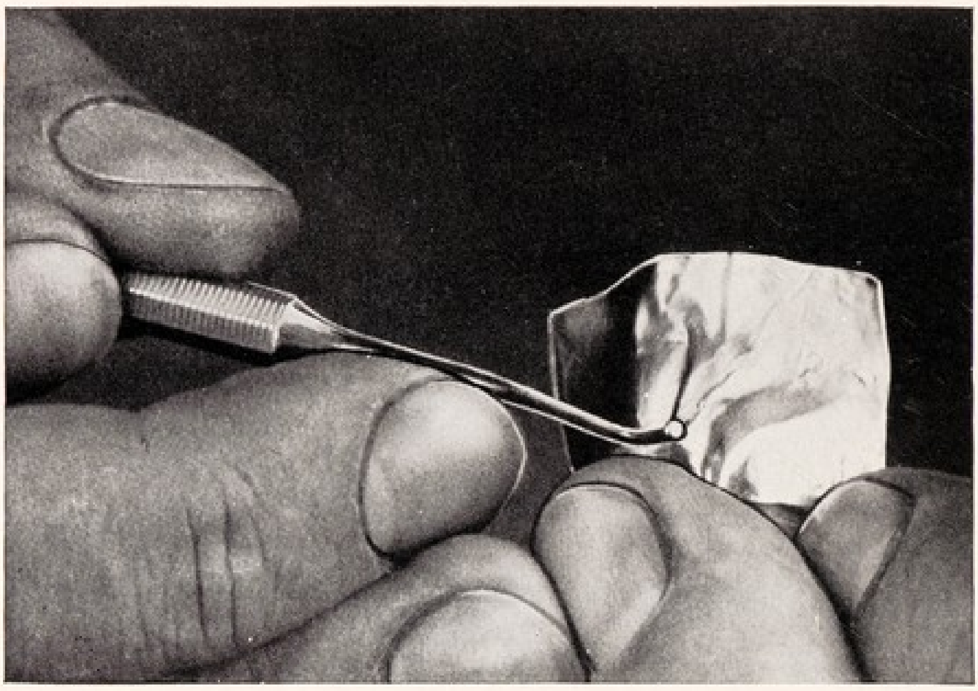


Fig. 134. Burnisher used for defining the shoulder on the matrix

cast. The copper band containing the impression is wrapped with Kerr's 28 gauge wax. The wax should extend approximately 3/4 of an inch from the cervical margin of the impression as in No. 1, Fig. 130. The impression is then embedded in plaster, in a metal, or rubber ring as in No. 2, Fig. 130. Soft amalgam is then packed into the impression, gradually removing the excess mercury with cotton pellets and adding alloy from which the excess mercury has been removed until the opening formed by the Kerr's wax is completely filled. Into the soft amalgam a base metal wire is embedded for convenience in handling and 'vibrating' the procelain as in No. 3, Fig. 130.

"The two sides of the modeling compound impression are placed in juxtaposition and united with sticky wax as in Fig. 131. The amalgam die is then inserted into the cement crown (or impression of the preparation if one of the other methods is used) and attached to the same with sticky wax. Lubricate the root portion and wire with vaseline and pour the cast.

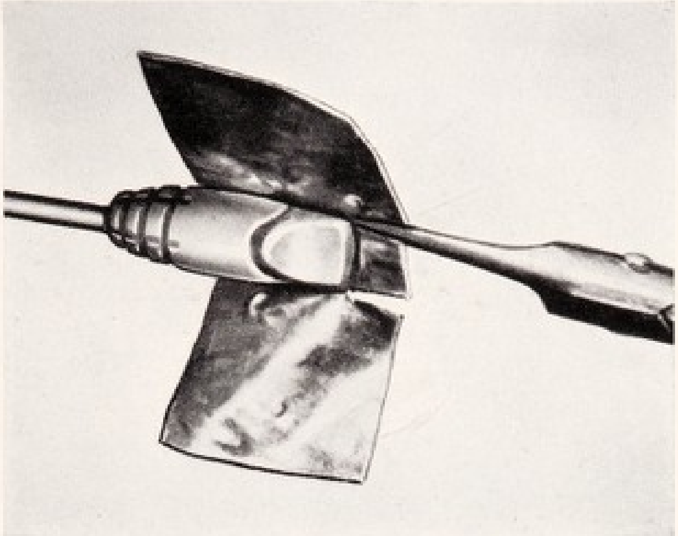


Fig. 135. Producing incisal flap

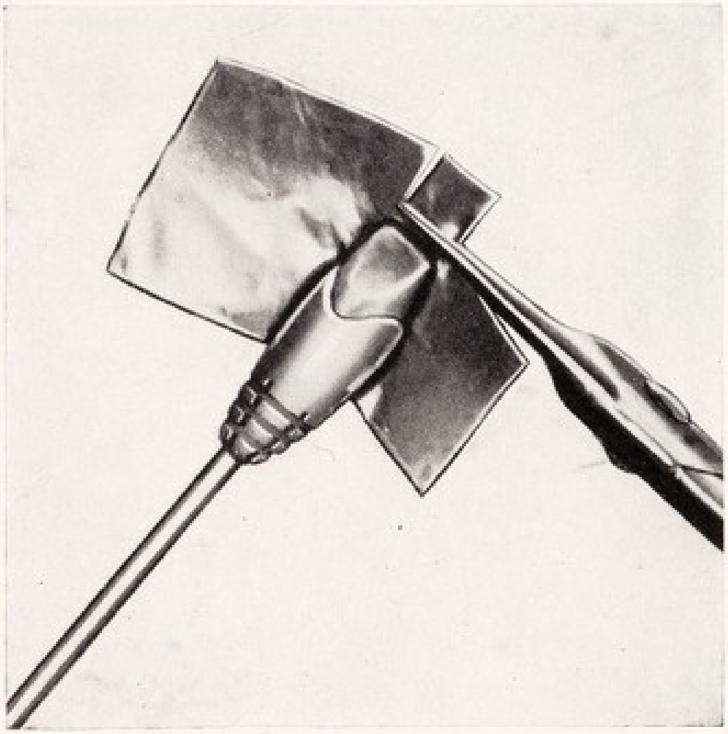


Fig. 136. Trimming incisal flap to proper length

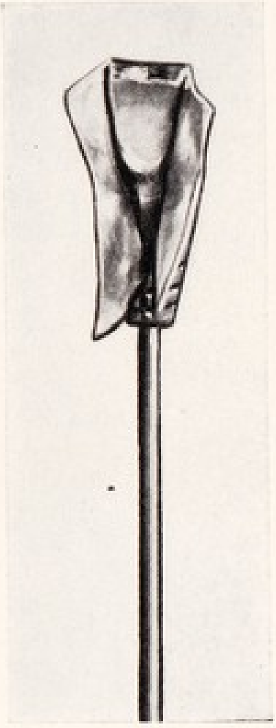


Fig. 137

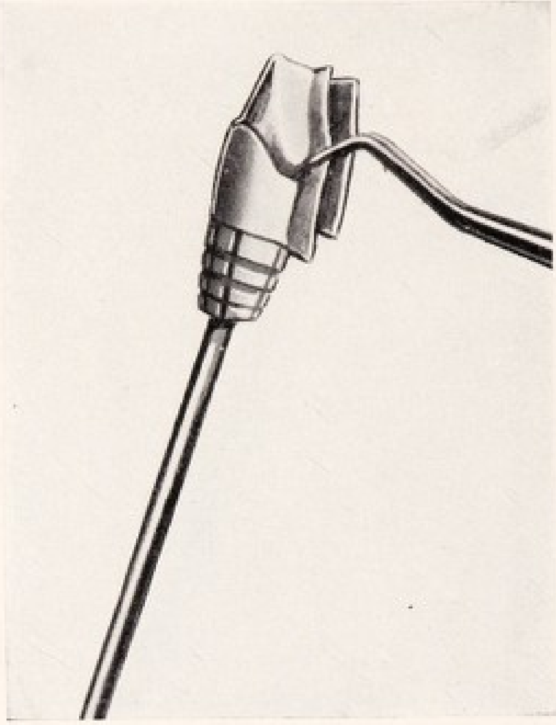


Fig. 138

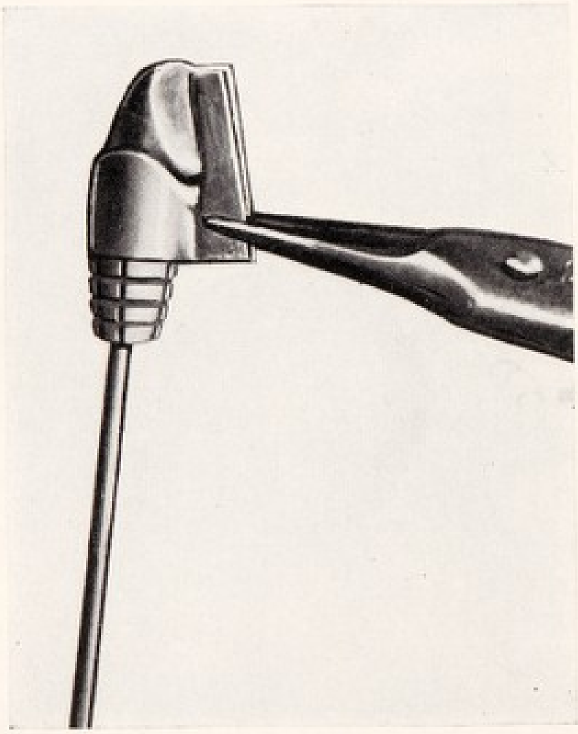


Fig. 139

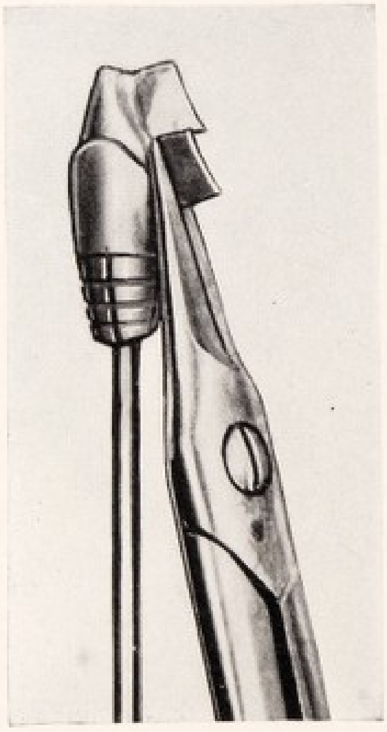


Fig. 140

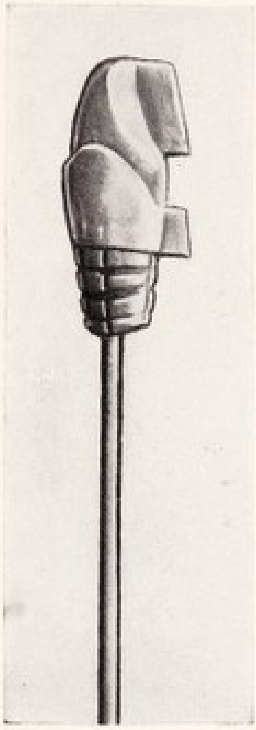


Fig. 141

Fig. 142

Fig. 137. Incisal flap burnished over incisal edge, and side flaps trimmed
Fig. 138. The side wings are brought together
Fig. 139. Technique for forming a tinner's joint
Fig. 140. The excess is trimmed away from the flaps
Fig. 141. The flaps trimmed so that they will just come together
Fig. 142. Final finish of tinner's joint

"The working cast with amalgam die in position is illustrated in Fig. 132.

(N.B. In several of the illustrations it will be noted that the root portions of the die is roughened with criss-cross grooves. This grooving is not done until after the working model has been made, else the roughened die would not be readily removed from the plaster cast. The grooving is only done to give the fingers a better grip on the die, while making the matrix, and while useful, is not an essential technic.)

"Platinum foil 1/1000 gauge is then placed across the labial side of the amalgam die, pressing the material against the die with the second finger of the left hand, so that the platinum will conform approximately to that surface, as illustrated in Fig. 133.

"Using a burnisher of the type illustrated in Fig. 134, define the shoulder on the labial side; do not allow the platinum to change its position after outlining the shoulder. When the labial surface is burnished, two parallel cuts are then made just the width of the preparation, from the top of the platinum to each approximal incisal angle. This will allow for trimming an incisal flap as shown in Fig. 135.

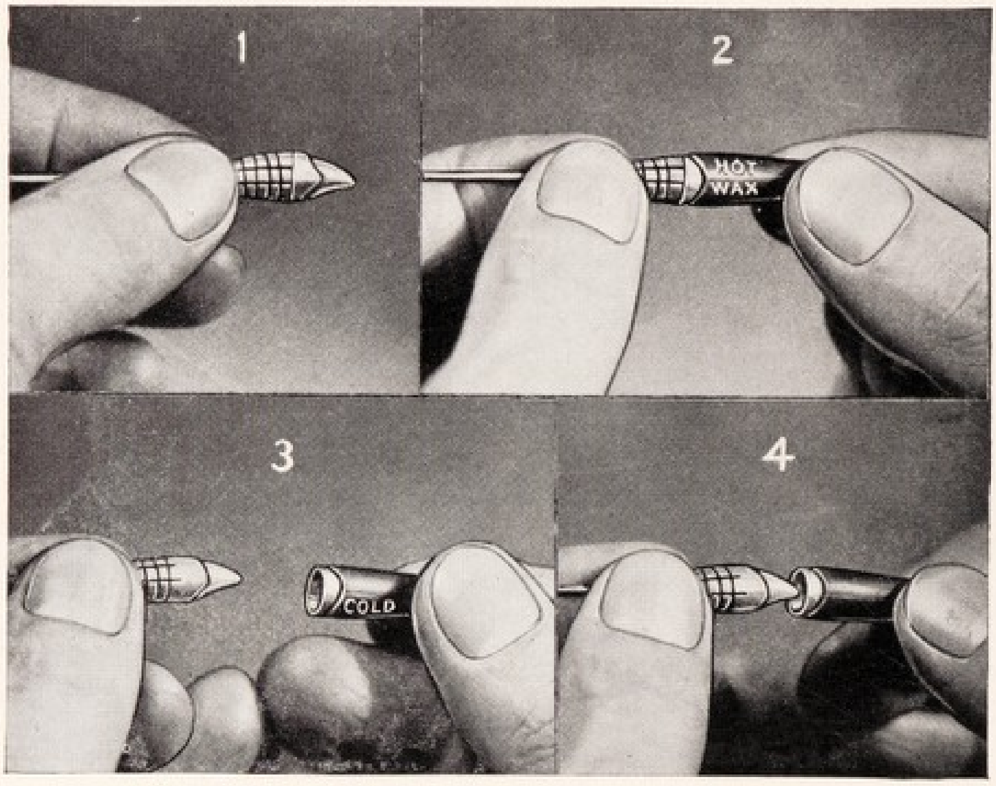


Fig. 143. No. 1, Finished matrix. No. 2, Sticky wax made to adhere to matrix. No. 3, Matrix removed from die. No. 4, The matrix is teased on and off several times

"To reduce the thickness of the platinum to a minimum on the lingual side, the incisal flap is cut so that when it is burnished onto the die it will nicely cover the incisal surface, as illustrated in Fig. 136.

"Fig. 137 shows the incisal flap burnished over the incisal surface, and the excess foil is cut from the wings.

"The platinum is then burnished on both mesial and distal sides. The platinum and die are now held with the thumb and second finger on the mesial and distal sides just short of the shoulder. Care must be taken not to let the platinum slip. The two wings of the main portion of the platinum are now brought together on the lingual side, and all excess platinum is cut away except enough to form a tinner's joint, which is not folded at this time. Carefully iron out the outline of the shoulder around to the joint on the lingual side. Note that the left flap is cut shorter than the right as in Fig. 138.

"It is very important that there should be but one thickness of platinum on the shoulder when the tinner's joint is made. This can best be provided

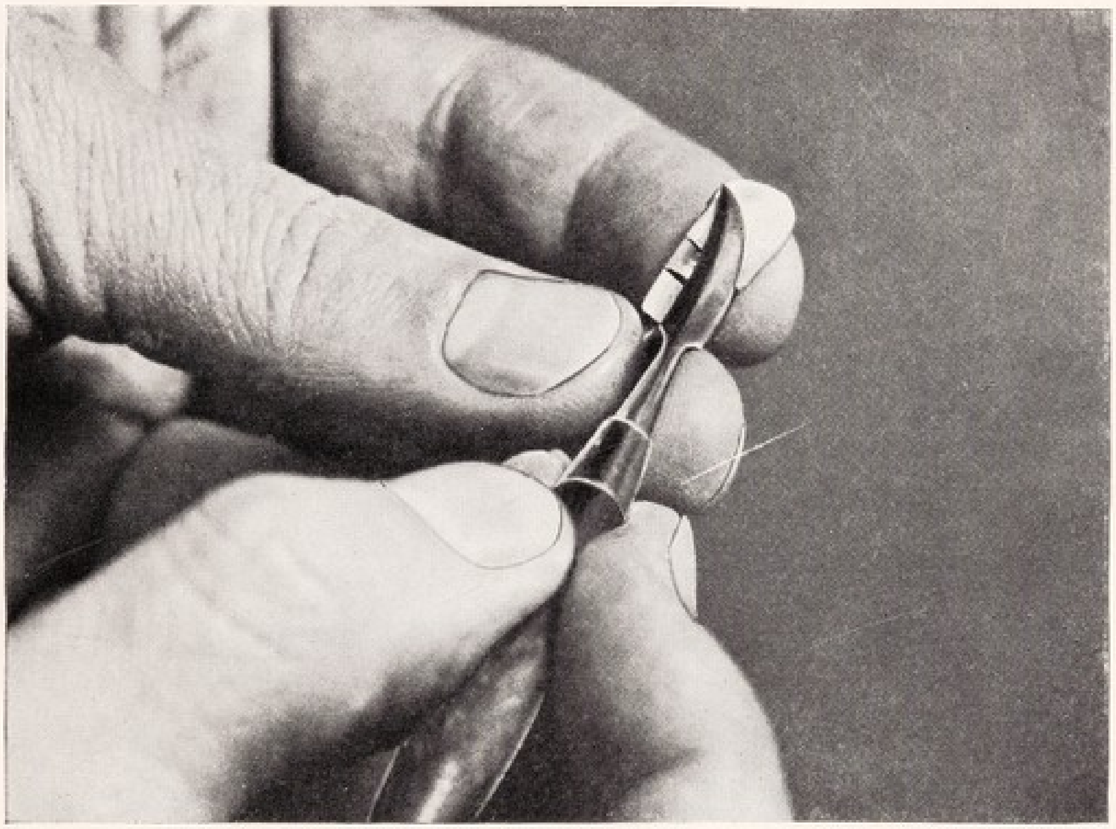


Fig. 144. The first layer of porcelain is applied with the spatula, the die being held in the left hand. A moderate quantity of porcelain, of the dentin color, is spread over the entire matrix, before the die is replaced in the cast

for by cutting the extra platinum off at this point before the lap is made. Holding the scissors as shown in Fig. 139 make a cut just gingivally to the shoulder, and as close to the die as possible. The platinum remaining gingivally to the shoulder is then folded to form a tinner's lap joint. Reburnish the shoulder carefully, and bring the two wings of platinum tightly together with pliers. Make a second cut similar to the first about 2 mm. nearer the incisal.

"The platinum is now cut so there is just enough left to have the two edges come exactly together as in Figs. 140-141.

"Finish the tinner's joint toward the incisal edge as shown in Fig. 142.

Burnishing is now done as completely as possible, and the excess axial apron is cut squarely around to allow the crown to sit firmly, leaving about 1 mm. gingivally to the shoulder, as shown in No. 1, Fig. 143. Replace the matrix on the die, reburnish carefully with polished orange wood sticks, then wrap with tissue paper and swage. Heat the end of

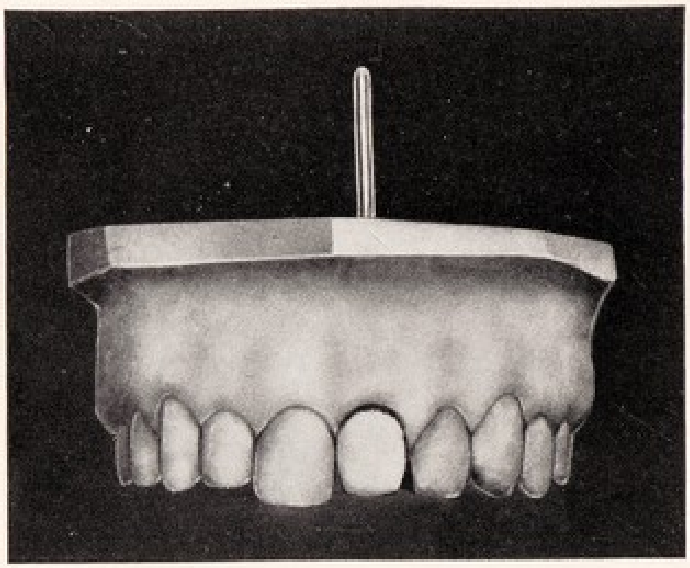


Fig. 145. The die replaced in the cast. The pin extending through the cast renders it possible to vibrate the porcelain

a piece of sticky wax and attach to the matrix as in No. 2, Fig. 143. When the wax has cooled the matrix is removed by exerting a pulling and lateral motion as in No. 3, Fig. 143. While the matrix is still attached to the stick of wax, it is teased off and on several times to insure easy movement when the porcelain is first put on, as No. 4, Fig. 143. The wax is then melted off and the matrix brought to a white heat, leaving the platinum perfectly clean.

Manipulation and Firing of Porcelain

"It is imperative that absolute cleanliness should be maintained during the manipulation and firing of porcelain. The hands should be thoroughly scrubbed and the fingernails given attention. In cities, where the air is constantly filled with flying particles from soft coal, smoke, etc., it is necessary to keep the windows closed while mixing and manipulating wet porcelain.

"In packing porcelain the vibrating method is used for several reasons. To secure a more dense mass of porcelain, thus having less shrinkage and greater strength when fired. It can also be packed more rapidly and it is a joy to carve.

"The first porcelain is applied while one holds the die in his left hand

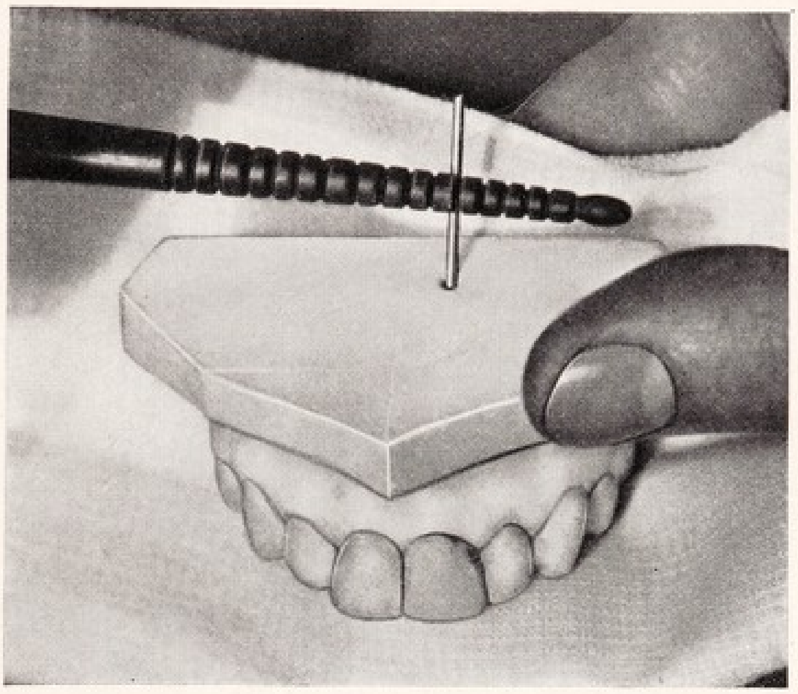


Fig. 146. When applying additional porcelain, folded linen is used, partly as a matrix and partly to absorb excess moisture. The porcelain is vibrated by drawing a serrated tool across the pin

as shown in Fig. 144. Spread a moderate quantity of porcelain, of the dentin color, over the entire matrix, before the die is returned to the cast. No particular effort is made to give form to this porcelain at first, but it is shaped roughly to the desired form.

"Fig. 145 shows the die after it has been returned to the working cast. Note the pin extending through the cast, making it possible to vibrate the porcelain.

"When applying more porcelain use folded linen on the lingual side as shown in Fig. 146, partly as a matrix but principally to absorb the moisture. More of the dentin color is then added on the labial side. Vibrate by gently rasping the pin which extends beyond the cast with a serrated instrument, until the porcelain shows a little moisture on the surface. Then place the linen on the labial side, and, applying porcelain on the lingual side, continue to vibrate and remove as much moisture as possible. The porcelain crown has now been built up larger than necessary and is ready for carving.

"On the lingual side carve to full lingual contour only. Do not remove any more porcelain than is needed to give the proper shape and size. It is desirable to have a considerable quantity of porcelain placed before the first bake. There will thus occur a shrinkage of as much porcelain as possible on the first bake. This will aid greatly in the forming

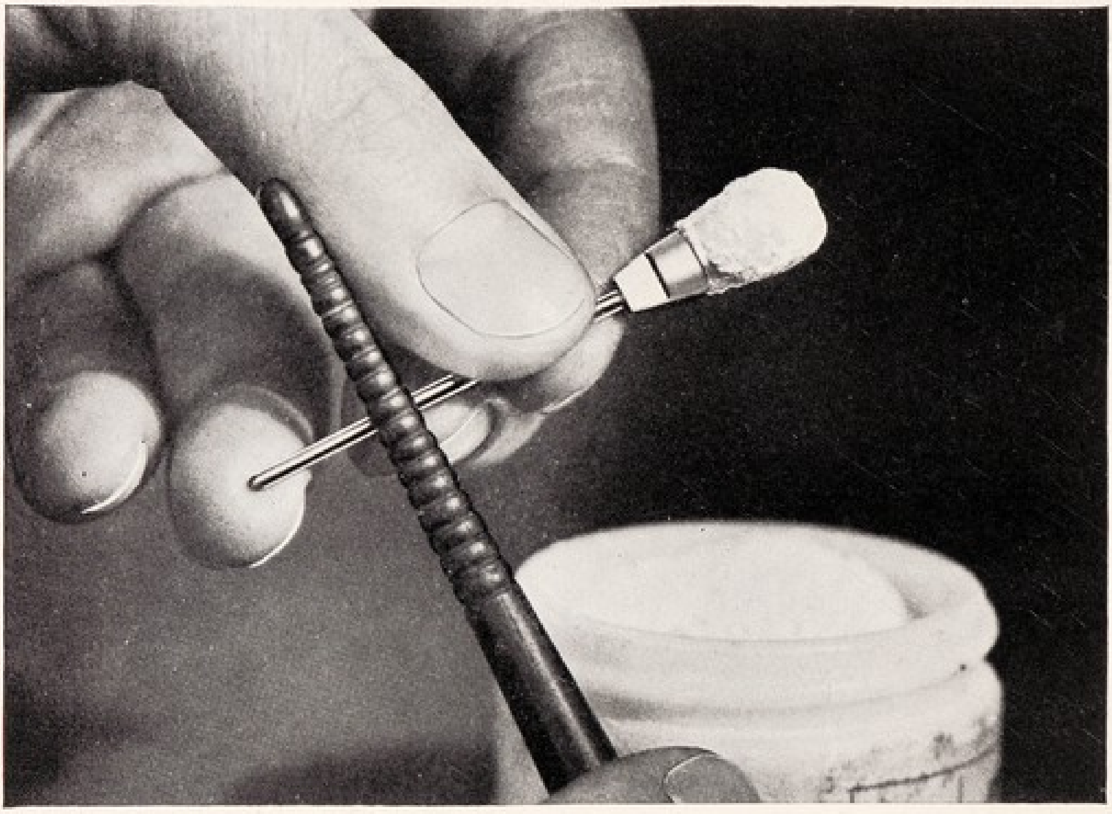


Fig. 147. The porcelain being moderately dry, is carved to approximate shape. The die is removed from the cast, the crown is dipped in powdered porcelain, and then vibrated

and coloring of the crown when packing and carving for the second bake. One can now tell definitely how much enamel color will be required to give the correct size and color, as shrinkage will be much less during the second baking. The porcelain is not brought to full contour on the labial side however, as the enamel layer is to be added before the second bake. Remove from the cast, dip the crown in powdered porcelain and vibrate carefully as shown in Fig. 147.

"The excess powdered porcelain is easily removed with a large sable hair brush as shown in Fig. 148 if the carving was reasonably dry before it was dipped into the powder. The porcelain will now be of a chalk like consistency and will carve very easily.

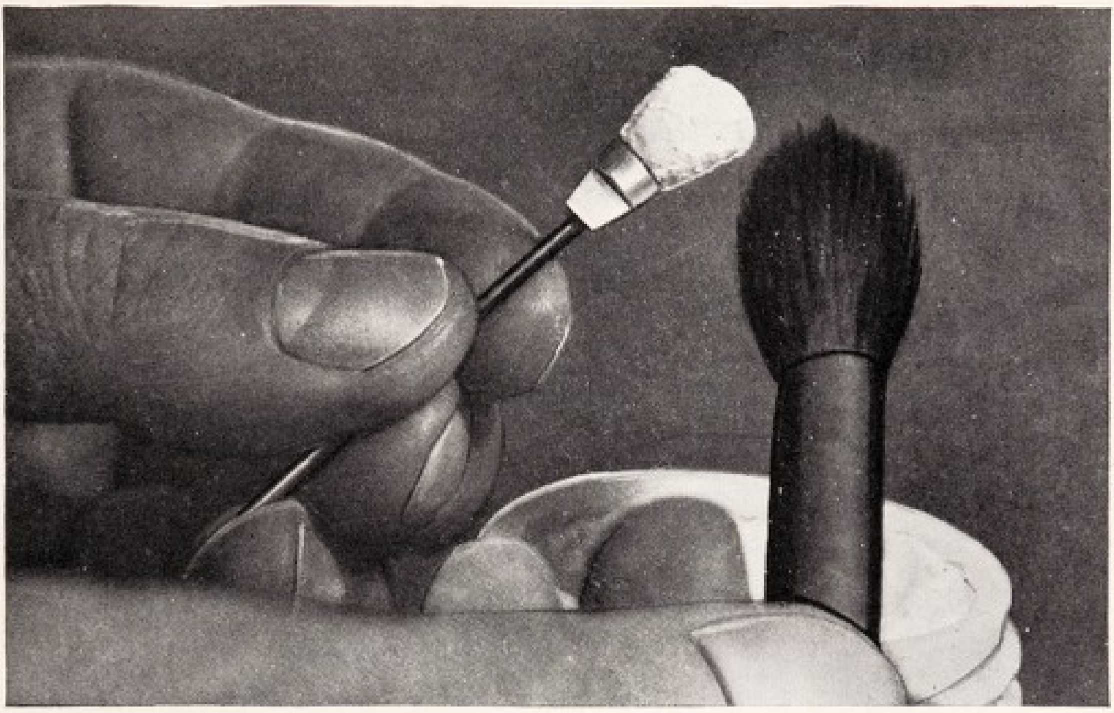


Fig. 148. Excess powdered porcelain is removed with a large, soft, sable brush. This is easily done if the carving was reasonably dry before it was dipped in the powder

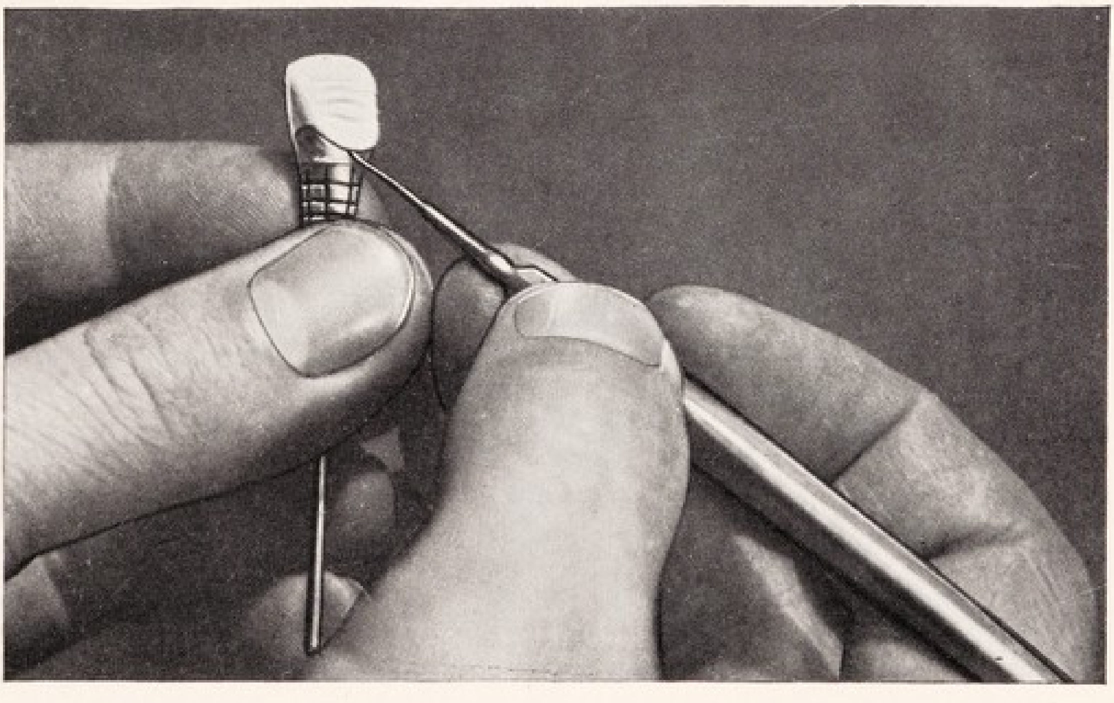


Fig. 149. Some of the porcelain is cut away at the shoulder so that the platinum can be reburnished after the first bake

"Some of the porcelain is cut out at the shoulder so that the platinum can be reburnished after the first bake. At this time, any required ir-

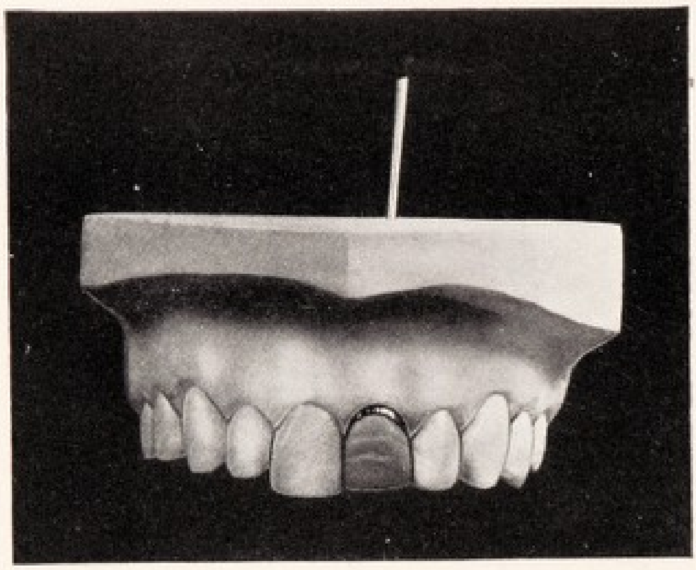


Fig. 150. The crown returned to the cast, after the first bake, and the contour scrutinized and corrected if necessary

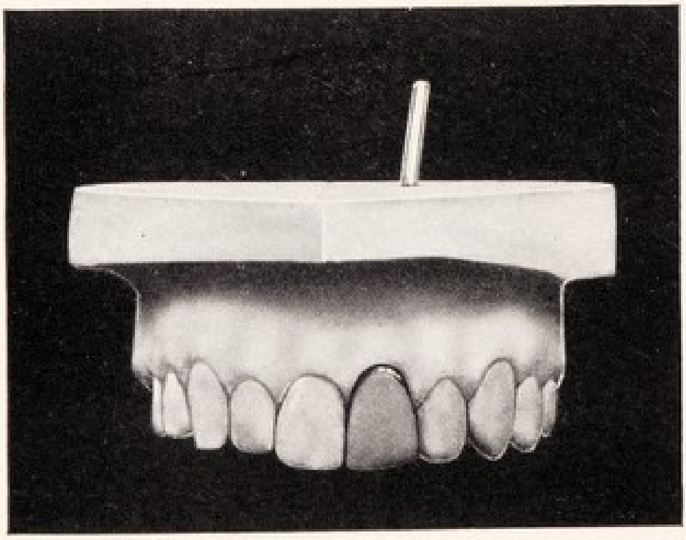


Fig. 151. After the second bake the crown is again replaced in the cast, and again scrutinized. Necessary corrections are made with stones and disks

regularities are produced in the labial surface of the dentin bake before it goes into the oven, as shown in Fig. 149.

After First Bake

"After the first bake the crown is returned to the cast as shown in Fig. 150. Examine carefully for contour, making all necessary corrections. Remove from the cast, clean thoroughly, using alcohol and a moderately stiff brush, and reburnish the matrix around the shoulder. Pack porcelain around the gingival edges at the shoulder, where it was cut out, making sure that after fusing there will be sufficient porcelain to give the correct gingival contour.

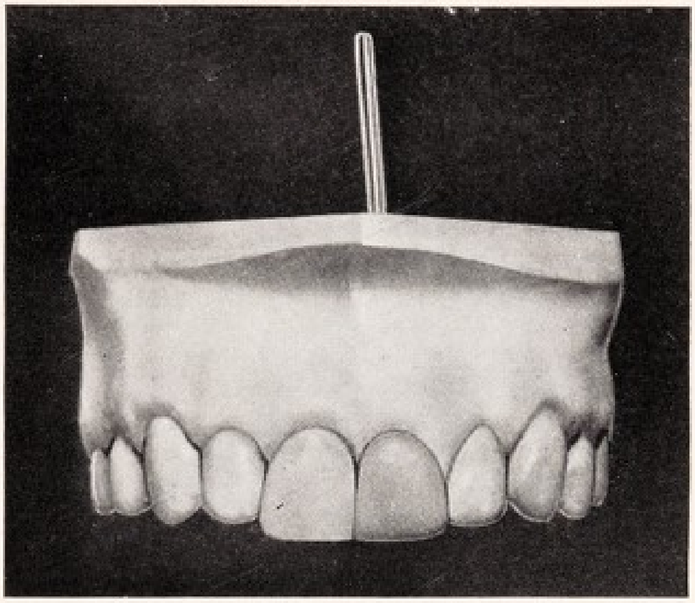


Fig. 152. The crown as it appears after the third bake

Return the crown to the working cast and apply the enamel colors, using linen on the lingual and labial sides, and vibrating, just as described in placing the dentin color. At this time carve the crown to proper contour. Remove from the cast, add extra porcelain to the contacts, dip the powdered porcelain, vibrate, and dust off the porcelain with a large sable brush.

After the Second Bake

"The crown is again returned to the cast after the second bake and examined for contour as shown in Fig. 151. Make all necessary corrections with stones and disks. Cleanliness throughout all these operations is essential to success. Stones used for trimming the procelain must be scrubbed before use; otherwise particles of dust, or other material, may be ground into the porcelain and will interfere with the appearance of the finished crown. If necessary, add porcelain, giving it the third bake, but avoid glazing it until the crown has been tried in the patient's mouth.

"If the porcelain fuses at 2500 degrees F., do not heat it to more than 2400 degrees F., at this time. In firing porcelain the operator should recognize that the time that elapses while bringing it to the desired temperature is just as important a factor as the actual heat recorded on the pyrometer. Porcelain that fuses at 2500 degrees F., will fuse at 2300 degrees F., if brought up to that heat slowly enough. Slow baking pro-

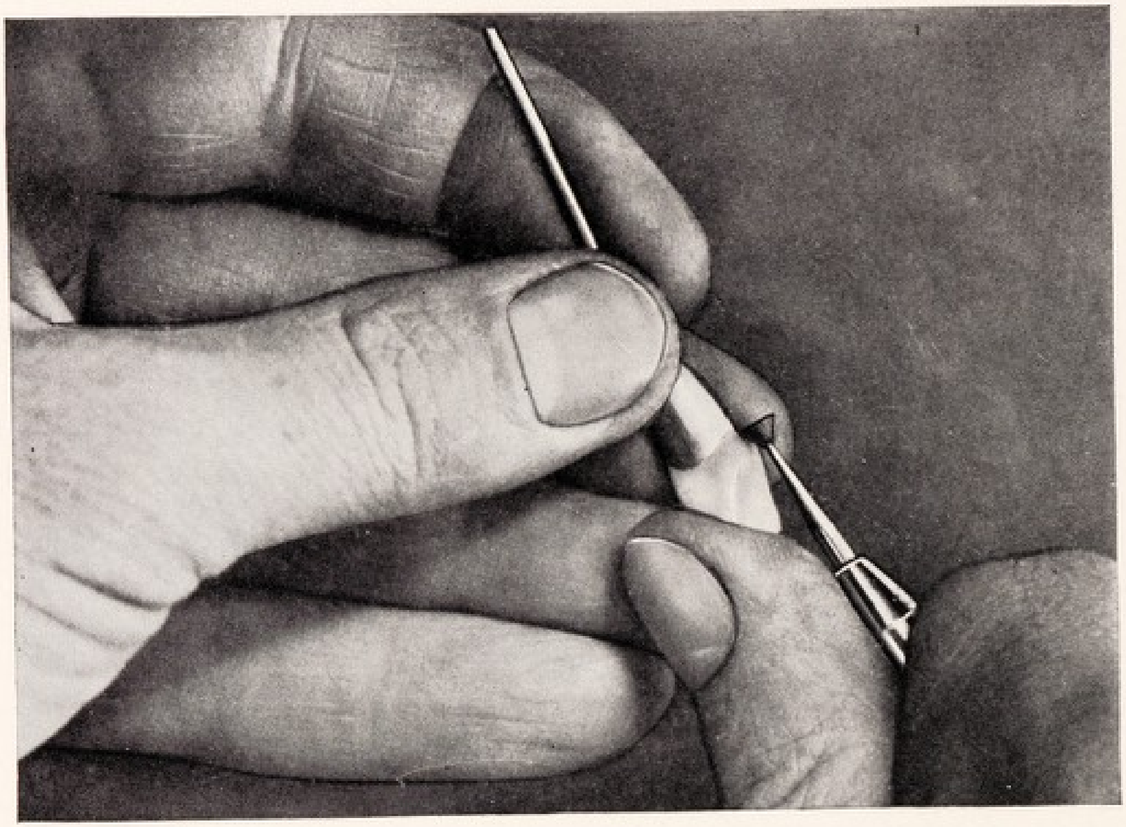


Fig. 153. The crown replaced on the die, and the cervical region perfected with an inverted cone stone, before trying in the mouth

duces better porcelain and reduces the chances of failure. It also prolongs the life of the muffle.

After the Third Bake

"Fig. 152 represents the crown on the cast after the third bake. The crown has been shaped carefully and baked to 2400 degrees F., not a full glaze but just enough to bring out the colors and shrink the porcelain sufficiently so that it will not change form in the final glazing after it has been adjusted in the patient's mouth.

"Remove the platinum apron at the cervical margin, place the crown on the die and shape the porcelain in this region with an inverted cone stone before trying the crown in the mouth, as shown in Fig. 153. Have sufficient porcelain at the gum margins to give the correct gingival contour. This is very important.

"Fig. 154 shows the crown in the mouth. Examine for contour, occlusion, color and fit. If we are to obtain the highest artistic results,

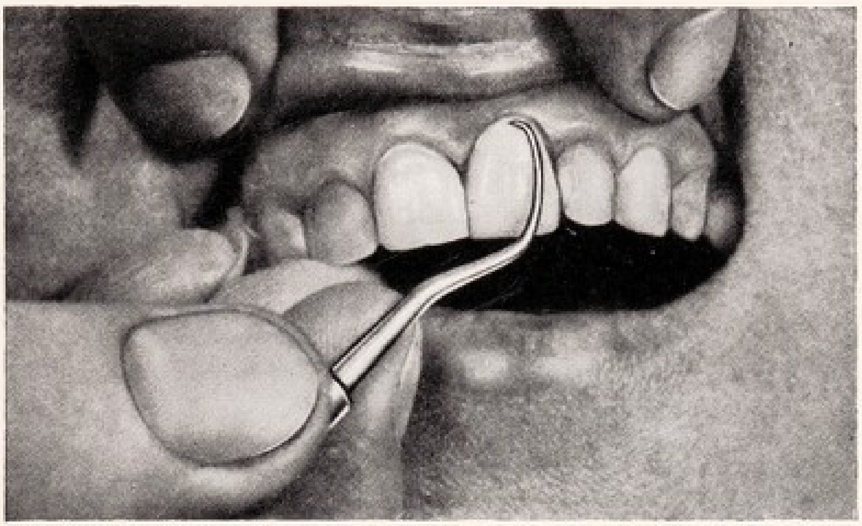


Fig. 154. The crown in the mouth. Examine for contour, occlusion, color, and especially for the adaptation at the gingival margins

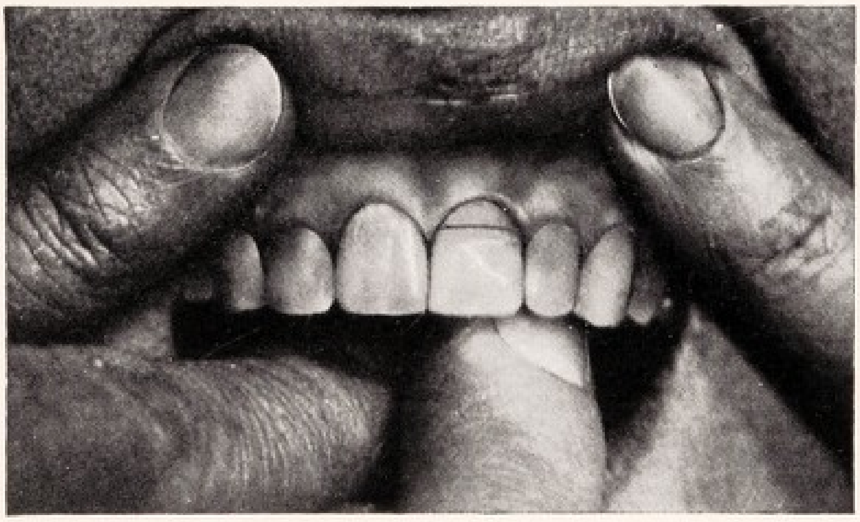


Fig. 155. After removing the major excess of cement with a fine explorer, the balance of the excess is cleared away with a fine silk tape, which is passed between the crown and the adjacent teeth, the ends toward the lingual

the form, color and fit must be correct. A small hook explorer may be used to examine for overhang, or deficiency at the cervical margin. This exploration is an extremely important part of the examination, inasmuch as failure to detect and correct overhang, or deficiency, at this time, may result in serious gingival disturbance later. It often happens that the gingiva grows down slightly around the cervical margin of the prepared tooth stump, between appointments. When the crown is tried in, it presses so firmly against this gingival tissue that it is difficult to explore the margin of the crown satisfactorily, especially on the approximal sur-

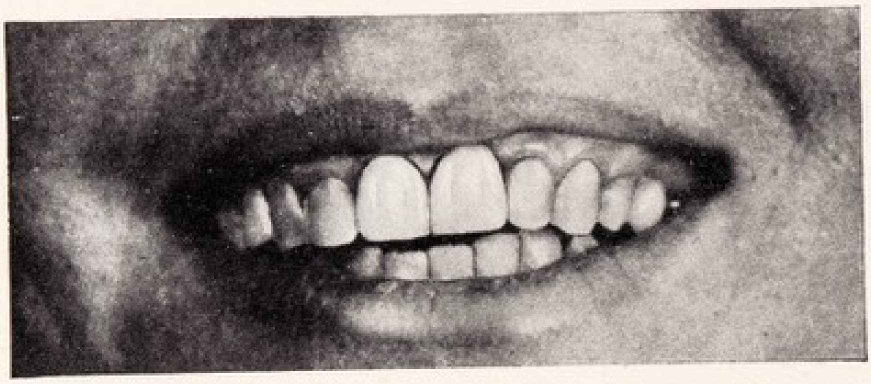


Fig. 156. Labial view of the finished crown

faces. Needless to say, if an overhang is discovered on an approximal surface after cementation, correction is seldom possible.

"The porcelain that comes in contact with the soft tissues, also the contacts with the neighboring teeth, should be highly glazed. These are usually the parts we grind when fitting the crown in the mouth, and which make the final glazing before cementation imperative.

Treatment of Root Stump

"Special attention should be given to the treatment of the root stump before cementation. The stump should receive the same treatment as described previous to taking the cup impression, namely using phenol and alcohol, followed by rosin and chloroform.

Cementation

"In cementing the finished crown, great care must be exercised to exert pressure in the proper direction. Unless such precaution is taken, serious damage may result, and this is especially true when the shoulderless porcelain jacket crown is used. As an example, when cementing an upper anterior crown, if too much pressure is brought to bear from the lingual-incisal direction this may cause the crown to fracture at the labio-cervical margin or cause a discrepancy at the lingual-cervical margin. A steady pressure should be maintained while the cement is hardening. After the cement has thoroughly set the bulk of the excess cement is picked off with a small explorer and the

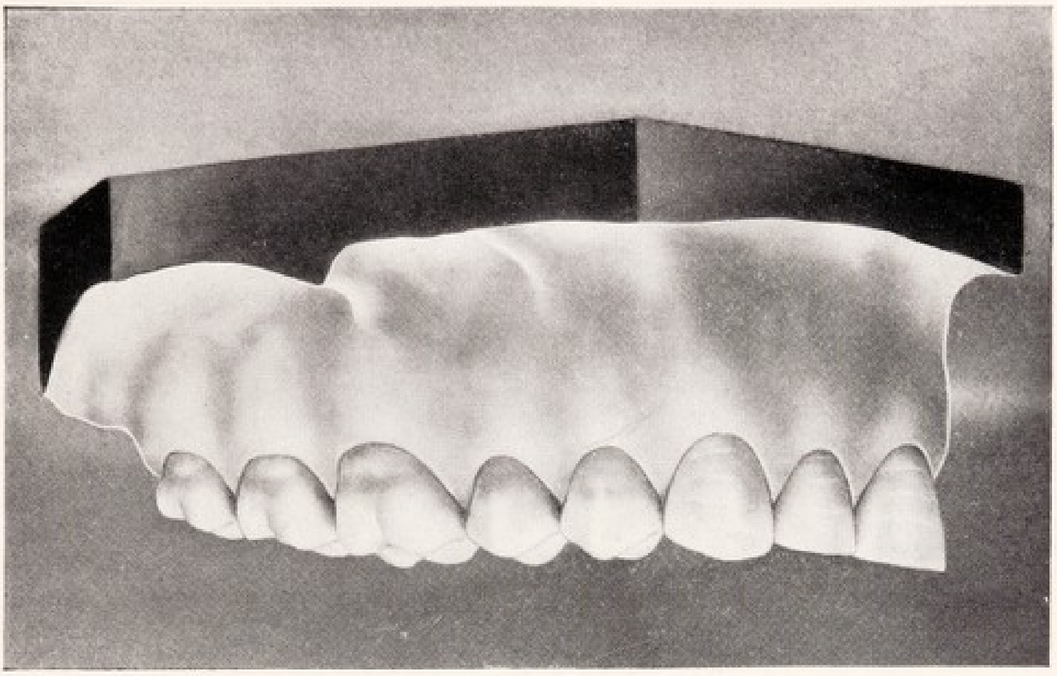


Fig. 157. The labial and buccal of surfaces of eight porcelain jacket crowns. The markings and staining indicate that these crowns were especially made for the individual patient

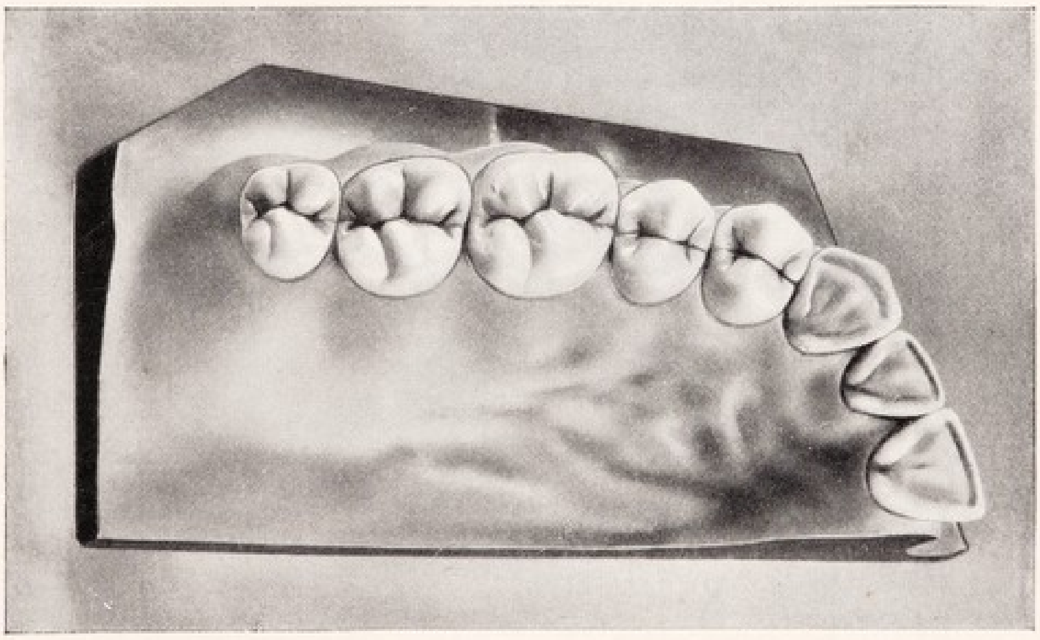


Fig. 158. Occlusal and lingual surfaces of the same crowns. Compare these crowns with ready made artificial teeth

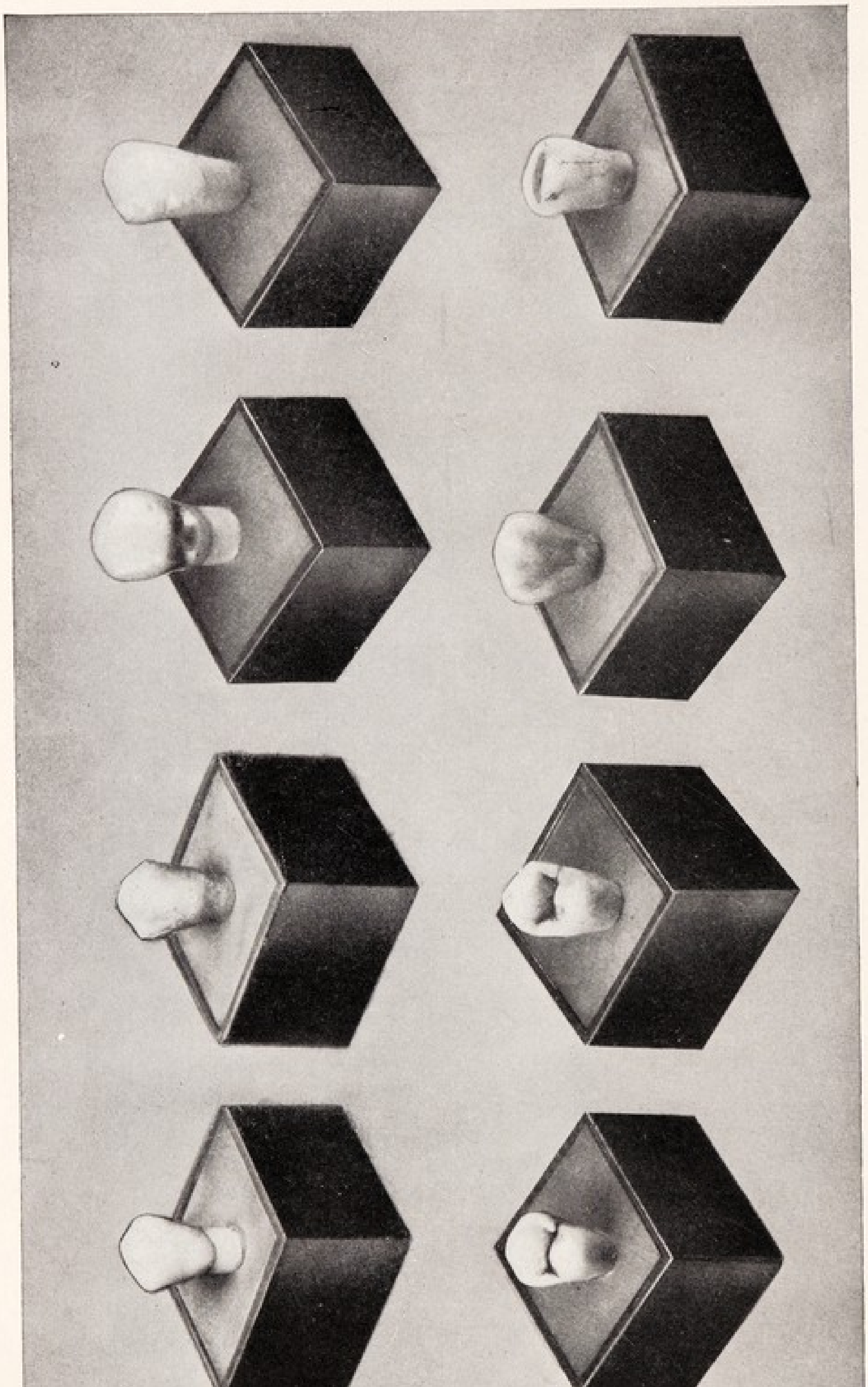


Fig. 159. Surface markings and stains on cuspids and bicuspids

remaining fine particles are removed with fine silk tape as shown in Fig. 155. This is first passed between the crown and the adjacent teeth with the ends passing to the lingual: alternate traction on the ends of the silk will clear away cement particles on the labial and approximal surfaces. The process is repeated in the opposite direction to clear the lingual surface. A labial view of the finished crown is illustrated in Fig. 156.

"Fig. 157 shows the labial and buccal surfaces of eight porcelain jacket crowns. Attention is called to the special marking and staining to demonstrate the possibilities for obtaining a more natural appearance. Compare these crowns with the ready-made porcelain crowns supplied by manufacturers.

"While in Fig. 157 the crowns have characteristics which indicate that they are specially baked, there has been no effort to bring out the possibilities of matching teeth of unusual surface form, or making of unusual shades. The possibilities in this direction are limited only by the artistic sense and skill of the operator. When natural teeth are studied as to their form and color, it will be seen at once that, of even the supposedly normal teeth, only about 10% can be matched, even approximately, with ready made crowns. And since so many teeth vary markedly from the normal form and color of their type, the shortcomings of the manufactured crowns are still more strikingly emphasized.

"Fig. 158 shows the occlusal surfaces of the same crowns. Note the staining of the occlusal grooves and the incisal edges of the anterior crowns. Special attention is called to the anatomy of the lingual surfaces of the anterior teeth. This is more often neglected than is the lingual anatomy of the posterior teeth. A very important advantage of the porcelain jacket crown for posterior teeth, is the opportunity it affords for developing an occlusal anatomy which will best harmonize with the occlusal contours of the opposing teeth.

"Fig. 159 shows the surface markings and stains on cuspids and bicuspids. The appearance of erosion may also be reproduced in a porcelain jacket crown as illustrated in the cuspid crown. See the second crown from the right in the upper row. Note also the fine lines representing cracks, or checks, on the crown at the right of the lower row.

"Figs. 160-161-162 represent ten porcelain jacket crowns which are reproductions of natural teeth. Special attention was given to the correct form and surface markings as well as the coloring and stains as found in the natural teeth. It is possible with the hand carved crown to reproduce the natural form and color of any tooth we desire to match in the mouth. A truly artistic restoration is one that harmonizes with its neighbors in the mouth.

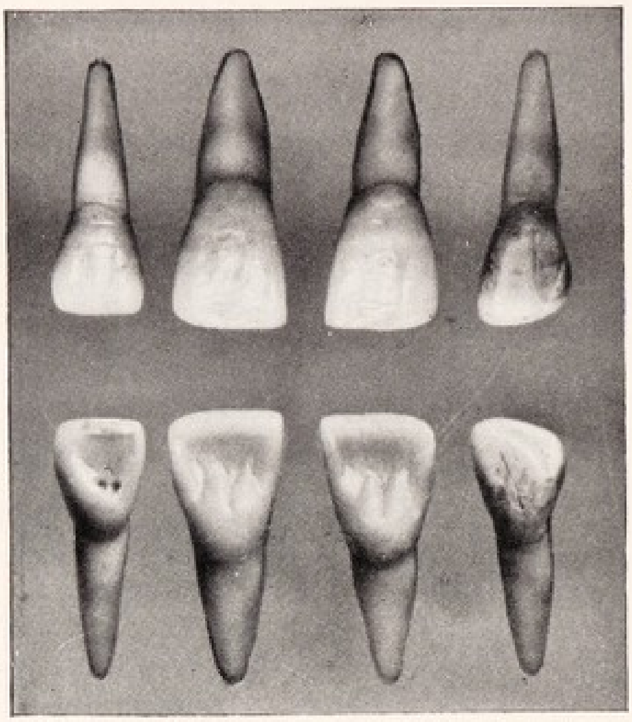


Fig. 160

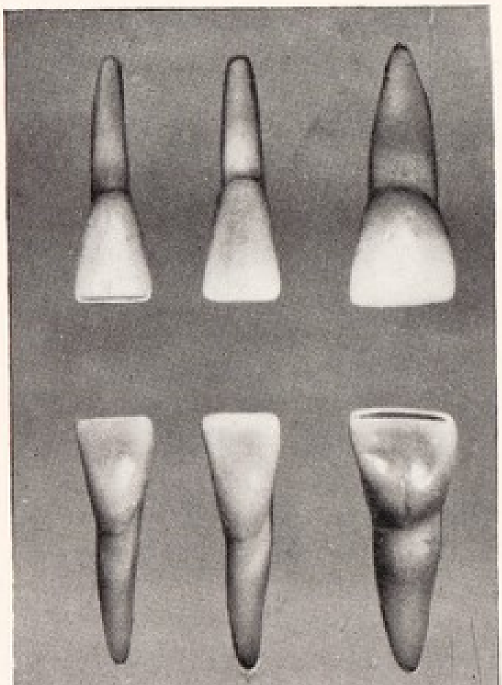


Fig. 161

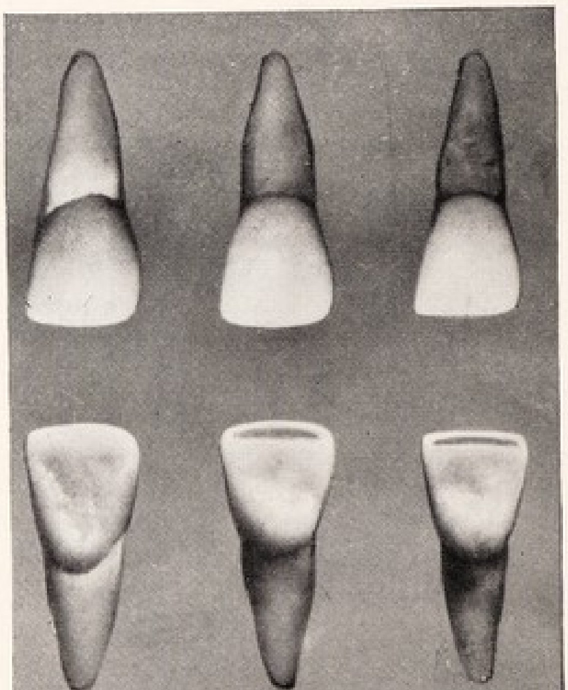


Fig. 162

Figs. 160, 161, and 162. Ten porcelain jacket crowns made in reproduction of natural teeth

"The so called transparent tip on some upper anterior teeth is often due to attrition, sometimes leaving the labial enamel plate denuded of its dentin, and one way to reproduce this effect in a porcelain jacket crown is to cut out the porcelain along the incisal edge, leaving the labial enamel color thin almost to the point of transparency. Into this groove is baked a stain of the proper shade for the effect we are trying to reproduce in the individual case. It is to be understood that no one stain will apply in all cases."

In presenting the foregoing technique for the construction of the porcelain jacket crown there is no desire to offer this as the only acceptable method. The student who aspires to prepare himself to give the highest type of service in dental ceramics should also familiarize himself with other techniques which have been devised by capable workers in this field. Special attention should be called to the outstanding work of LeGro. He has developed a technique for the construction of what he calls the "shoulderless porcelain jacket crown." With this crown it is possible safely and satisfactorily to restore many teeth which, because of their anatomy, or some other feature, could not safely be prepared with a shoulder.

Shoulderless Jacket Crown

The "shoulderless porcelain jacket crown" requires the minimum cutting of the tooth as a basis for its construction, and is therefore especially adapted to slender teeth, and also to peg shaped teeth. This crown may also be used, if desired, on teeth which are indicated for the shoulder porcelain jacket crown. Because of the demands for extreme accuracy in construction, it is suggested that the dentist should master the technique for the shoulder crown, before attempting the LeGro modification.

The shoulderless porcelain jacket crown thus meets the demands of a considerable number of cases, and should be at the command of every dental ceramist. The technique for this crown is fully described in Dr. LeGro's book *"Ceramics in Dentistry,"* to which the reader is referred. This book contains much valuable material in the field of dental ceramics, and the student in this specialty will find in it many practical hints and much helpful information.

Dr. LeGro deserves the greatest commendation for this very important contribution to dental progress.

CHAPTER XIV

The Porcelain Jacket Crown in Stationary Bridgework

In bridgework involving teeth in the anterior part of the mouth, including the bicuspids, the esthetic element imposes demands which are sometimes met with difficulty. Where abutment teeth are vital, and not attacked by caries, the three-quarter crown, or other cast attachment may often be used with entire satisfaction. But when either, or both, of the abutment teeth have been attacked by caries, to such an extent that pleasing restorations by this method are impossible, the porcelain jacket crown will often solve the problem.

The element of weakness may be the stumbling block to the use of porcelain, but in most cases where but a single tooth is to be replaced, sufficient strength may be had, even with the porcelain jacket crown. In such cases the operator should study his case very carefully before deciding against this most esthetic restoration.

It should be emphasized that bridges of this type are limited to one tooth spans, attached at one end. For the short bridge the porcelain jacket crown may be utilized as an abutment in several combinations. It may serve as the abutment to which the pontic is solidly attached; in this case the pontic and the crown are baked in one piece, at the same time baking into the pontic an iridio-platinum wire which may rest on an inlay, or on a porcelain jacket crown on an approximating tooth. The porcelain jacket crown may also be used as a rest at the unattached end of a bridge, where a metal inlay, or three-quarter crown, forms the other abutment. Here the rest may consist of a round wire extending from the pontic and resting in a platinum tube baked into the porcelain jacket crown, or lying in a groove on the occlusal surface of the porcelain jacket crown. In many cases it is difficult, at the free end of the bridge, to provide sufficient space in the porcelain jacket crown, for the reception of the platinum ferrule, due to the limited cutting range in a vital tooth. In these cases, the rest for the free end of the bridge is made by preparing a shoulder on the porcelain jacket crown, to which a clasp, or other supporting metal arm, is adjusted.

Bridges utilizing porcelain jacket crowns as abutments, are most satisfactory when the degree of opening of the bite is normal. Closing of the bite, or marked over-bite of the upper teeth over the lower, complicates the problem of obtaining strength without endangering the vitality of the

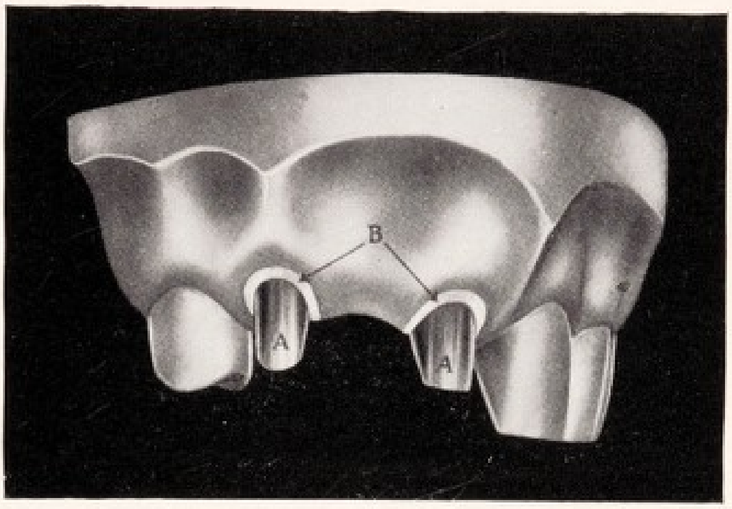


Fig. 163. Cast showing gold dentin-form cores cemented into devitalized upper right central incisor and cuspid, for the construction of porcelain jacket crowns, the teeth being prepared with a fairly wide shoulder. A. A. Dentin-form cores of cast gold. B. Shoulder of dentin, which must be exposed around entire periphery of root

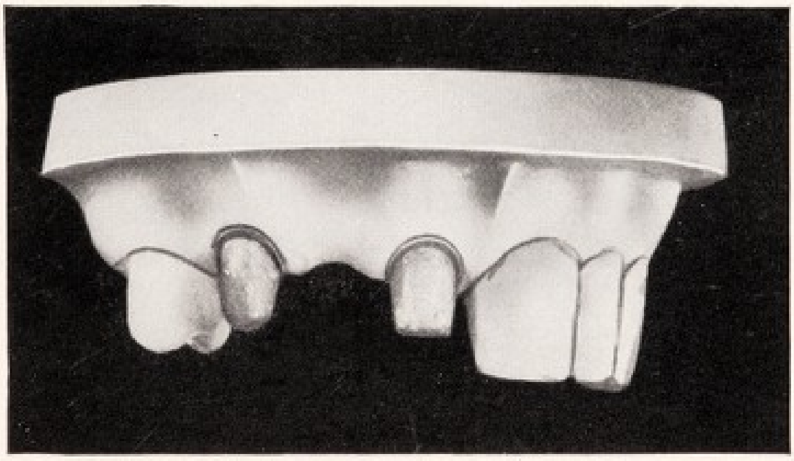


Fig. 164. Artificial stone cast, of case shown in Fig. 163 with platinum matrices swaged and in place on the removable amalgam dies

abutment teeth, and, in such cases, it is usually necessary to resort to some modification of the technique, in order to produce a satisfactory result.

A suitable case for the construction of an all porcelain bridge is one in which an upper lateral incisor is to be supplied, the cuspid and central incisor being used as abutments. (See Fig. 163.) The cuspid and central incisor are prepared for porcelain jacket crowns in the usual manner. If the teeth have been devitalized, it is usually best to use cast gold dentin-

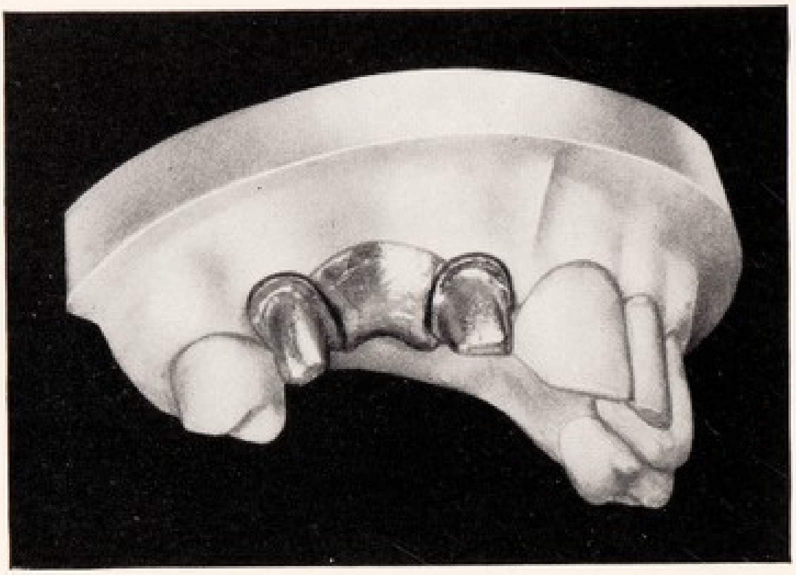


Fig. 165. A saddle of 1/1000 platinum burnished over the ridge between the central incisor and cuspid

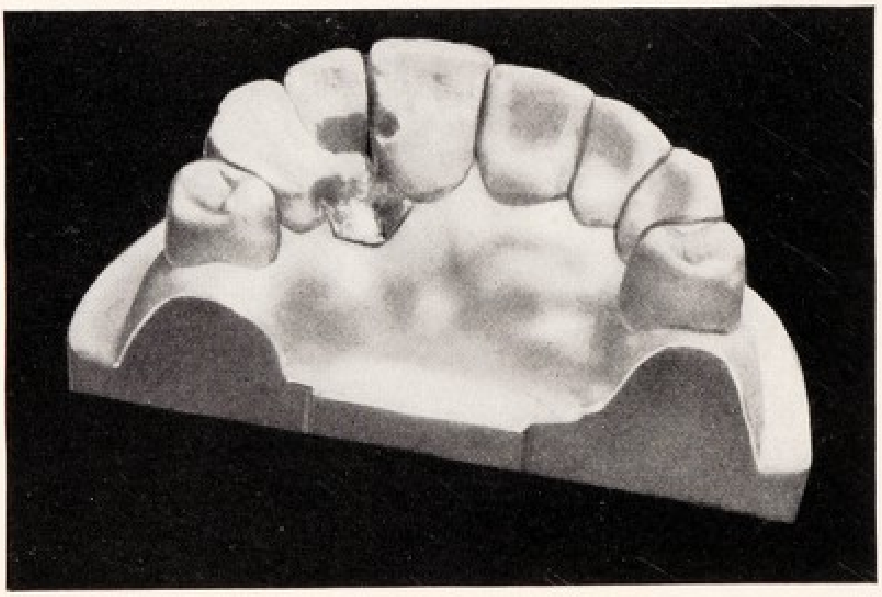


Fig. 166. Lingual view of cast, showing the porcelain built up to form the crowns and the pontic. Note oversize cuspid

form cores, in order to insure adequate strength. The technique for making such a core is illustrated in Figs. 178, 179 and 180.

Before investing the wax cores it is important to test the occlusion by having the patient close the jaws and perform the various protrusive and lateral movements. In every position which the mandible may assume there must be sufficient space between the lingual surfaces of the wax cores, and the labial incisal surfaces of the lower anterior teeth, to insure

Fig. 167

Fig. 168

Fig. 167. Amalgam die, with cuspid crown and pontic removed from the cast. A slight amount of porcelain is cut away at the neck of the crown to permit reburnishing of the matrix

Fig. 168. Cuspid crown and pontic shown in Fig. 167, mounted on clay crown-holder, ready for first bake. The porcelain is tipped in the direction of least bulk, to avoid distortion during shrinkage

adequate thickness of porcelain at these points. The wax cores are then invested and the castings made and cemented to place. The root end is invariably exposed around its periphery to provide a shoulder to which the porcelain may be adapted.

When the preparations are complete (See Fig. 164) the impressions are taken and the platinum matrices are made as has been described in Chapter XIII.

With the platinum matrices in place on the amalgam dies, in the artificial stone cast, a piece of platinum is burnished over the ridge between them, using the blunt end of a Roach carver. (See Fig. 165.) The cuspid crown and lateral pontic are then built up with porcelain, making sure that the cuspid crown is sufficiently oversize in all dimensions to provide for shrinkage. The central incisor crown is also built up, taking similar precautions with regard to shrinkage. When each unit is removed from the cast, more porcelain is added mesially and distally for the same reason. Next a groove is carved in the lingual surface of the pontic in which, later on, an iridio-platinum wire will be placed. In the central incisor crown a depression is also carved to receive the free end of this wire as is shown in Fig. 166.

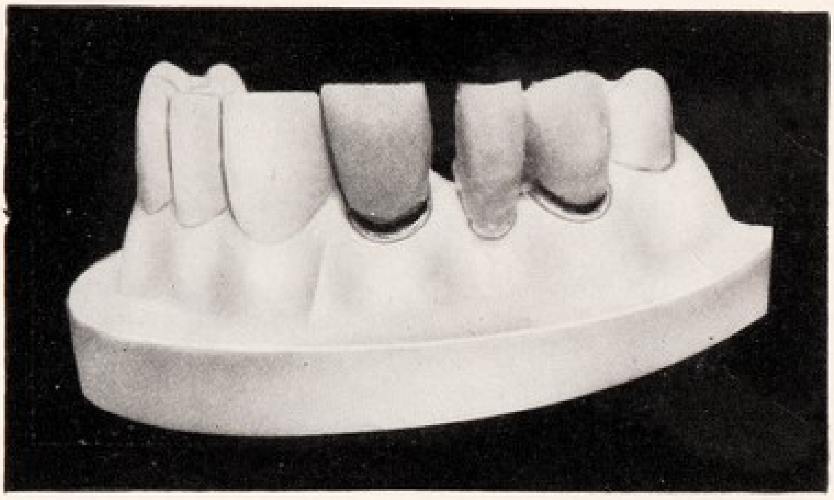


Fig. 169. Cast showing cuspid crown and pontic, and central incisor crown in place, after biscuit bake. Note extent of shrinkage

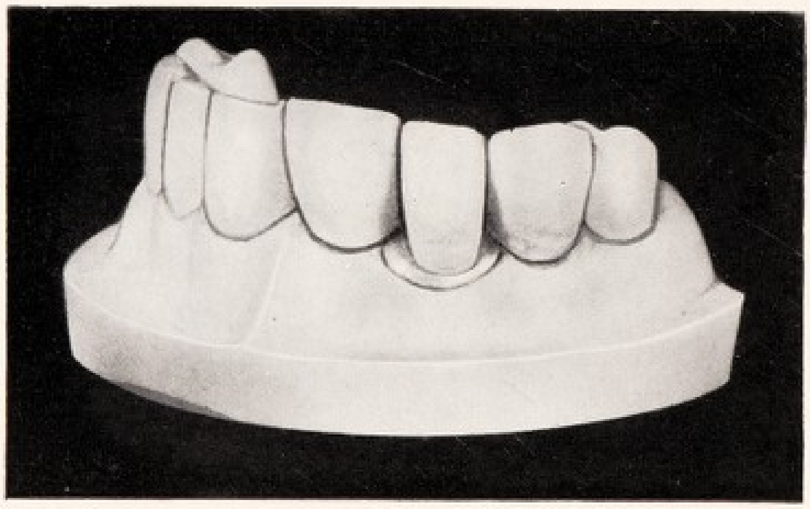


Fig. 170. Assembly showing new platinum saddle to provide for the further adaptation of the pontic to the ridge. Note also the addition of porcelain on the mesial surface

When the amalgam dies are removed from the cast with the built up crowns, the porcelain at the neck of the crowns is cut away sufficiently to permit reburnishing of the matrix after the first bake. (See Fig. 167.)

This assembly is next placed on a clay crown-holder and tipped at such an angle as will bring the greatest bulk of porcelain uppermost, as shown in Fig. 168. Porcelain tends to shrink toward the center of greatest mass, which, in this case, would be toward the lingual. This tendency may be

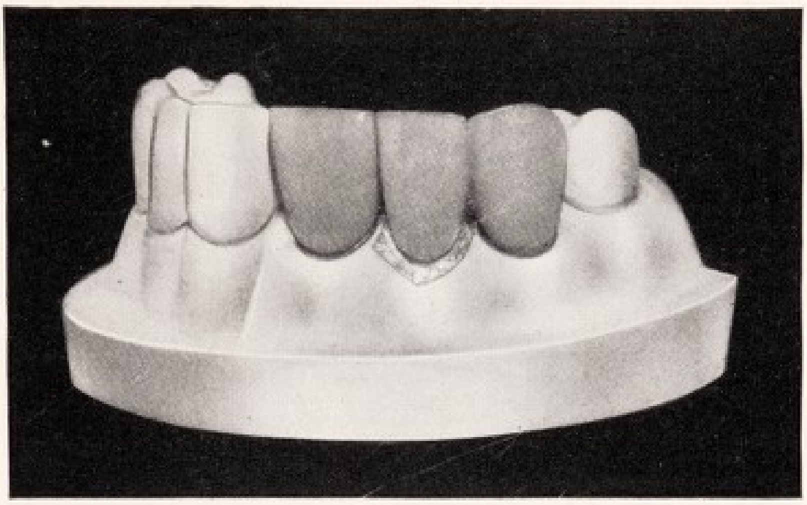


Fig. 171. Bridge assembly on cast, showing final development of surface contour and approximal contact

Fig. 172. 16 gauge 20 percent iridio-platinum wire, adapted for application to the bridge pontic

counterbalanced, in part, by opposing to it the force of gravity, as illustrated.

After the biscuit bake the units are reassembled on the cast, and the extent of shrinkage noted. (See Fig. 169.) The platinum matrices are next reburnished at the shoulders, and the grooves existing at these points are filled in with porcelain. Porcelain is also added on the mesial surface of the central incisor and the distal surface of the cuspid, to provide proper contacts with the adjacent natural teeth. These surfaces are slightly over contoured and the two units are placed in the oven and again carried to the biscuit bake. No addition of porcelain is made to the pontic at this time. The central incisor may be carried to a moderately glazed surface at this time. After baking, the pieces are taken back to the cast and ground to exact contact with the adjoining teeth.

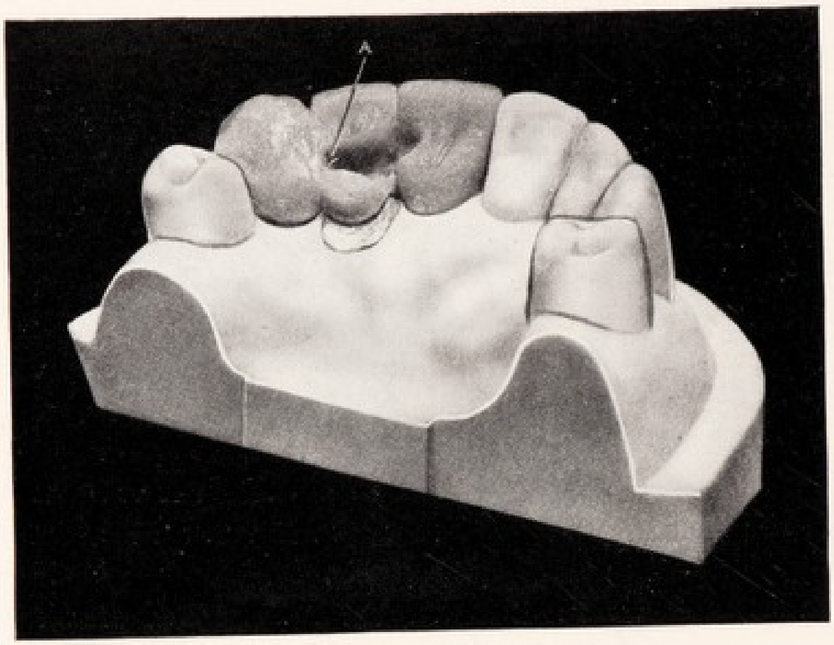


Fig. 173. View of the lingual surface of bridge showing the groove in the pontic and central incisor (See text)

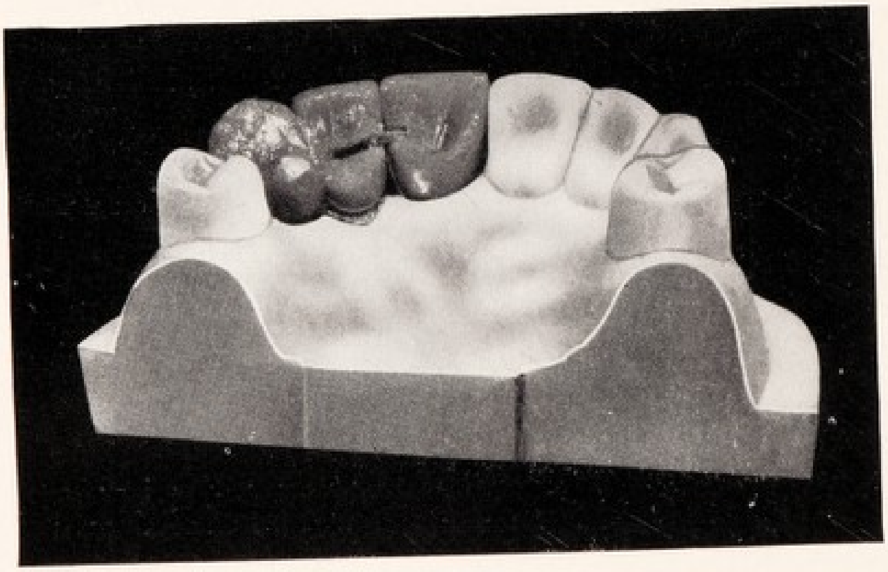


Fig. 174. Lingual view of bridge, showing iridio-platinum wire in place, with porcelain filled in around it, as described in text

At this point a new platinum saddle is burnished over the ridge, and the pontic is built up with additional porcelain to provide contact with the central incisor crown and adaptation to the ridge. (See Fig. 170.)

It will sometimes be found that the pontic has changed shape, or position, during the first and second bakes. This may be corrected by grinding,

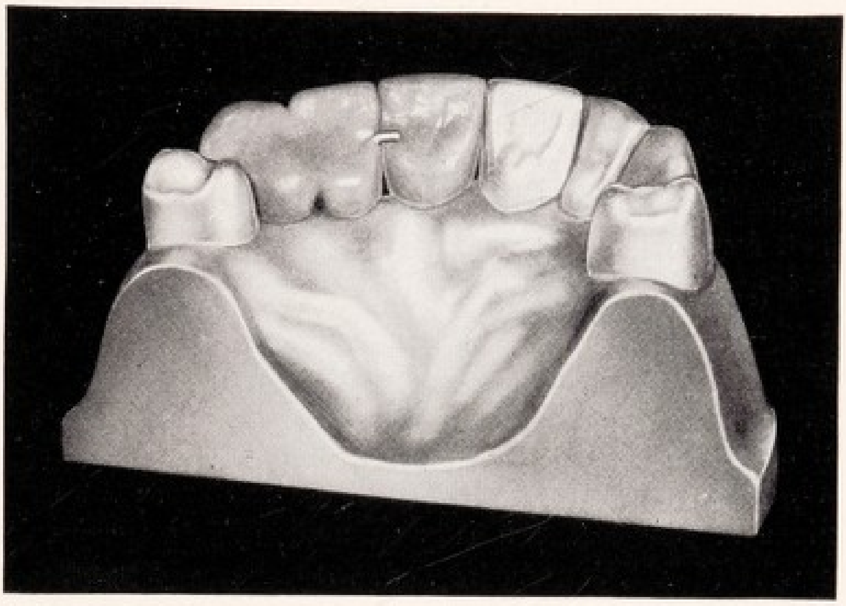


Fig. 175. Lingual view of finished bridge

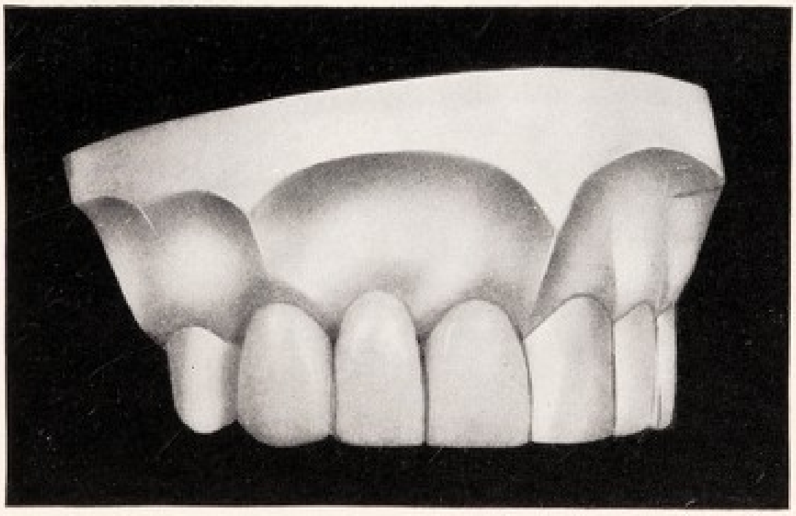


Fig. 176. Labial view of finished bridge

or by adding porcelain to give the proper contours and relations. It is then carried to the furnace and given another biscuit bake. It is again carried to the cast and porcelain is added to provide the requisite refinements of surface contour and approximal contact. (See Fig. 171.)

A piece of 16 gauge, 20 percent iridio-platinum wire, (See Fig. 172), is next bent to fit the groove previously prepared in the lingual surface of the bridge pontic, with its mesial end resting in the recess provided in the central incisor crown. Be sure that its distal end is in direct contact with the porcelain at the distal end of the groove in the pontic, as shown at A in Fig. 173. This will prevent the pulling away of the wire from the recess in the central incisor crown during the succeeding bake.

Porcelain is now filled in around the pin, in the groove in the pontic. Porcelain is also adapted to the pin in the central incisor crown, to provide a definite rest for the pin, but without covering it. A groove is cut in the newly placed porcelain in the pontic in order that the shrinkage of this porcelain may not cause warping of the pontic lingually, which would otherwise be likely to happen. (See Fig. 174.) It may also be necessary to renew the platinum saddle, if a space should develop between the pontic and the cast, due to shrinkage of the porcelain. It is then carried to the furnace and given a biscuit bake. It is again carried to the cast and the wire examined as to whether it is properly seated in the groove in the central incisor. If not, it may be bent to proper position at this time. The slot which was cut in the porcelain of the pontic, is now completely filled in, covering the wire, and porcelain is added to the central incisor to provide a close and smooth adaptation to the wire. The bridge units are now taken to the furnace and brought to a final high glaze. The lingual view of the finished bridge is shown in Fig. 175, and the labial view is seen in Fig. 176.

The Porcelain Jacket Crown as an Abutment

The porcelain jacket crown may often be used as an abutment when an anterior tooth has been lost and the tooth which is to act as one abutment has previously had a dowel crown. Such a crown may be used in a bridge, where the pontic is soldered to the other abutment. In the case illustrated in Fig. 177, the upper left cuspid has been extracted and the lateral incisor has been reduced to the gum line as the result of placing on it a dowel crown. If the periapical tissue is healthy, and the alveolar support is strong, with healthy gingiva, and a normal bite, such a tooth may properly be used for a bridge of this type, utilizing a porcelain jacket crown as the abutment. If it is desired to use a porcelain jacket crown for such a bridge, it is imperative that the attachment to which the pontic is to be soldered shall be a three-quarter crown, or equally strong restoration. If it is found in a case similar to that illustrated in Fig. 177, that the investing tissue is of doubtful strength, and if it were also found that the tooth extends beyond the gum line on the lingual side, it would then be more satisfactory to use a Richmond crown as the abutment, and to gain additional support by

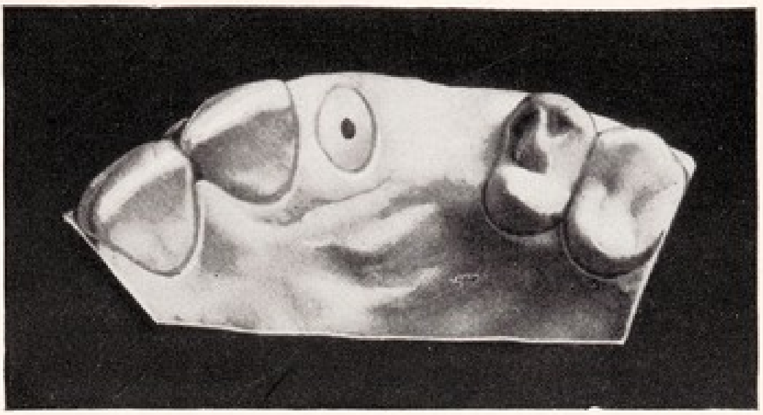


Fig. 177. Left lateral incisor reduced to gum line by previous operation for the placement of a dowel crown. The dowel having been removed from the canal, if the investing tissues are good, such a tooth may be used as a bridge abutment

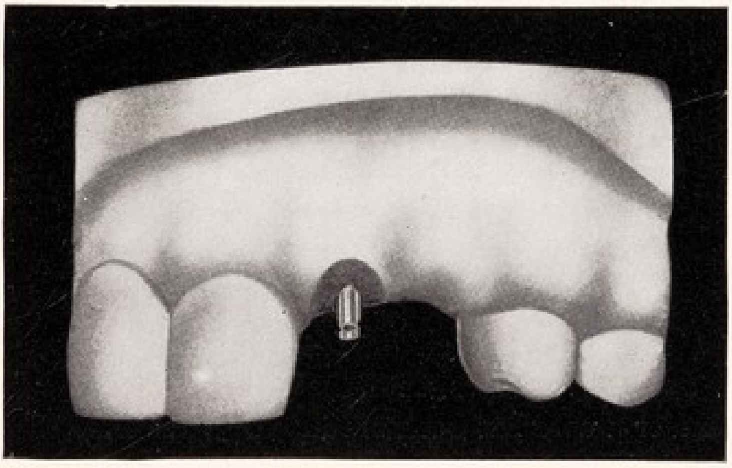


Fig. 178. Ney-Oro No. 4 wire, fitted to the root canal and grooved to permit mechanical attachment of inlay wax

obtaining a rest on the adjacent central incisor. This support should consist of a piece of round clasp wire, soldered to the backing of the Richmond crown, and resting in a seat prepared for it in a distolingual inlay placed in the central incisor.

However, assuming adequate alveolar strength, a porcelain jacket crown may be used on the lateral incisor root according to the following technique:

A piece of Ney-Oro, No. 4, round wire is fitted to the lumen of the root canal. A small bit of 18 K solder is flowed over the end of the wire where it extends out from the root canal. This is to insure a complete union of the cast gold with the wire, when the dentin-form core is cast to the pin. To enable the inlay wax to firmly grip the wire and also to aid the cast metal to secure a firm grip, the lower end of the wire is grooved with a carborundum disk. (See Fig. 178.) These grooves should never be made at the point where the pin makes its exit from the root canal as this

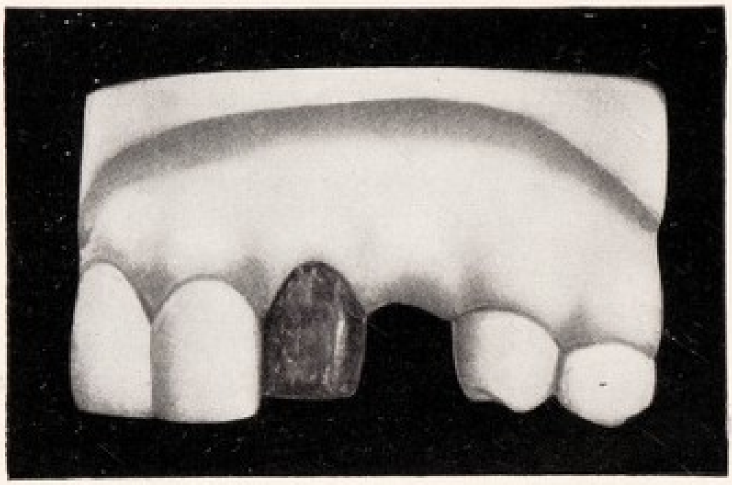


Fig. 179. Soft inlay wax forced over the pin

would weaken the pin at this point, but should be near the end of the pin. A cone of inlay wax is then softened in the flame of a gas burner, or alcohol lamp, and forced over the end of the pin. (See Fig. 179.) The inlay wax is chilled with cold air or water and the excess wax is cut away with chisels, and wax carvers until the desired thickness and dimensions for the dentin-form core has been produced. (See Fig. 180.) In producing this form, it is essential that a shoulder of dentin should be exposed around the entire periphery of the tooth. The wax core and pin are then removed, invested and cast.

To insure union of the cast metal with the pin the investment should be heated to a degree of temperature higher than is usually employed for gold inlays. After casting, the union of the gold and pin should be tested by gripping the pin and the gold dentin-form core with pliers. It should be impossible to withdraw the pin from the gold core, or to move it within the core. In the event that a firm union has not been established, drill a hole through the side of the gold core until the pin is exposed. Place small pieces of solder in the hole and solder the pin to the gold core. The dentin-form core is then cemented to place on the root, an impression is taken and the platinum matrix adapted as outlined in Chapter XIII.

The porcelain jacket crown is constructed in the usual manner. When the soft porcelain is cut away to expose the matrix at the neck before the biscuit bake, a hole is cut in the porcelain on the distal surface of the crown, approximately midway between the gingival margin of the crown and the incisal edge, without exposing the platinum matrix. A platinum

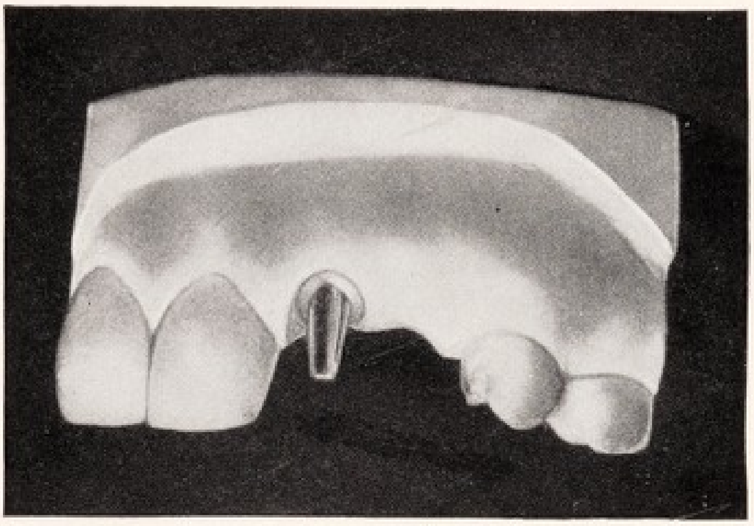


Fig. 180. Inlay wax carved to produce dentin-form core

tube is later to be baked into this opening, and it is important that it shall be of such a size, that even after subsequent shrinkage, it may accommodate the platinum tube. The crown is now given a biscuit bake, and the matrix is reburnished at the neck. Porcelain is added at the neck of the crown, and it is built up to proper contour, being careful to retain the opening at the distal surface of the crown. After the second bake, the crown is tried in the mouth and tested for contact with the approximating central incisor as well as for the occlusion.

A platinum tube, with a platinum floor, is then constructed as shown at B. Fig. 181. This tube is constructed to fit the clasp wire C. Fig. 181. The details of the construction of this tube will be found illustrated in Figs. 339, 340 and 341, and described in the accompanying text, Chapter XXI.

The tube is constructed of 34 gauge platinum and the floor is soldered with platinum solder (10 parts platinum, 90 parts pure gold). The tube is made longer than necessary, to permit the addition of porcelain on the distal surface which must be thoroughly condensed around the tube, when it is placed in the opening, before the final bake. It is important, at this time, to make sure that the tube is placed far enough toward the lingual, to permit soldering the clasp wire to the bridge segment, without interfering with the proper placing of the porcelain facing. The tube is placed in the correct position in the distal opening of the crown, and properly

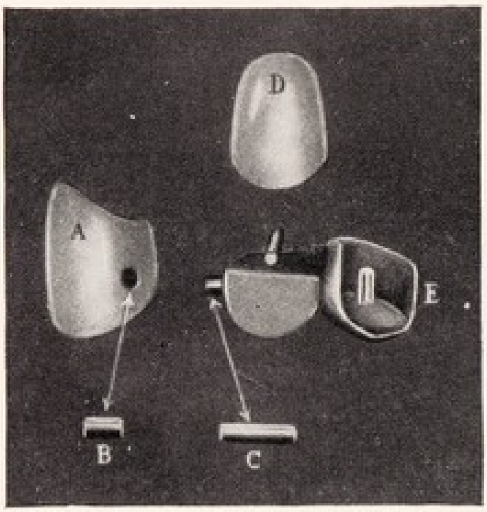


Fig. 181. Units of the bridge structure. A. Porcelain jacket crown. B. 34 gauge platinum tube. C. 16 gauge Ney-Oro No. 4 round wire. D. Steele's Trupontic facing. E. Three-quarter crown

aligned to accommodate the clasp wire which is later to be soldered to the bridge segment. Soft porcelain is next packed around the tube, and the crown is given the final bake.

After the final bake, the portion of the tube extending out of the crown is trimmed flush with the side of the crown. The crown and distal abutment are then placed in position in the mouth and an impression and bite are taken, for the construction of the bridge. To insure accuracy, and to avoid any possibility of displacement of the porcelain crown, the amalgam die on which the porcelain crown was constructed is placed in the porcelain crown before pouring a cast of artificial stone. The amalgam die can be held in proper position by attaching it to the plaster impression with sticky wax. Two short pins may be used as a means of stabilizing the amalgam die in the impression, attaching the pins to the amalgam die on the opposite sides with sticky wax and attaching the opposite ends of the pins to the plaster with sticky wax. The artificial stone should be allowed to set overnight.

A Steele's porcelain pontic cuspid (D. Fig. 181) is then ground into position and soldered to the three-quarter crown (E. Fig. 181). The clasp wire (C. Fig. 181) is then placed in position in the platinum tube in the crown, and attached to the gold of the bridge segment with sticky wax. The porcelain jacket crown, bridge segment and three-quarter crown are removed from the cast simultaneously. The porcelain jacket crown is

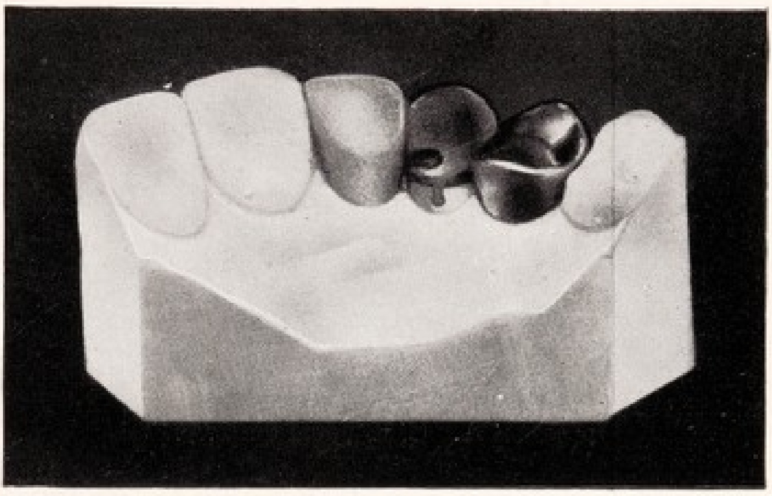


Fig. 182. Groove cut in the gold of the bridge pontic to receive the distal end of a partial clasp

slipped off the clasp wire, the bridge segment with three-quarter crown is invested and the wire is soldered to the bridge segment.

This type of attachment will afford ample support without extra reinforcement, when used on devitalized central incisors, cuspids, or bicuspids; however, when used on lateral incisors, or vital teeth, extra reinforcement, in the nature of a partial clasp may be necessary. Furthermore, if the supporting structure of the teeth is of such a nature that there is any possibility of drifting, this extra support is absolutely essential.

Technique for Partial Clasp

The partial clasp is constructed as follows:—Cut a groove in the gold of the bridge segment, as illustrated in Fig. 182. Inlay wax is then adapted to the lingual surface of the porcelain jacket crown to form the outline of the clasp. The wax is extended into the opening cut in the gold of the bridge segment. The wax pattern is invested, cast, and soldered to the bridge segment. For those who have a predilection for the wrought gold clasp the author recommends the following technique:—

An impression of the lingual surface of the porcelain jacket crown and bridge segment shown in Fig. 182, is taken with plaster, as at A. Fig. 183. This impression is embedded in a rubber ring with moldine, and a die of Dee low fusing metal is poured, as at B. Fig. 183. The surface of this

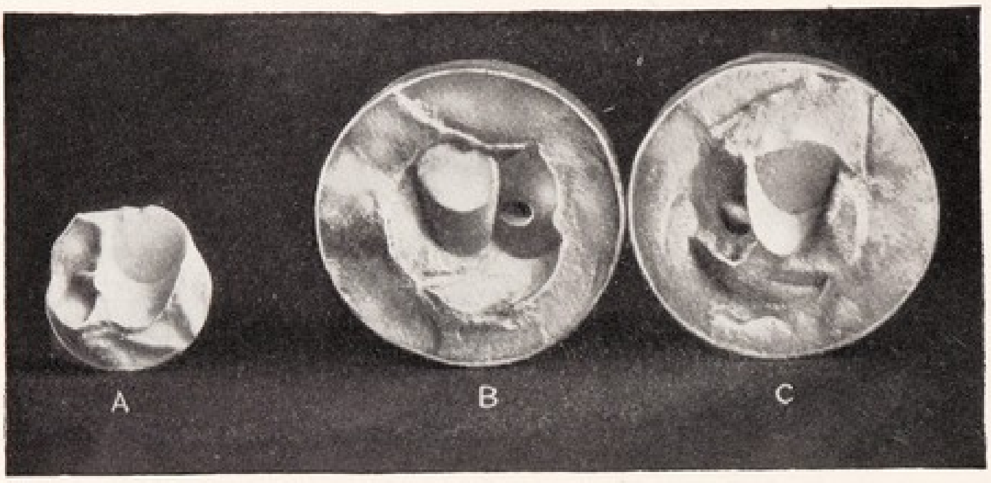


Fig. 183. Steps in impression technique. A. Plaster impression of lingual surface of porcelain jacket crown and pontic shown in Fig. 182. B. metal die poured in impression A. C. Counter die for B

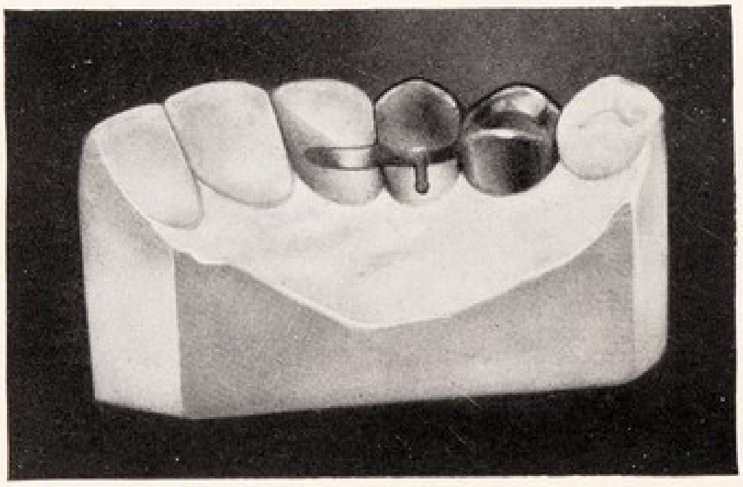


Fig. 184. Partial metal clasp soldered to bridge pontic

die is coated with alcohol and whiting, placed in the rubber ring, and a counter die of the same metal is poured. (C. Fig. 183.) A piece of clasp metal plate is then cut to the desired shape and swaged between the metal die and counter die. The metal clasp is then soldered to the bridge segment, as shown in Fig. 184. Note that the clasp extends around the porcelain jacket crown toward the interproximal space. This will prevent distal drifting of the bridge segment, and will act as a support against labial stress. A lingual view, showing the relationship of the clasp, wire and porcelain jacket crown, is shown in Fig. 185.

Clasp Wire Occlusal Rest

Clasp wire may also be used in conjunction with the porcelain jacket crown as an occlusal rest, as illustrated in Fig. 186. When used in this manner, a groove is prepared on the occlusal surface of the porcelain crown, and

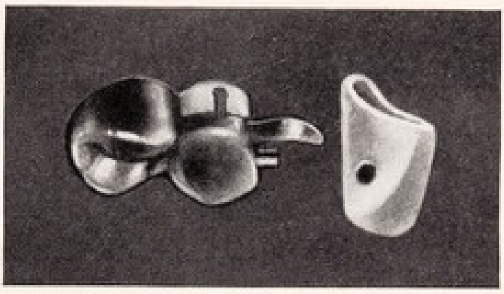


Fig. 185. A lingual view of finished bridge, showing relationship of the clasp, wire and porcelain jacket crown

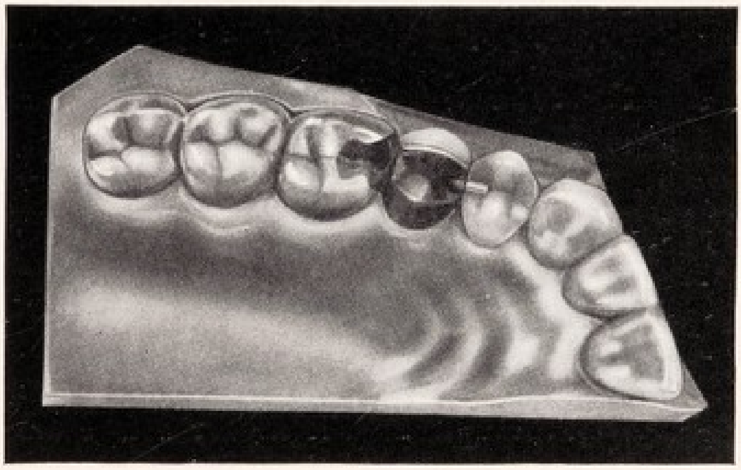


Fig. 186. 16 gauge round wire extending from bridge pontic, resting in a groove formed in the occlusal surface of the porcelain jacket crown

retained until the final bake. At that time the wire is placed in the groove and soft porcelain is condensed around the wire. The wire is removed and the crown is given the final bake. Shrinkage of the porcelain may necessitate a little grinding, to accurately seat the wire in the groove, after the final bake. Cover the surface of the wire with graphite from a lead pencil and rotate in the groove. The graphite marking will be transferred to the porcelain, indicating the points to be reduced. Repeat the operation until the wire is seated to its full diameter. When this type of occlusal rest is used on a porcelain jacket crown it is imperative that there be at least 2 mm. of porcelain between the wire and the platinum matrix on which the crown is built. A wire smaller than 16 gauge should not be used for this purpose.

Fig. 187

Fig. 188

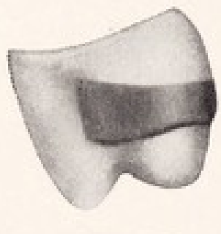


Fig. 189

Fig. 187. Upper left first bicuspid, porcelain jacket crown, with shoulder prepared for reception of clasp

Fig. 188. Mesial view of upper left first bicuspid, porcelain jacket crown, showing clasp in position against the shoulder previously prepared. Note that the clasp is curved toward the cervical on the mesial surface to prevent displacement by stress toward the lingual. The shoulder in the porcelain has been given the same curvature

Fig. 189. Distal view of crown and clasp shown in Fig. 188. Note the increased width of the clasp on this surface, designed to afford a larger area for soldering

Porcelain Jacket Crown as an Abutment

The porcelain jacket crown may be utilized as an abutment in conjunction with a clasp, for either a short stationary bridge, or for a removable bridge, by developing a shoulder on the crown as illustrated in Fig. 187. An excess of porcelain is added to the crown in the cervical region, before the first bake, at the locality where it is desired to form the shoulder. More porcelain is added if necessary before the second bake, and the desired outline of the shoulder is produced with stones after the second bake. The crown is then baked to the final high glaze.

The surface of the porcelain crown is coated with a thin layer of cocoanut oil before adapting the inlay wax to secure the outline for the clasp. An excess of inlay wax may be taken for this purpose, using the thumb and finger of the left hand to confine the soft inlay wax in snug surface contact with the crown, while it is forced into position with the thumb of the right hand.

The wax is chilled with cold water while held in this position under pressure. The excess wax is then trimmed away until the desired outline has been obtained. After casting with Ney-Oro E gold, the inner surface of the clasp should be examined with the magnifying glass in order to detect any surface irregularities in this region. If such are found, they are removed with a small sharp bur. The clasp must have uniform surface contact with the crown at all points.

Fig. 190

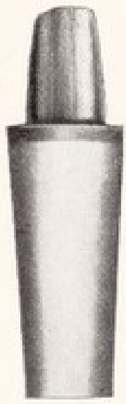


Fig. 191

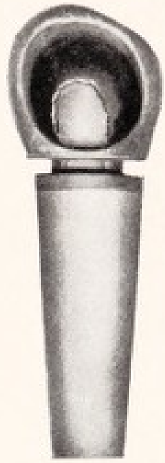


Fig. 192

Fig. 190. Represents a right upper cuspid, with cast gold dentiniform core

Fig. 191. Amalgam die of upper right cuspid with platinum matrix adapted

Fig. 192. Inlay wax adapted to the platinum matrix, carved to the form of a cuspid tooth, and cut away at the neck and on the labial. The groove at the cervical is to be filled in with solder after casting. The labial window will receive a baked porcelain inlay

By curving the clasp slightly toward the cervical, on the mesial surface, the clasp will act as a stabilizer for the bridge against stress tending to displace it toward the lingual, as in the case illustrated. (See Fig. 188.) The clasp on this surface will also form the contact point with the approximating tooth and must be so placed as to fulfill this function. On the distal surface, the clasp is made slightly wider to permit an adequate surface area for soldering to the bridge segment. (See Fig. 189.)

Consideration of Occlusal Stress

When contemplating the use of the porcelain jacket crown in bridgework the operator must be guided in his choice by the factor of occlusal stress as it exists at the time, as well as by the possibility of increased occlusal stress in the future, due to changes elsewhere in the mouth. Satisfactory esthetic results may often be obtained and the element of strength increased by a modification of the technique, when the bite is abnormal, or shows possibilities of developing excessive occlusal stress in the bridge area at some future time.

The following case will illustrate such a condition:—Upper right cuspid, supporting a porcelain jacket crown over a cast dentin-form gold core; the upper right first bicuspid has been recently extracted; all other upper teeth in position. The lower right second bicuspid; first, second and third molars, as well as the lower left first and second bicuspids; first, second, and third molars have been recently extracted, requiring the insertion of a partial denture in the lower jaw. Under such conditions there will be resorp-

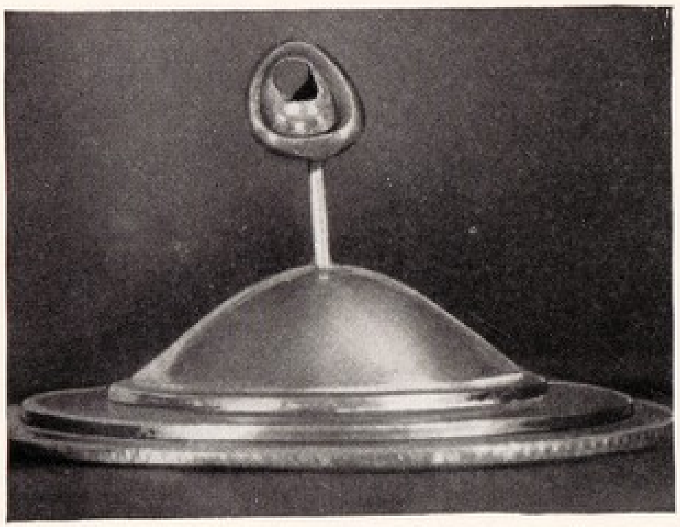


Fig. 193

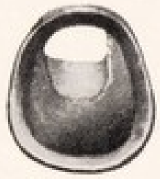


Fig. 194

Fig. 193. Wax form shown in Fig. 192 mounted, ready for investing

Fig. 194. Cast gold crown, with labial opening trimmed to enlarge peripheral outline

tion of the tissue in the lower jaw, causing loss of occlusal surface contact, in the partial denture area. These cases should be kept under careful observation and rebased when necessary, to maintain the desired occlusal contact. Unfortunately, such cases are often neglected, due in part to the failure of the dentist to warn the patient of the danger of prolonged use of the denture without rebasing, and also because of negligence on the part of the patient, even when so warned. Under such conditions the patient will naturally form the habit of masticating in the area of the firmest occlusal contact. Due also to the fact that the natural teeth wear away faster than the porcelain, stress upon the porcelain jacket crown will become increasingly severe, and a typical porcelain jacket crown on the upper right cuspid, in a case such as cited, might not be strong enough to withstand this increased occlusal stress.

In view of the fact that the tooth has been reduced to the gum line, and that it contains a well shaped dentin-form core, it will be possible to use some modification of the porcelain jacket crown which will give greater strength. The author has found that a cast gold crown for whose labial surface a porcelain inlay is prepared, furnishes the most satisfactory solution of this problem. Fig. 190 represents a right upper cuspid, which contains a cast gold dentin-form core.

Fig. 195

Fig. 196

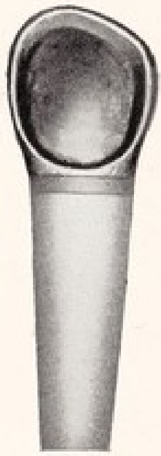


Fig. 197

Fig. 195. Gold casting in place over platinum matrix, and space at neck filled in with sticky wax

Fig. 196. Same as Fig. 195 after soldering the gold casting to the platinum matrix

Fig. 197. Cast gold and solder at cervical margin reduced, so that only a narrow shoulder of metal remains

The impression is taken and the amalgam die and platinum matrix are constructed, as outlined in Chapter XIII. (See Fig. 191.) The platinum matrix is coated with a thin layer of cocoanut oil, and inlay wax is adapted to the matrix and carved to the form of a cuspid tooth. A little of the inlay wax is then cut away at the neck of the tooth. The labial area is also cut away until part of the platinum matrix toward the cervical region is exposed. (See Fig. 192.) This is to insure the greatest possible depth, in this region, for the retention of a porcelain inlay. The wax tooth form is removed from the platinum matrix, invested and cast. (See Fig. 193.) After casting with Ney-Oro G gold, the metal on the labial surface is reduced until a fairly thin margin of gold shows at the incisal tip, as in Fig. 194. The gold casting is then examined for surface irregularities.

Corrections are made if necessary, and the casting is placed in position on the platinum matrix.

The space at the neck is filled in with sticky wax. (See Fig. 195.)

Fig. 198

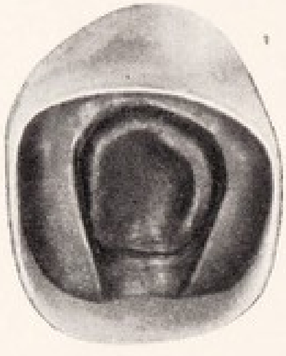


Fig. 199

Fig. 198. Modeling compound impression of inlay area

Fig. 199. Impression wrapped with 26 gauge wax

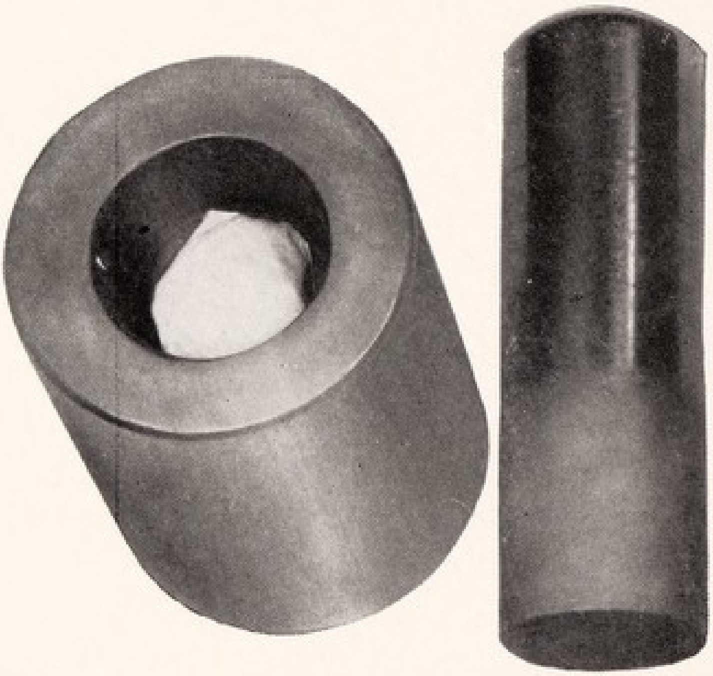


Fig. 200. Amalgam die and platinum matrix wrapped in tissue paper, and placed in swager. Moldine is used in the swaging process

The casting and platinum matrix are removed from the amalgam die, invested and the space at the neck of the crown is filled in with 22 K solder. A slight amount of solder is flowed over the exposed platinum in the inlay area, as shown in Fig. 196. The gold at the cervical margin is reduced with burs and stones, until only a slight margin remains, being careful not to expose the platinum. (See Fig. 197.) A modeling compound impression is then taken of the inlay area, as shown in Fig. 198.

Kerr's 26 gauge wax is then wrapped around the compound impression. (Fig. 199.) The impression is invested in plaster in a rubber ring and

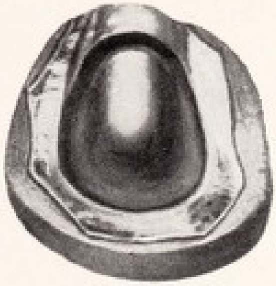


Fig. 201

Fig. 202

Fig. 203

Fig. 201. Platinum matrix swaged to place on amalgam die

Fig. 202. Labial view of finished crown

Fig. 203. View of finished crown showing width of shoulder

an amalgam die is prepared. A piece of 1/1000 platinum of proper size is cut, and burnished into the cavity in the amalgam die with suitable instruments. The amalgam die, with platinum matrix, is then wrapped in tissue paper, placed in a swager containing moldine (See Fig. 200), and swaged to close contact with the amalgam die. Fig. 201 illustrates this step.

1/1000 platinum is used for the matrix. If a thinner platinum is used there will be a greater possibility of warping. It is necessary to reburnish the platinum several times during the construction of the inlay and this burnishing tends to thin the platinum. The best results are obtained by baking about four times. For the first bake, partly fill the matrix with porcelain, expel moisture, cut grooves in the porcelain and carry to a biscuit bake.

Second bake. Reburnish the platinum at the margins. Apply wet porcelain to fill cracks and the space at margin. Wrap in tissue paper and swage. (See Fig. 200.) Remove tissue paper and apply more porcelain. Trim away excess, but do not completely fill the matrix. Then carry to a biscuit bake.

Third bake. Add more porcelain. Swage and carry to biscuit bake.

Fourth bake. Reburnish platinum at the margins and fill the matrix completely. Do not swage at this time. Then carry the inlay to the final high glaze.

A labial view of the finished crown, with the porcelain inlay in place, is shown in Fig. 202. A view showing the comparative width of the shoulder, is shown in Fig. 203. This type of crown has all the advantages of a full cast gold crown and very nearly the esthetic appearance of a porcelain jacket crown. In addition it may be soldered to the bridge segment.

Preparation of Roots Containing Dowels

The preliminary preparation of the root end, for the construction of this type of crown, often presents serious difficulties. In the case just described the cuspid tooth had originally been prepared for a porcelain jacket crown with a well formed dentin-form core. However, it is frequently necessary to construct the dentin-form core for a tooth that has some type of dowel crown cemented in place. Under such conditions the operator is confronted with the apparent difficulty of removing the post from the canal with safety. This is, however, a very simple operation and can be approached with the assurance of success in nearly all cases.

The method usually followed for removing posts from roots, where sufficient material remains, is to apply the "Little Giant Post Puller," or some similar device. Under certain circumstances this method is highly satisfactory. A requisite for its successful operation, however, is that the face of the root shall afford support for both lateral prongs of the post puller, with even pressure on each prong. If, through decay, or because of the method of root preparation, or the position of the post, there is support for only one prong, the use of this type of instrument is likely to result in fracture of the root.

When there is no post material protruding from the root, the post puller cannot be used, for obvious reasons. In these cases it is customary to use a small bur and drill around the post, until it is sufficiently freed to be removed with the cotton tweezers. There are several points to be urged against this method. In the first place, it weakens the root too much, and therefore endangers the success of future prosthetic operations. A still more serious danger is that of possibly causing a perforation of the side of the root. This is a mishap which cannot always be avoided, even with the exercise of the greatest care, when using this method. The use of the radiograph, as a preliminary step, is of course, always necessary. This will give information as to the diameter of the root, and also the approximate position of the post in the root.

It might seem at first glance that the radiograph would give all necessary information of this sort. A post inclined mesially or distally, will at once register its inclination in the radiograph, but a post which is inclined labially or lingually may register as being squarely in the center of the root. To drill completely around such a post may, of course, result in a perforation. The danger of this increases with the length of the post. Even when no actual perforation occurs, if the bur approaches closely the

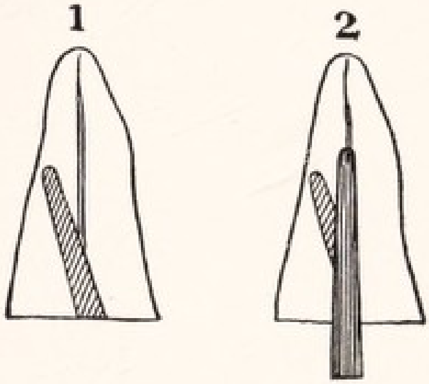


Fig. 204. Illustration showing method of management of root in which previous dowel has been inserted in a false canal

side of the root, thereby involving the cementum, it is quite likely that the heat developed by the bur may cause death of cementum cells, and injury to the pericementum.

A method which has been found to be uniformly satisfactory, is based on a different principle. When the post protrudes from the root, an effort is made to remove it with the "Little Giant Post Puller" as previously described. Even where the desired support for both prongs is provided, the post puller should be used only with a moderate tension in order to avoid fracture. If the pin is not dislodged with reasonable tension, a safer procedure is to cut the post flush with the end of the root, with a fissure bur, and then use a stone to provide a flat surface. A round bur of the same diameter as the post, is then selected, and the post is drilled out by carrying the round end of the bur against the flattened end of the post. Throughout the drilling the bur is kept on the end of the post, thus avoiding making a larger hole, and also avoiding perforation. The same procedure is employed when the post has been broken off below, or flush with the face of the root.

The operator must be guided in his drilling by adequate light, such as the direct light of a Cameron Lamp, or light reflected from such an operating light as the Lazar. It is understood that the root has been radiographed, so that the general direction of the post is known. The radiograph also furnishes other valuable information, such as the possibility that the post has been carried out of the line of the root canal, either mesially or distally, and also indicates whether in such a case the end of the post approaches the side of the root closely, as at No. 1, Fig. 204. If such a thing has occurred, it may be both unwise and unnecessary to drill out the entire post.

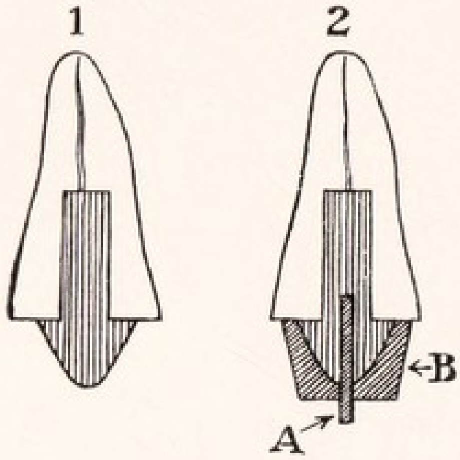


Fig. 205. No. 1. Illustration of upper central incisor having previously placed dentin-form core of improper form. No. 2. A. Platinum alloy wire inserted in hole drilled in original dentin-form core. B. Properly formed wax core adapted to previous core and retained by union with post A

Simply drill far enough to completely expose the true root canal beyond the post. Then enlarge the true canal for the reception of the new post, leaving the tip of the old post in position as at No. 2, Fig. 204.

The rapidity with which the post may be removed will depend on the metal used and the sharpness of the bur. Base-metal posts may be drilled quite rapidly. Platinum alloy posts, however, are harder and require more time. As the bur becomes dull, it is, of course, replaced with a new one. It will take from four to eight burs to drill out the average, precious metal post.

Occasionally, a patient will present with a tooth root in which a cast gold dentin-form core has been set for the purpose of making a porcelain jacket crown. If the dentin-form core as shaped for the crown is too conical, (No. 1, Fig. 205, a preparation for an upper central incisor) the crown may fail, and it then becomes necessary to make a new preparation. To remove a casting which has involved considerable cutting of the root, and the insertion into it of a large block of metal, is both arduous and dangerous. A plan which is usually feasible, is to drill a small hole in the metal core, in line with the long axis of the root and extending about 2 mm. beyond the gum line. Casting wax is adapted over the metal core and carved to such form as will provide a suitable base for a porcelain jacket crown as at B, No. 2, Fig. 205. It is sometimes more convenient to take a modeling compound impression of the root end and the metal core, and make an amalgam die on which the casting wax is carved to suitable form. The wax pattern is then placed in position in the mouth and a post of platinum alloy as at A, No. 2, Fig. 205, is forced through the wax. The wax pattern with post in position is removed and cast. That portion of the metal post which extended beyond the wax pattern at the incisal end is trimmed flush with the gold, and the casting is cemented in position over the metal core, the metal post aiding its retention. A porcelain jacket crown is then constructed in the usual manner.

CHAPTER XV

The Three-quarter Crown with Accessory Anchorage

The three-quarter crown was originated to meet the demand for an attachment which would provide the strength of the gold shell crown, but without its disadvantages. It may be worth while to approach the consideration of this attachment by enumerating the advantages and the disadvantages of the gold shell crown.

The Gold Shell Crown

The gold shell crown has one outstanding advantage, which makes it desirable in restorations, and this is the element of strength. It not only provides strength, which, for instance, makes it suitable for the anchorage of bridgework, but it also protects against weakness, if any exists, in the tooth on which it is to be placed.

The disadvantages of the gold shell crown are of course familiar to all dentists, but may well be stated here, because of their relationship to the subject under discussion. The first disadvantage and, from the biologic standpoint, the one of least importance is that of appearance. This point needs no elaboration, but it may be mentioned that, in many places in the mouth, the three-quarter crown meets this objection quite satisfactorily. The second disadvantage of the gold shell crown, as usually constructed, is the inadequate occlusal anatomy. The making of a cast occlusal surface for the full gold crown will, of course, answer this objection. And it may be said that, in the small number of cases in which a full gold crown is indicated, it should have a cast occlusal surface, properly carved to provide for the restoration of normal function. A third disadvantage of the gold shell crown is the almost invariable poor fit of the old band at the gum line. It would seem, at first glance, that this objection could be met by exercising greater care in the preparation of the tooth and in the fitting of the band to it.

Experience has shown, however, that there are many teeth whose crowns have a general diameter so much greater than the diameter at the gum line, that the preparation of the tooth to provide for proper fitting of the band would seriously endanger the pulp. In fact, in the past, many operators have advocated pulp extirpation as a preliminary to the preparation of teeth on which gold crowns were to be placed. It might be said in passing that the full gold crown is only to be advised in cases where pulp extirpation has been performed, or where, because of the ravages of caries, it is necessary. Of course, it should be unnecessary to warn against pulp extirpation where this can possibly be avoided. There is, however, a further anatomical difficulty, quite often encountered, which renders accurate fitting of a gold band extremely difficult, even with extreme cutting. This is found in teeth with roots which have a pronounced taper, or in which the crown of the tooth presents a distinct angle to the long axis of the root.

The Three-Quarter Crown

The three-quarter crown has certain advantages which make it the attachment of choice, in a great many places; sometimes even where a full gold crown might conceivably be used. The question of appearance has been mentioned. This applies, with special force, to the anterior teeth, and to the upper bicuspids and upper first molars. Many single, upper incisors may be well restored with the three-quarter crown, when they have been so weakened by caries as to be unsuited for even a porcelain jacket crown without resorting to pulp extirpation. When an incisor is to be used as a bridge abutment, the three-quarter gold crown has a special appeal, because of its strength, freedom from approach to the pulp and satisfactory appearance.

With regard to the matter of securing a satisfactory fit at the gingival line, the three-quarter crown has several advantages over the full gold crown, especially if the shoulder preparation is used. In these cases, because of the fact that only three surfaces are involved, in addition to the occlusal, the preparation may usually be accomplished without excessive cutting, and, of course, the presence of a shoulder to which the crown may be finished, simplifies the matter of avoiding overhang. It is not always necessary to carry the crown below the gingival border, and when the preparation of a shoulder would involve excessive sacrifice of tooth structure, a shoulderless three-quarter crown may be made. Even in these cases, also, it is easier to obtain an accurate fit at the cervical border, than with the full gold crown, because of the fact that only three surfaces of the tooth are involved.

The processes which are a part of the construction of the three-quarter crown provide ample opportunity for checking up on possible overhang, even before the crown is cast. It will, of course, be understood that an indirect-direct technique will be used. This technique will not only provide for the detection of drawing at the cervix, in case of improper preparation, this being detected in the compound, but will also lead to detection of errors, when the wax form is tried in the mouth.

Accessory Anchorage

In many instances, the three-quarter crown may be improved by providing accessory anchorage. This usually takes the form of 2 mm. pits sunk into the tooth structure at suitable locations, with a square end, plain, fissure bur. These pits must be cut without taper, or undercut. The inlay wax is forced into these pits, and, when the casting is made, the gold elevations will fit the pits very closely. In this respect they present an improvement over pins, which can seldom be made to so accurately fit the pits in which they are placed. With the superior fit of the gold dowels, which thus are an integral part of the casting, excellent accessory anchorage is provided, even if the pits are as shallow as just described. The same principle may be employed in securing additional anchorage for inlays.

With accessory anchorage provided, as just described, it is often possible to make a strong, well anchored attachment, without carrying out the full extension of the three-quarter crown as is required with the usual technique. On an anterior tooth, for instance, it may be possible to make a crown which will have strength and retention, without carrying it to the approximal surface which has normal contact with the adjacent tooth. In the posterior region also, exigencies of the anatomy, or the position of the tooth, may make it desirable to use less than a three-quarter crown, and in such cases accessory anchorage may usually be employed to provide the required retentive quality.

Close Bite Cases

In occasional cases, three-quarter crowns which have been left in the mouth for some time, have been found to be worn so that a hole is seen in the gold. This is, of course, an indication either of inadequate preparation, or of shortcoming in planning the occlusion of the case. The latter error is the more serious and more common. Too often, extensive operations are planned and executed, for cases in which the "bite" is abnormally close, without taking steps to "open the bite." When a three-quarter crown preparation is made for such a case, it will usually be found that the tooth on which it is to be placed has already had quite a bit of wear. Further cutting may then endanger the pulp. If this should be a fact, the only remedy available is to shorten the opposing tooth, and in the "close bite" case this is not always to be safely accomplished.

With regard to inadequate planning of the cavity preparation, it may be said that if the indirect-direct method is used, the prepared wax form will give an indication of possible shortcomings in cavity preparation. It is tried in the mouth and trimmed for the various occlusions during mandibular movement, and is then removed and held up to the light. Abnormally thin spots are readily detected in this manner. It is, of course, a better policy to make a similar test before making the die. Inlay wax, or even ordinary paraffin wax, may be moulded into the cavity, using a matrix if necessary; it is then held up to the light after the patient has made the various mandibular movements with the teeth in occlusal contact.

Shoulderless Three-Quarter Crowns

The suggestion of a shoulderless three-quarter crown naturally brings to mind the shoulderless porcelain jacket crown, and a comparison of these two crowns is, therefore, in order. In the preparation for the shoulderless porcelain jacket crown, a false shoulder is made and the porcelain is carried to this pseudo-shoulder. The technique, while more difficult than for a true shoulder crown, is, nevertheless, fairly exact as regards the point to which the porcelain is carried. In like manner, the construction of a shoulderless three-quarter crown is more difficult than the shoulder preparation. In constructing this type of crown the greatest care must be exercised in fitting the band.

A band of 30 gauge copper is selected and fitted accurately to the prepared tooth. The end of the band is forced under the margin of the gum, and the curvature of the gum line is marked with a sharp instrument. The band is then removed and trimmed, so that the end of the band will conform to the curvature of the gum line. A sharp instrument is then used to mark a line on the copper band, 1 mm. from the end, and parallel with the curvature of the gum line. The band is then filled with compound and heated over the flame, until the compound is hot enough to adhere to the copper band. The compound is then immersed in hot water for a few seconds, and forced onto the tooth until the end of the copper band is in contact with the gum line. The compound is chilled and removed, and all rough edges of compound at the cervical margin are trimmed until the copper band is exposed. Next, about half of the festooned end of the copper band is immersed in water, at 160 degrees F. for five seconds, when it is forced over the preparation until the 1 mm. mark is at the gum line, indicating that the copper band has been carried 1 mm. under the gum margin. The impression is then chilled and removed, and all rough edges of compound are trimmed until the end of the copper band is again exposed. The impression is now wrapped in a piece of Kerr's 26 gauge wax, invested in plaster, and packed with soft amalgam. The outline of the copper band will appear on the amalgam die, indicating the point to which the wax pattern is to be carried. It is necessary to exercise extreme care in determining the point to which the wax is extended. And, in trying the wax pattern in the mouth, care must be exercised to avoid distortion of the thin margin of wax at the cervical border. As a safeguard against this error, it is permissible to make the wax pattern thicker than necessary in this region. This extra thickness is reduced with stones and disks after the crown is cast.

Unlike the shoulderless porcelain jacket crown the operator has the advantage of being able to test the shoulderless three-quarter crown before the crown is cast. If the impression has been carried too far under the gum margin, this error will be detected when the wax pattern is tried in the mouth, and it is then easily remedied. After the wax pattern has been accurately adjusted to the preparation, select a sharp pointed explorer, and mark the curvature of the gum line on the inlay wax. The wax pattern is removed and the wax is reduced until it extends 1/2 mm. under the gum margin.

At this stage in the construction of the crown, the anatomical requirements should receive special attention. Contours in the gingival region are correctly formed. Any shortcoming in this respect may later on cause recession of the gum and destruction of the surrounding tissues. After the crown is cast there will be a further slight reduction when the gold is disked and polished to the requisite high degree of smoothness. The vascular tissues have not the tolerance for gold that they have for highly glazed porcelain; therefore, the operator should endeavor to carry the cervical margin of the finished crown just under the gum margin. Errors at this point will inevitably result in leakage and gingival irritation. In mouths that are susceptible to caries, this type of crown, as well as the shoulder three-quarter crown should be carried to the gingival border. When, however, the teeth are apparently immune to caries on the lingual surfaces it is not always necessary, nor desirable to extend the crown to the gingival border. When this latter technique is employed in the construction of a shoulderless three-quarter crown, the lingual surface of the tooth should be beveled slightly to indicate the point where the finished crown shall terminate. The wax pattern is carved to a very thin edge at this margin, in order to obtain a uniform continuity, and to enable the operator to disk and burnish the gold to a close marginal contact before the crown is cemented in place.

The casting of this crown calls for the utmost care, in order that the margins shall be faithfully reproduced. Thus it will be seen that, as in the case of the porcelain crowns, the shoulderless type is more difficult to execute successfully. Wherever indicated, however, as in the case of slender teeth, or for patients who are unable to endure the extensive preparation involved in the shoulder crown, the three-quarter shoulderless crown presents an ideal means of making the necessary restoration.

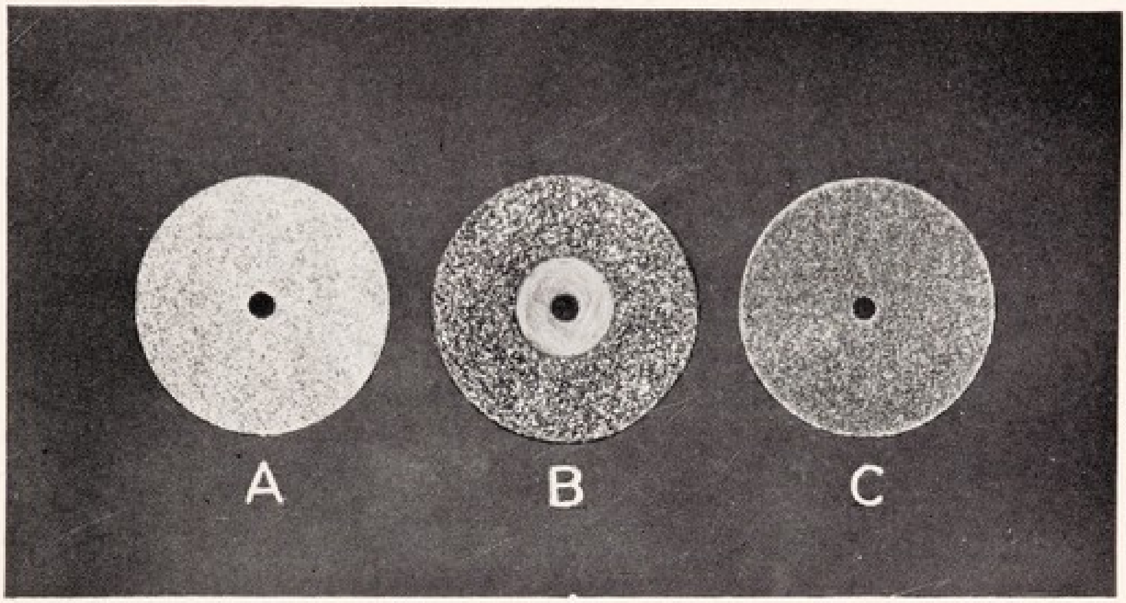


Fig. 206. Steel, carborundum, and sand-paper disks

In Fig. 206 A is shown a very thin steel separating disk commonly called "The Lightening Disk." This disk is smooth on one side, to prevent injury to the adjacent tooth. Its use is indicated in the preparation of a tooth which has close contact with an approximating tooth, for a shoulderless three-quarter crown. A paste of glycerine and carborundum powder may be used to increase the cutting efficiency of this type of disk. A slice cut with a thicker disk might establish a shoulder, the reduction of which might necessitate the needless destruction of sound tooth structure, and, as the object of the shoulderless three-quarter crown is to prevent the sacrifice of sound tooth structure such an error is to be avoided. At B, is seen a "Red Center Disk," a composition of carborundum and rubber with a soft rubber center. Its use is indicated in the preparation of a tooth for a shoulderless three-quarter crown, when the approximating tooth, or teeth are absent. It is also used to make a slice cut on the mesial and distal surfaces, in the preparation of a tooth for a three-quarter crown with a shoulder. Fig. 206 C shows a "Wet or Dry" sandpaper disk.

Coarse, fine and extra fine disks of this type are used in the final preparation of the tooth, to produce a smooth surface where stones, carborundum disks and burs have been used.

When steel, or carborundum disks are used for fast cutting, a stream of hot water should be applied to the disk to prevent pain and injury to

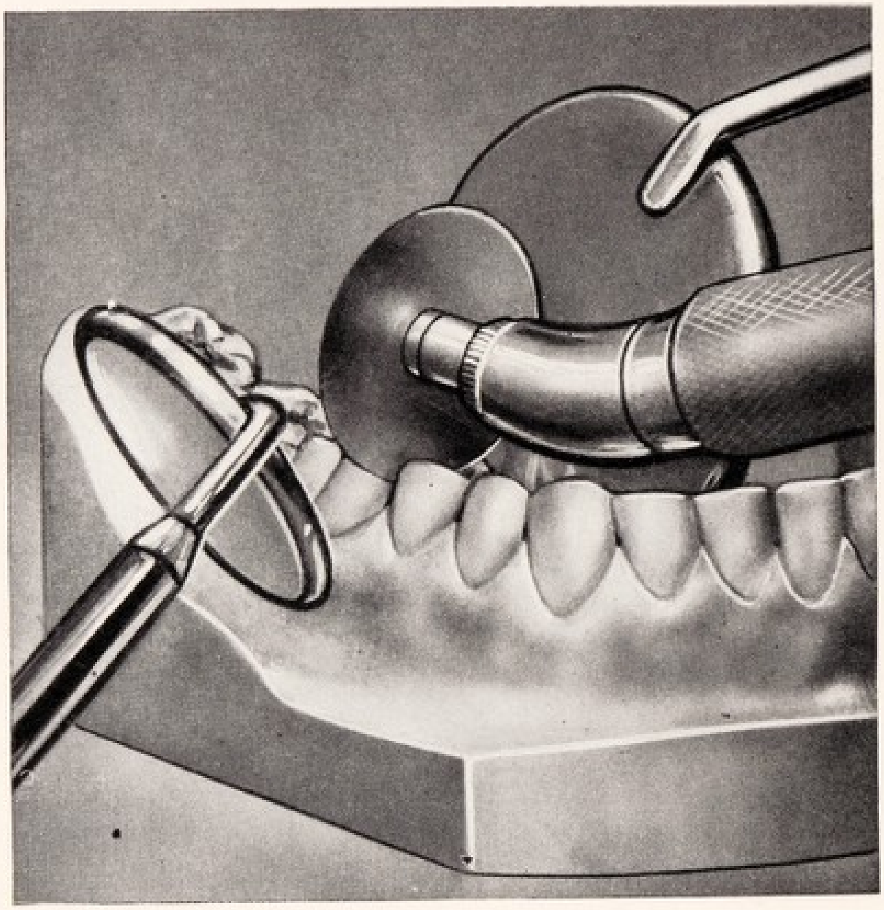


Fig. 207. Protection for tongue and cheek when using disks

the pulp by overheating the tooth. This rule applies, with even greater force when the tooth has been desensitized by an anesthetic. Under such circumstances, the patient will not be aware of the heat produced by the disk and severe thermal shock may cause irremediable injury to the pulp. Water, as hot as the patient can readily tolerate, is recommended for this, rather than cold water. This is because it is equally efficient in preventing overheating during the cutting of the tooth, and there is no shock, either to the tooth being operated upon, or to other nearby teeth, during the operation.

Protection From Disks

The greatest care should be exercised at all times, when steel or carborundum disks are used on teeth that have close contact with adjacent teeth. Here there is always the possibility of the disk becoming wedged between the teeth, thus causing the operator to lose control of the handpiece. Such an accident might partially sever the tongue, deeply incise the tissue under it, or inflict a deep wound in the cheek or roof of the mouth. As a guard against such an accident the author recommends the use of a mouth mirror of large size, as illustrated in Fig. 207. When operating

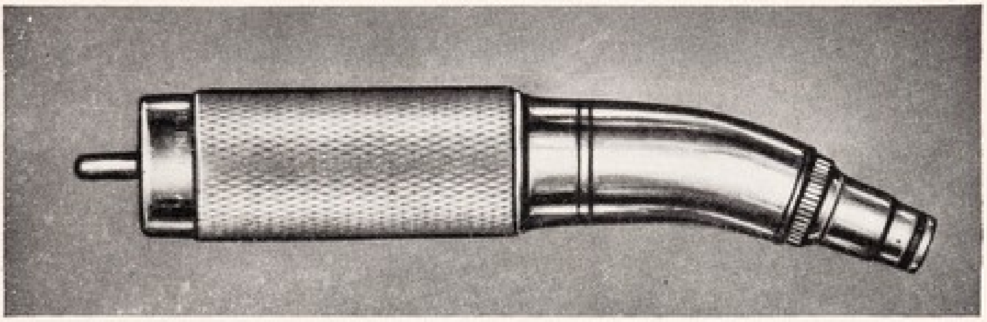


Fig. 208. Smith Universal Grinding Attachment

on the right side of the mandible the large mirror is held by the assistant, with the lower edge of the mirror in close proximity with the teeth at the gingival border. The cheek muscles are retracted from the field of operation by the use of a small mouth mirror in the hand of the operator. Both mirrors are used with their metal backs towards the revolving disk. When operating on the left side of the mandible the assistant holds the large mirror between the cheek and the teeth with the lower edge of the mirror in close proximity with the teeth as previously described. In this position the operator retracts the tongue with the small mouth mirror. When this operation is being performed on the right side of the maxilla the aid of the assistant is usually unnecessary. In this position the operator holds the large mirror between the teeth and the cheek. On the left side of the maxilla, however, it is usually advisable to have the assistant retract the cheek muscles with a small mouth mirror, while the operator holds the large mirror between the teeth and the roof of the mouth. The student will do well to heed the advice given here, as serious accidents have occurred, due to the careless use of separating disks.

The Smith Universal Grinding Attachment illustrated in Fig. 208 will be found very useful when disks are used in the preparation of teeth for crowns, or inlays. Long incisors, or malposed teeth will frequently make it impossible for the operator to place a disk at the proper angle with a straight handpiece.

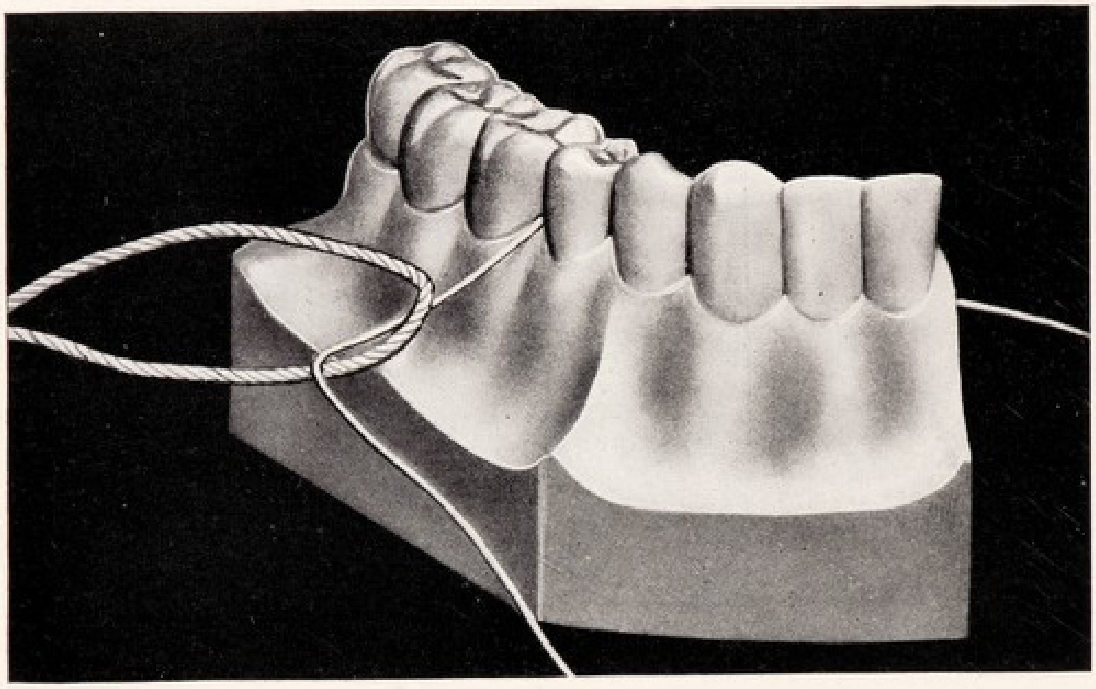


Fig. 209

Figs. 209, 210, 211, 212, 213 and 214, show method of separating teeth with silk ligature

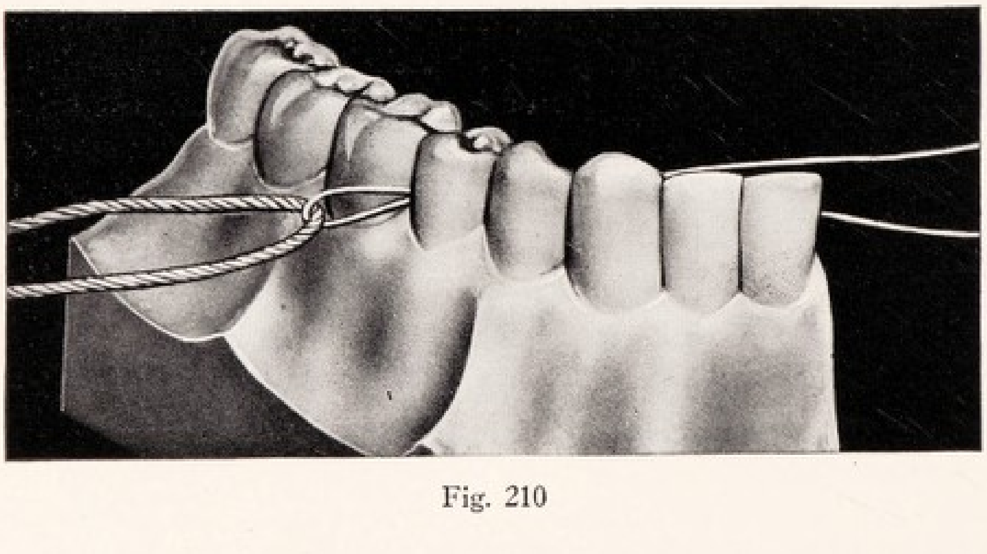


Fig. 210

Painless Separation of Teeth

The danger of a disk wedging between teeth can be greatly reduced if the teeth are separated. This can usually be accomplished in a few hours with little discomfort to the patient by the following method:— Force a piece of waxed dental floss past the contact point of the teeth to be separated and form a loop of silk ligature, (fine, medium or coarse, according to the requirements of the case.) This ligature silk is manufactured for the cores in enameled silk fishing lines, and is used by orthodontists because

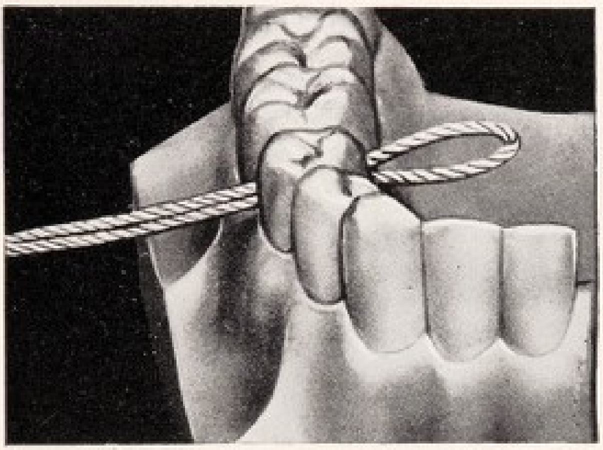


Fig. 211

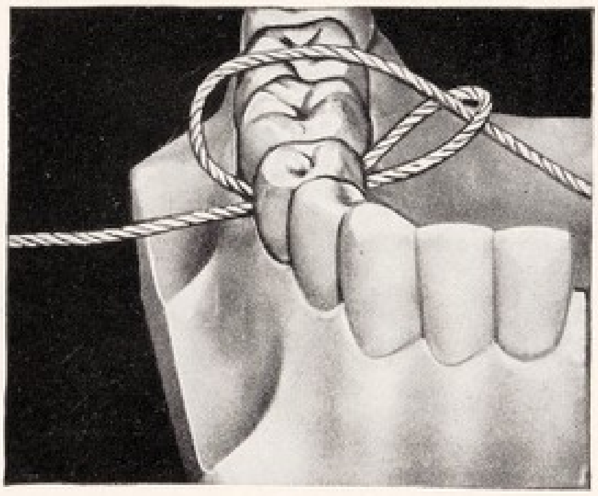


Fig. 212

of the fact that it contracts when wet. One end of the dental floss is passed through the loop of the ligature as illustrated in Fig. 209. This section of the dental floss is then forced past the contact point and the loop of silk ligature is drawn through the interproximal space as illustrated in Figs. 210 and 211. One end of the silk ligature is then passed over the occlusal surface and through the loop as illustrated in Fig. 212. The opposite ends of the silk ligature are then brought together and a double knot is tied as illustrated in Figs. 213 and 214. Considerable force should be used when tying the knot in order to draw the silk taut against the contact point. Contraction of the silk when moistened by the saliva, draws the loop tighter still, thus creating a perceptible space between the teeth. At times it will be found easier to introduce the loop of the ligature from the lingual side of the embrasure, instead of from the buccal as shown in Fig. 210. In very close bite cases the knot should be located in the buccal

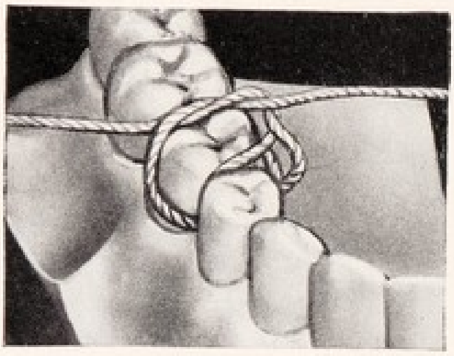


Fig. 213

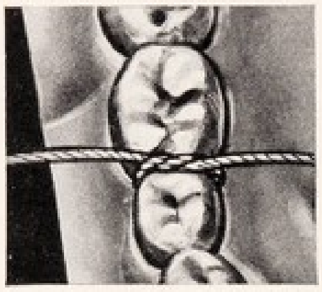


Fig. 214

embrasure instead of the occlusal as illustrated (Fig. 214), because in the occlusal situation the knot may be cut by the antagonizing teeth.

Other instruments used in the preparation of teeth for three-quarter crowns are illustrated in Figs. 215, 216, 217 and 218. It is of paramount importance that the dentist should provide himself with a complete equipment, consisting of the best instruments available, before attempting the construction of any unfamiliar units in the field of restorative dentistry. Many failures in this field can be traced to lack of proper equipment.

In Fig. 215—No. 1 shows the Crystalon knife edge stones No. 37. No. 2 the Miller knife edge stone No. 232½. No. 3 the Miller knife edge stone No. 332½. These stones are used to cut the incisal groove in the preparation of cuspids and central and lateral incisors, for three-quarter crowns, and to establish the outline for a shoulder preparation. No. 4 the No. 228½ Miller mounted stone. No. 5 the No. 4 Crystalon stone. These stones are used to reduce the enamel on the lingual surfaces of cuspids and central and lateral incisors. No. 6 the Cutwell fissure burs No. 558. These burs are used to reduce the tooth structure in the preparation of the shoulder, where an adjacent tooth will not permit the use of a stone. No. 7 the Miller mounted point No. 269. No. 8 the Miller mounted point No. 369. No. 9 the Miller mounted point No. 327. These stones are used to reduce the tooth structure and to parallel the walls

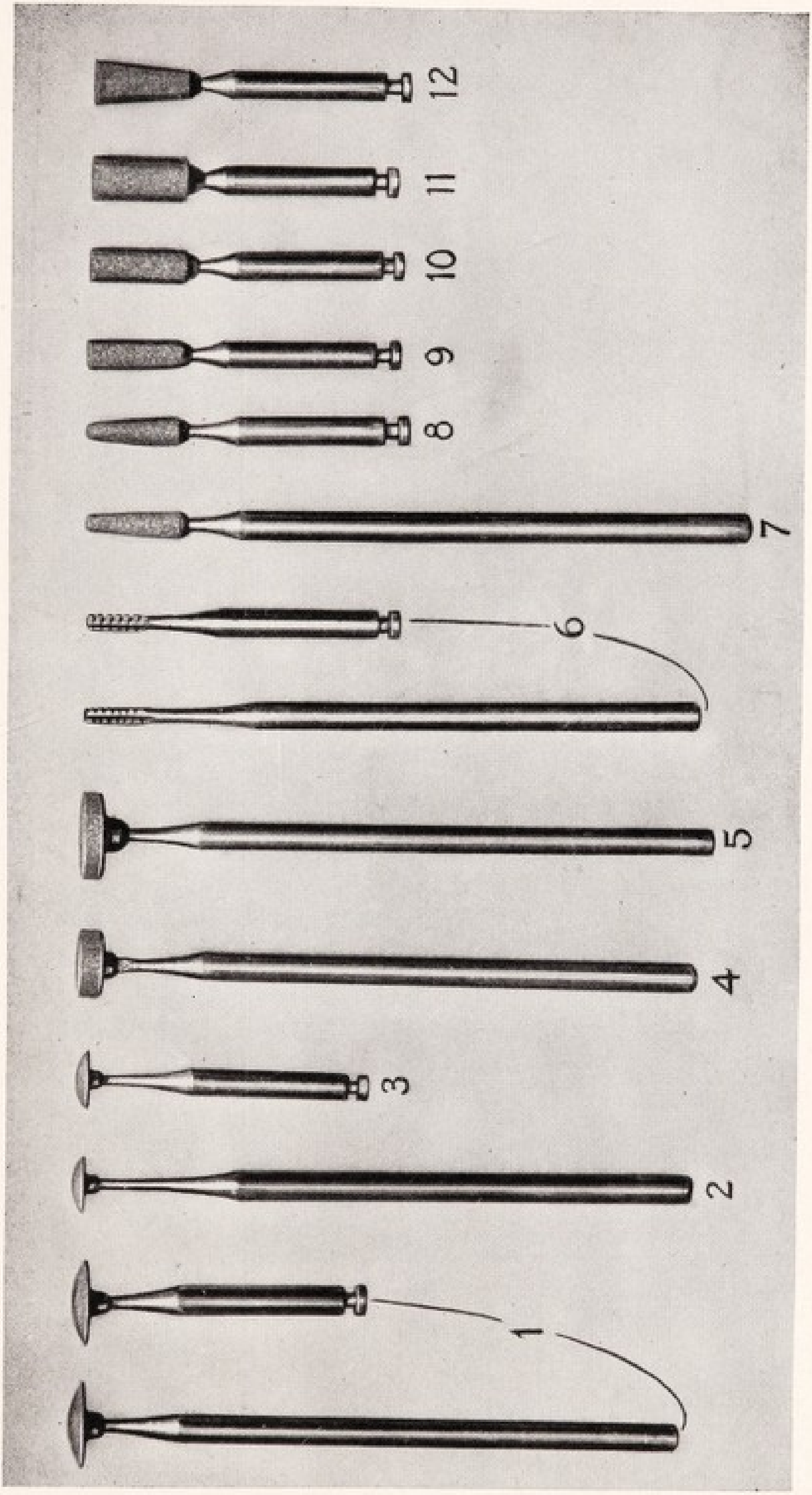


Fig. 215. 1—Crystalon knife edge stones. 2-3—Miller knife edge stones. 4—Miller stone. 5—Crystalon. 6—Cutwell fissure burs. 7—12—Miller mounted points

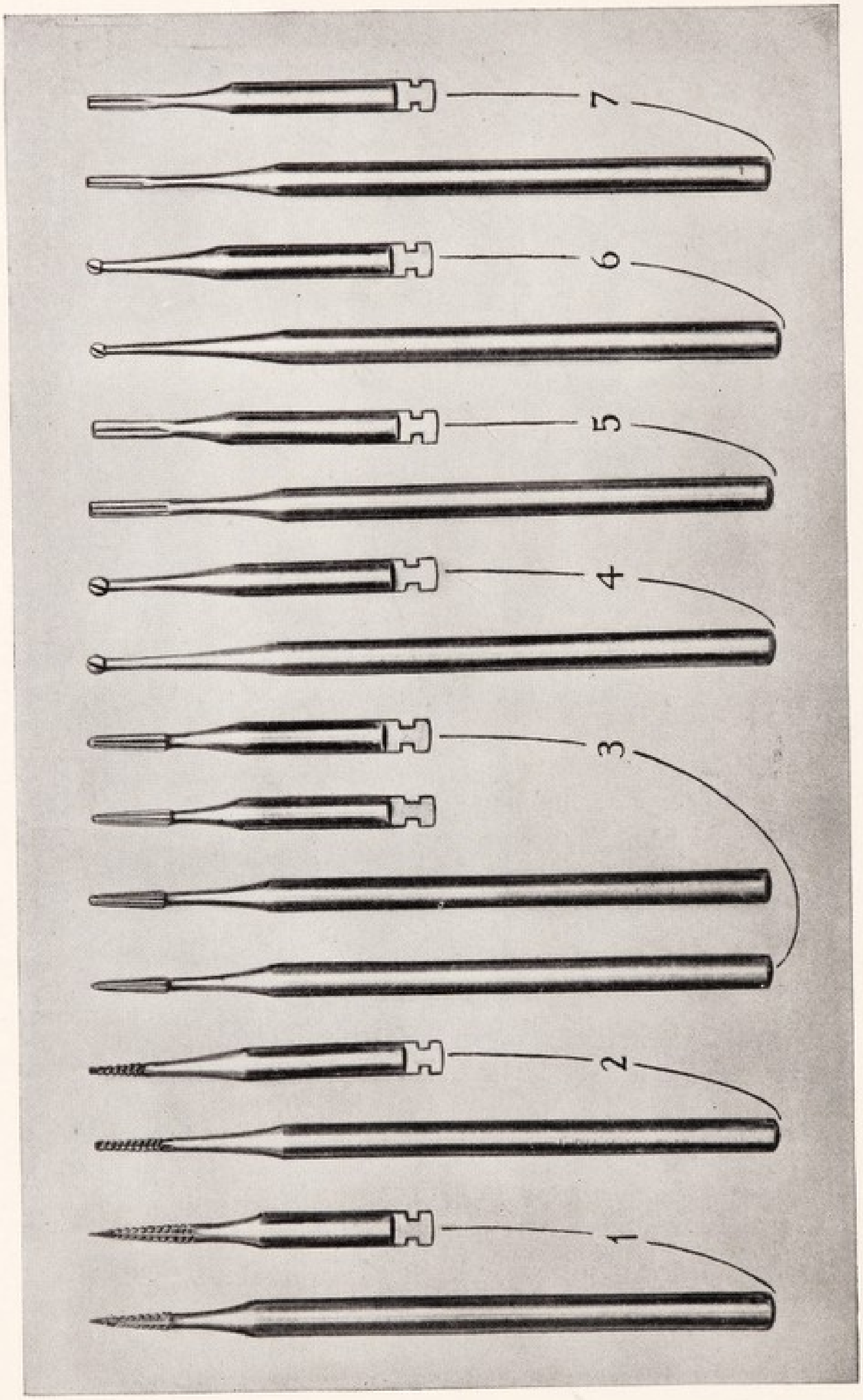


Fig. 216. Special burs. For description see text

in the preparation of the shoulder on cuspids, and central and lateral incisors. No. 10 the Miller mounted point No. 326. No. 11 the Miller mounted point No. 326½. No. 12 the Miller mounted point No. 341. These stones are used to reduce the tooth structure and parallel the walls in the preparation of a shoulder on biscuspids and molars.

In Fig. 216—No. 1 are shown the Krause burs. These burs are used to outline the parallel grooves at the interproximal spaces after using a

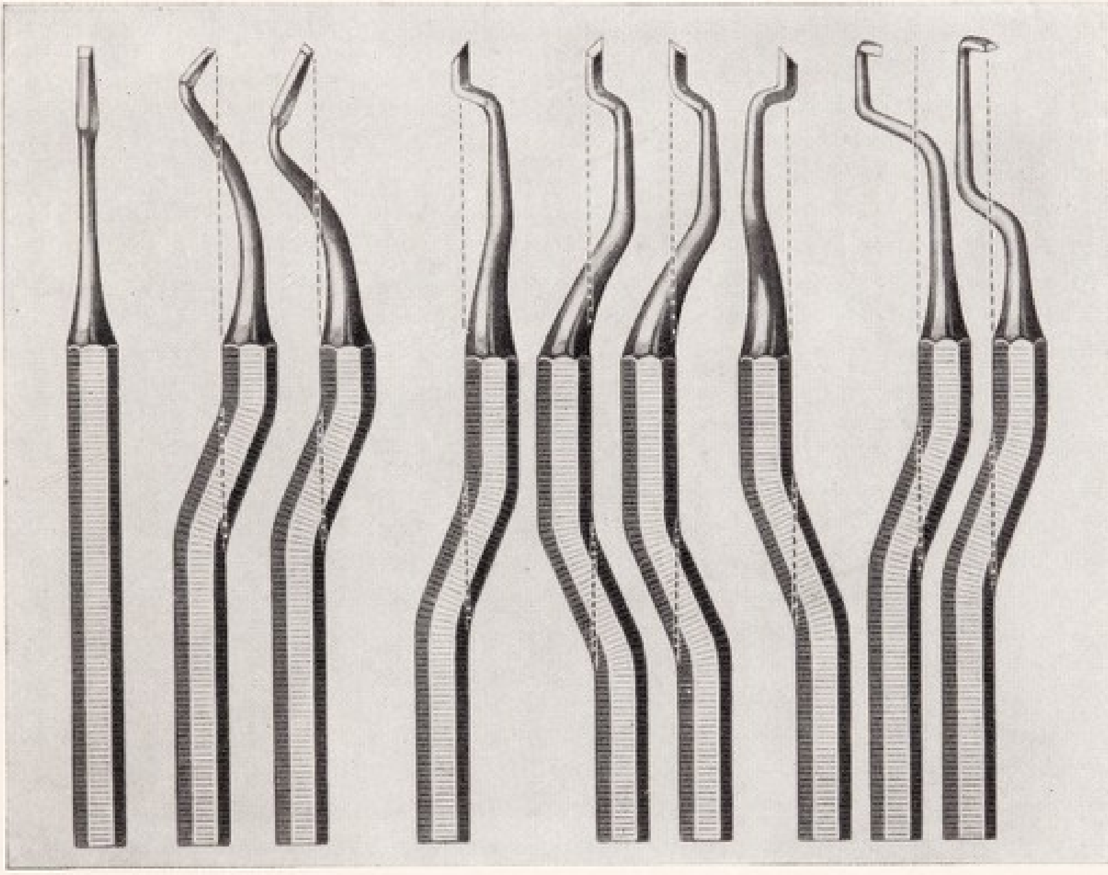


Fig. 217. Bronner chisels

carborundum disk. They are also useful in trimming the teeth on the lingual side at the gingival margin. No. 2 the Busch cone shaped, square end, cross cut, fissure burs No. 0. These burs are used in forming the outline of the interproximal grooves, after the Krause burs have been used. No. 3 the Tinker burs Nos. 1 and 2. These burs have a 45 degree angle point and are the last burs used in forming the interproximal grooves. No. 4 the Cutwell round burs No. 3. These burs are used to drill the 2 mm. pits in bicuspids and molars. No. 5 the Cutwell plain fissure burs No. 57. These burs are used to complete the pits in bicuspids and molars forming smooth parallel walls. No. 6 the Cutwell round burs, No. 2, used to drill the pits in cuspids, and central and lateral incisors. No. 7 the Cutwell plain fissure burs No. 56 used to complete the pits in cuspids, and central and lateral incisors.

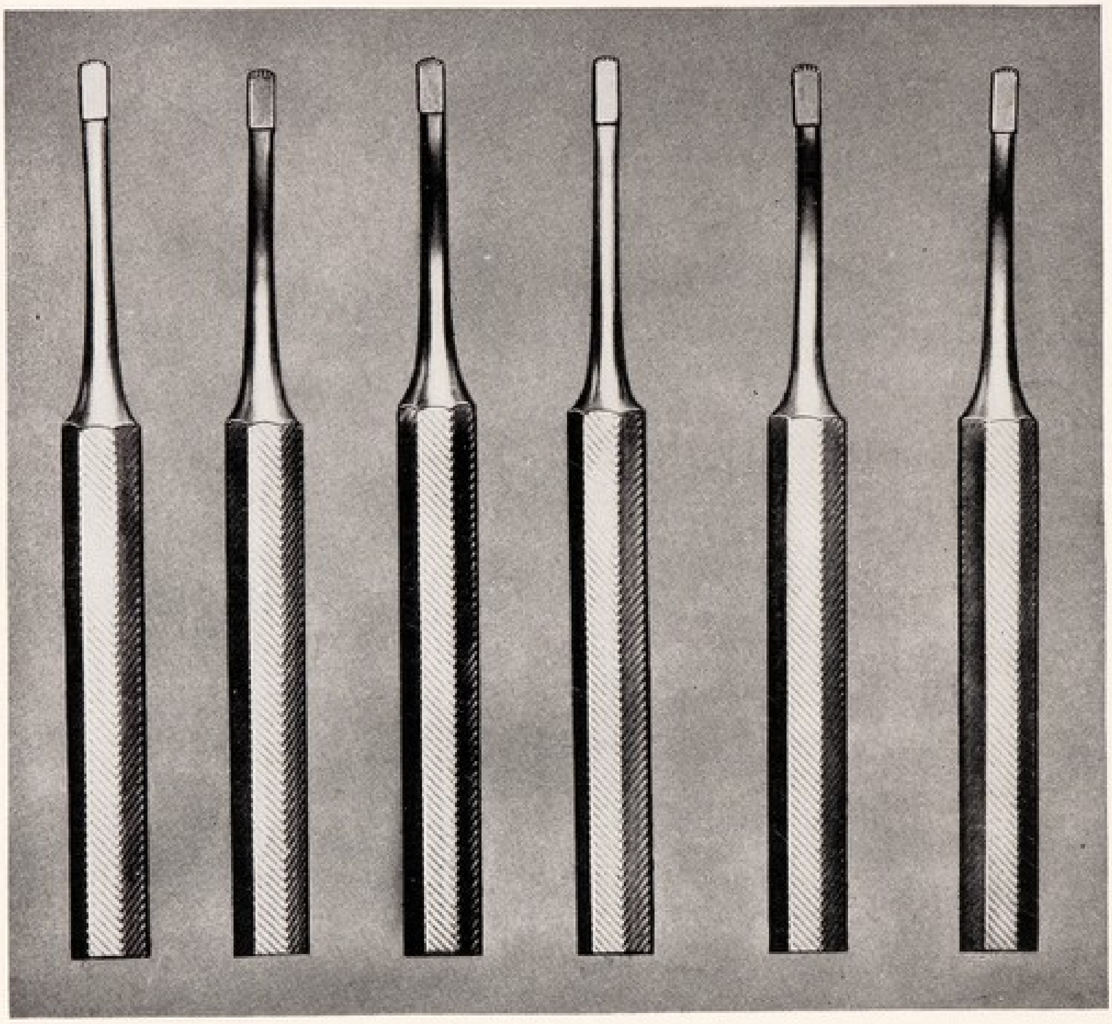


Fig. 218. Bastian files

Fig. 217. A set of Bronner chisels. These chisels are very useful in inlay work and the small chisels are very efficacious in planing down the interproximal grooves in three-quarter crown preparations to produce a smooth surface.

Fig. 218. A set of Bastian files. These files vary in thickness and are very useful in finishing the shoulder.

Fig. 219. A jeweler's magnifying glass. No conscientious operator can afford to be without this magnifying glass. Impressions and wax

patterns that appear to be satisfactory to the naked eye will frequently show many imperfections when examined under a magnifying glass. A slight break in the compound will often be revealed, when an impression is subjected to magnification, showing that a margin has been improperly beveled, or indicating the presence of an undercut in the preparation. A few minutes' extra work when such errors are detected will assure the operator a perfect impression.

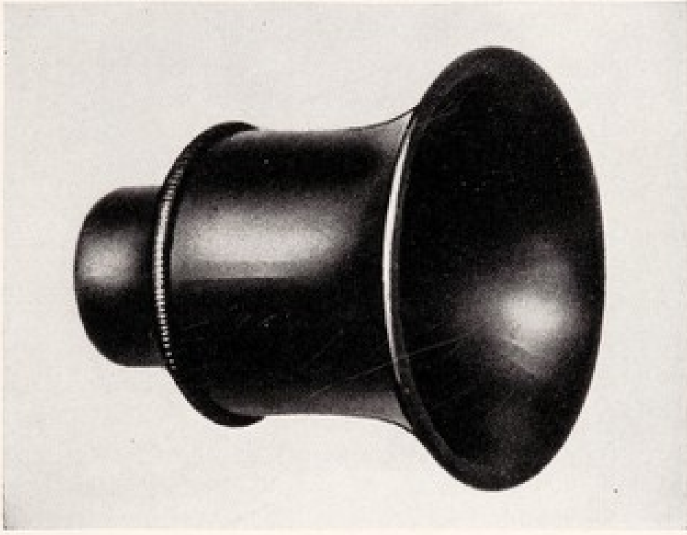


Fig. 219. Jewelers' magnifying glass

Preparations For Anterior Teeth

We may best approach the technique for the construction of the three-quarter crown by considering the type of preparation in vogue at the present day. The illustrations in Figs. 220 and 221 show the mesial and lingual view of a typical preparation on a right upper central incisor. In making this type of preparation, the enamel is removed from the lingual surface with a Miller mounted stone No. 228½, or a No. 4 Crystalon stone. The enamel is removed from the approximal surfaces with Lightening and carborundum disks. The disks should be held so that they lean toward the lingual surface and away from the incisal edge, in order to avoid a display of gold on the labial surface in the finished preparation. The incisal groove is formed by using a Crystalon knife edge stone No. 37, or a Miller knife edge stone No. 232½. These stones are also used to establish the outline and width of the shoulder. The shoulder and axial walls are formed by using the Miller mounted points Nos. 269-369-327. The greatest care must be exercised in outlining the grooves at the interproximal spaces. This is best accomplished by starting with a Krause bur, (illustrated in Fig. 216). Insert the bur at the point where the incisal groove terminates. This bur will cut rapidly, and will symetrically outline the groove, from the inside outward. Follow with a Busch cone

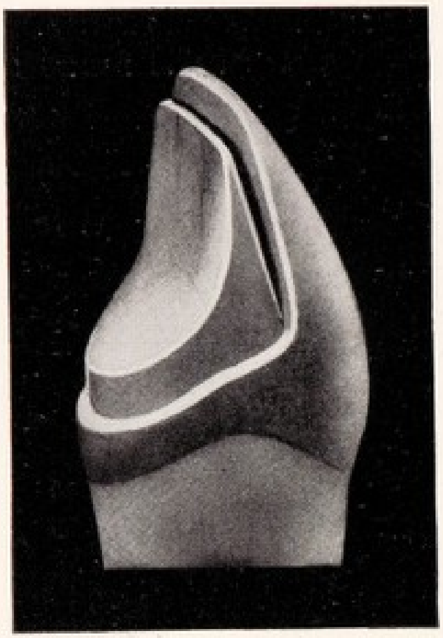


Fig. 220

Fig. 221

Fig. 220. The mesial view of a right upper central incisor, showing the usual preparation for a three-quarter crown. Note the incisal and approximal grooves, and the shoulder

Fig. 221. The lingual view of central incisor shown in Fig. 220

shaped, square-end, cross-cut, fissure bur No. 0 and allow this bur to feed itself about three-fourths of the length of the groove. Then apply the Tinker bur (Fig. 216) which has a 45 degree angle point, thus attaining a 45 degree angle base, instead of a square base. This procedure will eliminate the possibility of approaching too close to the pulp chamber. The smaller size Bronner chisels are used in the final preparation of the interproximal grooves, in order to produce a smooth surface. The surface of the shoulder is finished with Bastian files, and all sharp angles elsewhere on the tooth are reduced with fine stones.

Figs. 222 and 223 show the mesial and lingual view of the same type of preparation, adapted to a right upper cuspid. The incisal edge in either case is given a slight bevel, so that the gold may be carried to the labial line angle with but the slightest display of gold.

This preparation has given much satisfaction and is acceptable in many cases. It requires, however, considerable cutting of the tooth, which it is desirable to avoid, especially on a tooth which has not been attacked by caries. By combining the dowel principle with the principle

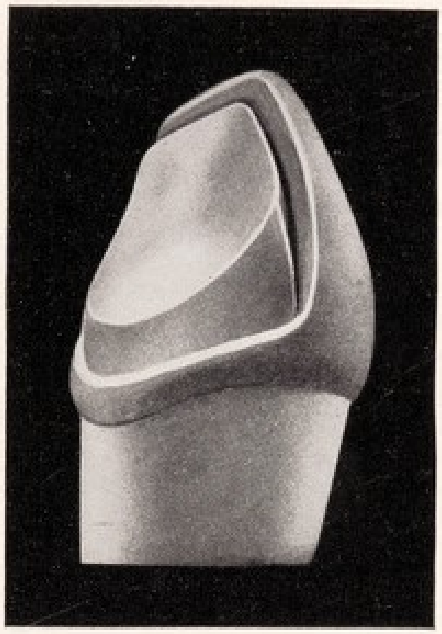


Fig. 222

Fig. 223

Fig. 222. The mesial view of a right upper cuspid, showing the usual preparation for the three-quarter crown. Note the incisal and approximal grooves and the shoulder

Fig. 223. The lingual view of cuspid shown in Fig. 222

of the three-quarter preparation it is possible considerably to reduce the necessity of cutting the tooth. Adequate strength for this modification of the three-quarter crown demands the greatest precision in following out the various details. Experience with pins, set into pits drilled into the tooth, has made it evident that these anchorages cannot be fitted accurately enough to provide the maximum retention. It has been found, by the author, that shallow pits, into which the inlay wax is forced and then reproduced in gold, provide a superior anchorage and involve less cutting of the tooth structure. It is imperative that considerable force be used when adapting the inlay wax to the amalgam die. A copper band is placed around the die and one end of a cone of inlay wax is heated in warm water, to the proper working consistency. The amalgam die, with copper band, is held in the left hand and the softened end of the wax cone is forced into the preparation with the maximum strength of the operator's right hand. The wax is held in this position until hard. This continuous tension is needed in order to force the inlay wax to the full depth of the retention pits, and to thoroughly condense the wax. The

Fig. 224

Fig. 225

Fig. 224. The lingual view of a right upper central incisor showing the author's preparation. The approximal margins were cut with disks, but there is no shoulder either on the approximal, or on the lingual surfaces. The incisal groove is used

Fig. 225. Another preparation for a right upper central incisor. This is also shoulderless, but has no incisal groove. Note the slight concavity of the approximal surfaces, to provide a greater bulk of gold. The line of removal and insertion of the crown necessitates slight grooving of the axial wall where the pits are sunk

operator who uses the direct method only, will find it necessary to use a matrix on the tooth, and as much pressure as the patient will tolerate, when adapting the inlay wax to the preparation in the mouth. The greater accuracy of fit gives such superior anchorage, that the piece can only be dislodged with difficulty even before cementation.

The preparation for the three-quarter crown of the type used by the author will usually be of the shoulderless type. The incisal edge may have a groove, or, if the tooth has not sufficient thickness for this, the incisal edge may be given merely a fairly deep bevel. In either case the approximal surfaces are given a bevel as shown in Fig. 224. It is of course, understood that in all these cases the lingual surface has had its enamel

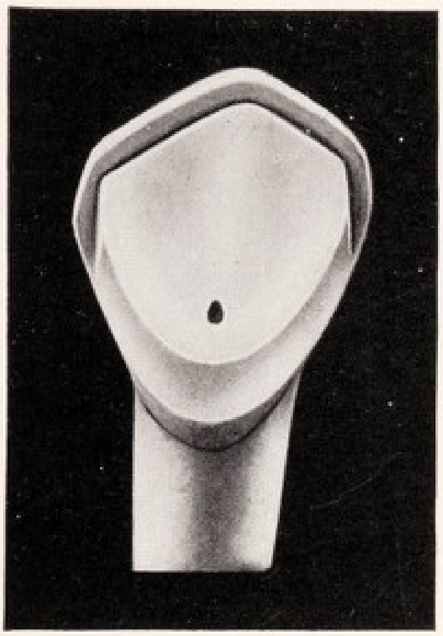


Fig. 226

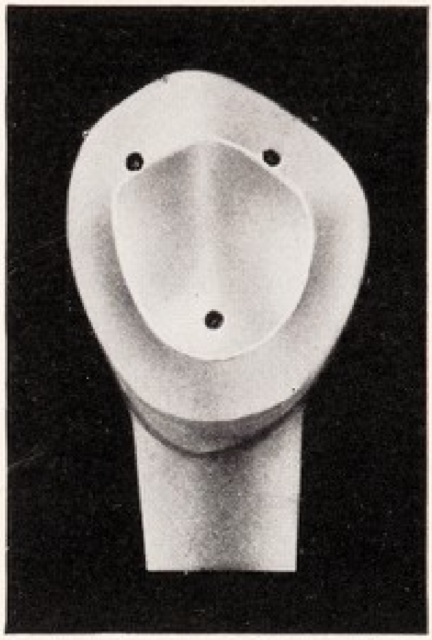


Fig. 227

Fig. 226. The lingual view of the author's preparation in a right upper cuspid. This is a shoulderless preparation. The angulation of the mesial and distal portions of the incisal groove make it unnecessary to use more than one pit

Fig. 227. The author's preparation of a left upper cuspid, in which no incisal groove is employed. In this preparation two pits are sunk in the incisal portion of the tooth, and one pit in the lingual surface

Fig. 228. The preparation of a left upper central incisor where it is desired to avoid the inclusion of one of the approximal surfaces. The mesial surface is left intact, the distal being cut away as shown in Fig. 220

removed in part, or fully, the extent of tooth substance removed depending on the clearance needed for the gold in that location. Enough space must be created between the upper and lower teeth to make possible

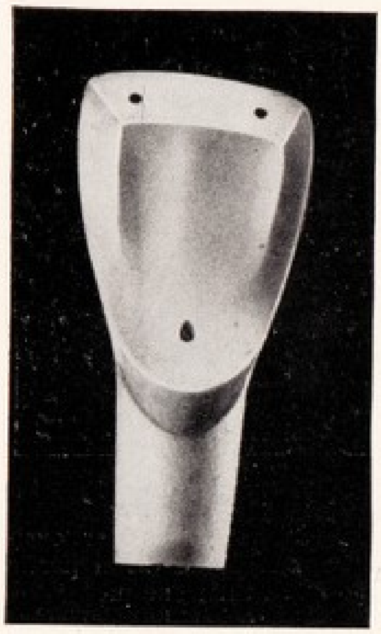


Fig. 229

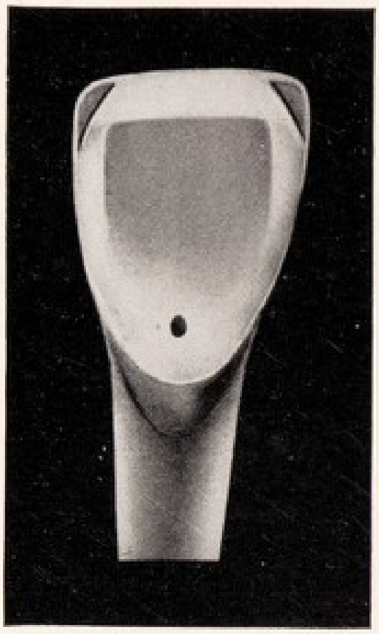


Fig. 230

Fig. 229. Shoulderless preparation on a right lower central incisor. The lower incisors seldom present sufficient tooth structure at the incisal margin to permit cutting an incisal groove. The approximal surfaces also can seldom be safely grooved. It is usually unnecessary to remove all of the lingual enamel at the incisal area. The pits, however, must of course be placed in the dentin

Fig. 230. Another preparation of a lower central incisor. Note the cutting of the incisal portion at its mesial and distal extremities. This provides short shallow grooves which assist in retention. It is therefore only necessary to use one pit

the construction of a strong restoration, without inducing occlusal trauma by the completed piece.

The location of the pits will depend on the location of the pulp and the distribution of available tooth substance. For an upper central incisor it will usually be as illustrated in Fig. 224. If the mesial and distal pits lie close to the axial wall, they will involve a slight grooving of this wall as shown in Fig. 225. The depth of the pits themselves will be the same in either case, that is, approximately 2 mm.

Fig. 225 shows a modification of the approximal bevel, which, in this case is given a slight concavity, thus providing a greater bulk of gold and increased strength. This is particularly desirable where the crown is to be used as a bridge abutment.

Figs. 226 to 230, inclusive, illustrate the application of the principles

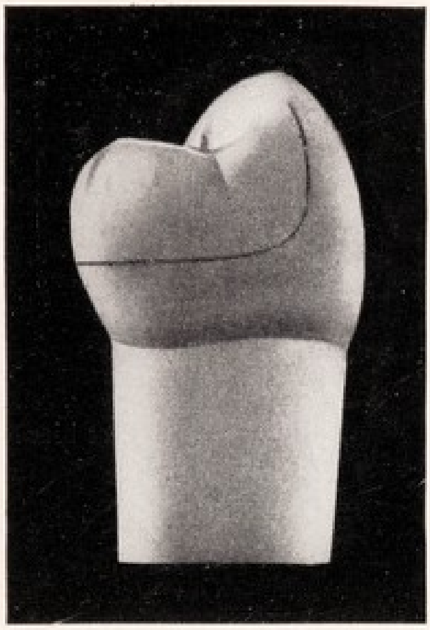


Fig. 231

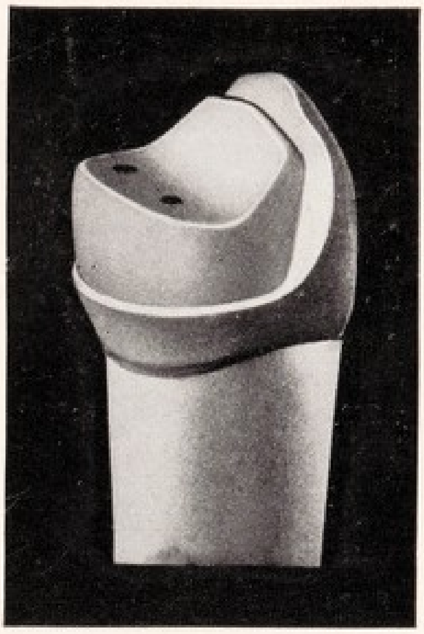


Fig. 232

Fig. 231. A bell shaped left lower second bicuspid. The line indicates the point to which the shoulder should extend, to avoid an unnecessary destruction of sound tooth structure when this type of tooth is used as a bridge abutment for a cleansable bridge

Fig. 232. The author's preparation on a lower second bicuspid shown in Fig. 231. This is a shoulder preparation, and has an incisal groove, but no approximal grooves. Two pits are sunk in the lingual cusp. These pits improve the retention and insure the proper seating of the crown, with special reference to the close approximation of the gold to the lingual surface

just described to the various upper and lower anterior teeth. Attention is called to Fig. 228. In this case the mesial surface is not included in the preparation, the distal being cut as in the usual preparation. The advantage of this, where the mesial surface is free from caries, is that the natural contact point is not disturbed and the appearance is also better.

Preparations for Posterior Teeth

In preparing posterior teeth for three-quarter crowns, the same basic principles should be followed as for the anterior teeth, namely the avoidance of unnecessary cutting of tooth structure. This end may be attained in several ways. Its application is particularly desirable where teeth have

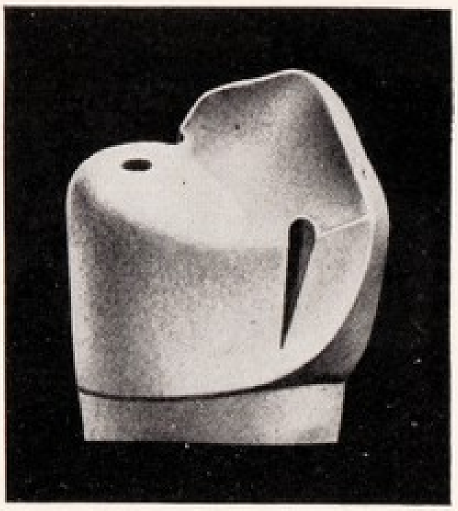


Fig. 233

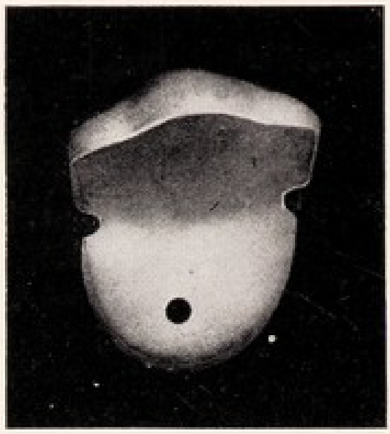


Fig. 234

Fig. 233. The distal view of a shoulderless preparation on a left upper first bicuspid, employing approximal grooves, and a pit in the lingual cusp

Fig. 234. The occlusal view of the preparation shown in Fig. 233

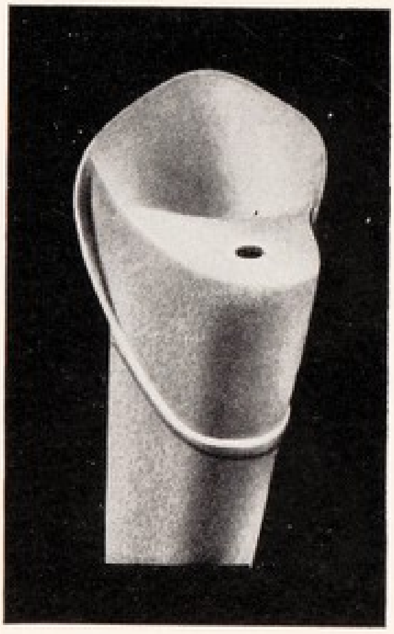


Fig. 235

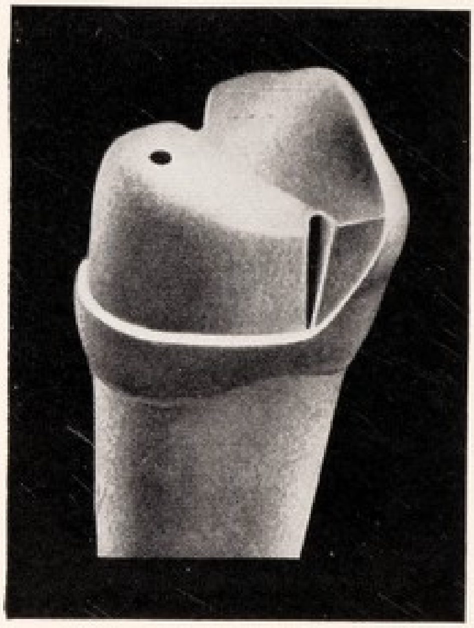


Fig. 236

Fig. 235. The lingual view of a right upper first bicuspid, showing a shoulder preparation with a single pit

Fig. 236. The distal view of a left upper first bicuspid, showing a shoulder preparation employing approximal grooves and a pit in the lingual cusp. This method may be used where extra retention is desired and the axial walls are short

had no invasion of the dentin by caries, and also for the neurasthenic individual and for patients who have an idiosyncrasy against procain. (See Figs. 231, 232, 233, 234, 235, 236, 237, 238, 239 and 240.)

The shoulderless preparation is one means to this end. (Figs. 233, 234.)

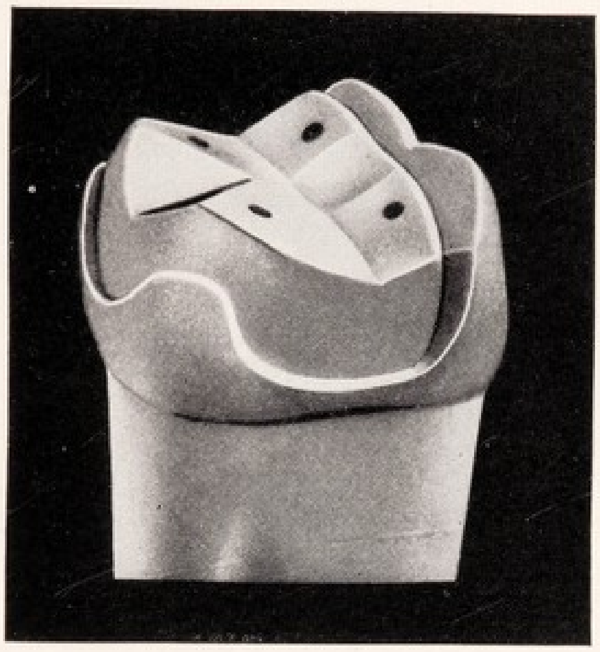


Fig. 237

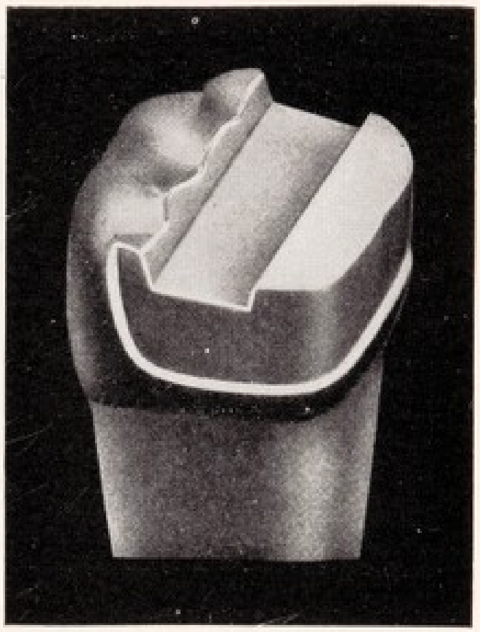


Fig. 238

Fig. 237. A preparation of a right upper second molar. An incisal groove is used, but no approximal grooves. The shoulder on the lingual surface is so placed as not to necessitate the cutting away of bulging contours. Pits provide accessory anchorage

Fig. 238. A preparation of a right lower first molar. The occlusal sulcus has been attacked by caries. This is consequently cut out and provides a broad groove which gives ample anchorage. A shoulder preparation extending well toward the gingiva is commonly used in this type of preparation

Another is the avoidance of cutting grooves in the occlusal and approximal surfaces; however, it is sometimes desirable to combine both of these principles.

Where the contour of the lingual surface presents a marked bell shape, as is so often the case with the lower bicuspids, and sometimes with the molars, usually it is unnecessary to carry the preparation to the gingival line. It is thus possible to avoid the complete obliteration of the bulge, and the consequent deep cutting of the tooth, which would otherwise be necessary.

When the buccal portion of the occlusal surface of a molar is free from caries, it is unnecessary to include the entire occlusal surface in the preparation, as adequate retention can be obtained by appropriate

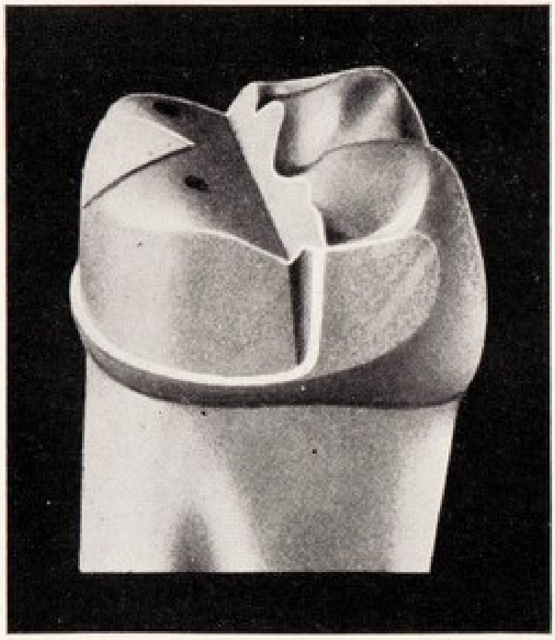


Fig. 239

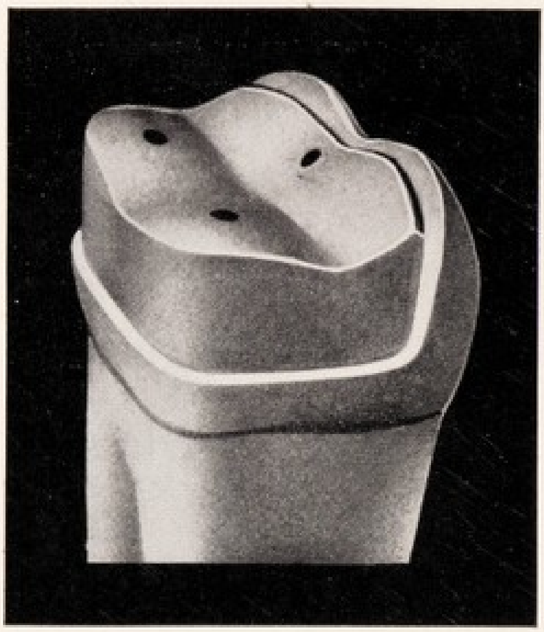


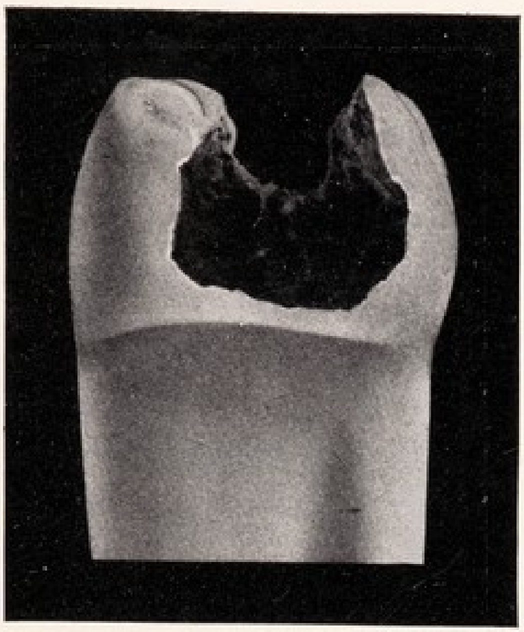
Fig. 240

Fig. 239. A preparation of a right upper first molar which does not include the buccal portion of the occlusal surface. Approximal grooves and occlusal pits are employed. Note the "slice" cut of the buccal portion of the approximal surface in order to carry the margin to a self cleansing area

Fig. 240. A preparation of a left lower second molar. There is a slight incisal groove, but the nearly parallel approximal surfaces and the pits provide the anchorage

grooves and pits, confined to the median and lingual portions. In these cases the approximal surfaces are given a "slice" preparation with a disk, to permit carrying the gold to self-cleansing areas on these vulnerable surfaces, as shown in Fig. 239. This also provides a broader surface of gold to which to solder the pontic, when the crown is used as a bridge abutment. If the grooves of the buccal portion of the occlusal surface show a minute extent of caries, or if enamel defects, such as pits or fissures, are found, these can be cut out and filled after the insertion of the crown.

When the tooth has been deeply attacked by caries on the approximal and occlusal surfaces, so that devitalization is necessary, the problem of



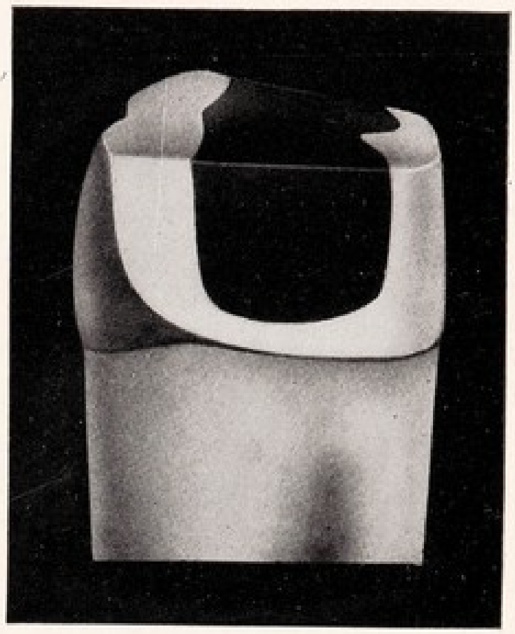
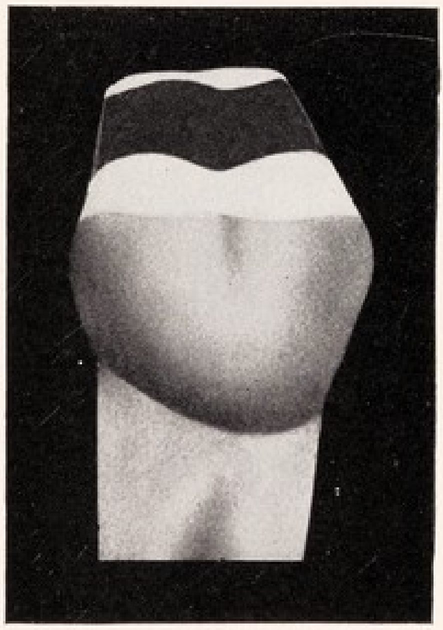


Fig. 241

Fig. 242

Fig. 241. A left upper first molar deeply attacked by approximal and occlusal caries

Fig. 242. A core of cast gold, or of amalgam, inserted in the molar cavity shown in Fig. 241, and the tooth prepared for a shoulderless crown



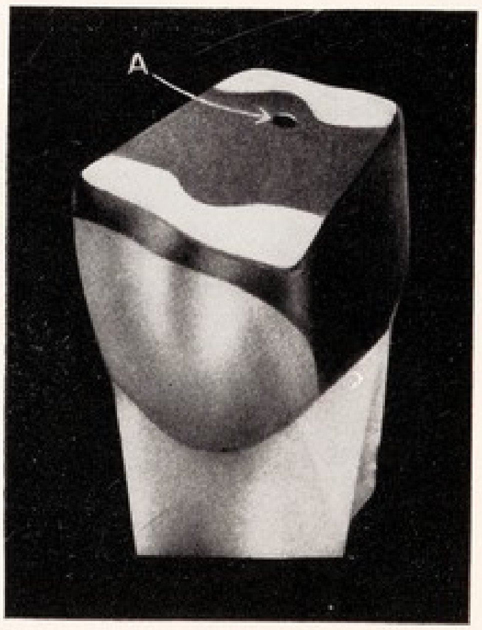


Fig. 243

Fig. 244

Fig. 243. Buccal view of molar shown in Fig. 242. Note bevel on the buccal aspect

Fig. 244. A gold band is carefully fitted at the approximal and lingual gum line, and is closely adapted to the tooth

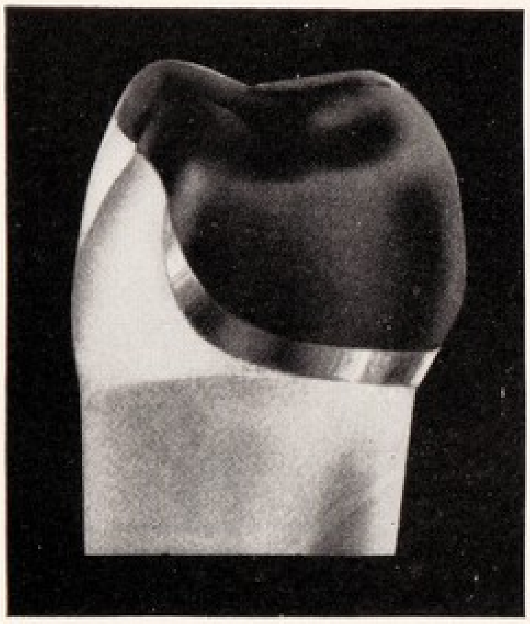


Fig. 245

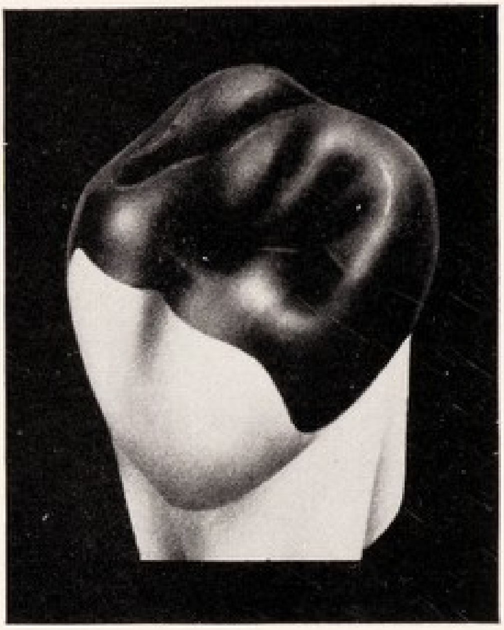


Fig. 246

Fig. 245. Inlay wax moulded to the band shown in Fig. 244 and carved to lingual, approximal and occlusal contour. Note that the wax is not carried to the gingival margin of the band

Fig. 246. Occlusal view of completed crown

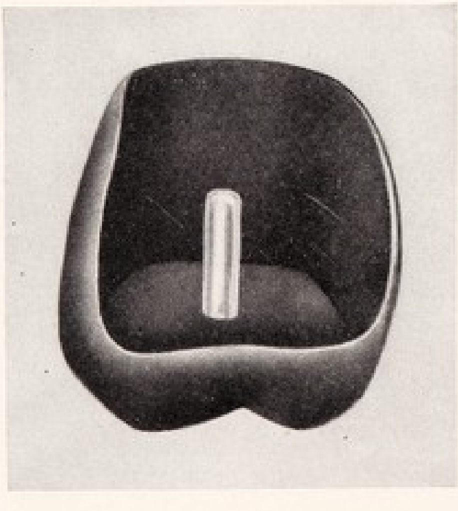


Fig. 247. Crown shown in Fig. 246 removed from the tooth. Note long dowel which may be employed if the crown is to be used as a bridge abutment or where extra retention is desired

conserving tooth structure necessitates still more acute study. In these cases it is very important to protect the lingual and buccal cusps from fracture. After the root canal treatment and filling has been completed, the center of the tooth is filled with either a gold inlay, or an amalgam filling, as indicated in Fig. 242. Following this, a shoulderless preparation is made, the particular feature of which is the beveling of the buccal cusp. This is carried out in such a way that when the casting is completed, the buccal cusp is entirely covered by the gold. It is of course inevitable that a slight edge of gold will show on the buccal surface, but the demand for strength and protection justifies this, in such a case.

When the tooth so involved happens to be an upper first, or second molar, the fitting and trimming of the wax on the distal surface sometimes presents a difficult problem. In such a case, after the completion of the root canal work, the placing of the central core, and the preparation of the approximal and lingual surfaces, a gold band is fitted to the tooth as shown in Fig. 244. Note that the buccal portion of the band is carried only slightly over the buccal cusp of the tooth, which has been beveled as indicated by the location and contour of the band. This band is accurately fitted to the tooth on the approximal and lingual surfaces. Over it inlay wax is moulded and carved to the proper contours. A pit may be employed for accessory anchorage. This may be shallow, as in A-Fig. 244, in which case the inlay wax is forced into it. Or it may be deep, in which case a dowel is fitted and incorporated in the casting, as in Fig. 247. Notice that on the lingual and approximal surfaces, the wax is not carried to the margin of the band, but is about 2 mm. short of this margin. (Fig. 245.) The wax mould of the crown which has been adapted to the 22 K. gold band and properly contoured and tested for occlusion and contact is then invested and the crown is cast with 20 K. gold. The sprue wire should be placed in such a position that the molten gold will not be projected directly against the gold band. This precaution and the use of 20 K. gold will eliminate the possibility of fusing the gold band. After the crown is cast, the free edge of the gold band may be further fitted, or contoured, to improve its adaption at the neck of the tooth. The exposed part of the gold band is then covered with 22 K. solder.

When the question of expense is not to be considered the ideal method for constructing this type of crown is as follows:—A band of 34 gauge platinum is fitted to the tooth and the crown is cast with Ney-Oro "B" metal. The exposed part of the platinum band is then covered with Ney-Oro "G-3" metal.

CHAPTER XVI

Principles Underlying the Use of the Gold Inlay as an Attachment for Bridgework

Early in the history of the gold inlay it was recognized as presenting certain desirable features, which might be applied in bridgework. Chief of these was the opportunity to avoid the display of gold and extreme cutting of tooth structure, and also the difficulties of securing perfect margins, features which had brought the gold shell crown into disrepute. These good points the gold inlay still has to its credit. Certain disadvantages which interferred with its early success have been largely overcome, and, when properly used, it provides a most satisfactory attachment for bridgework, both fixed and removable.

At this point it might be well to mention one of the reported disadvantages of the gold inlay in its present day application. This is the tendency of stress on the bridge to break the cement bond around the inlay, and thus cause the bridge to become loose at one or both ends. This very trying situation can be avoided by correct cavity preparation, in all properly planned cases, and the gold inlay may be used with satisfaction in many cases in which it is now regarded as unsafe.

Cavity Preparation for Abutment Inlays

The first consideration in a case in which it has been decided that a gold inlay is indicated, is the preparation of the cavity. It must first be determined that the tooth itself is a suitable one in which to insert a gold inlay. Attention has already been drawn to the danger of deep cutting in a tooth which has had no recession of the pulp as a result of previous caries. On the other hand, it is equally important to determine whether a tooth, which has had previous caries, has sufficient strength to submit to the necessary excavation and squaring of side walls without being liable to subsequent fracture. Given a tooth which has not suffered too severely from the ravages of caries, it is possible to make a preparation which will afford ample anchorage to resist the tendency to displacement.

The important feature of cavity preparation is the preparation of the buccal, lingual and axial walls. These walls must be nearly parallel. The slight divergence necessary for withdrawal of the wax pattern should be

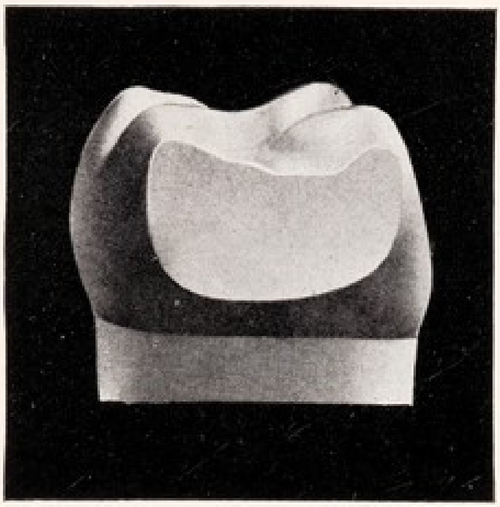


Fig. 248

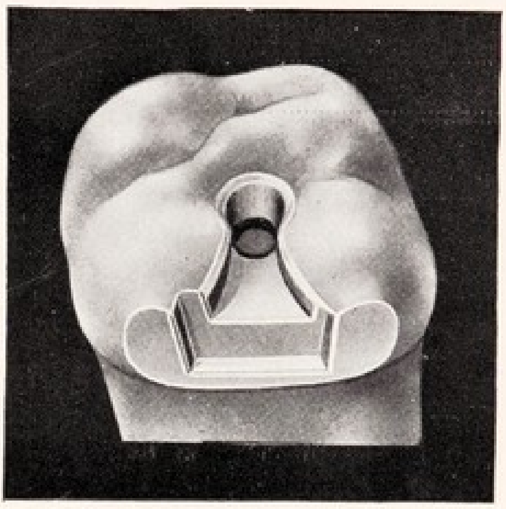


Fig. 249

Fig. 248. The slice cut. This is the first step in the preparation of a right upper first molar, in which there has been no previous approximal decay. This slice is made with a flat sided, carborundum disk. In order that the finished inlay may have a satisfactory margin, it is necessary to make this slice deep enough, so that the cut surface provides a distinct margin with the external surface of the tooth at all points

Fig. 249. An occlusal view of the tooth shown in Fig. 248, showing the extension from the approximal into the occlusal portion of the tooth. In the case illustrated the central pit has developed caries extending well toward the pulp. This portion of the tooth is excavated, covered with a suitable varnish and lined with copper cement. This pit is then given appropriate form to act as an accessory retention

about 5 degrees from the parallel. Care must be taken not to have the walls so nearly parallel that the insertion of the finished inlay may cause undue strain on the tooth structure.

When it is decided that the slice preparation of the approximal surface is to be made, as first recommended by the late M. L. Rhein and more recently developed into a system by Drs. Gillett and Irving, it will be found that approximate parallelism of the axial walls, and of the slice on the abutment teeth, or a slight divergence from the parallel in these surfaces, may readily be carried out. (Fig. 261.) This not only facilitates the preparation of the teeth themselves, but also renders easier the insertion of the finished bridge. Without parallelism of the approximal slice and axial walls, it has been frequently found that the bridge would bind when being inserted, thus resulting in severe strain on the abutment teeth. Further assurance against such strain may be provided by the use of the Evslin bridgemeter. (Fig. 311.) This instrument is used in determining the angle at which the slice is to be cut.

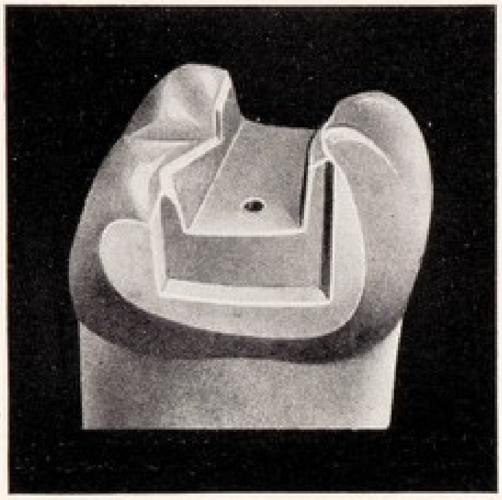


Fig. 250

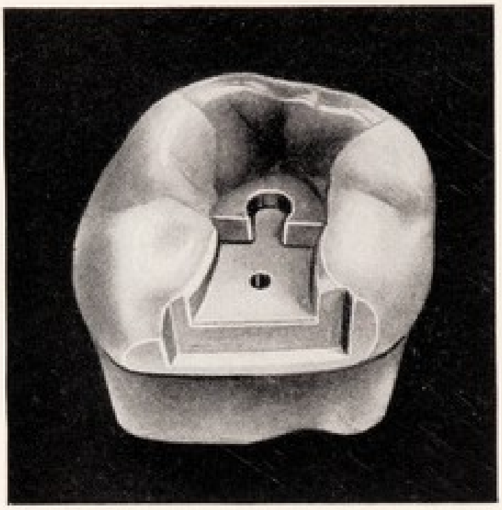


Fig. 251

Fig. 250. Upper left second molar with m.o.d. cavity prepared. Note that the gingival wall of the cavity is above the margin of the slice; extreme beveling of this margin is unnecessary—it is slightly rounded to remove the sharp angle

Fig. 251. The same tooth as in Fig. 250. A distocclusal inlay has been prepared, in which is provided an occlusal lock, as shown in the illustration. This inlay is cemented in place and a mesiocclusal inlay is constructed which will serve for the attachment of the bridge. Note the shallow occlusal pit which may be employed when additional retention is required

The slice preparation is desirable in bridgework, because it gives a large surface for soldering in uniting pontics, etc. It also carries the margin of the inlay to a point where it is readily cleansed by the tooth brush. However, as we approach the anterior part of the mouth the slice preparation is not always desirable, especially on the mesial surface of upper bicuspids. Here it is incumbent on the operator to avoid a display of gold, and a less extensive preparation is recommended as shown in Fig. 262.

Where the slice preparation is used on the approximal surface it provides a suitable margin at the gingival area for finishing purposes. It is only necessary to round over slightly the junction of the gingival wall with the approximal slice. If however, the margin of the gingival wall with the external surface extends further toward the gingival margin than the extent of the slice, it is necessary to carefully bevel this margin in order to provide for suitable finishing. This situation is frequently encountered in the case of bicuspids.

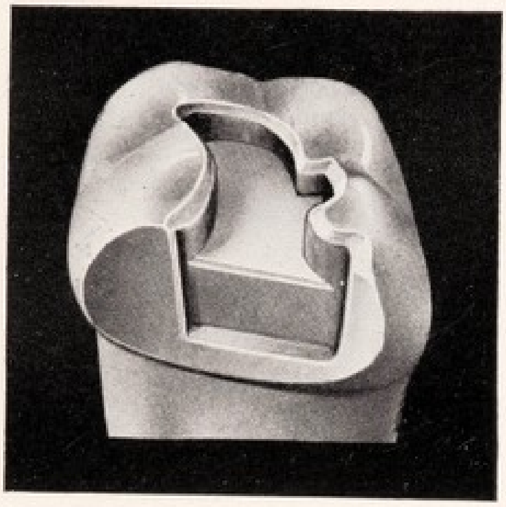


Fig. 252

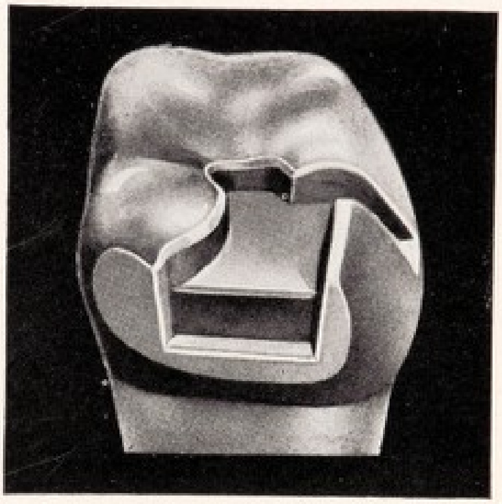


Fig. 253

Fig. 252. Right upper second molar. The broad and irregular outline form of the occlusal part of the preparation has been dictated by the ravages of previous decay. On the lingual of the approximal portion decalcification was found, requiring an unusual extension of the approximal slice. This is further modified by slightly concaving this portion of the tooth to include all decalcified structure

Fig. 253. Lower left second molar, which has had caries involving the buccal groove. If the tooth structure of the mesiobuccal cusp is strong, the cavity may be prepared as shown above

Accessory Anchorage

If the operator feels that the opportunities for retention, as afforded by the routine cavity preparation, will be inadequate, he may avail himself of accessory anchorage. This usually takes the form of pits, which are drilled in appropriate places in the tooth structure. They are usually not more than 2 mm. in depth, but must be drilled so that their walls are parallel, and not tapered. Parallelism with the cavity walls is also requisite. The inlay wax is forced into the pit, so that when the inlay is finished, the gold of the inlay itself projects into the pit. In this way a closer adaptation, and consequently a stronger retention is provided, than when pins are fitted into such pits. This type of accessory retention is desirable in cavities where only one pit is used as in Figs. 249, 250, 251, 262, 263.

However, where three or four pits are used as in Figs. 256, 257, 258, better results, and sufficient anchorage may be obtained with pins. This is especially true where the indirect-direct method of inlay construction

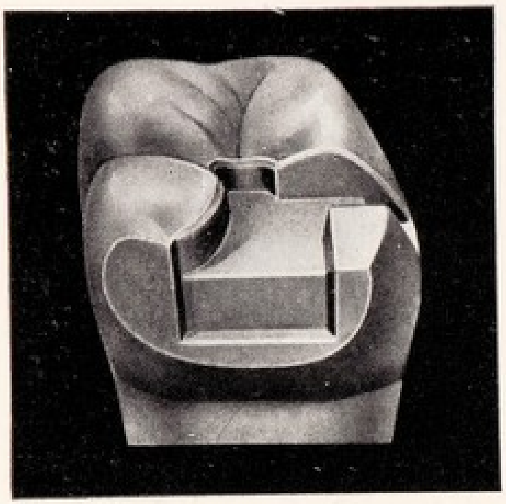


Fig. 254

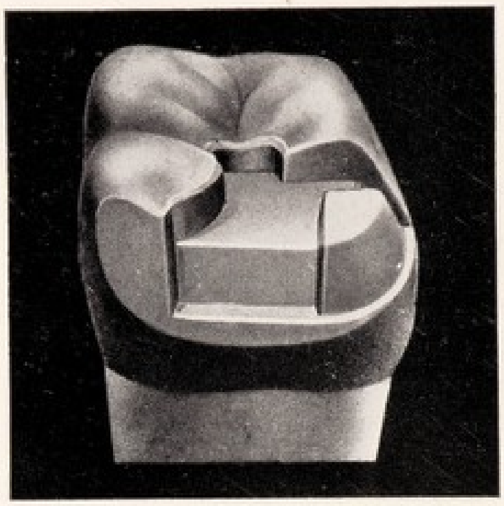


Fig. 255

Fig. 254. Lower left second molar. In this case it is found that the mesiobuccal cusp has been slightly undermined by caries. In such a case the summit of this cusp is flattened and is then reproduced in the gold of the inlay

Fig. 255. If the tooth shown in Fig. 254 has suffered more extensive decay and especially if there has been enamel decalcification on the buccal surface of the mesiobuccal cusp, it will be necessary to prepare this cusp as shown above, with a shoulder. Note that the margin of the shoulder is made continuous with the margin produced by the approximal slice cut

is used. Unless absolute parallelism of the pits is obtained there may be distortion of the compound when taking the impression. Under such conditions pieces of Ney-Oro No. 4 wire, of a gauge that will fit the pits fairly accurately, are placed in the pits and allowed to extend about 3 mm. above the floor of the cavity. These portions of the pins are nicked with the edge of a Joe Dandy disk, to provide undercuts in the pins, which will be engaged by the modelling compound when the impression is taken; however, those portions of the pins extending into the pits must have smooth sides, in order to facilitate removal from the amalgam die. After the impression is taken the exposed ends of the wires are covered with a thin coat of oil, previous to making the amalgam die. This will facilitate removal after the amalgam has hardened.

The pulpal wall and the gingival wall are to be cut at a right angle to the long axis of the tooth, as is customary in inlay cavity preparation. All margins are to be beveled so that finishing of the inlay may be carried

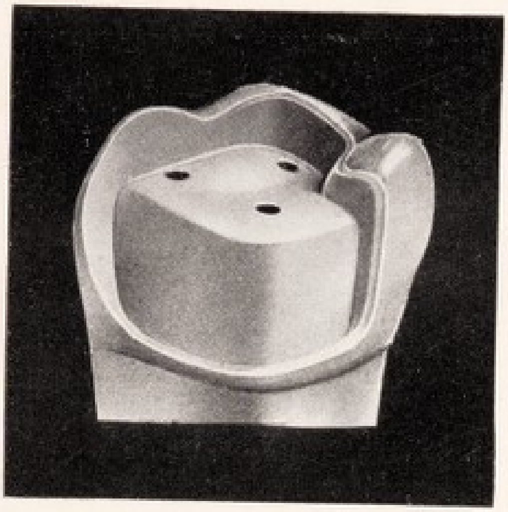


Fig. 256

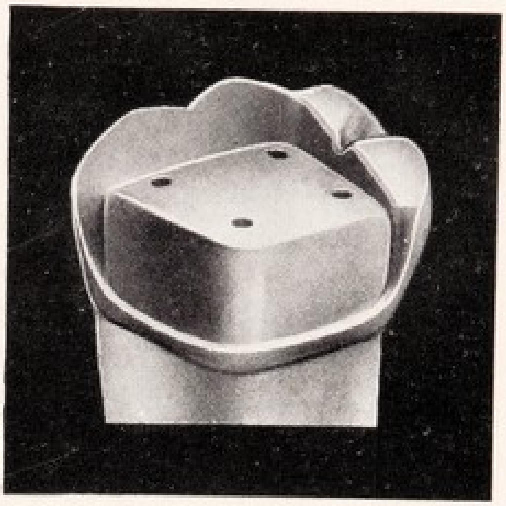


Fig. 257

Fig. 256. Lower right second molar which has suffered extensive caries involving the occlusal, lingual and mesial surfaces. If the distolingual cusp is strong, it is left standing as shown above. In the absence of an occlusal lock, retention is obtained by pins set into the pits in the occlusal surface. These pits are so shallow that they will not endanger the horns of the pulp

Fig. 257. Lower right first molar. The condition illustrated is similar to that shown in Fig. 256, except that the distolingual cusp is weaker. This cusp is reduced and beveled, being then reproduced in the gold of the inlay

out to the best advantage. All external angles should be rounded, so that sharp corners in the finished preparation are avoided. This is an important safeguard for the enamel prisms, which otherwise are liable to subsequent fracture, even though supported by dentin. When these angles are rounded, it is found, furthermore, that the inlay investment is less likely to fracture during the casting process. Internal line angles, and point angles, should be clearly marked, although not necessarily so sharply carried out as in the preparation for gold foil fillings. Weak buccal or lingual walls, which might fracture if left standing, should be reduced and included in the preparation so that they may be protected by the gold of the inlay as in Figs. 254, 255, 257.

The Two Piece Inlay

For all large m.o.d. cavities the author recommends the two piece inlay first advocated by Conzett, (Figs. 250-251), placing first, that part of the inlay which is not to act as the bridge support, and preparing in this an occlusal

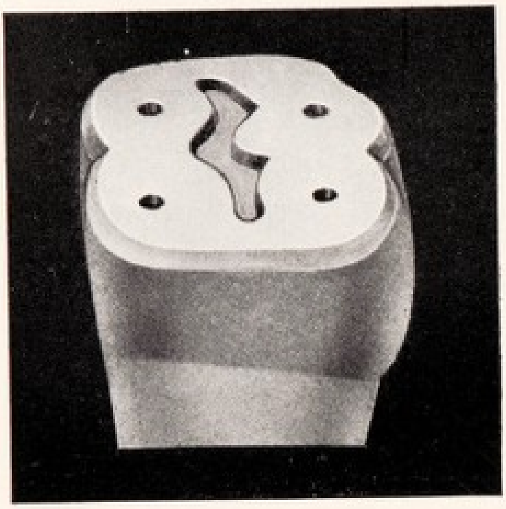


Fig. 258

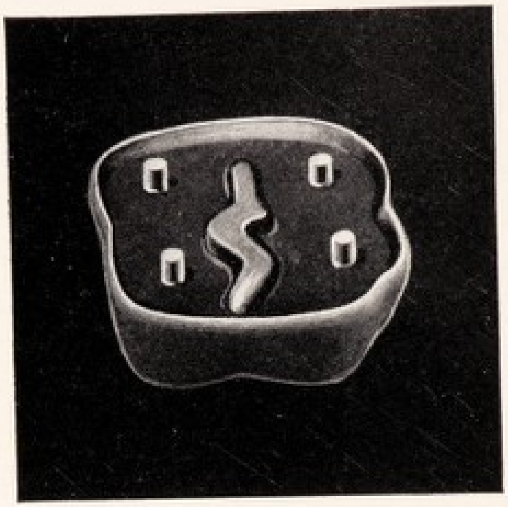


Fig. 259

Fig. 258. Lower left first molar which has tipped forward out of occlusion. It is unnecessary to cut away much tooth structure since the surface is to be built above its former level. The occlusal surface is given a slice cut as shown, with the margin bevelled for finishing purposes. In the event of decay in the sulcus, it is deepened with its walls nearly parallel. Additional retention is provided by means of shallow pits into which pins are inserted

Fig. 259. Cavo-surface view of the finished inlay for the case shown in Fig. 258

lock, to provide anchorage for that part of the inlay which is to act as the bridge attachment. Correct cavity preparation will provide adequate anchorage or short fixed bridges with this type of attachment.

Where only the sulci of teeth have been slightly attacked by caries, these teeth may be utilized as abutments for short span bridges, with very little destruction of sound tooth structure as illustrated in Fig. 261. The sulci are opened with a 13 gauge fissure bur, and the preparations are extended down the approximal surfaces in conjunction with the approximal slices. A non-malleable casting gold, should be used when such small inlays are planned.

Malposed Teeth as Abutments

Malposed teeth may often be utilized as bridge abutments, with the destruction of very little sound tooth substance. Lower molars are frequently tipped mesially, until only the distal cusps are in contact with the upper teeth. Under such circumstances, the occlusal surface is sliced so as to remove most of its enamel, and any decay in the sulcus is removed. Four pits are drilled in the occlusal surface as seen in Fig. 258. Pins are inserted and an inlay constructed as in Figs. 259 and 260.

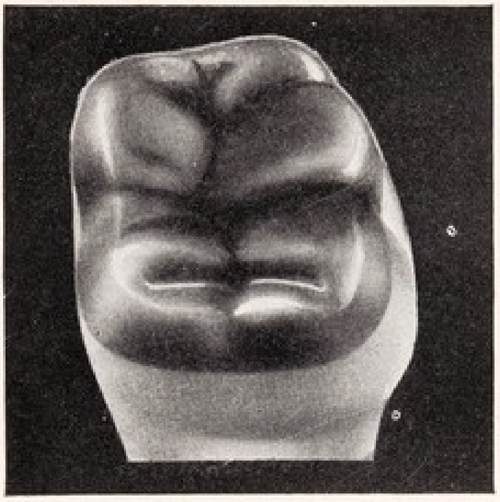


Fig. 260. Finished inlay shown in Fig. 259, in position in the tooth

In the cuspid, if devitalized, an inlay may be used in conjunction with a pin in the canal. This inlay need involve only the mesial or distal surface, provided that the remaining walls are fairly strong, as in Fig. 264.

Technics of Construction

The author recommends the use of the indirect-direct method for the construction of the majority of gold inlays. The direct method is ideal for certain types of cavities, such as medium sized cavities that are easily accessible. But for the larger approximal-occlusal, or m.o.d. cavities that are not accessible, the disadvantages of the presence of saliva, and inaccessible gingival margins, especially if the patient is of a nervous type, make the direct method of questionable value. On the other hand the indirect method, while superior to the direct for use in this type of cavity, has certain shortcomings, as for instance the possibility of distortion of the compound, in the hands of the inexperienced operator, when taking the impression; and the fact that patients seldom give a correct centric occlusal bite, when instructed to bite into a piece of softened wax. Furthermore, this is not the only bite necessary to secure a properly fitting inlay. The inlay must be constructed to function properly in centric, protrusive and right and left lateral occlusions. This degree of accuracy may be obtained by using the indirect-direct method. After the wax inlay pattern has been carved to the greatest possible degree of accuracy, on the amalgam die on the articulator, the wax pattern is then carried to the cavity in the

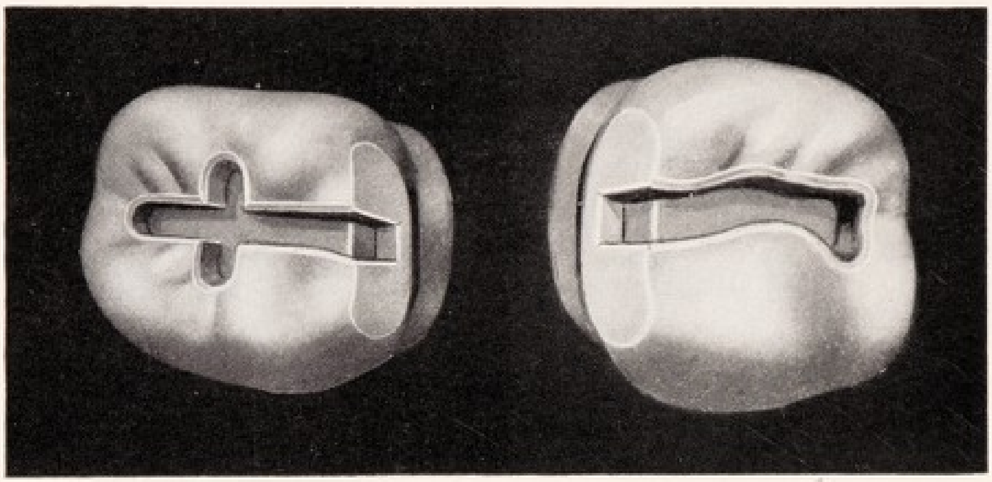


Fig. 261. Lower right second molar and second bicuspid which have had only slight caries in the occlusal fissures. The occlusal caries is removed and the cavity extended to the approximal by means of a narrow cut as shown. The approximal slice then provides the requisite preparation for this surface. These teeth are tipped slightly from the normal, to show the approximal preparation

tooth and tested for marginal adaptation and occlusal contact in the various mandibular movements. The necessary corrections are made at this time, care being taken not to distort the wax pattern. A method used by some operators to obtain correct occlusal contact of the wax inlay pattern, is to force inlay wax into the cavity in the tooth and instruct the patient to close in centric occlusion and also to perform the movements of mastication. This wax pattern is later transferred to the amalgam die, on the articulator, and carved to correct marginal contact and contour. However, to secure close adaptation to the axial walls and proper condensation of the inlay wax it would be necessary to construct a properly fitting matrix which would require more time than the extra appointment necessary to test the inlay pattern, when the indirect-direct method is used. But, as there is usually other work to be done, this is not necessarily a loss of the patient's time. In any event the finest type of dental services cannot be rendered, when the element of time is given the first consideration.

When using the indirect-direct method for constructing inlays, it is usually necessary to make minor adjustments of the wax inlay pattern in the cavity. Under such conditions all small particles of inlay wax must be removed from the oral cavity by flushing with luke warm water and

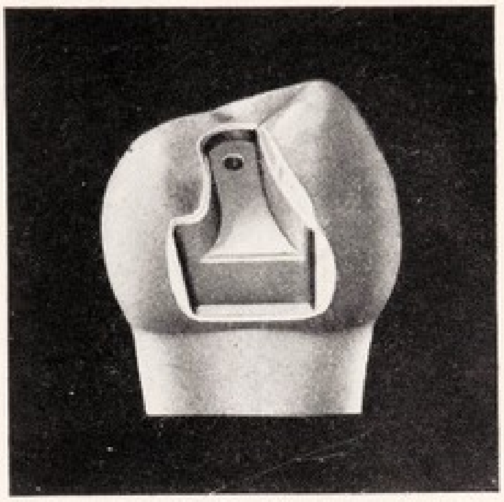


Fig. 262. Upper right first bicuspid. Mesial view. In this case a slice preparation on the mesial surface would involve an undue display of gold. The preparation therefore follows the usual gold foil preparation, modified for withdrawal of the pattern. Note the occlusal pit for accessory retention

wiping with cotton pellets saturated with warm water. Otherwise, these small particles of inlay wax may become incorporated in the saliva and creep over the margins of the wax pattern when the inlay pattern is removed.

No attempt should be made to produce extra smooth axial cavity walls. A slight roughness will enhance the retentive qualities of the inlay. In large inlays it is good practice to cut away, with sharp instruments, some of the inlay wax of the wax inlay pattern at a place that will not interfere with the mechanical retention of the inlay. This procedure will act as a protection to the tooth from thermal shock, as well as aid in the retention of the inlay. The inner surface of the inlay may be roughened with a sharp instrument after casting. This roughness will give the cement a firmer grip and aid in the retention. However, a word of warning is necessary at this point. The outer margins of the cavity should be as smooth as possible and the outer margins of the finished inlay should not be altered in any way. Here the greatest possible perfection of contact must be established. Modifications of the preparations shown may be developed to meet varying conditions encountered.

Important Minor Technics

Use the rubber dam. Burs will not clog so readily and therefore produce less heat. For the comfort of the patient do not use air too hot, nor too cold. Work slowly. Heat produced in cutting enamel and dentin, and in

Fig. 263

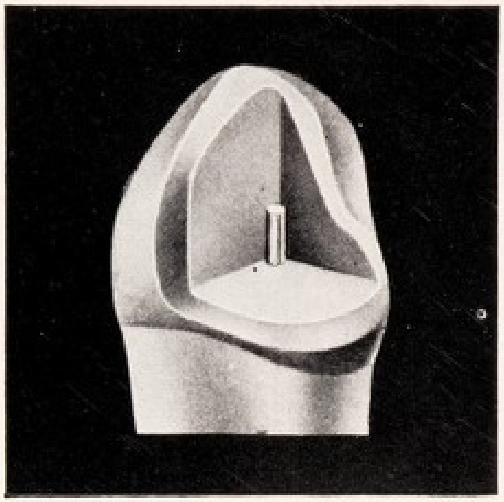


Fig. 264

Fig. 263. Lower left cuspid. Distal view. This preparation is suitable for vital cuspids. The mesial surface is not involved, retention being provided by the incisal groove in conjunction with a lingual pit into which the inlay wax is forced

Fig. 264. Upper left cuspid. Mesial view. This is a pulpless tooth in which the distal and buccal walls are strong. Anchorage is provided by a pin set into the root canal

polishing inlays may endanger the vitality of the pulp, or may induce chronic hyperemia. This is especially to be considered when working with an anesthetic. There is danger in such a case, of overheating the tooth and also of cutting dangerously close to the pulp.

Correct anatomical form should be established to protect the gingival tissues, and the occlusal anatomy of the inlay should conform to the occlusal anatomy elsewhere in the mouth. Older patients frequently present with the cusps of all teeth badly worn. Restorations in such mouths must conform to the general conditions present. A twenty year inlay in a fifty year mouth is an esthetic and physiologic incongruity.

The floor of deep cavities should be covered with a cavity varnish, which in turn should be covered with as thick a layer of copper cement as can be used without interfering with the retentive form of the cavity. This will aid in protecting the tooth from thermal shock.

While being prepared, cavities should be flushed several times with warm water from a spray bottle, and wiped with cotton pellets saturated with warm water in order to remove all debris previous to taking the impression. Examination under magnification, of the impressions of cavities that appear clean, will frequently show a deposit of debris on the surface of the compound. The author has found it good practice to make a test impression with a cone of modelling compound, heated to the proper consistency, previous to taking the final impresion. This procedure will sometimes remove minute particles of debris that remain after flushing and wiping the cavity. See to it also, that the amalgam die is thoroughly cleansed with soap and water before inserting inlay wax, and use only clean fresh wax.

Pure warm alcohol is recommended for cleansing the surface of cavities previous to the setting of inlays.

CHAPTER XVII

The Pinledge Attachment

It is frequently necessary to use an anterior tooth as an abutment. Since it is usually not good practice to place removable bridges on anterior teeth, it is necessary to provide anchorage for a fixed bridge. The requisites, briefly are, that the tooth shall not be devitalized, nor shall the health of the pulp be endangered. The esthetic requirements call for the avoidance of a display of gold on the labial surface. Strength is of course essential.

The "Pinledge" attachment has been found most useful in meeting this situation and since this attachment has been brought to its highest perfection and its technics most definitely standardized by Dr. James K. Burgess, his technique is herewith presented.

"The Pinledge attachment in the last analysis, is a backing for a vital tooth. It is designed for use from cuspid to cuspid inclusive, in both the upper and lower jaws. Basically it consists of a series of ledges from each of which protrudes a pin. When the attachment is placed in position on the tooth, the pins extend into openings through corresponding ledges formed on its lingual surface. The technique of the preparation of the tooth is as follows:—

Preparation of a Tooth for Pinledge Attachment

"Using a thin, flat disk (carborundum preferably) the linguoproximal angle of the tooth is sliced away (Fig. 265), taking care not to extend the slice to include any part of the labial enamel plate. This done, two notches about the thickness of the enamel, are cut horizontally across the lingual surface (Fig. 266) using for this purpose a new mounted stone such as the Miller 43 or 44. The cervical notch should be cut through the shoulder at the thickest part of the tooth, hence furthest from the pulp. The incisal notch should be placed where the thickness of the tooth permits, say 1/16 of an inch, or slightly less, from the incisal edge. In the case of very thin teeth the notch must be placed further away in order to find sufficient thickness in which to make the proper preparation.

"Three grooves are now cut vertically, with their bases at the floor of the respective notches, and extending incisally, one groove from the cervical notch about its center and two from the incisal notch, one at each approxi-

Fig. 265

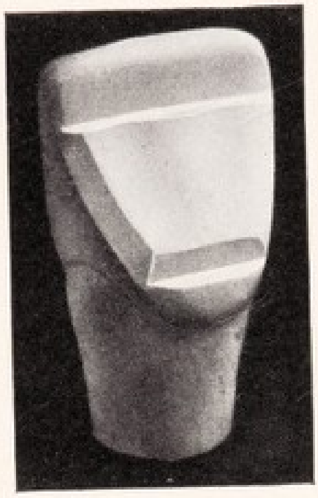


Fig. 266

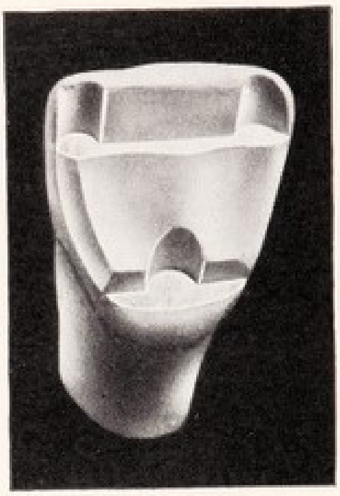


Fig. 267

Fig. 265. Showing lingual approximal slice Fig. 266. Showing slice and notches

Fig. 267. Showing slice, notches and grooves

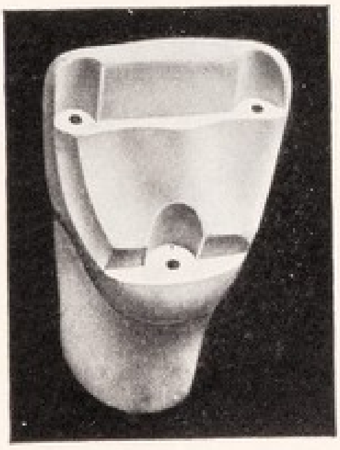


Fig. 268A

Fig. 268B

Fig. 268A. Showing completed preparation

Fig. 268B. Showing completed preparation with slight variation of incisal notch sometimes used for cuspids

mal side. (Fig. 267.) For this purpose new mounted points say No. 29 for upper cuspids and central incisors, and No. 30 for all other teeth, are used. Through the base of each of these grooves is drilled an opening for the reception of a pin. (Fig. 268A and Fig. 268B.) The openings should in every case be drilled in the dentin as near the enamel juncture as circumstances will permit, and for two obvious reasons: one for greater security of anchorage of the attachment; and the other for the greater protection of the pulp. They should be about 1/16 to 3/32 of an inch in

Fig. 269

Fig. 270

Fig. 269. Showing notches and grooves filled with inlay wax

Fig. 270. Showing notches and grooves filled with inlay wax, right half covered with thin film of adhesive wax, with additional layer of 30 gauge wax shown on left

depth, parallel to each other and, in the normal case, parallel to the long axis of the tooth. Where two or more teeth are being prepared, if not perfectly parallel, a mean angle between the angles of the teeth is usually chosen for all of the openings, which are made in every case with a number 1/2 bur. The preparation is now complete.

Construction of the Attachment

"The technique for the construction of the attachment is as follows:—A pin for each opening is made of 24 gauge iridio-platinum wire, tapered at one end, and flattened at the other, and of sufficient length to protrude out of the opening about 1/16 of an inch, or slightly more. Place a small mass of modeling compound in a tray made of thin metal, such as Ash's soft metal number 7, cut slightly larger in every dimension than the lingual surface of the tooth and curved somewhat to its shape. Heat slightly, press to position and remove. This constitutes the primary impression, and is made without the pins in position. With a pellet of cotton, smear the tooth surface very lightly with vaseline, place a pin into each opening, and, from the end of a small instrument, drop on the primary impression a piece of modeling compound the size of a small pea and heated to its melting point. Smear evenly and carry quickly to position

Fig. 271

Fig. 272

Fig. 271. Showing wax complete and ready for insertion of sprue pin

Fig. 272. Showing preparation with completed attachment

on the tooth; chill with cotton roll saturated in cold, but not necessarily ice, water and remove. The pins should come out in the impression. Mix in the palm of the hand with a short, stiff spatula, a small quantity of investment material, and carry this carefully to position on the tip of an artist's brush of small size and good quality, working well around the pins and avoiding bubbles. This investment material is composed of two parts of Weinstein's Cast Clasp Investment, and one part of Brophy's Imperial, put into a box and well shaken. It should be mixed to the consistency of thick cream, or thin paste. Allowing 15 minutes or longer (it may stand indefinitely) for setting, the tray is removed and the impression and model are placed in water warm enough to be somewhat uncomfortable to the naked hand, and allowed to soften to the point where it loses resistance without becoming sticky. It is then rolled from the model, beginning at the cervical edge. The model is allowed to dry, or is dried in a heater, such as is used for spray bottles. Any slight excrescences, or irregularities are removed. Outline the attachment with a sharp, soft lead pencil. Flow in the notches and around the pins, enough inlay wax to bring the lingual surface to about the normal shape and thickness of its original. (Fig. 269.) Cover the remaining surface with a mere film of wax of any kind, preferably a good adhesive wax. Press to position a piece of Kerr's saddle wax, 30 gauge, though 28 is permissible. (Fig. 270.) Smooth to position with a pellet of damp cotton, trim to penciled outline with keen bladed instrument, fuse the approximal and cervical margins to a feather edge, and trim the incisal edge accurately to the model, leaving no overlap. (Fig. 271.) Insert at any point, preferably near the cervical pin, a sprue wire (victrola needle); mount in a crucible former, invest and cast by any technique used for small castings. (Fig. 272.)

Correcting Occlusion

"When the attachment is cleaned and placed into position and well seated, if it be found to interfere with the occlusion, accommodation may be made by slight thinning of the attachment at points determined by the use of carbon paper, taking care not to cut through. In the case of close bites where this will not complete the occlusal accommodation, the incisal edges of the labio-incisal angles of the occluding teeth should be ground slightly.

"In marking the outline, four margins are to be considered. Usually the cervical is placed far enough beyond the margin of the ledge so as to overlap slightly the tooth shoulder, and form a finished flange. If this overlap carries the margin to, or beneath, the gingival margin, no harm is done, provided it is well finished and not allowed to bring pressure on the attaching fibers. The approximal margin continuous to the space to be bridged, is finished at the labial edge of the slice; the other approximal margin just lingually to the contact point. The incisal margin is finished to the irregular linguo-incisal edge left by the preparation. In very rare instances (generally in the case of the close edge-to-edge bite) it is permissible to bevel the incisal edge and place the margin at the labio-incisal angle so formed. Experience has shown that decay rarely occurs along any of these margins, if the technique of preparation, fitting and finishing are properly carried out.

Principles of the Pinledge Attachment

"The basic principles of all oral restorations are surgery, engineering, art and workmanship. The Pinledge attachment, properly constructed, satisfies all of these requirements. It does not necessitate pulp destruc-

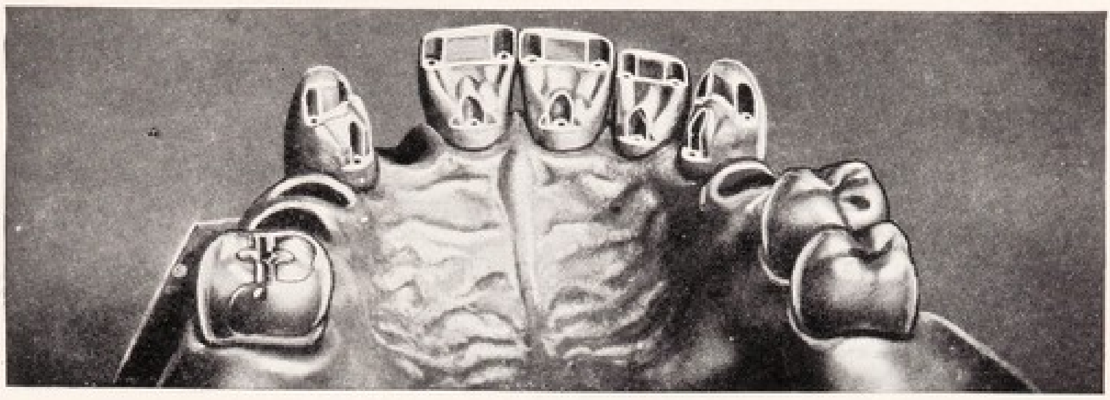


Fig. 273. Preparation of series for stabilizer (Right lateral incisor lost from this model)

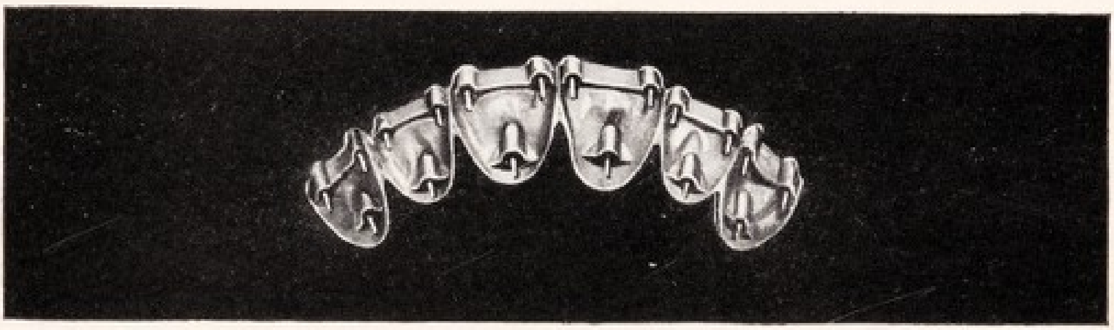


Fig. 274. Completed stabilizer

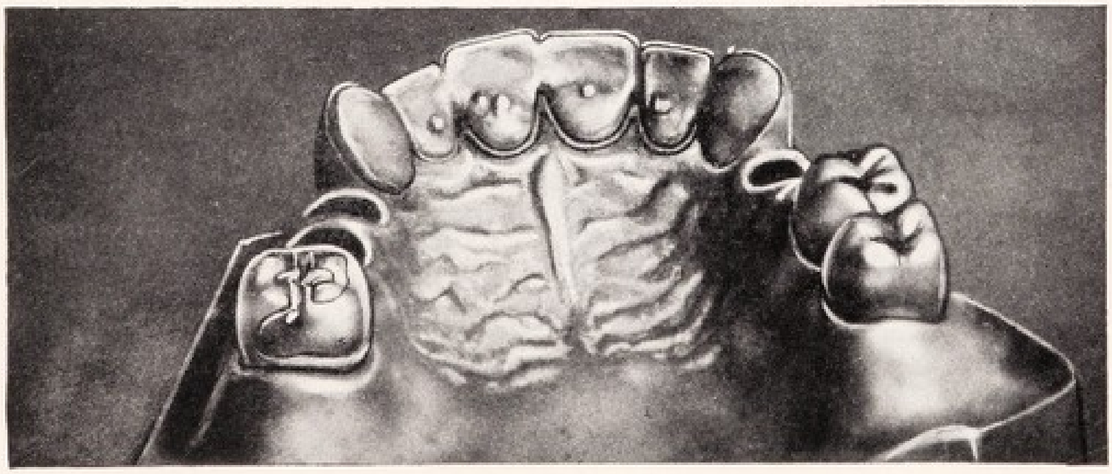


Fig. 275. Stabilizer in position

N. B.—The little knobs seen in the illustration show where the sprue wires were attached, and of course would be polished away.—Editor.

tion, nor endanger its welfare. It gives adequate support to the end of the bridge span which it carries, and provides secure anchorage to the abutment tooth. The formation of the ledges throws the occlusal stress on the body of the tooth, rather than on the pins, which merely hold the attachment in position. Since no metal is brought into view on upper teeth, and practically none on the lower, where the incisal margins are properly beveled, the cosmetic values are not disturbed. In the matter of workmanship, it is simple and easy of construction, and with many variations (which may be made by the individual operator) from the technique described, it lends itself to every man's ability and opportunities.

Precautions

"Common faults as observed, especially in beginners, is misplacing the notches, grooves and pin openings, the cervical notch being placed too far incisally from the shoulder; the incisal notch too far cervically, and the incisal groove and pin openings too far away from the approximal wall, bringing the openings dangerously near the pulp.

Uses

"The Pinledge attachment was designed as a primary bridge support. In this service it has sufficient strength and gains sufficient anchorage to take full advantage of the strength inherent in the tooth on which it is used as a bridge support, and in these capacities serves every purpose rendered by any attachment which may legitimately be used on anterior teeth. Its uses have been extended, however, to include numerous other functions. Amongst these are; First:—as a secondary bridge attachment, for the purpose of including additional teeth in the foundation; Second:—as an aid in the retention of synthetic porcelain in cases of extensive decay, fracture, attrition, etc., where such restorations need anchorage greater than that afforded by the tooth walls. Used in this way it not only affords increased anchorage in the cavity, but on its lingual side gives protection against occlusal stress that might otherwise fracture, or dislodge the synthetic restoration; Third:—as a protection where the lingual surfaces of upper anterior teeth, worn by attrition, need only protection; Fourth:—as an aid in postòperative stabilization in cases of periodontal disturbances. (See Figs. 273, 274 and 275.) In such cases it is used in series, the terminal attachments being anchored, where conditions will admit, in secure teeth: Fifth:—in the case of the elongating tooth where, notwithstanding adequate bone support, the tooth continues to elongate unless some mechanical means is provided for its retention. Where such elongation is confined to an individual tooth two Pinledge attachments, the second being anchored to an adjacent tooth, are usually found sufficient; Sixth:—in cases of irregularity in the adult denture, whether through elongation, displacement in any direction, or torsion, where some permanent means must be used for retention after correction. In such cases the Pinledge attachment is used in the construction of the regulating device. When the regulating is complete the attachments, with wires, hooks, loops, etc., removed, are soldered together and become the permanent stabilizer; Seventh:—as an anchorage in partial denture work where the retaining device consists of two parts, one of which must be secured to the natural tooth; Eighth:—as a means of building the lingual cervical wall for anterior teeth which must be clasped, and are found to be poorly shaped for that purpose."

CHAPTER XVIII

The Coördination of the Occlusion

In an earlier chapter the statement was made that traumatic occlusion is a very important and frequently occurring cause of the failure of bridge cases. And it was further stated that the proper time for the elimination of any traumatic occlusion which might be present in the mouth is before the beginning of actual construction of the bridge.

Traumatic Occlusion Defined

Traumatic occlusion is an excessive stress brought to bear on the crown of a tooth, or transmitted to a tooth from a bridge span, or similar prosthetic appliance. This stress acts directly on the pericementum, and it is the ensuing disturbance in this tissue which constitutes the initial step in the development of periodontal disease.

A phenomenon which should be mentioned at this point is that many teeth are to be seen which are in a relation indicating that they are receiving excessive stress, yet these teeth may not, when first observed, exhibit definite symptoms of periodontal disease. The apparent anomaly is explainable on the basis of tissue resistance, which varies in different individuals and at different times in life. Observation by those especially interested in this phase of dental science has been to the effect that few people possess a sufficient resistance to withstand indefinitely a continued traumatic occlusion. The result is that, unless the traumatic occlusion is relieved, there will sooner or later occur, a definite breaking down of the periodontal tissues.

One of the factors which seems to bring about a lowering of resistance, in some mouths, is the insertion of bridgework. Many cases have been observed in which the teeth exhibited no perceptible periodontal disease, in spite of the presence of traumatic occlusion, yet soon after the insertion of bridgework there has been a perceptible inauguration of disease. Most commonly the teeth affected are those which carry the bridge, or with which the bridge occludes. But quite often a similar, but possibly less severe breaking down is to be seen in other parts of the mouth.

It seems but logical then to adopt a program calling for the elimination of traumatic occlusion throughout the mouth whenever a bridge is constructed. Proceeding on this basis it next becomes necessary to decide when this operation shall be performed. Experience indicates a decided advantage in adjusting the occlusal relations of the teeth before the construction of the bridge is begun. This is not universally necessary, but to adopt it as a routine procedure will save many embarrassing moments. The reason is that teeth requiring shortening, or considerable remodeling during the process of coördinating the occlusion, may be directly related to the proposed bridge, either as abutments, or as antagonists. If the bridge is constructed first, it may then be impossible to make the necessary changes in form without weakening the bridge itself, or seriously interfering with its future function. Furthermore, it will sometimes be found that occlusal coördination can only be attained by opening the bite. If this fact is discovered after the bridge has been inserted, it may necessitate remaking the bridge.

On the other hand, when the occlusion is adjusted before starting the bridge case, the bridge is constructed under the most favorable conditions and the dentist is assured that only a slight adjustment of the occlusion will be required, after the completion of the case.

In approaching the operation of occlusal harmonization it will be most helpful to make study models and to mount them on an adjustable articulator with proper reproduction of the patient's mandibular movements. With this as an aid, it can be quickly determined whether opening of the bite will be required, or whether there are teeth present which would need an excessive amount of grinding to bring them into occlusal harmony with the rest of the dentition. These two items constitute the major problems in occlusal coördination in the proposed bridge case. Where extreme grinding would be required the dentist must make up his mind whether he shall devitalize the tooth, or teeth, in question, and then proceed to grind, or whether he shall open the bite. In some cases it may even be necessary, if neither of the foregoing courses can be safely pursued, to extract such a tooth, or teeth. Even this drastic course would be safer, and more in the interest of the patient, than to perpetuate in a bridge case an existing traumatic occlusion.

Study of the Existing Occlusion

Having decided these major points, the cases are next studied to determine how occlusal coördination in the various movements of the mandible may be obtained with the least sacrifice of tooth substance. Attention is first given to the protrusive occlusion. The case is studied to see if a simultaneous contact of one, or more, of the posterior teeth, and of the anterior teeth, can be obtained in the protrusive relation. This is the ideal condition,

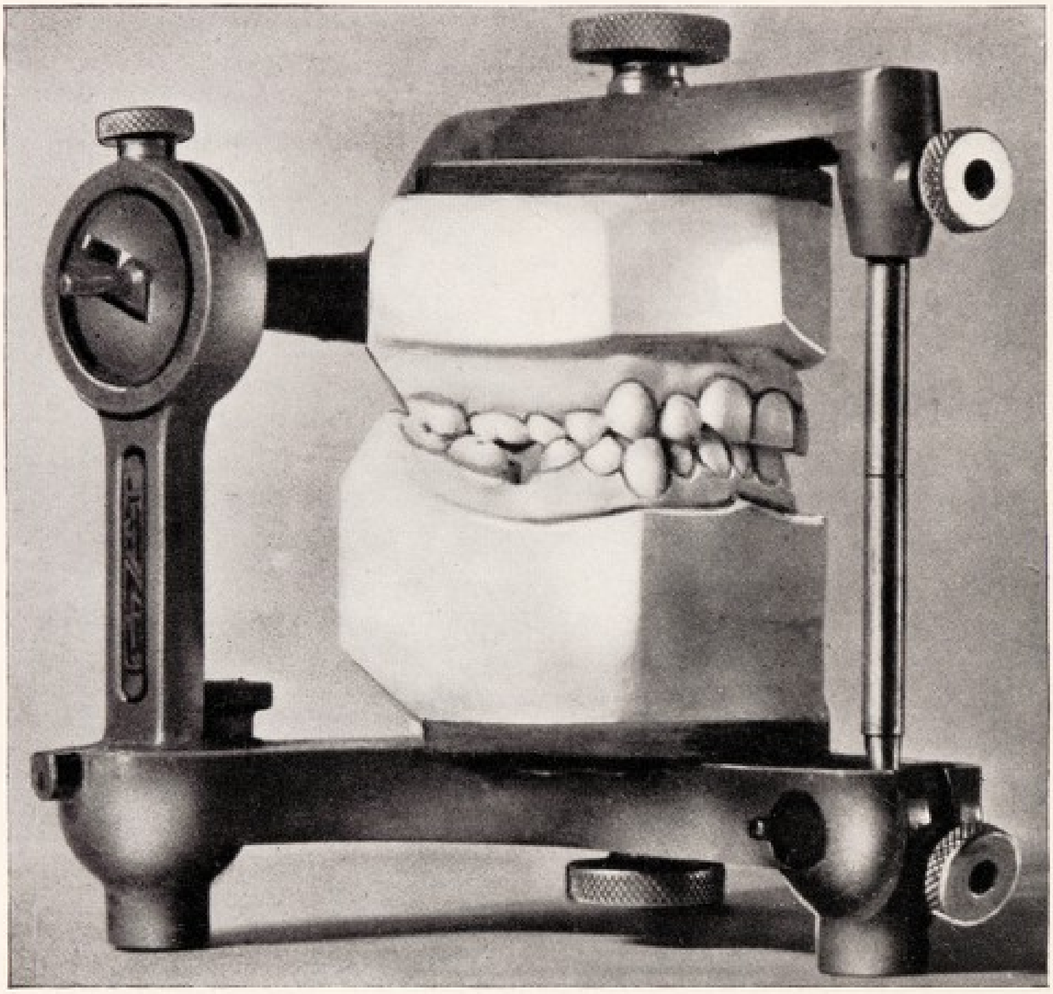


Fig. 276. Case requiring occlusal coördination. Shown in centric occlusion

since it divides between anterior and posterior teeth the stress imposed by the muscles of mastication. In many mouths, however, it will be found that the anterior teeth are capable of withstanding this stress, provided it is divided among a sufficient number of the teeth in that part of the mouth. This means that at least the four lower incisors must make simultaneous contact with the upper incisors in the protrusive position. It is of course, desirable to have included in this contact, the lower cuspids, and even the lower bicuspids, and the corresponding upper teeth.

One of the factors entering into this part of the problem is the length of the clinical crowns of these teeth. When the crowns of either upper, or lower, incisors are naturally long, or where noticeable recession has taken place around these teeth, resulting in a lengthening of the clinical

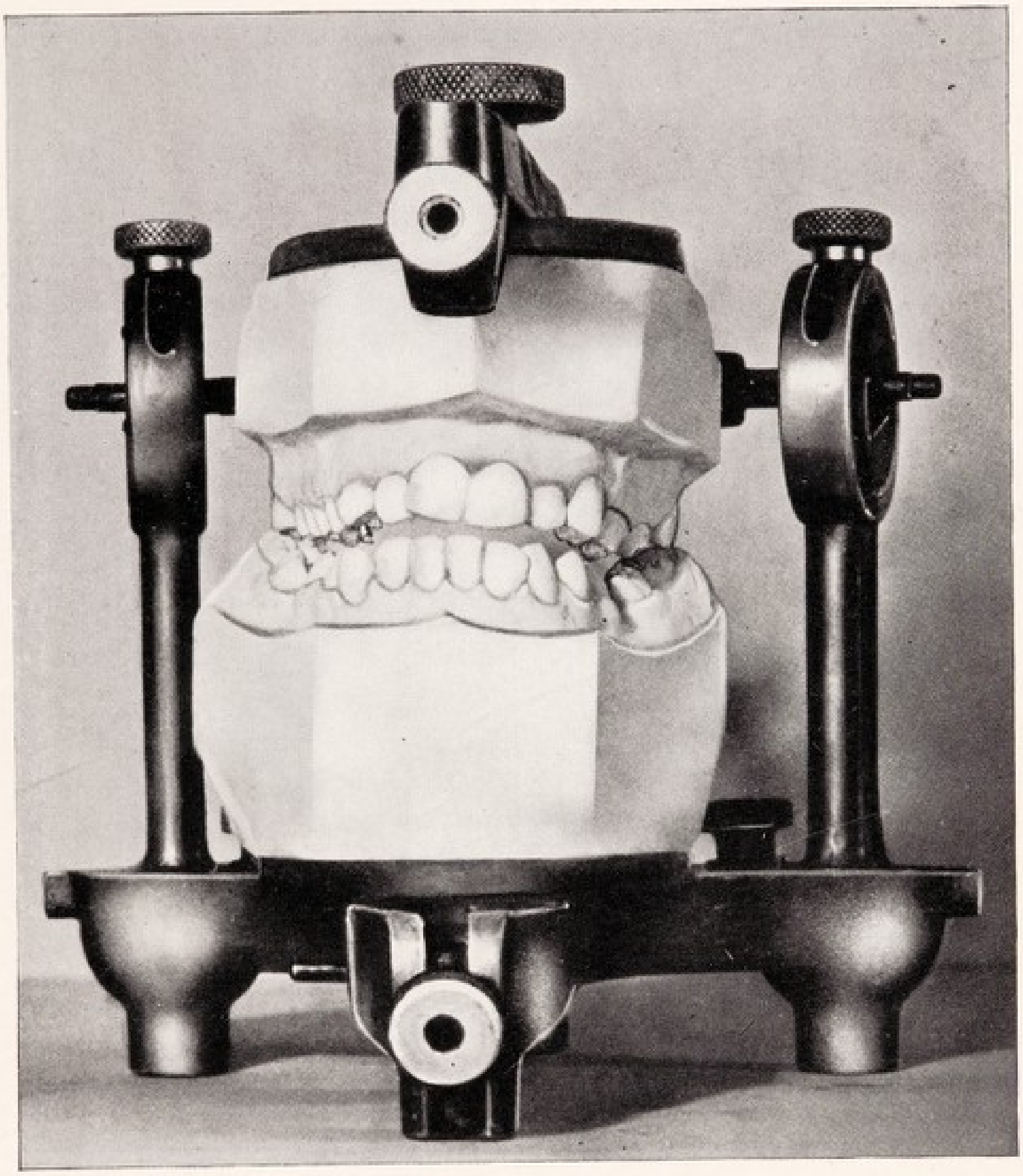


Fig. 277. Case illustrated in Fig. 276, here shown in protrusive occlusion. Note that the only contacts are those of the lower third and upper second molars

crowns, the increased leverage thus produced, introduces a complication which must be carefully considered. Such teeth should always be reduced in length, as a means of decreasing leverage, even though their relations in their original length might have been satisfactory.

After determining approximately the amount of grinding which will be required to produce the desired relation of the anterior teeth, the lateral excursions of the mandible are studied. One of the most injurious oc-

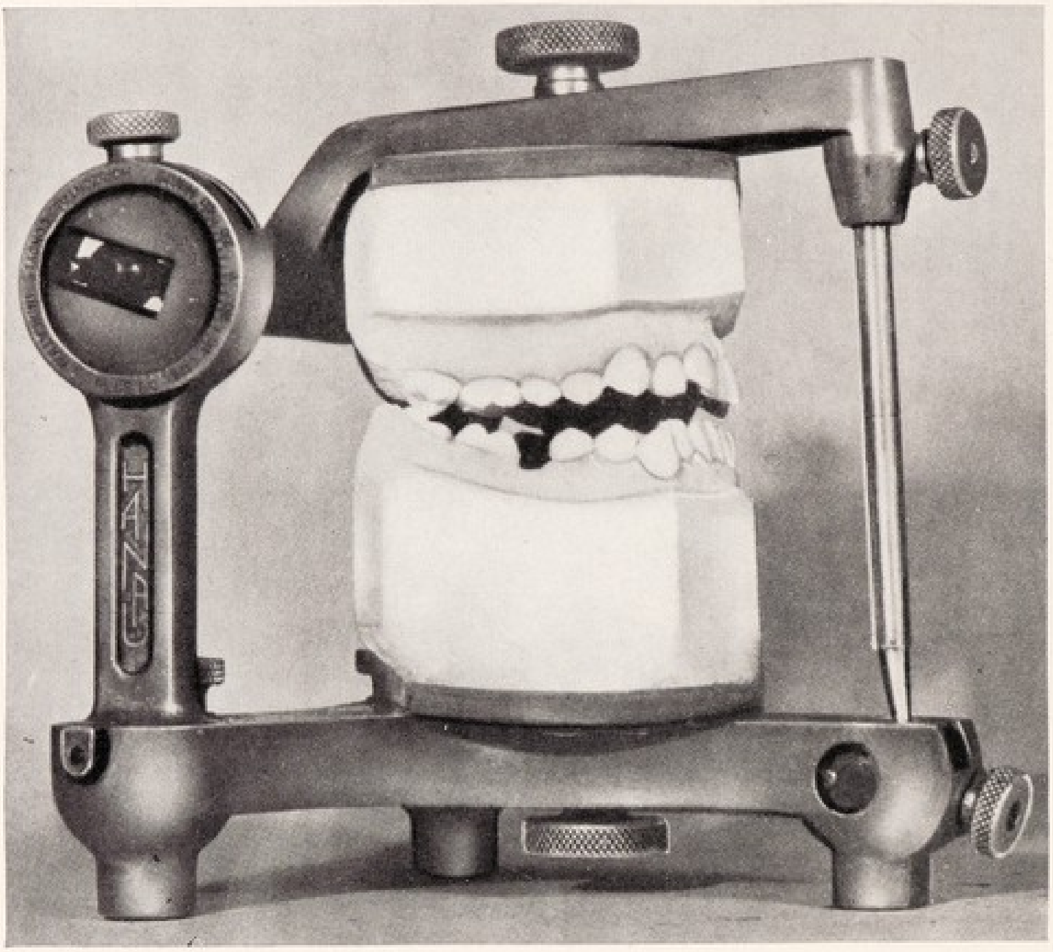


Fig. 278. View of right side of case shown in Fig. 276, here seen in right lateral occlusion. The cusp relations are such that the jaws are increasingly separated during the course of this movement

clusal relations in the posterior part of the mouth is that caused by long pointed cusps in that region. The gliding of steep cusp inclines against one another during lateral excursions, imposes great stress on the teeth involved, and even in the mouth having the strongest alveolar processes it cannot be indefinitely endured. It is therefore wise when adjusting the occlusion, to reduce such cusps with the idea of lessening this severe lateral stress, even when several teeth maintain simultaneous contact in the lateral excursions. In a large number of cases however, it will be found that there is a lack of harmony of the teeth in these lateral movements, and therefore it becomes necessary to shorten those cusps which ride on one another, and which thus take the entire strain of the muscle pull.

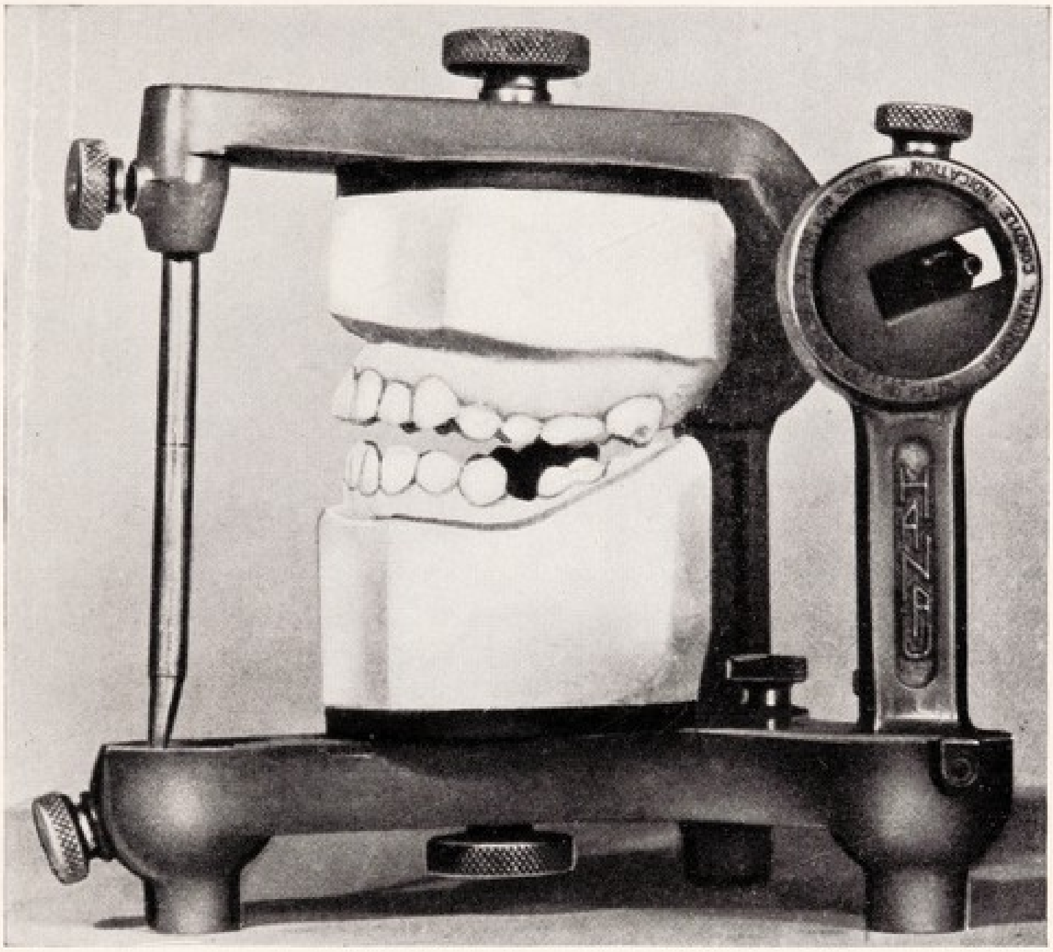


Fig. 279. Left view of case shown in Fig. 276, here seen in left lateral occlusion. The condition is similar to that shown in Fig. 278

When the occlusion has been adjusted throughout the mouth, to conform with the principles just enunciated, it will be seen that the general effect produced is such as will be found in the mouths of adults fortunate enough to have teeth in good alignment, and who have produced natural wear through the exercise of normal function. A distinction is here to be made, however, regarding the character of the mandibular movements in these cases. Those who are able to make free lateral and protrusive excursions of the mandible produce a type of wear characterized by a melting down of high cusps and a shortening of the anterior teeth. These people, as a rule, show little or no periodontal disease, and such disease as may be found will be of the type designated by Box as "periodontitis simplex." On the other hand people who suffer a restriction in the range of mandibular movement due to cusp interference, or to excessive overbite, exhibit a type of wear which tends to accentuate and increase cusp height. Because of this fact, traumatic occlusion becomes increasingly severe in these mouths, and "periodontitis complex" inevitably results.

Technique of Occlusal Coördination

The technique for securing occlusal coördination may best be presented in conjunction with illustrations of casts mounted on the articulator. As indicated before, the adjustment of the protrusive occlusion is given the first consideration. In Fig. 276 there is illustrated a case having considerable irregularity, complicated by the loss of the lower first molars. This figure shows the case in centric occlusion. When the protrusive movement is performed it is found that the contact of the posterior molar relation is such that only these teeth can be brought into contact. (See Fig. 277.) The right and left lateral movements are found likewise to result in contact on the posterior molars only. (See Figs. 278 and 279.)

Grinding is begun in the lower third molar region, and is carried on until it is possible to bring the anterior teeth into contact in the protrusive occlusion. This result is shown in Fig. 280. Attention is next given to the lateral occlusions, the teeth being ground wherever interference is found, until the maximum contacts are obtained. In Fig. 281 we see the right lateral occlusion of the case which is being described, with contact of the upper and lower first bicuspids and of the upper and lower molars. Compare the relations here shown with those illustrated in Fig. 278.

The left side is then adjusted with the similar object of producing contact on as many teeth as possible in left lateral occlusion. The result is shown in Fig. 282, with cuspid, bicuspid and molar contacts. Compare this result with the condition shown in Fig. 279.

If necessary, attention is next given to the balancing occlusions. The teeth are ground so that contacts are made on the balancing sides in both right and left lateral occlusions. (See Figs. 283 and 284.) In many cases it is impossible to secure occlusal contact on the balancing sides of the mouth without excessive grinding of the cusps on the working sides.

It may be well at this point to explain what is meant by "balanced occlusion." This term came into vogue only a few years ago, and apparently was meant to take the place of the more cumbersome phrase, "three point contact," which was a system of contact at three points which would aid in the retention of full dentures. Thus "balanced occlusion" really refers to such arrangement of artificial teeth as will keep them in position, keep them

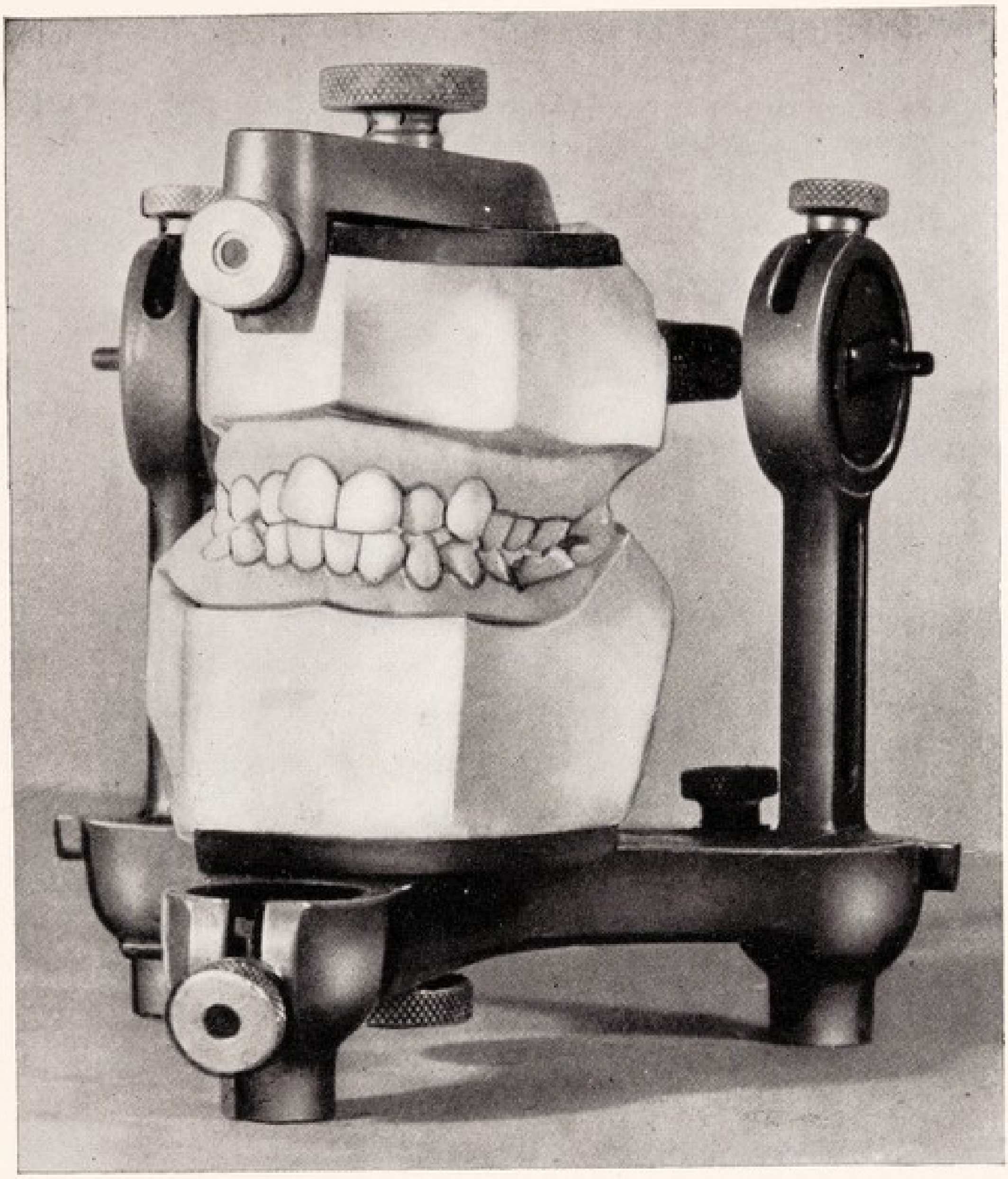


Fig. 280. Anterior view of case shown in Fig. 276. After grinding to permit contact of the anterior teeth in protrusive occlusion

from being "unbalanced" during mastication, and hence keep them "in balance." Prosthodontists, dealing with partial dentures for mouths where the original functional occlusion had been disturbed through extractions and consequent tipping or elongation of one or more of the remaining teeth, conceived the idea of grinding the natural teeth much as they would artificial teeth. Hence the term "balanced occlusion," is used by many,

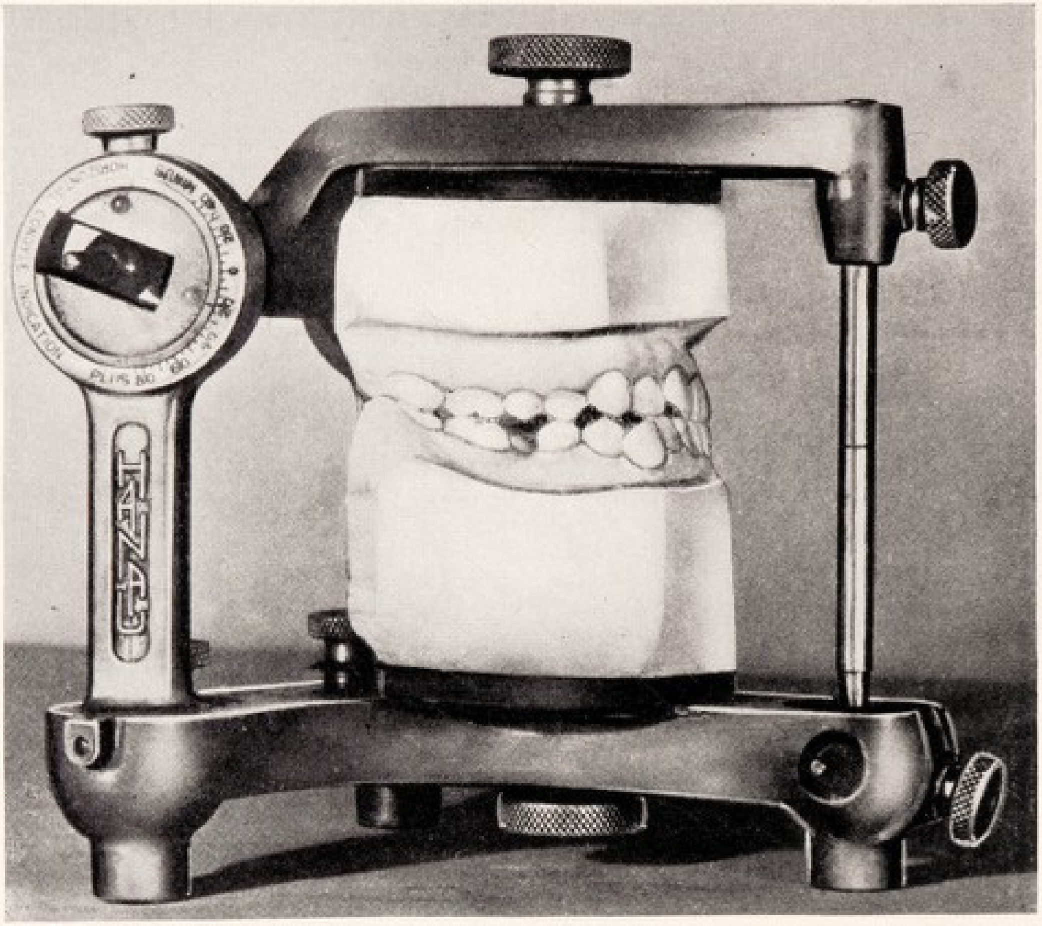


Fig. 281. Right lateral occlusion of case shown in Fig. 276, after adjustment of the right lateral occlusion in the right lateral movement. Compare with Fig. 278

in relation to natural teeth, which is unfortunate, because the natural teeth cannot become "unbalanced." However, the term is in common usage, and until a better is coined the author finds it convenient to use it in a limited manner. Balanced occlusion, as used here, may be understood to mean such arrangement and form of the natural teeth as will enable the patient to masticate his food without cusp interference, and without trauma. The balancing side, means the side opposite to that on which mastication is being performed, and is said to be "in balance," when there is harmonious cusp contact on the balancing side during this function.

While such harmony between the working and balancing sides is desirable it is not always essential. Where the alveolar support is adequate and where there are sufficient natural teeth remaining, it may suffice to

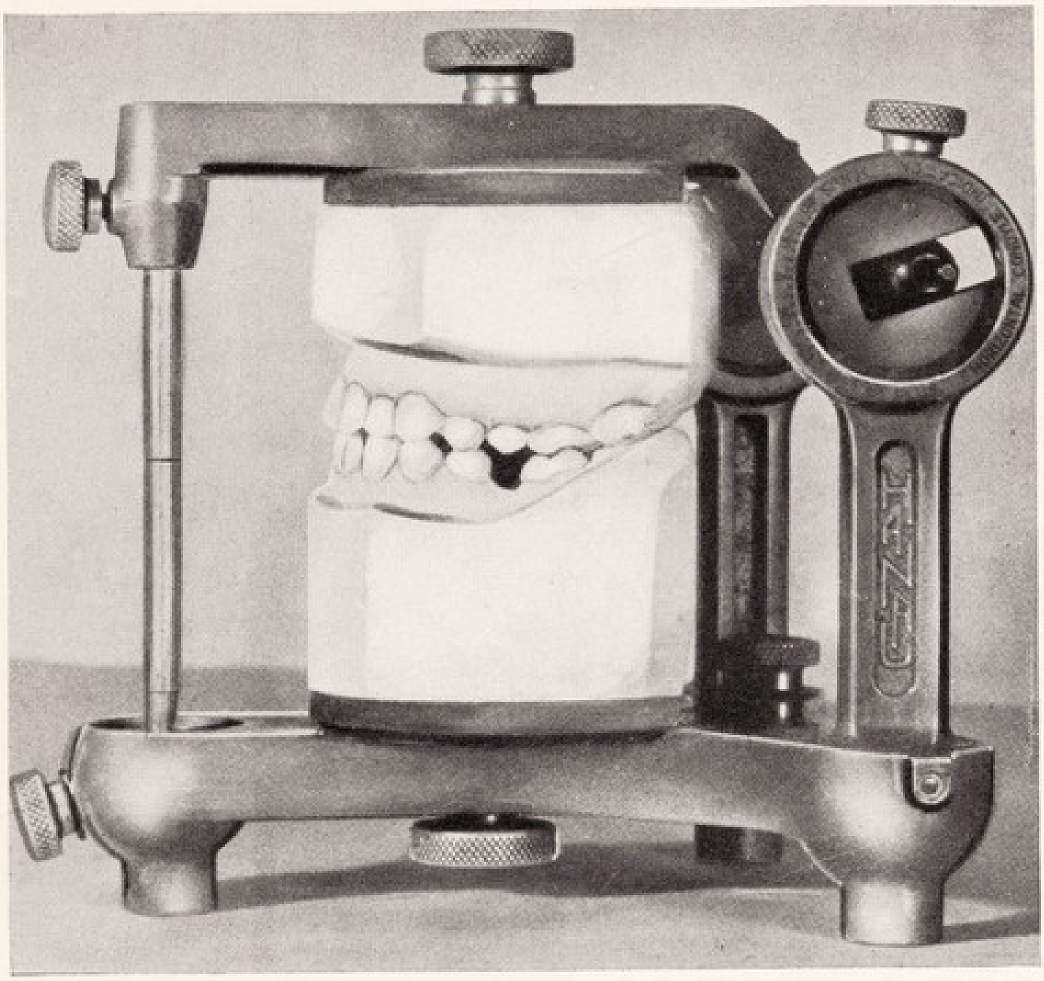


Fig. 282. Left view of case shown in Fig. 276 after adjustment of left lateral occlusion. This illustration shows the left lateral excursion. Compare with Fig. 279

grind simply to the extent of providing harmonious contacts among the teeth of the working side. In the course of securing such adjustment of the occlusion on the working side, it may be noted that some cusp on the balancing side is causing interference. It will usually be found that this is the lingual cusp of an upper molar; less often, of an upper bicuspid. Such contacts are of course reduced, and, if carefully adjusted, will provide a partial balance which may contribute materially to the coördination of the finished case.

Interference such as has just been mentioned is frequently found in bridge cases which have failed to give full masticating efficiency. In such cases it is usually evident upon examination that the abutment teeth have

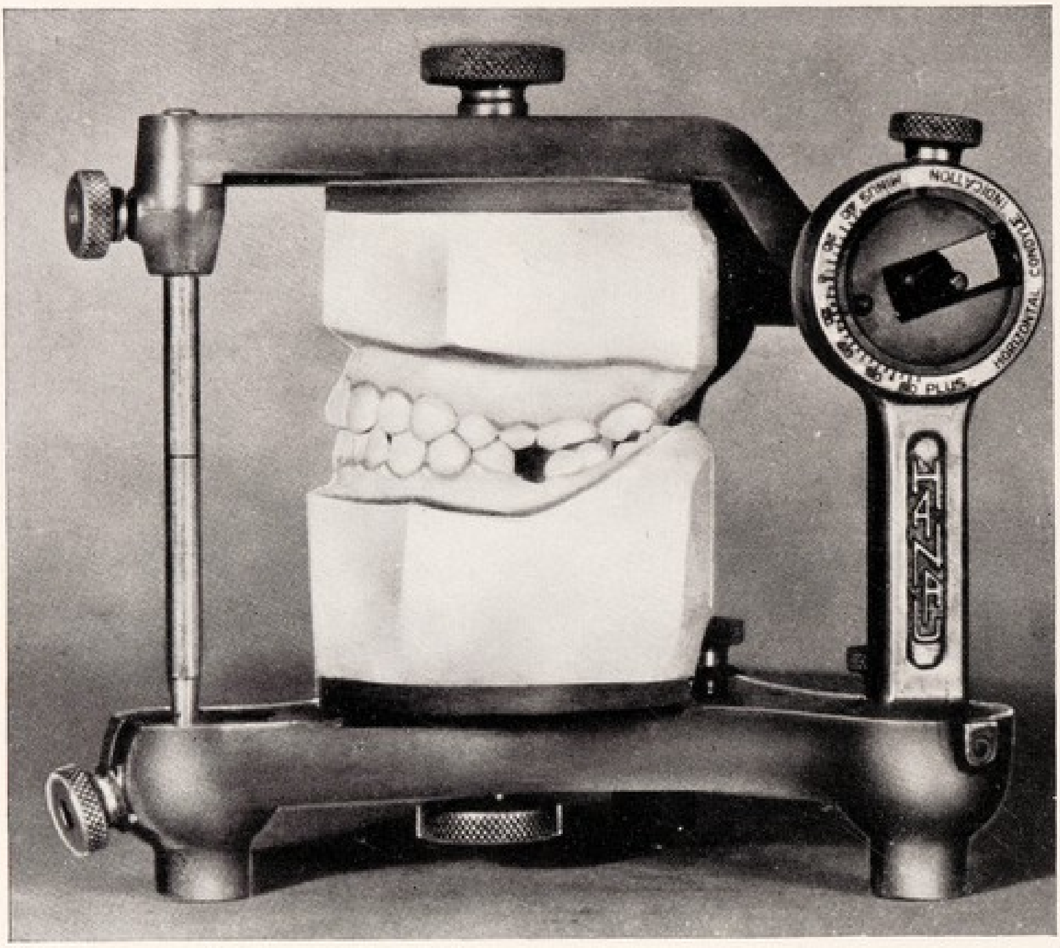


Fig. 283. Left view of case shown in Fig. 276 in the right lateral occlusion. The left side is now the balancing side

had their cusp height considerably reduced during the construction of the case without corresponding adjustment of the cusps on the opposite side of the mouth. The cusps of the bridge pontics are often correspondingly low in their occlusal contour, also. Under these circumstances there may be correct contact in centric occlusion, but when the mandible is moved into the working occlusion for the side on which the bridge has been placed, the occlusal surfaces are lifted apart by the contact of the interfering cusp on the balancing side. Such bridges may be markedly improved in efficiency by reduction of such interfering cusp, or cusps, on the balancing side.

A type of case very frequently encountered is that shown in Fig. 285. This view shows the case in centric occlusion, in which there is little evidence of lack of harmony. When the protrusive movement is performed

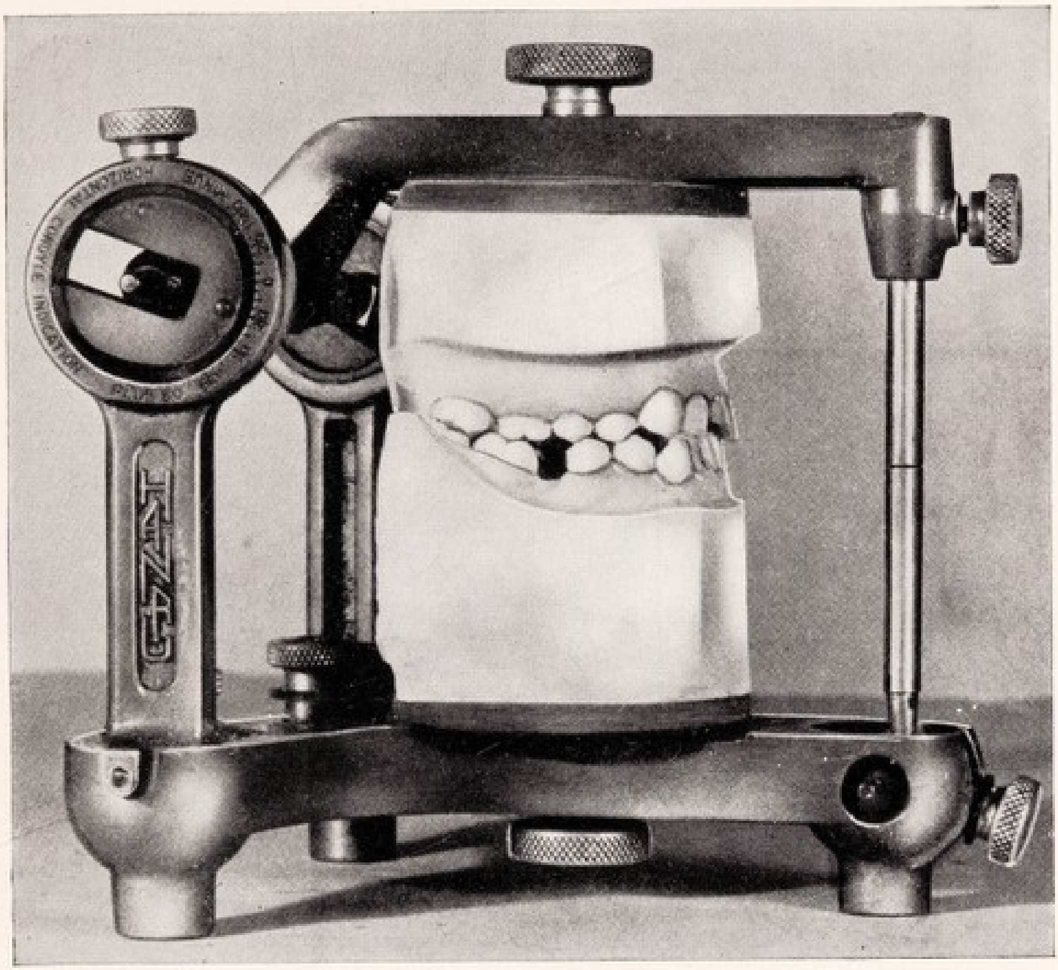


Fig. 284. Right side of case shown in Fig. 276 in left lateral occlusion. This shows the contacts on the right side when it is the balancing side

however, it may be found that only one of the upper incisors is in contact, touching two, or sometimes only one, of the lower incisors. (See Fig. 286.) The correction of such cases is fairly simple, calling for the reduction in length of the tooth which was making the sole contact. When such a case is finished it should show simultaneous contact of the four upper incisors with their antagonists of the lower jaw. It will often be found that with a moderate amount of grinding the upper cuspids and sometimes some of the posterior teeth may also be brought into contact in the protrusive relation. (See Fig. 287.) It will be understood that in all cases the right and left lateral occlusions are to be adjusted as previously described.

When the examination of the mouth reveals the presence of an extreme overbite of the upper anterior teeth over the lower teeth a complication is

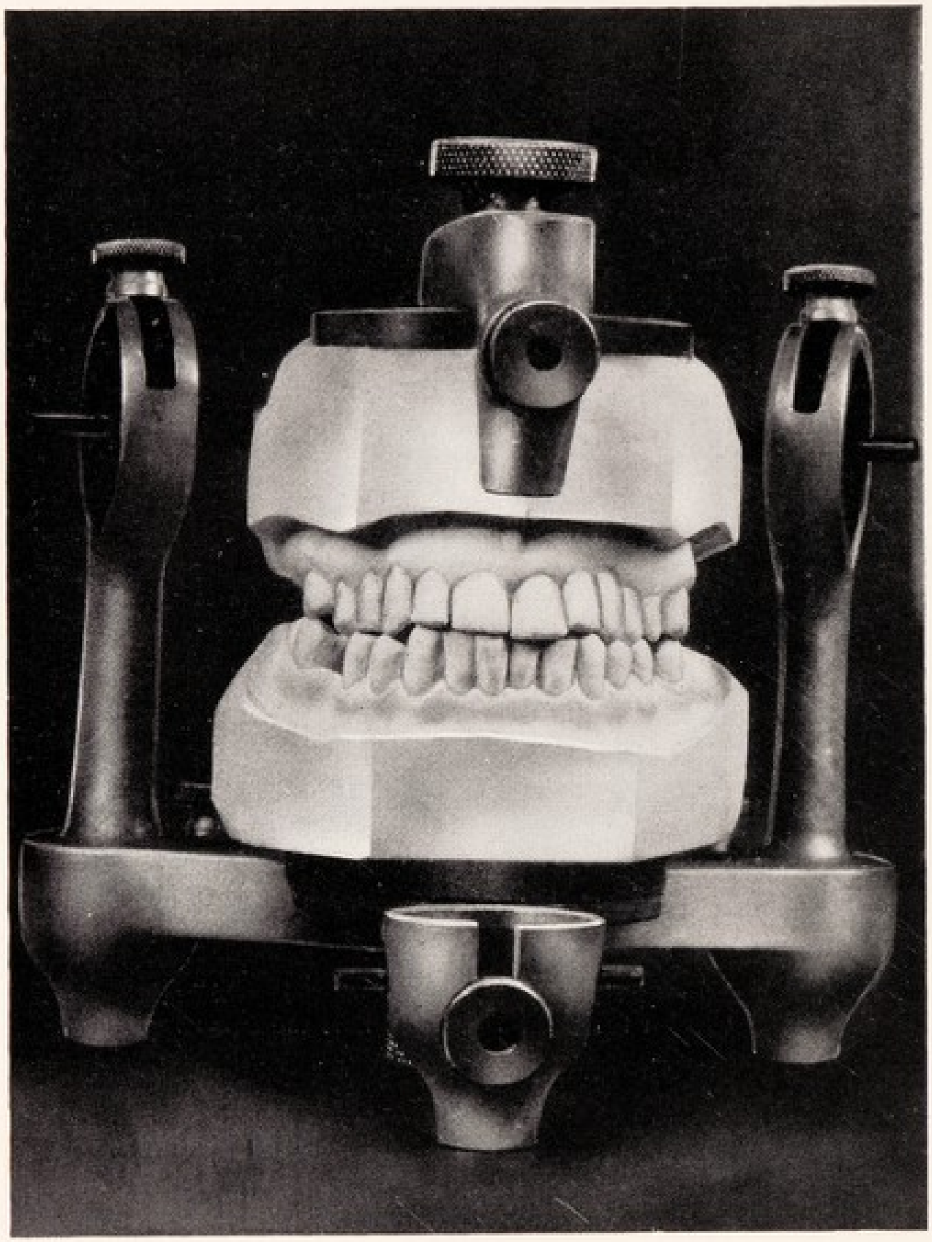


Fig. 285. Case requiring occlusal coördination. Shown in centric occlusion. Cases such as this having but a slight overbite are most easily adjusted to secure ideal results in protrusive occlusion

introduced which is often extremely difficult to eliminate in an entirely satisfactory manner. In such cases the protrusive movement of the mandible lifts the posterior teeth so far apart that balance in the protrusive position cannot be attained except at the expense of excessive and injurious grinding of these teeth. This is a condition which induces a severe traumatic occlu-

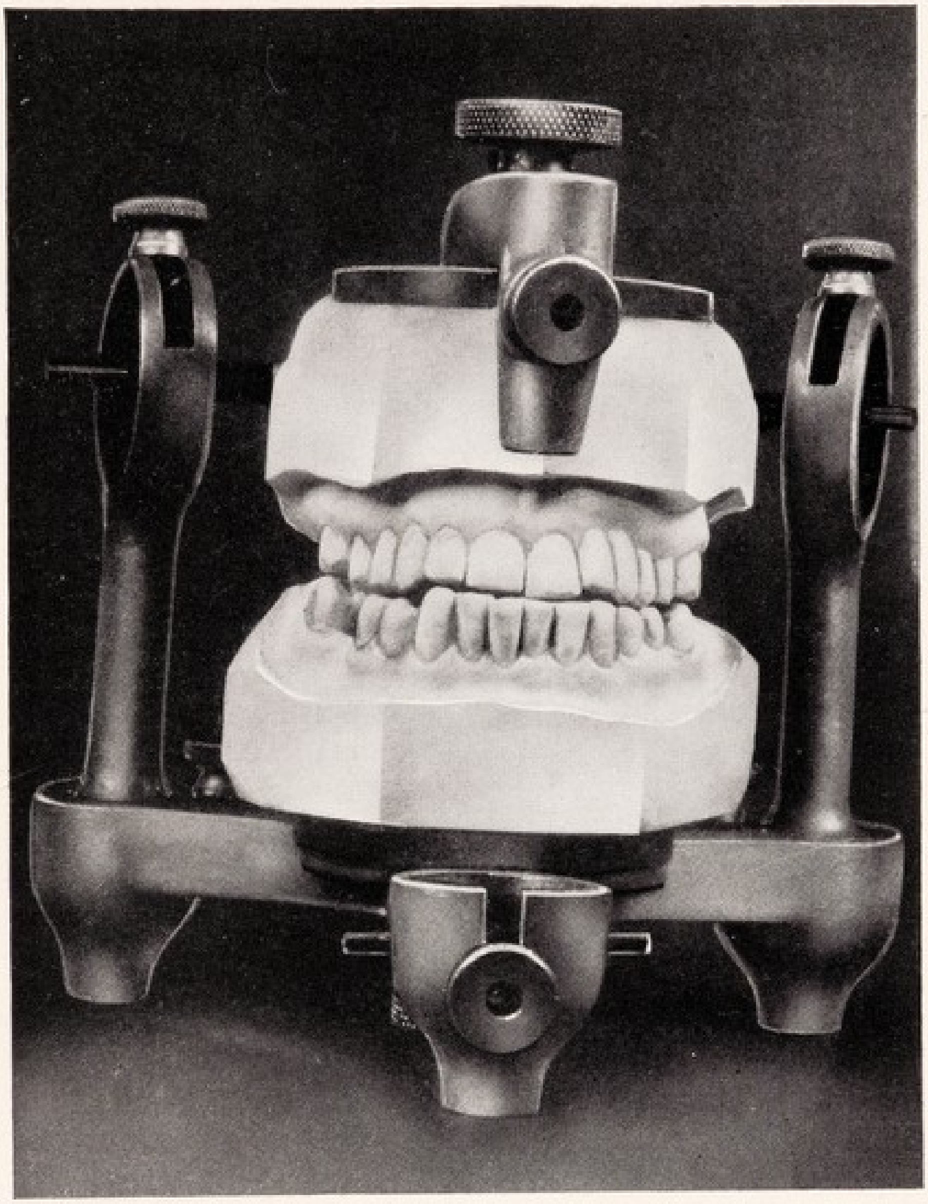


Fig. 286. Case shown in Fig. 285, here seen in protrusive occlusion. Note that the only contact is that made by the upper left central incisor with the lower left central and lateral incisors

sion and therefore commonly leads to periodontal disease of the complex type. Periodontists recognize such cases as presenting difficulties in treatment which are frequently insuperable, except through the aid of the orthodontist.

A case illustrating such a condition is shown in Fig. 288. In this case the extreme overbite of the anterior teeth renders it difficult to secure satis-

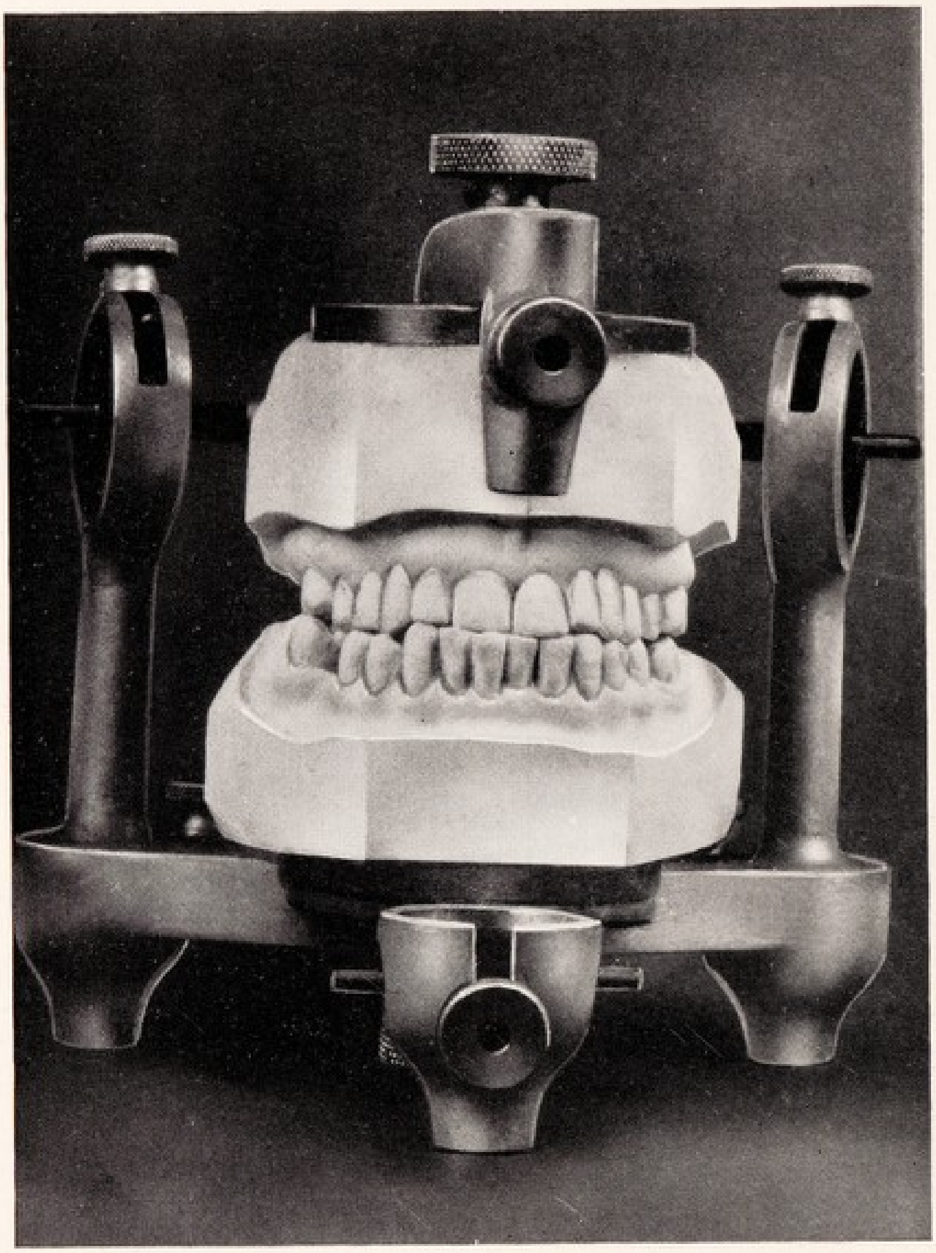


Fig. 287. Case shown in Fig. 285 after adjustment of the protrusive occlusion. Note multiple contacts in anterior and posterior regions

factory protrusive occlusion. In such cases also, there is very frequently found an interference in the anterior region during right and left lateral movement which complicates the adjustment of these occlusions. Fig. 289 shows the teeth lifted completely apart to illustrate the extent of the overbite. It is usually found in such cases that the patient does not habitually use the full protrusive occlusion when incising food. Such a contact would

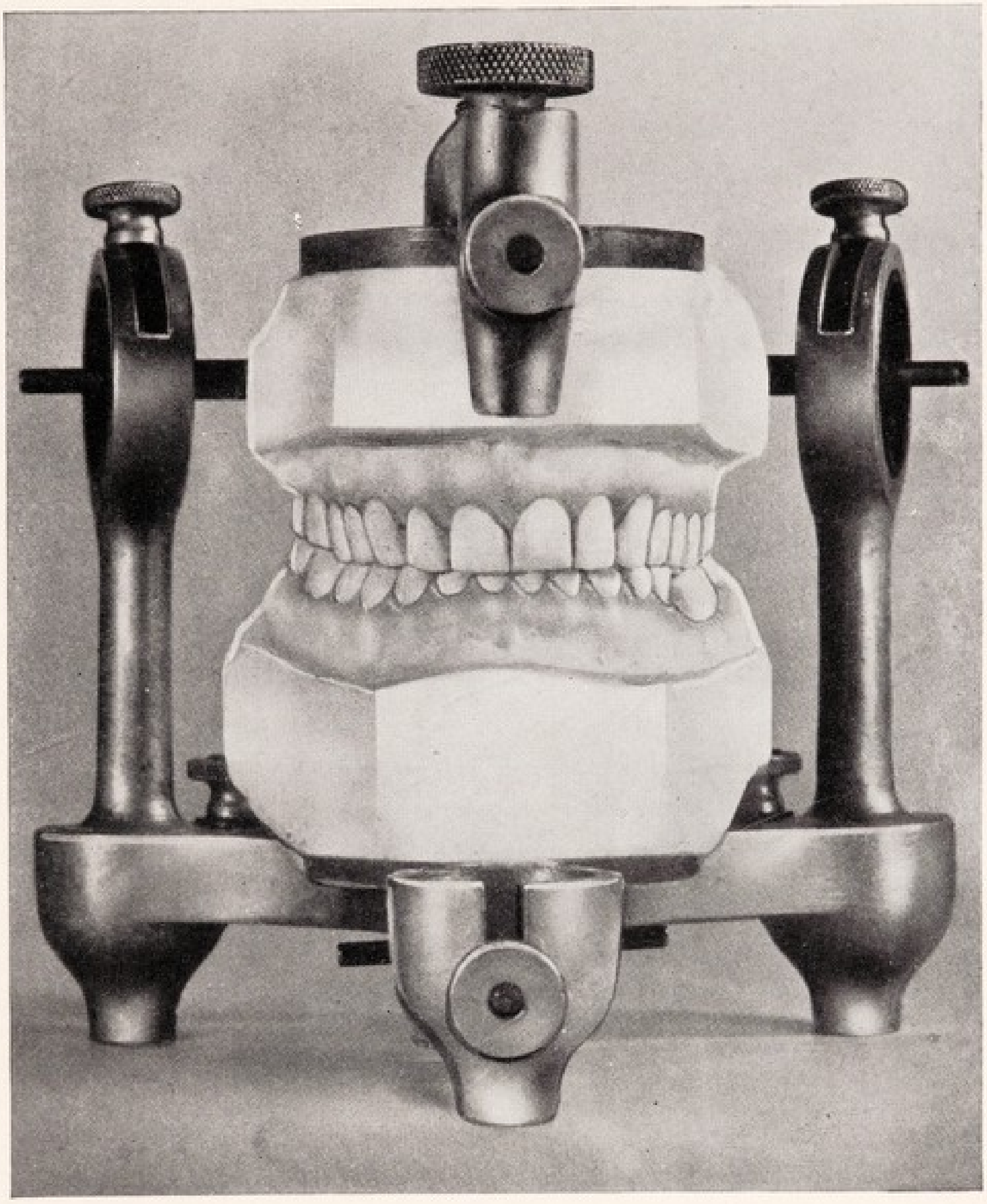


Fig. 288. Case exhibiting extreme overbite of the anterior teeth requiring occlusal coördination

lift the posterior teeth far apart and impose an excessive stress on the anterior teeth. (See Fig. 290.) When such cases are complicated, as often happens, by the occurrence of a Class II malocclusion, the patient not only fails to use the edge to edge bite of the incisors in protrusive occlusion, but frequently finds it impossible to produce the usual protrusive movement,

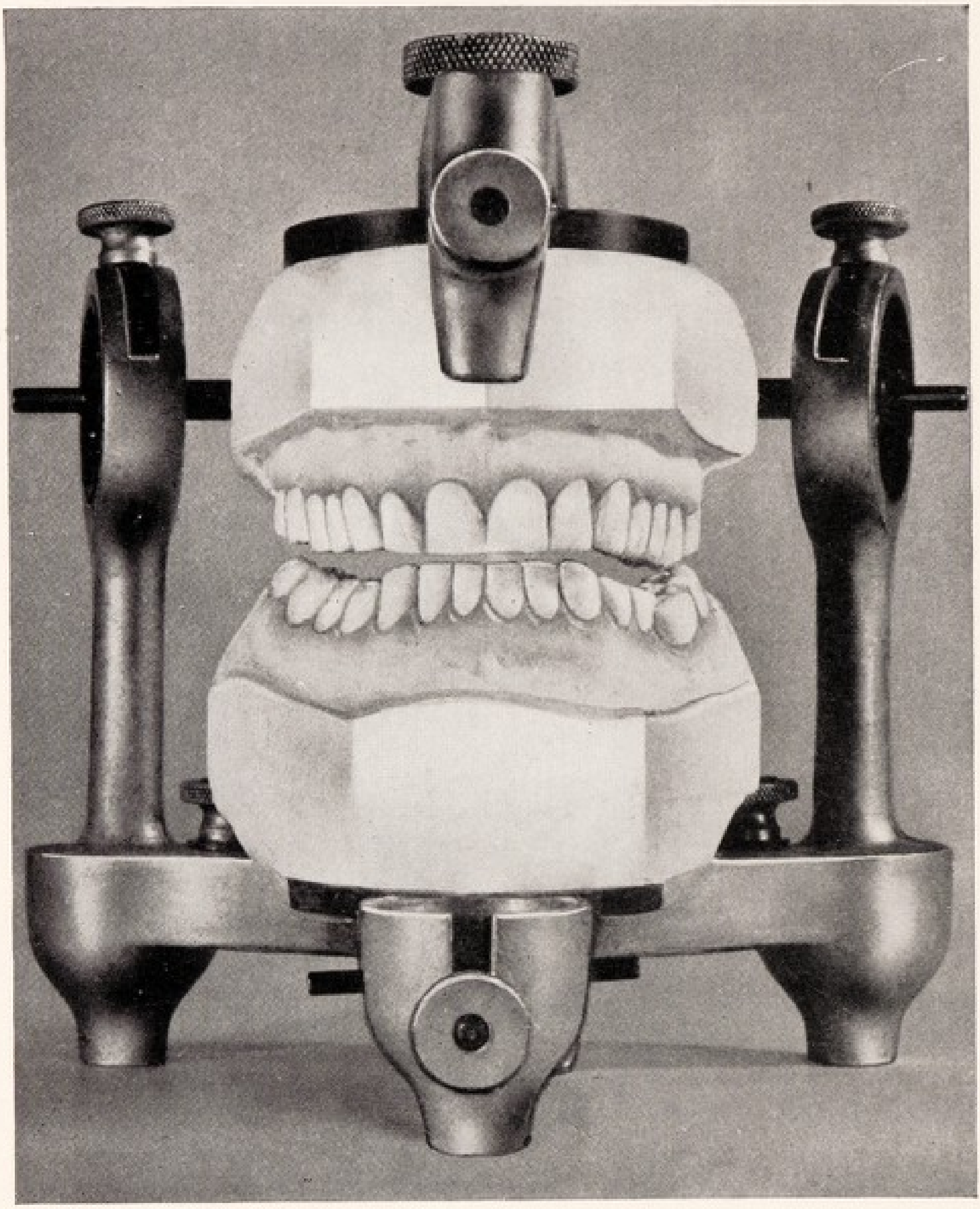


Fig. 289. Case shown in Fig. 288 with the jaws lifted apart to show the extent of the overbite

even by a conscious effort. Fig. 291 shows the lingual view of the extreme overbite case shown in Fig. 288. Fig. 292 shows the usual method of incising food in such a case. The patient does not make an edge to edge contact as shown in Fig. 290, but opens the jaws only about 2 or 3 mm. and incises his food by pressing the edges of the lower incisors against the lingual surfaces of the upper incisors.

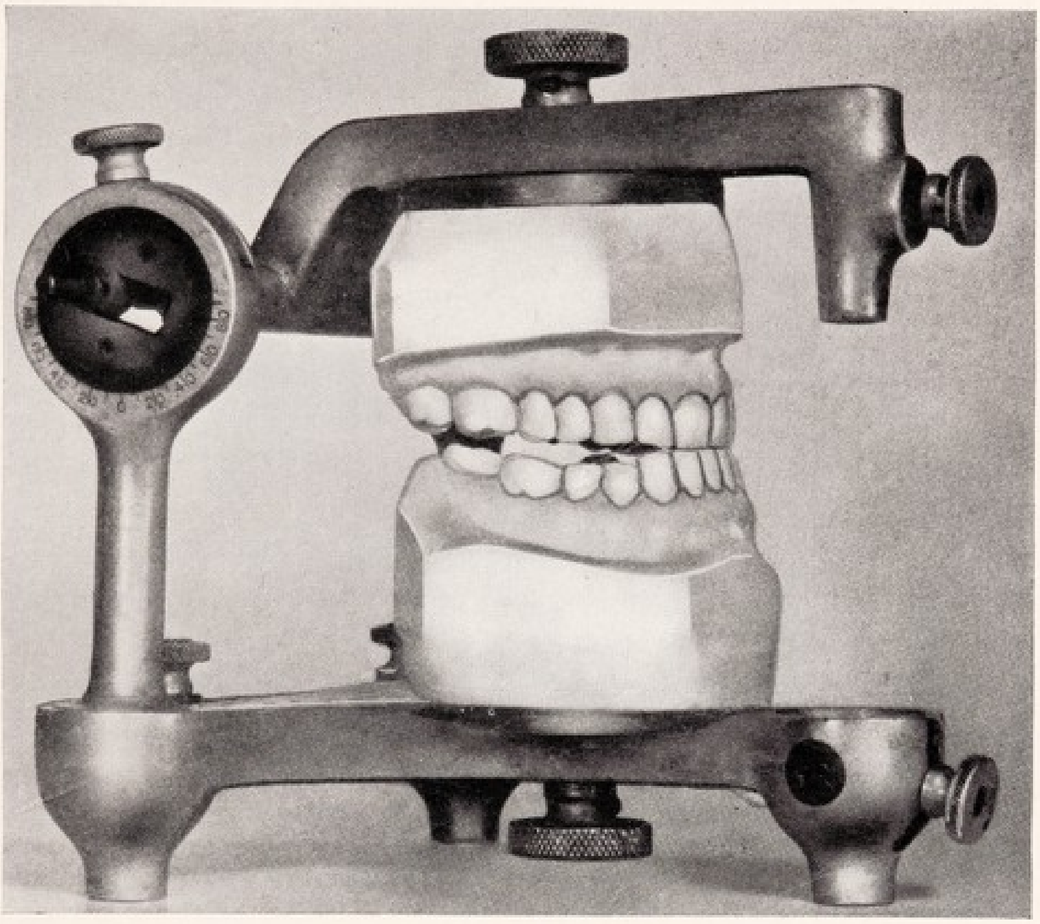


Fig. 290. Right side of case shown in Fig. 288 illustrating the extent of opening in the posterior region when in the protrusive occlusion to produce edge to edge contact of the incisors

In the adjustment of such cases it is feasible only to provide for simultaneous contact of the labial surfaces of the lower incisors with the lingual surfaces of the upper anterior teeth. It will also be found in these cases, that there is a limited range, at best, to the right and left lateral excursions, this being at most 2 mm. or possibly 3 mm.

It may be of interest to consider here briefly the factors which have lead to the development of a condition such as has just been described. Nearly all of the cases exhibiting this extreme overbite are found to have suffered the loss of one, or both, of the lower first molars during the early years of the existence of these teeth in the mouth. When a lower first molar is extracted before the other permanent teeth are established in their proper relationship there occurs invariably, unless a space retainer has been inserted, a distal drifting of the bicuspids and of the anterior teeth. This results in the development of a Class II malocclusion and permits the lower incisors to errupt to an excessive degree, the upper incisors usually partaking of a similar movement. The end result is that the lower incisors will be found to extend beyond the cingulum of the corresponding upper teeth, frequently occluding against the gum margin on the lingual side of the upper incisors. Sometimes the upper central incisors will assume a decided lingual inclination which further complicates the situation. Much

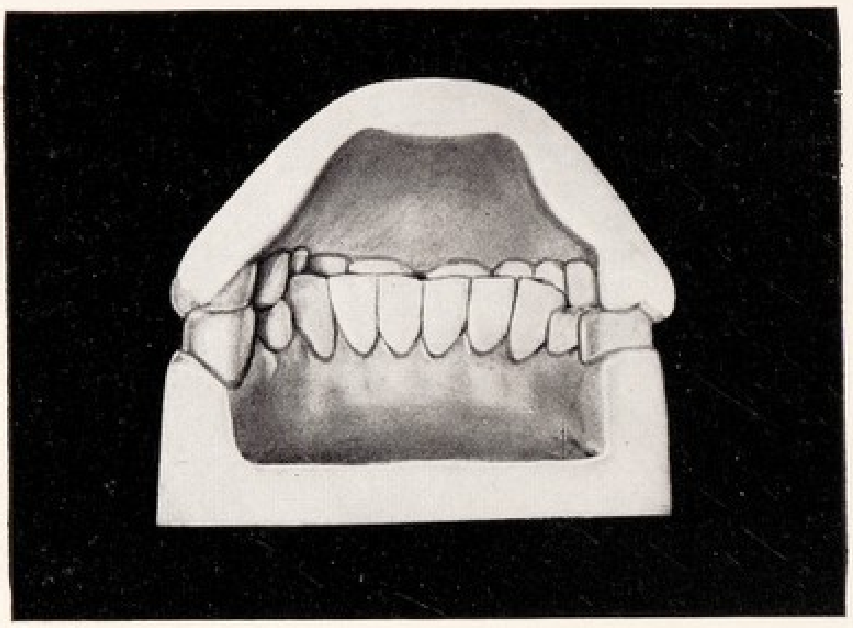


Fig. 291. Lingual view of the case shown in Fig. 288 illustrating the extreme overbite

has been written about the importance of preserving the first permanent molars and this cannot be emphasized too strongly, but it seems to be not fully understood how directly their early loss, especially that of the lower first molars, contributes to the development of periodontal disease in later life, and when the bridgeworker is called upon to make restorations in a mouth in which such loss has occurred, he is facing one of his most difficult problems.

Another type of case presenting difficulties in occlusal coördination is that illustrated in Fig. 293. Here the patient has contact only on the second and third molars, even in centric occlusion. Such a condition imposes a considerable strain on the molars which are in contact, and it is desirable to distribute this stress among more of the teeth. In the younger patient, presenting such a condition, there may be no evidence of harm, but as the patient approaches middle age the traumatic occlusion on these teeth may result in their loss, unless some relief is given. It is almost always possible to improve these cases by shortening the posterior molars thus bringing into contact the first molars and sometimes the second bicuspids. Because of the great amount of grinding required, it may be necessary to extend this operation over a considerable period of time, in order not to produce a shock to the dental pulps by extreme grinding at one time.

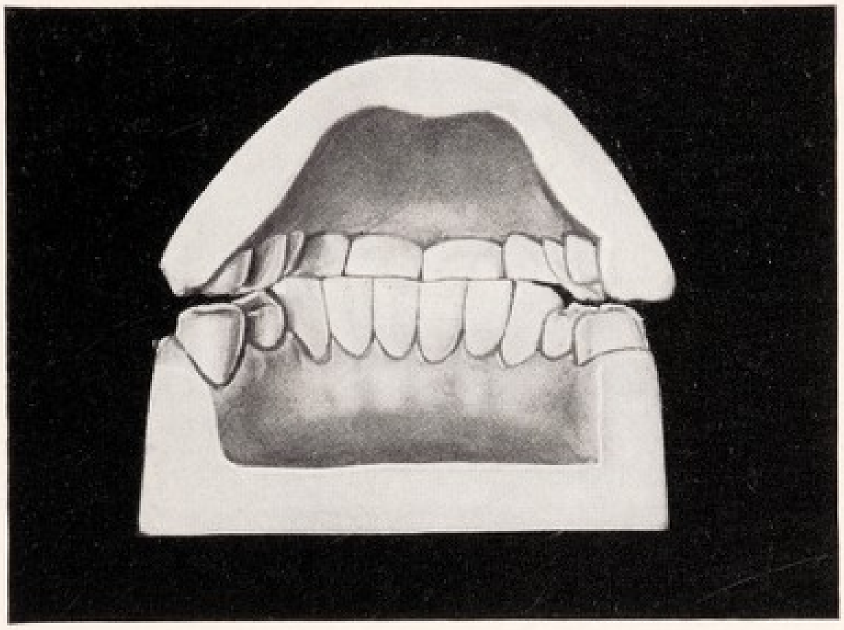


Fig. 292. Lingual view of case shown in Fig. 291 illustrating the usual incising position of the anterior teeth in patients having extreme overbite

Fig. 294 shows the progress of grinding with first molars and second bicuspids in contact. If such a case is found in the mouth of a neurasthenic it may be necessary to cease grinding at this point, because of the burden on the nervous system induced by extensive grinding. In such a case it is permissible to build up the lower first bicuspids by means of onlays, to make contact with the upper teeth. If, on the other hand, further grinding can be performed, it may be possible to get the upper first bicuspids and cuspids into contact with the lower bicuspids, as shown in Fig. 295.

The lack of function of the anterior teeth in such cases, even after the extensive adjustment just described, may result in a loss of tone of their investing tissues, and may lead to periodontal disease. To guard against this possibility, it is well to instruct the patient to exercise these teeth by biting a piece of rubber, such as a lead pencil eraser, for a period of ten to fifteen minutes daily. By this means, together with proper use of the

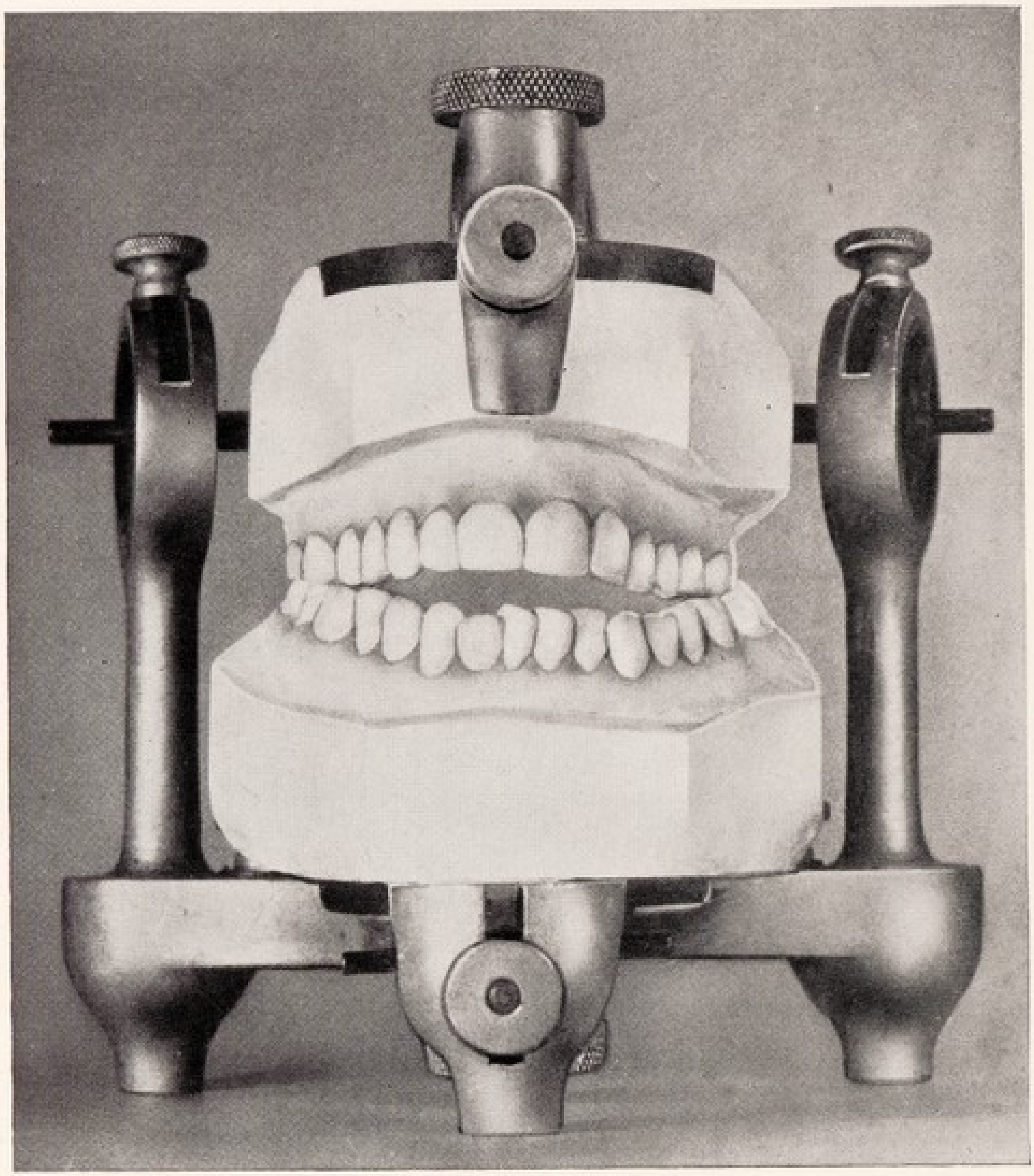


Fig. 293. Case requiring occlusal coördination having contact on second and third molars only, when in centric occlusion

tooth brush in massaging the gingivæ it is usually possible to maintain these teeth in a healthy condition.

There is an almost endless variation in the types of cases showing occlusal aberations. Space will not permit describing all of these. The ones which have been illustrated represent what might be termed fundamental types of occlusal disharmony. Rotated teeth and teeth in improper buccolingual relation complicate each of these types. The operator will find it necessary to study each case and work out for himself the method

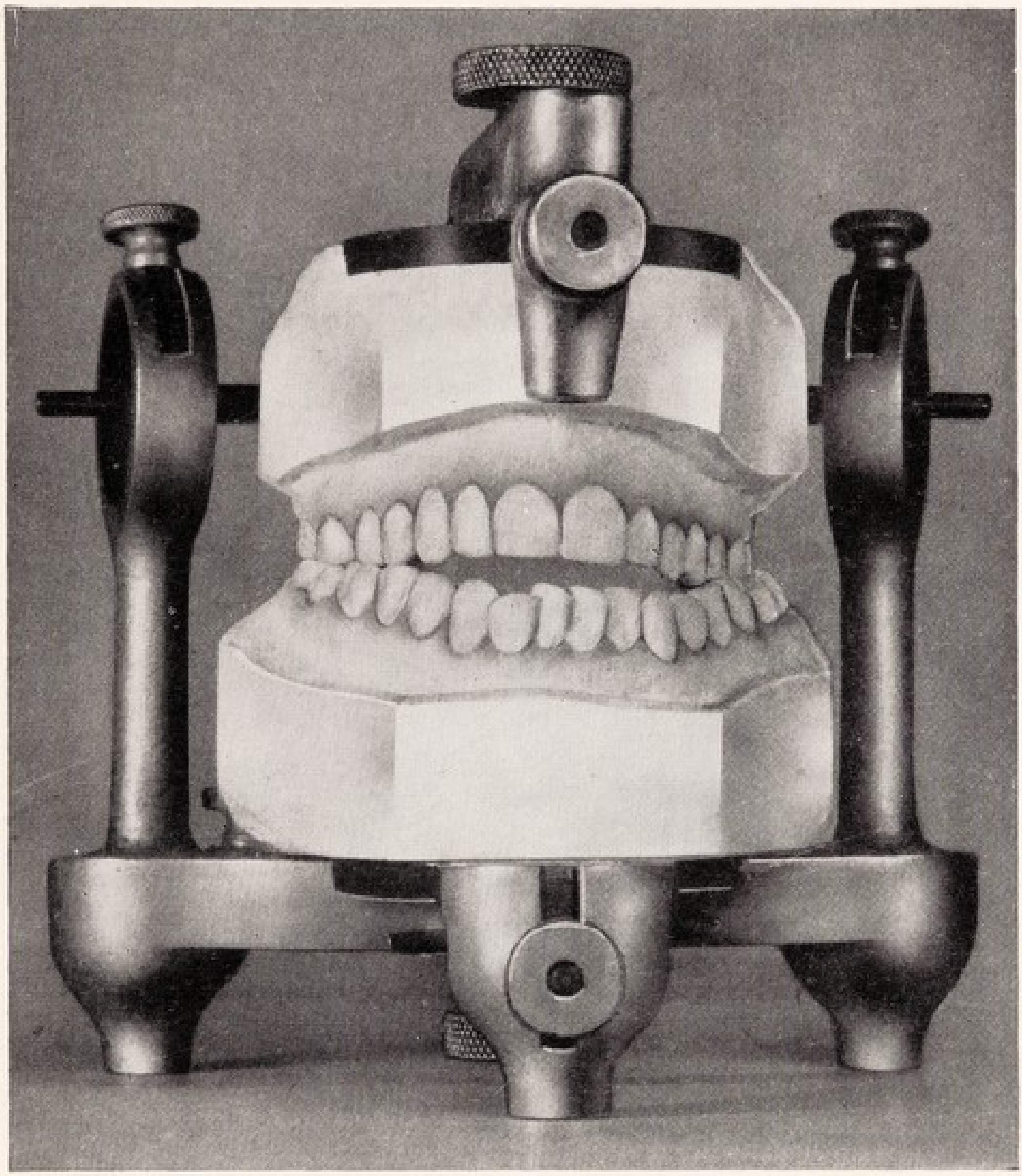


Fig. 294. Case shown in Fig. 293 after partial adjustment of occlusion. Note contacts of first molars and second bicuspids

for the correction of that case. But it will be found that the principles which have been laid down in this chapter, are applicable to all types of cases.

Final Tests of Correction of Occlusion

The steps in coördinating the occlusion which have been so far described are performed before beginning the construction of the bridge. After these major adjustments have been made, it will be found, in almost all cases, that evidence of slight disharmony may still be discov-

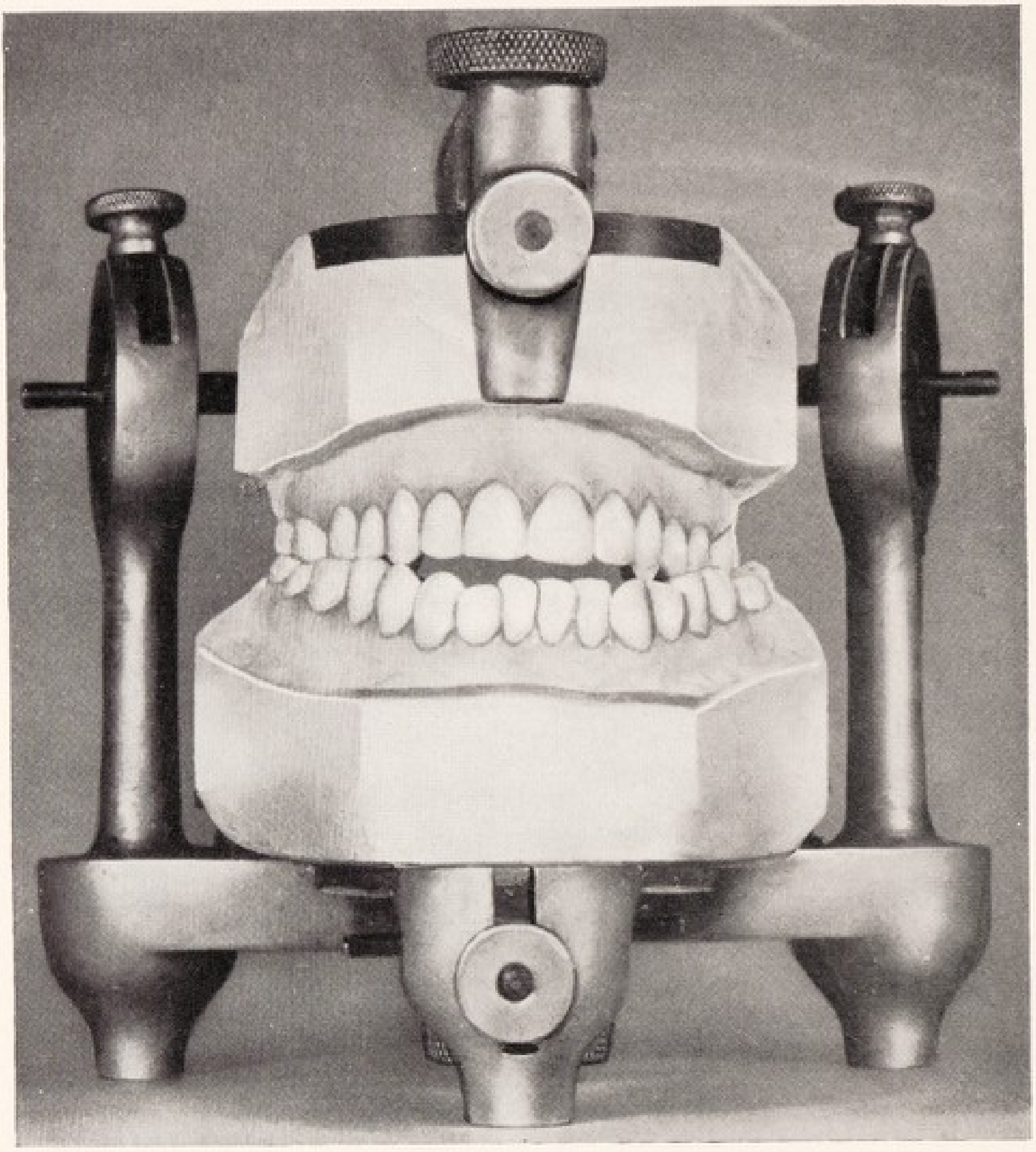


Fig. 295. Case shown in Fig. 293 after greatest possible adjustment of occlusion. Note contact of the upper teeth as far forward as the cuspids

ered. It is not always possible to determine slight differences in occlusal stress by the use of carbon paper alone, because of the variation in resiliency of the peridental membranes of the teeth being tested. Nevertheless the patient, if questioned, will indicate a consciousness of inequalities in pressure and is usually able to locate the teeth which are striking the hardest. Such teeth are then ground very slightly, using the carbon paper markings as a guide, until the patient no longer notices the impact of individual teeth. Failure to make this adjustment at this time will probably cause considerable discomfort to the patient.

After the bridge is inserted, the carbon paper is used to determine any noticeable irregularities in the occlusion in the bridge area. Spots which take a heavy marking are reduced, until the carbon paper markings are distributed as desired. The patient is then questioned as to where the heaviest pressure is felt. Parenthetically it should be stated, that the question is asked as just stated, and not as a query as to whether there is any heavy striking. The reason for this is the psychologic attitude of the patient, who expects to feel a heavy impact on the new restoration and who therefore may not call attention to such stress, unless asked the question as to where the point of heaviest stress is located. When such a point has been localized, the exact spot is identified by means of carbon paper and then reduced. This question and the resulting reduction are repeated until the patient is no longer able to point to any one spot of heavy pressure.

At first thought, it may seem unsafe to place this dependence on the patient, but experience has shown that the tactile sense of the pericementum furnishes the most reliable indicator of the incoördination of the occlusion. The dentist should of course use his discretion as to how far he will follow this guide at any one sitting. But ultimately the occlusion must be so adjusted that the patient is not conscious of striking in any one part of the mouth. Otherwise discomfort and eventually disease will surely follow.

As a final step in this process, abrasive paste should be applied to all of the teeth of the lower jaw and the patient instructed to close and produce the various protrusive and lateral excursions of the mandible. This process of milling is continued until the patient is able, after the paste has been removed, to make these various movements without being conscious of rough spots, or of cusp interferences.

Pulp Hyperemia

One of the phenomena connected with the occurrence of traumatic occlusion, which is not always associated with this condition in the mind of the dentist, is pulp hyperemia, evidenced by extreme sensitiveness to heat, and especially to cold. This reaction is usually found in patients having strong alveolar support offering great resistance to the incidence of periodontoclasia. This phenomenon occurs on single teeth and also on teeth which are acting as abutments for bridges. The irritation produced by traumatic occlusion is transmitted through the pericementum to the periapical region, and affects the pulp, both as to its nerves and its blood supply. Relief of the traumatic occlusion is the remedy for this condition, and will also prove to be of advantage, in the case of bridgework, in protecting the bridge abutments from ultimate periodontal disease.

Another phenomenon, having a similar background, is that of excessive sensitiveness at the neck of the tooth. This is usually due to localized acidity and the relief of the condition depends on determining the source of the acid. In many instances this condition also can be traced to traumatic occlusion, although the possibility of a deranged condition of the alimentary canal, as a causative factor, is not to be overlooked. When the latter condition is eliminated, the correction of occlusion, plus the use of a mild alkaline mouth wash, will usually give relief. When such sensitiveness develops on a bridge abutment, or on teeth occluding with a bridge, the first thought of the dentist should be the relief of the occlusion, since this condition is the most common cause of the localized production of acid.

CHAPTER XIX

The Stationary Bridge Pontic

The term "pontic" is applied to the portion of a bridge which is suspended between the abutments. The pontic ordinarily replaces a missing tooth and is expected to represent it in form, appearance and function. The drifting of teeth, which often takes place when missing teeth have not been properly substituted, may result in almost complete closure of such spaces. Wherever a space exists between two teeth, however, the structure which is interposed is a pontic, in a technical sense of the word.

Contact of Pontics with Soft Tissues

There are several types of pontics in use, each of which has its advantages and indications for use. For the anterior bridge and for the bridge supplying teeth in the bicuspid region, some form of pontic having a porcelain facing is employed. The esthetic demands were responsible for the use of this material in early bridgework. But in late years it has been recognized that porcelain has another advantage which adds to its value. That is the physiologic consideration of the tolerance of the soft tissues for highly glazed porcelain. This fact is so important that it is frequently found to be desirable to utilize porcelain for that part of the pontic which is to make contact with the mucosa of the ridge, even when this material is not demanded for esthetic reasons.

Occlusion of Pontics

In the earlier days of bridgework, the functional demands of the pontic were made decidedly subservient to the esthetic requirements. This frequently resulted in the insertion of bridges which made no provision for the mastication of food, or if they did this, they also introduced the element of traumatic occlusion, with resulting damage to the periodontal tissues of both bridge abutments and antagonizing teeth.

The pontic, as used in stationary bridgework, is a structure which provides the function, form, and as far as possible, the appearance of the missing tooth, or teeth. The most important item is that of function. This implies correct anatomical form, both as regards the occluding surface and also as regards buccolingual measurement. This latter point is frequently disregarded, with resultant disarrangement of the direction and extent of the forces acting upon the bridge. When teeth have drifted after an extraction, the remaining space will be too small to permit the restoration of the original mesiodistal diameter of the missing teeth. No harm is to be expected from this if the occlusal form of the pontic provides for harmony in function with the opposing occlusal surface.

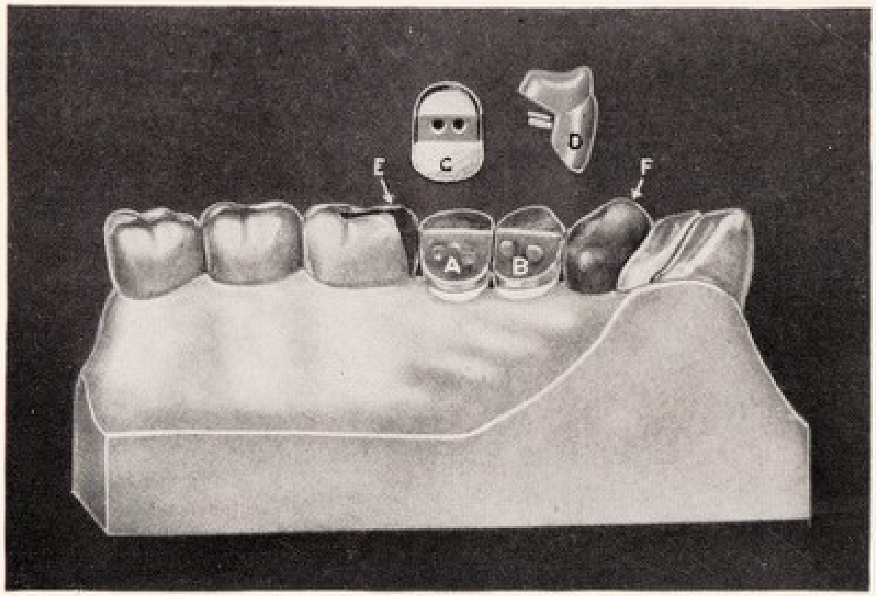


Fig. 296. Upper right posterior bridge illustrating the use of the "Pontopin" tooth. A and B—Gold backings in position but not waxed. C—Individual gold backing showing holes to receive the pins of the porcelain tooth. D—"Pontopin" tooth. This is inverted to show the porcelain (upper part in illustration) which is to make contact with the ridge. E—Mesial-occlusal gold inlay. F—Three-quarter gold crown

Construction of Pontics

The foundation of the pontic is of gold. This may constitute the occlusal surface, with a porcelain tooth so adapted that the porcelain makes the contact with the alveolar ridge. (Fig. 298.) Or the gold foundation may be in effect a backing, on which is superimposed a porcelain facing which restores both occlusal and buccal surfaces. An all porcelain bridge with an all porcelain pontic is not indicated, except for restoring one of the upper incisors, in a small number of favorable cases. In this posterior part of the mouth it is seldom possible to give sufficient strength to make the all porcelain bridge practicable. It may be made with a cuspid and central incisor as abutments, each having a porcelain jacket crown applied; or it may be made with a porcelain jacket crown on the cuspid, and a support at the incisor end provided by a suitable lug resting in a recess cut in a distal gold inlay inserted into the central incisor. (This type of pontic has been described in connection with the porcelain jacket crown in stationary bridgework.)

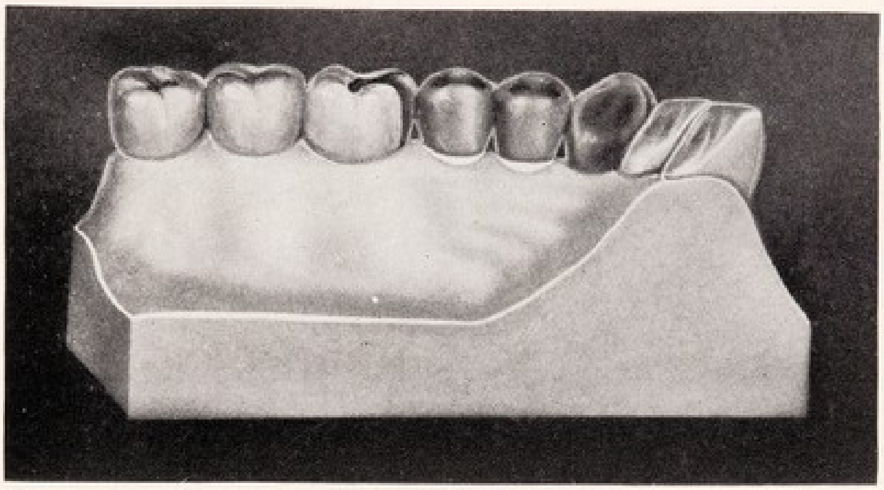


Fig. 297. Illustration of same case as Fig. 296. The cusps and lingual surfaces of the bicuspid pontics have been built up in inlay wax. Note that the porcelain of the "Pontopin" teeth and not the gold makes the contact with the mucosa. Note also the interproximal spaces; the space between the pontics is slight, and while providing for cleansing, does not invite the retention of food

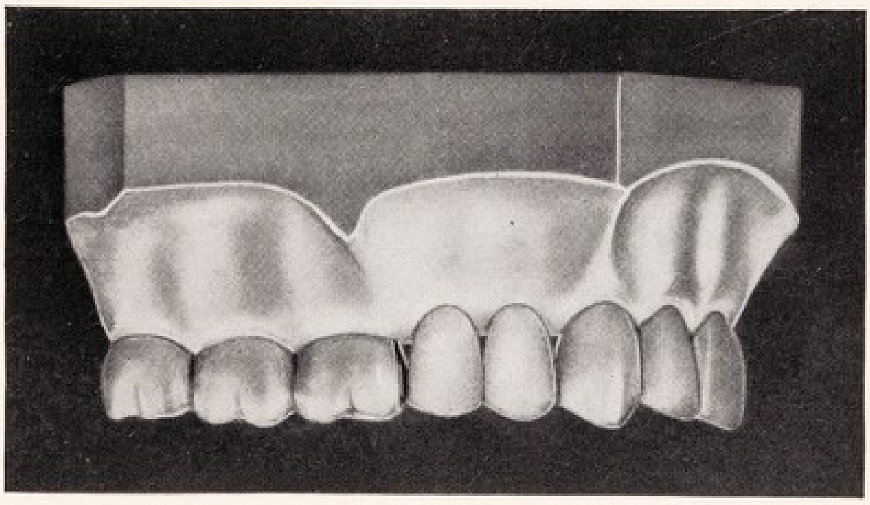


Fig. 298. The buccal view of the bridge shown in Fig. 297

In the posterior part of the mouth, when space will permit, the pontic employing an occlusal surface of gold combined with porcelain is to be preferred. This provides for the union of the pontic to the abutment attachment in a location relative to the abutment which will give the greatest strength. It also makes possible the use of a gold having sufficient malleability to permit natural adjustment to harmonize with functional wear elsewhere in the mouth.

Ney-Oro A-1 gold is recommended for this purpose. As noted before, this also provides for the contact of highly glazed porcelain with the mucous tissue of the ridge, a factor of importance from the health standpoint.

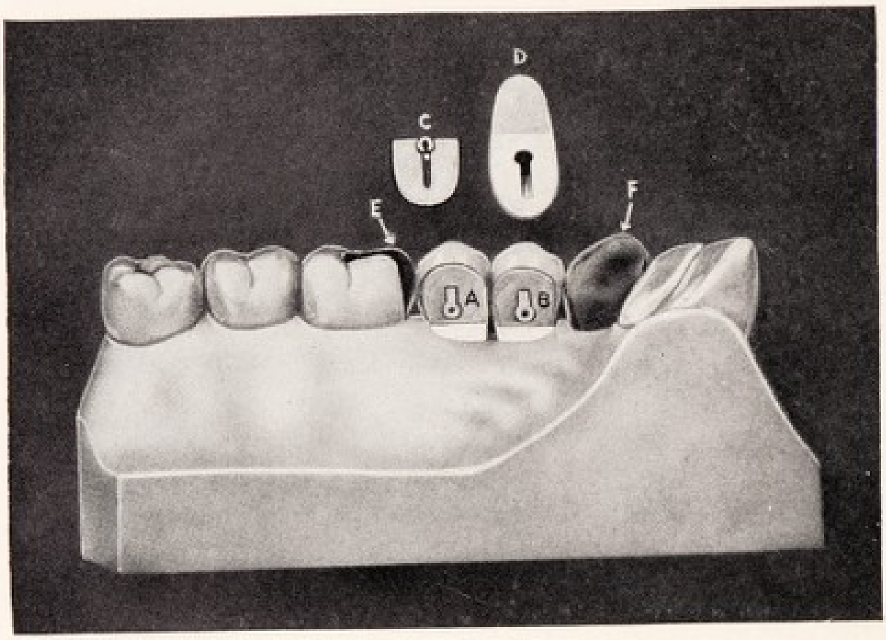


Fig. 299. A bridge similar to the one shown in Fig. 296, using Steele's All Porcelain Posterior Pontics. A and B—The porcelain teeth with their metal backings in place on the cast. C—The metal backing showing the post and rib. D—The porcelain tooth showing post hole and rib slot. E—Mesial-occlusal gold inlay. F—A three-quarter gold crown

Porcelain Occlusal Surfaces

When esthetic consideration must be given the prime consideration, it is necessary to build the gold foundation in such a manner that both the occlusal and buccal surfaces may be restored in porcelain. (Fig. 301.) An occlusal porcelain surface is more resistant to wear than the enamel of the natural teeth. When so employed it is necessary to have the patient return at regular intervals for adjustment of the occlusion to compensate for wear of the natural organs.

When the "bite" is close, the use of porcelain as a part of the pontic, presents a difficult problem. In such cases, it may often be possible to use Steele's facings, in combination with gold pontics. (Fig. 304.)

In the extremely close bite cases, when there is insufficient room for the use of Steele's facings, the gold pontics may be prepared with recesses cut in

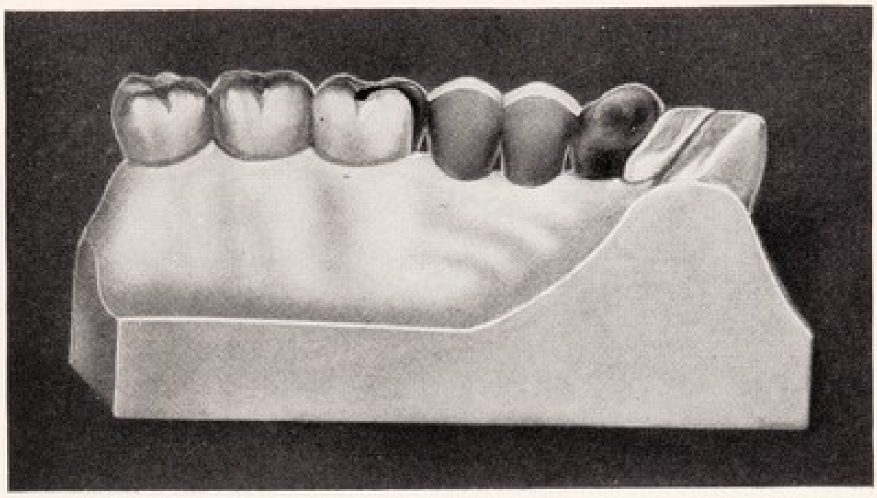


Fig. 300. Case shown in Fig. 299, with the lingual portion of the pontics built up in inlay wax to envelope the teeth and approximate the contours of the original teeth. Note the small but definitely executed interproximal spaces

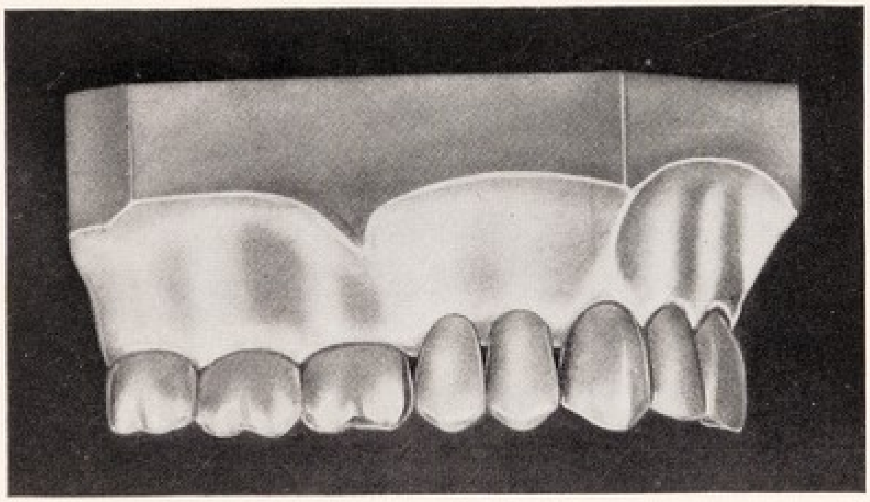


Fig. 301. Buccal view of the case shown in Fig. 300. Note the all porcelain occlusal surface

the buccal surfaces, these being made in the wax before casting. (Fig. 306.) After the casting is completed, porcelain inlays are baked and cemented into the recesses. (Fig. 309.)

Relation of Pontics to the Alveolar Ridge

The relation of the pontic to the alveolar ridge, is a matter of considerable importance. With the exception of the cleansable bridges the pontic

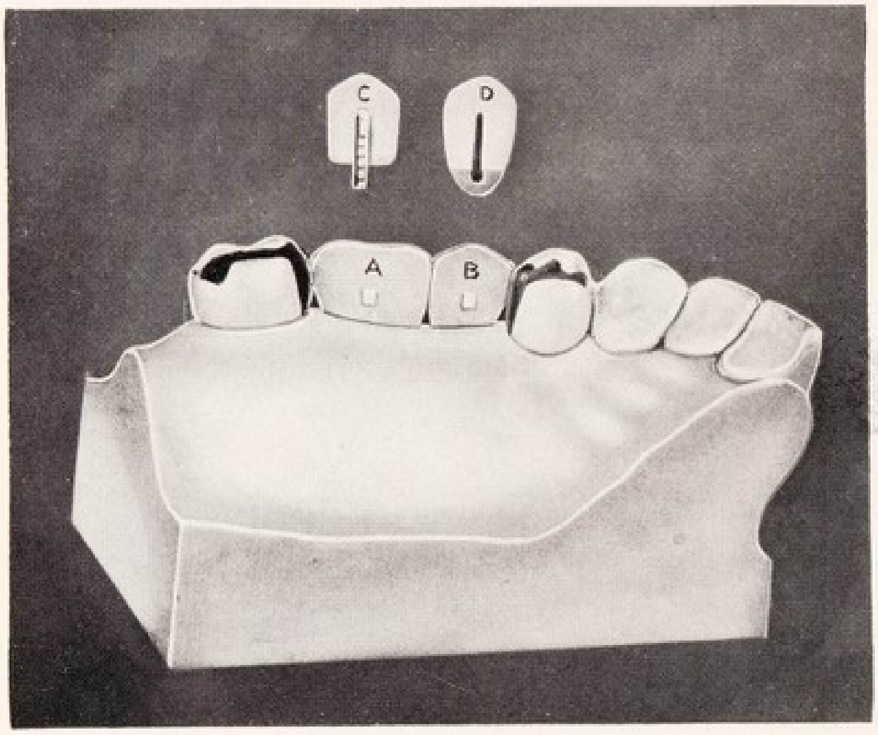


Fig. 302. Bridge illustrating the use of Steele's Posterior Facings. A and B—The metal backings with porcelain facings in place on the cast. C—The labial view of metal backing shown at B. D—Steele's porcelain facing, lingual view showing slot to receive the post of the backing

must make contact with the mucosa, this requirement applying to either the porcelain, or the gold pontic. The contact must be firm, but the pontic must not be so long as to produce marked pressure. If the pressure is excessive, irritation will follow, leading to infection. In order to ascertain the correct degree of pressure, it is always wise to set the bridge with temporary cement, leaving it in place for several days until the effect of the pontic on the mucosa, has been determined. After this period of observation, the bridge is removed and any necessary grinding is done, to be followed of course, by high polishing of the gold, or glazing of the porcelain according to the case.

The interproximal spaces between the pontic and the abutment teeth, and also between adjoining pontics, require careful consideration. Sufficient space must be provided between the pontic and the abutment so that

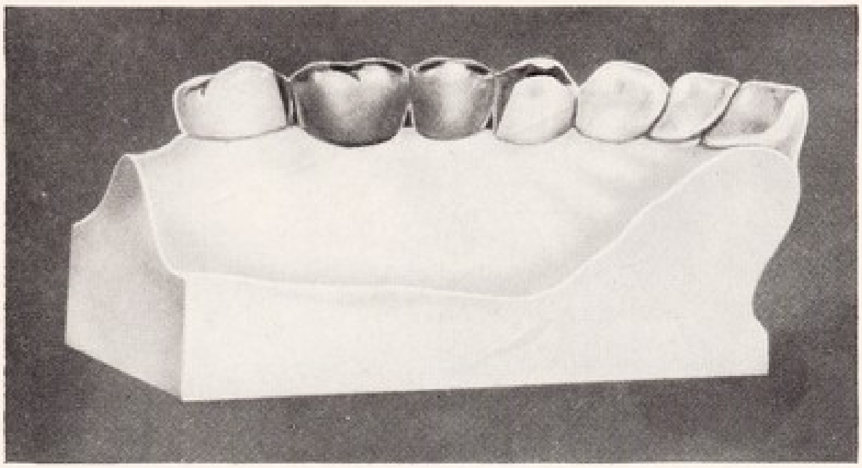


Fig. 303. Lingual view of bridge shown in Fig. 302. The cusps and lingual surfaces are built up in inlay wax. Note the lingual contours and the interproximal spaces

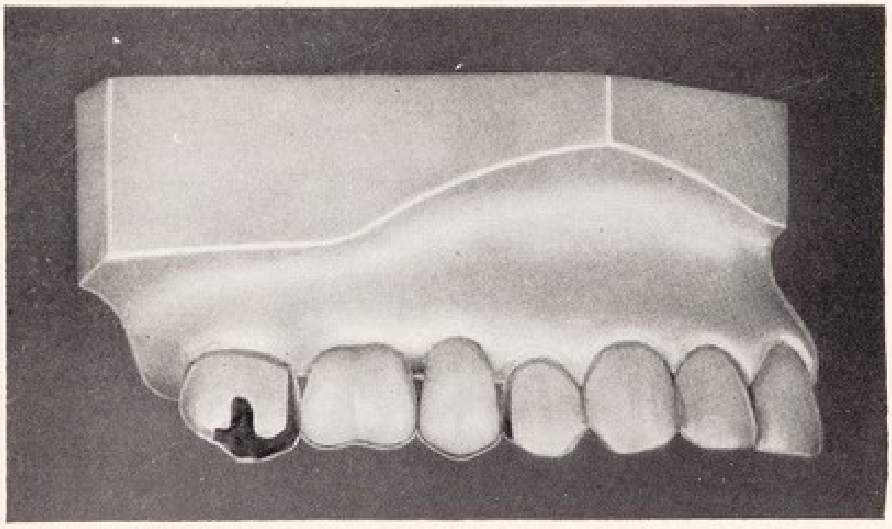


Fig. 304. Buccal view of bridge shown in Fig. 303. Note the metal extensions protecting the incisal tips of the porcelain facings

the cervical portion of the abutment tooth is accessible to scaling and polishing instruments and to the floss silk and tooth brush. On the other hand, the spaces must not be so wide either at the abutment teeth, or between the pontics, as to provide undue access for and retention of food particles.

A common practice in the making of upper posterior bridges has been to make a somewhat abrupt slope from the lingual portion of the occlusal surface toward the buccal. This technique is seen both in cases where Steele's posterior facings have been used, and also where other porcelain facings have been combined with gold occlusal surfaces. The part of the

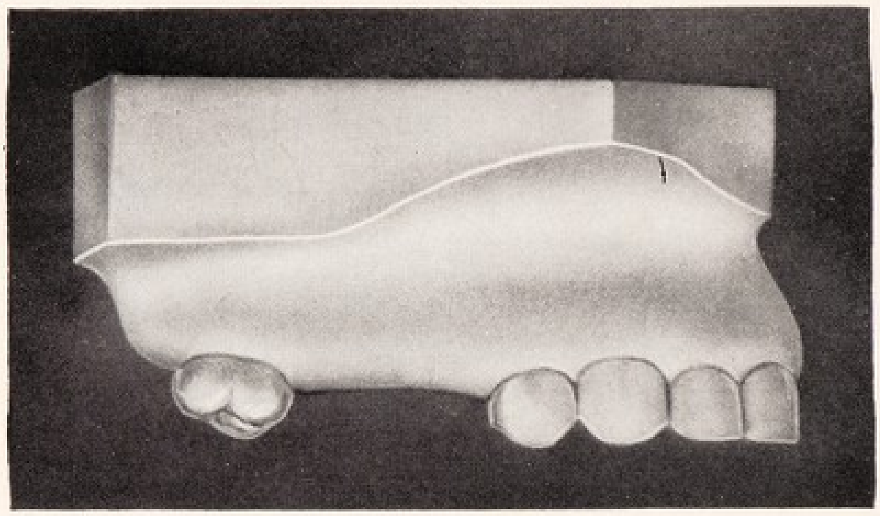


Fig. 305. Cast showing a bridge case in which the abutment teeth are short and in which there is not sufficient room to place any of the usual types of porcelain facings

gold which faces toward the mucosa, extending from the lingual part of the occlusal surface to the point where the porcelain of the facing makes a contact with the mucosa, has very much the effect of a shelf. It tends to favor the retention of food particles, and is both unhygienic and a source of irritation as well. A better practice would be to give to this portion of the pontic approximately the same contour as that of the teeth which are being replaced. It will thus extend more or less vertically upward, to make contact with the mucosa in such a way as to guard against impaction and retention of food particles. This is illustrated in Fig. 300.

Cleansable Bridges

The cleansable bridge is one in which the pontic is made entirely of gold. This pontic does not touch the alveolar ridge, and is, in fact, made to allow as much space between it and the ridge as is possible, while keeping the bulk of the pontic itself sufficiently thick to provide the necessary strength. This pontic is used only on lower posterior bridges. The lower surface is made slightly convex so that it may readily be reached from both buccal and lingual sides by the tooth brush.

The lingual view of a bridge supplying the right upper bicuspids is illustrated in Fig. 296. The teeth used in this case are "Pontopin" biscuspids. The glazed porcelain roots are ground to establish contact with the mucosa of the ridge, and the occlusal ends of the porcelain teeth are beveled to accommodate the opposing teeth. A space of approximately 1 mm.

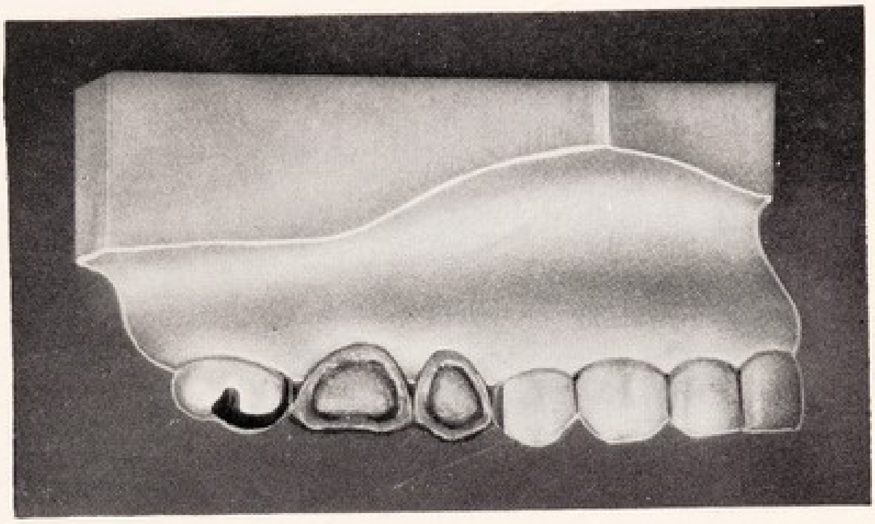


Fig. 306. Wax pontics for the case shown in Fig. 305. The pontics have been built up entirely in inlay wax. Recesses have been roughly cut in the buccal surfaces in which, after completion, porcelain inlays will be set

should be established between the occlusal tips of the porcelain teeth, and the opposing teeth, to insure a sufficient thickness of gold to protect the porcelain teeth from subsequent fracture. After the porcelain teeth are ground to proper alignment, the metal backings are placed in position over the pins of the porcelain teeth, and the backings are burnished and swaged to close contact with the "Pontopin" teeth. The metal backings should extend approximately 1/32 of an inch beyond the occlusal ends of the porcelain teeth. When the cusps are cast, this precaution will carry the gold well over the occlusal tips of the procelain teeth and this small excess of gold is reduced with stones and disks after the final soldering of the supplied teeth to the attachments.

Soldering and Casting Technique

To prevent oxidation and to insure a perfect union between the metal backings and the cast metal, cover the lingual surfaces of the metal backings with a saturated solution of boracic acid in grain alcohol, using only the clear liquid. Hold the backing in the flame allowing the alcohol to ignite until the deposit fuses, but do not heat the backing to a red heat. After the backing cools, the surface will be covered with a flux that will remain during the waxing up and carving of the cusps, preparatory to casting. A suitable casting wax is then applied to the metal backings and carved to conform to the opposing teeth. (Fig. 297.) Ideal occlusal anatomy may be secured by following the technique outlined in Chapter XX. When this

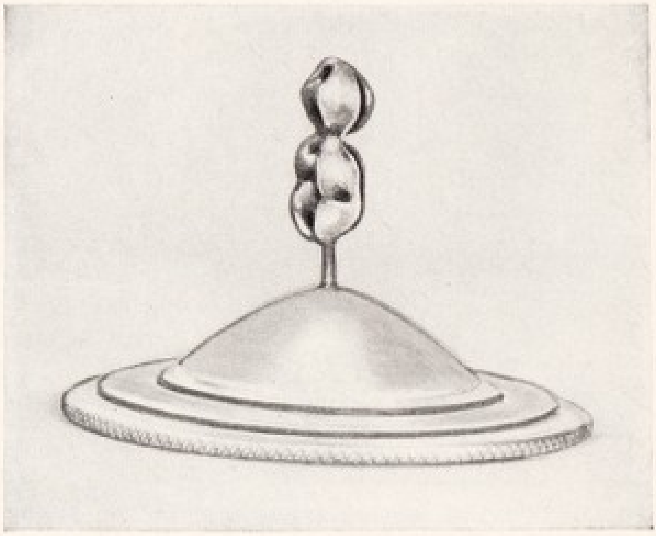


Fig. 307. The wax pontics illustrated in Fig. 306, mounted ready for investment

technique is utilized in conjunction with a porcelain tooth, it will be necessary to adapt the occlusal wax form to fit the metal backing as well as the opposing teeth. The porcelain teeth are removed and the wax cusps and backings are invested and cast. To eliminate the possibility of the cast gold not making a perfect union with the metal backing, the author recommends that a small area of the metal backing at the cervical margin on the lingual side be left exposed when the inlay wax is applied to the backing. This space is filled in with solder after the cusps are cast to the backings, thus insuring a strong union between the cast metal and the metal backings.

The fusing point of "Pontopin" backings is 1978 degrees F. Therefore, the gold used for casting must be of a lower karat. Ney-Oro A-1 gold is recommended for this purpose.

When this type of tooth is used in the anterior part of the mouth, it is necessary to reinforce the incisal tip of the metal backing with a piece of 26 gauge clasp metal. After the tooth has been ground into position, and the metal backing has been burnished and swaged to proper adaptation on the porcelain tooth, select a piece of 26 gauge clasp metal and bend it to approximately fit the backing from the incisal edge to the pin receptacles, and solder to the metal backing.

After casting and soldering the gold cusps to the metal backings the porcelain teeth are placed in position on the cast to insure proper alignment. The porcelain teeth are again removed and the gold casting is soldered to the posterior attachment. The bridge is placed in position in the mouth and a second plaster impression is taken for the final soldering of the anterior attachment to the gold casting. A shallow impression tray should be used for this purpose as it is only necessary to engage the anterior attachment and the occlusal surface of the bridge span in the plaster. Terraplastica, or any suitable soldering investment is packed into the impression. After the investment material has hardened, the plaster impression is cut away and the anterior attachment is soldered to the bridge. This extra step is recommended as a safeguard against errors that may easily occur when bridges are completed from one impression. There is the possibility of the attachments not being properly placed in the impression; the possibility of dimensional change of the material of which the cast is made; or contraction of the solder.

The use of Steele's "All Porcelain Posterior Pontics," is illustrated in Fig. 299. These teeth have a full cusp of porcelain and make possible the construction of bridges without the display of gold, retaining, at the same time, the advantages of interchangeability. There are two moulds of this type of tooth. The "Ordinary," and the "Short Bite" moulds. The short bite moulds have a smaller post hole than the ordinary bite moulds, and consequently take a backing with a smaller post. The short bite teeth are indicated for those cases where the occlusion is close, and where a smaller tooth is required. When this type of tooth is used, additional support may be secured by boxing-in the porcelain tooth, even though the space between the teeth and the gum will permit of a bulk of reinforcement, it is better practice to box-in the porcelain teeth. This will insure a greater area for the distribution of solder, a stronger union with the attachments and a stronger bridge without a great bulk of reinforcement next to the ridge.

Technique for Boxing-in

"Boxing-in" means the envelopment of the tooth with an extension of 36 gauge platinum. The tooth is first ground to proper alignment and ridge contact. The backing is then trimmed to fit the tooth. A piece of thin gauge platinum is then cut, large enough to envelope the base of the tooth and to extend over the ridge lap with a little surplus. To attach the thin platinum to the backing, punch a hole in the metal where it covers the riveted post on the backing. Place the thin platinum on the backing and solder the two pieces together in a Bunsen burner, using a small piece of 20 K. solder. The backing, with the thin platinum, is then placed on the tooth and the platinum is burnished to fit the tooth. The surplus platinum is trimmed away. Allow the boxing to extend over the ridge lap and a trifle higher, approximally and lingually on the tooth, than is desired in the finished

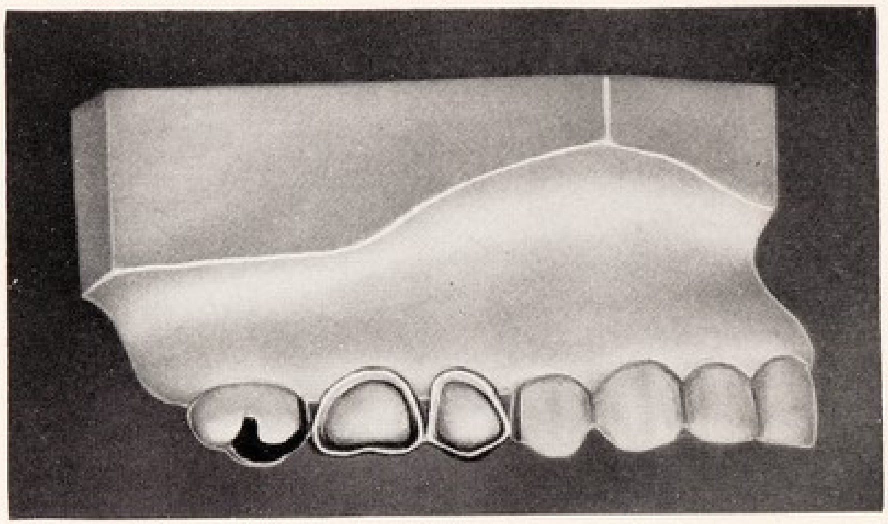


Fig. 308. Bridge shown in Fig. 306. The pontics have been cast and in the finished casting, the recesses are now properly carved and shaped as to depth and contour, with fissure burs and fine stones

boxing. After the boxing has been partially adapted and trimmed, the tooth, with boxed backing in position, may be placed in a swaging device and the boxing swaged to fit the tooth. After swaging, the tooth is removed from the backing and replaced, several times, to insure easy removal after being waxed to position on the cast. A piece of sticky wax heated and attached to the buccal surface of the tooth will facilitate its removal without distorting the boxing. To insure union of the cast metal with the platinum, flow a small quantity of 20 K. solder over the platinum. The teeth may also be boxed-in without enveloping the teeth with an extension of thin platinum. This is done by allowing the inlay wax to make contact with the porcelain tooth around the base and over the ridge lap. When this is done considerable care must be exercised in adjusting the wax and in investing and casting to insure an accurate fit.

The teeth, with their backings in place, are then set up on the cast and the final adjustments are made. Inlay wax is adapted to the lingual surface and extended to make contact with the ridge, as in Fig. 300. The teeth are removed and the inlay wax with the backings to which it has been united, is invested and cast. That part of the gold casting which makes contact with the ridge, should be polished to a high degree of smoothness. The teeth are placed in proper alignment and the gold casting is soldered to the attachments as previously described.

Close Bite Cases

When the bite is too close to permit the use of a porcelain cusp tooth, or a tooth with a porcelain pontic, a Steele's facing may be employed as in

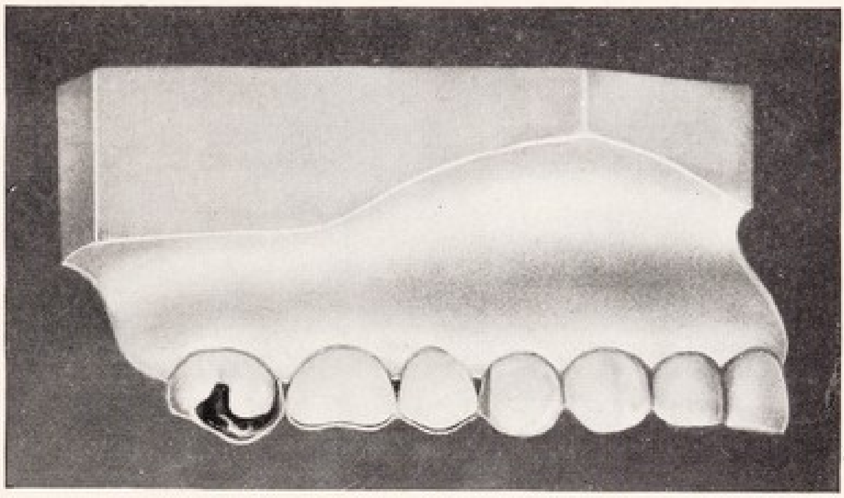


Fig. 309. Buccal view of case shown in Fig. 308 as completed. Note that the porcelain inlays which are set in the recesses are carried up at the cervical areas and also interproximally so as to hide the gold of the pontic. Sufficient gold is left exposed at the occlusal edge to provide protection for the porcelain

Fig. 302. The porcelain facing should be ground to fit the ridge very accurately, and then disked slightly to allow a thin layer of gold to extend over the cervical edge of the porcelain facing when the gold pontic is cast. This will insure a smooth surface of gold to establish contact with the mucosa of the alveolar ridge, and will eliminate the possibility of the cement washing away from the post of the gold backing. Inlay wax is adapted to the lingual surfaces of the gold backings and extended to make contact with the ridge as seen in Fig. 303. To insure perfect union of the cast metal with the gold backings, the same technique, as previously described is carried out. However, in a case of this type a small portion of the gold backing, near the incisal edge, may be left exposed when the inlay wax is attached to the backing. This small space is filled in with solder after the cusps are cast.

When the bite is so close that a Steele's facing must be reduced to a point where its retentive qualities and strength would be of questionable value, as in Fig. 305, the only recourse is to construct an all gold pontic, with porcelain inlays inserted in the buccal surface. The wax form for the gold pontic is carved as in Fig. 306. The outline for the recesses which are to hold the porcelain inlays are roughly outlined in the wax. No attempt is made to accurately outline these recesses at this time as the wax is usually too frail to allow the thinness necessary, especially at the cervical margin. After the pontic is cast the recesses are properly carved in the gold with fissure burs and stones as shown in Fig. 308.

Interproximal spaces, sufficiently large to allow for proper cleansing are necessary, and in these extremely close bite cases the points of contact between the gold casting and the attachments are so small that it is usually necessary to embed pieces of 16 gauge Ney-Oro No. 4 wire into the gold casting and the attachments at the points of contact. Small holes are drilled into the attachments at the contact points, sufficiently large to engage the end of the wires and slots are cut in the lingual portion of the gold casting to accommodate the opposite ends of the wires. The wires are then soldered to the attachments and the casting.

CHAPTER XX

Technique for the Construction of a Cleansable Stationary Bridge

It is the desire of the author to present the various steps in the construction of crowns and bridgework so that the student, as well as the general practitioner, will be able readily to comprehend and apply them to his individual needs. This will necessitate a minute description of details, with illustrations, that would be unnecessary if the book were intended only for the general practitioner.

It is to be understood that wherever inlays are to be used in the construction of bridge cases, the cavities are to be prepared in conformity with the fundamental principles laid down by Black, with special attention to those details which will make for superior retention. Margins are given a slight bevel, except those, which, because of extensive decay, must be cut below the gingival border.

If the tooth will permit a preparation which will provide adequate retention, and if the details of the making of the inlay are properly carried out, there need be no fear of the inlay becoming loosened after the bridge is set, provided that the occlusion of the inlays and bridge span is correct. This latter point is quite as important as the matter of cavity preparation. Where adequate retention form cannot be gained, it may be necessary to resort to supplementary anchorage by means of pins incorporated in the inlays. This technique, as also the moveable joint technique, will be illustrated in subsequent chapters.

Paralleling Cavity Walls

In the mandible, where one or two teeth in the posterior part of the mouth have been lost, and the adjoining teeth have been attacked by caries, or already contain inlays or fillings, but have strong alveolar support, a cleansable stationary bridge is the ideal type of restoration. The bridge should be constructed without pontic, or pontics, simply employing a properly carved, cast span, leaving the under surface open for the free passage of the tongue or toothbrush. Fig. 310 illustrates such a case. The right lower second bicuspid and first molar have been lost and the distocclusal surface of the second bicuspid and the mesiocclusal surface of the second molar have been attacked by caries. As a means of securing parallel margins and axial walls in the cavity preparation the author recommends the use of the Evslin bridgemeter. (Fig. 311.) The margins of the cavities should be parallel, or should diverge slightly to enable the prongs of the bridgemeter to establish contact with the cervical margins of the cavities.

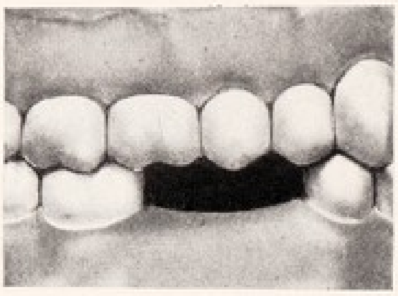


Fig. 310. Case suitable for cleansable fixed bridge

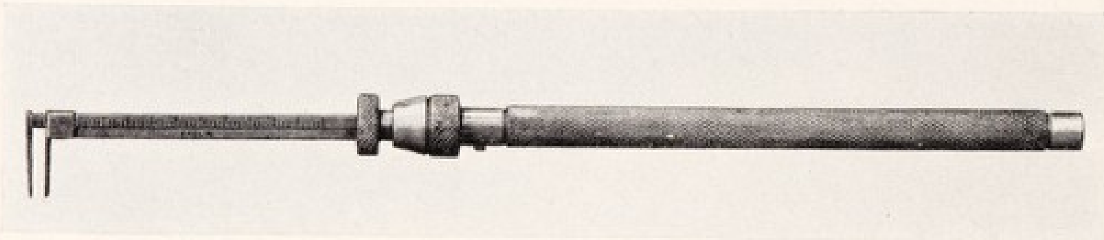


Fig. 311. Evslin bridgemeter (half size)

(Fig. 312.) It is also necessary to secure parallelism of the axial walls of the cavities. (Fig. 313.) Unless these precautions are taken it may be necessary to grind the inlays after the bridge is completed in order to seat the inlays to the full depth of the cavities. Such a procedure might cause the loss of marginal contact, or reduce the retentive qualities of the inlays to such an extent as to entail the risk of a short duration of life for the bridge.

Direct Method of Constructing Inlays

Matrices for Impressions

When using the direct method for the construction of gold inlays some type of matrix retainer should be used when forcing the inlay wax into the cavity to insure close adaptation of the softened wax to the walls and margins of the cavity. A matrix suitable for this type of work can be easily and quickly made with 34 gauge copper and dental floss. For an approximal occlusal cavity, select a piece of copper about 3/4 of an inch in length, and trim it to conform to the contour of the gingival crest,

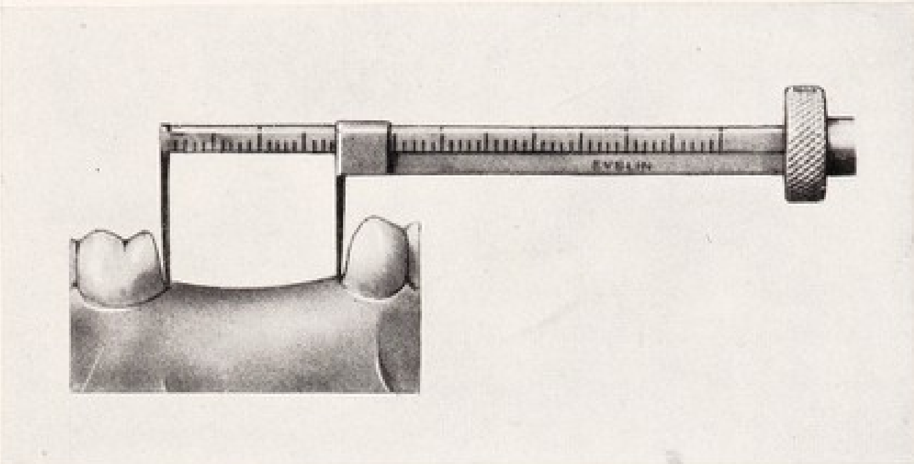


Fig. 312. Bridgemeter in contact with cervical margins of cavities

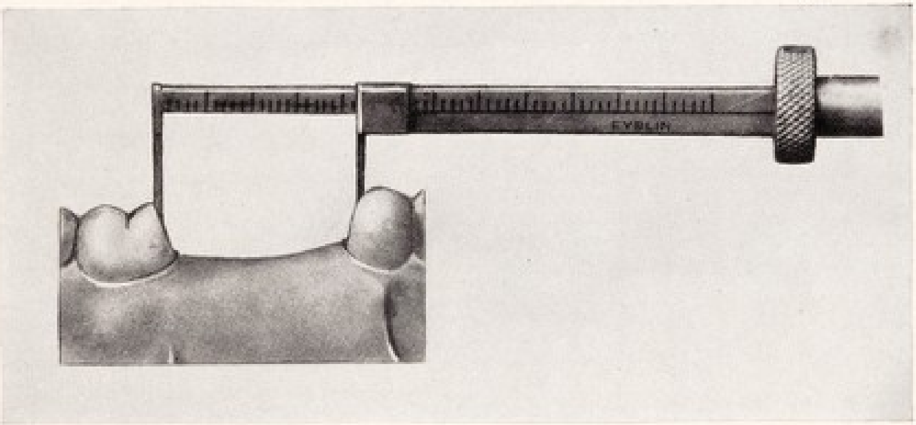


Fig. 313. Bridgemeter in contact with axial walls of cavities

allowing the metal to extend beyond the cervical margin of the cavity. Trim the upper edge of the matrix to avoid interference with the occlusion of the opposing teeth. When cutting the metal, allow two short prongs to extend from the lower, or gingival edge of the matrix. A piece of dental floss is then placed on the matrix and the metal prongs are bent back against the matrix to engage and hold the floss in position, as illustrated at X X, Fig. 314.

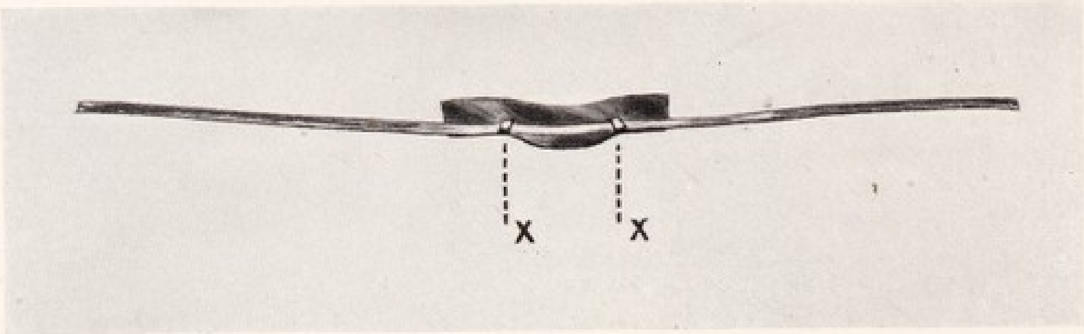


Fig. 314. Matrix of copper tied with silk

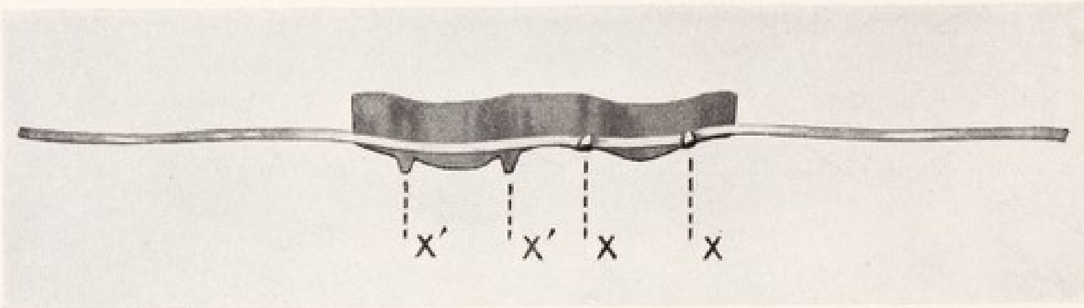


Fig. 315. Matrix for m.o.d. cavity

Fig. 316. Matrix tied in place

For an m.o.d. inlay select a longer piece of metal, the length corresponding to the size of the tooth and adapt the same to the gingival crest, allowing the matrix to extend well down on the mesial and distal sides to engage the cervical margins of the cavities. X′X′, Fig. 315 shows the metal prongs before they are bent back against the matrix to engage the

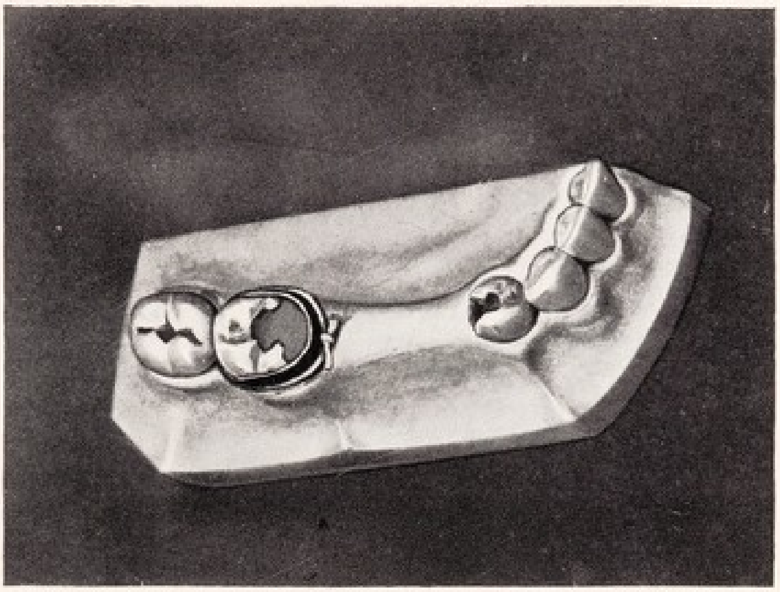


Fig. 317. Inlay wax forced into cavity

dental floss as represented at X X. To place the matrix in position on the tooth, pass both ends of the dental floss past the contact point of the adjoining tooth. The opposite ends of the floss are then brought together around the tooth, and a knot is tied to hold the matrix in place as represented in Fig. 316. Inlay wax is then softened in warm water and forced into the cavity. (Fig. 317.) The patient is instructed to close in centric occlusion, and then to perform the movements of mastication in order to reduce the occlusal portion of the wax to the proper height. The wax is then chilled and the matrix is removed.

The Ivory Matrix Retainer No. 1 may also be used for approximal occlusal cavities. This matrix retainer is made in two sizes as illustrated in Fig. 318. The smaller size is very convenient for use on bicuspids. This matrix retainer provides a simple and effective means of holding a matrix band on a tooth. The band is drawn with equal tension to the neck and crown of the tooth because of its proper curvature. And being supported by improved shields attached to the points that engage in the holes, the band is readily drawn into place against the surface of the tooth and with less danger of being punctured. These shields also provide against the holder slipping, or tilting down, to get in the way of the operator

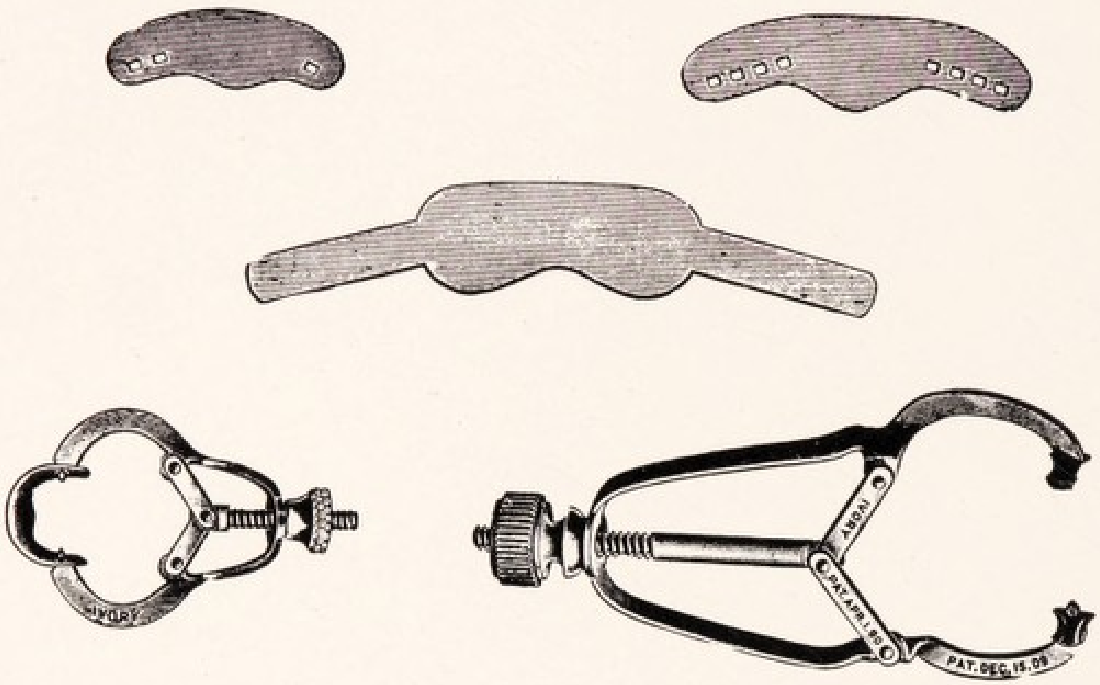


Fig. 318. Ivory matrix retainers

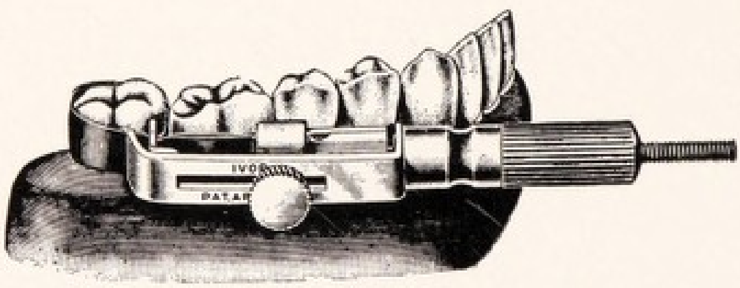


Fig. 319. Ivory matrix retainer, No. 8

when used on an upper tooth. It has the disadvantage, however, that the patient cannot bite into the wax while the matrix is in the mouth. To have the patient bite into the wax with any degree of force after removal of the matrix invites fracture of the chilled wax, or distortion if it is still warm. When this matrix is used the occlusal anatomy should be carved in the wax after the matrix has been removed. The patient is then instructed to close the jaws until contact is established with the wax, but not to use force. The necessary corrections are made until proper occlusion has been established. To attempt to prepare a wax pattern for an approximal occlusal cavity, by the direct method, without a matrix, is an error which no experienced inlay worker will commit. It need only be

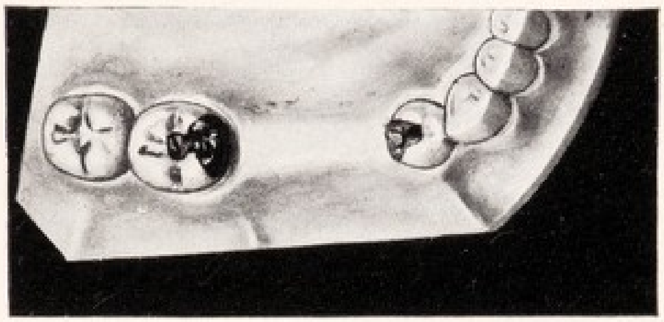


Fig. 320. Occlusal carving of wax pattern

added that the operation is so important as to deserve adequate equipment for its performance.

For m.o.d. cavities the Ivory Matrix Retainer No. 8 may be used as illustrated in Fig. 319. This retainer is simple in construction yet most efficient, and is never in the way of the operator. It draws the band tight around the tooth, and fits the crown and the neck of the tooth at the same time. The band is threaded into the vise, one end in either hole in the retainer that rests against the tooth, and is fastened in the vise by the end nut. Having the proper curvature it adapts itself close to the neck of the tooth when drawn to position by the middle nut. Where two nuts are working on one thread there is always a possibility that they may become locked. Should it be difficult to turn one nut, do not use force, but turn the other nut slightly, then both will work freely.

To secure a wax impression when using the No. 8 retainer, place the matrix in position, and see that the teeth can be closed. Then loosen the band slightly to allow the wax to go beyond the margins. Soften a piece of inlay wax of suitable size, in warm water, and force the wax into the cavity. Instruct the patient to close in centric occlusion, and to hold the teeth in close contact while the band is drawn taut with the retainer. After chilling the wax and removing the matrix, the occlusal anatomy is carved in the inlay wax as illustrated in Fig. 320.

Indirect Method of Constructing Inlays

Impression Technique

When it is desirable to use the indirect method for the construction of the inlays, copper bands of suitable size are selected and cut to fit the teeth, allowing the bands to extend below the gingival margins of the cavities.

Fig. 321

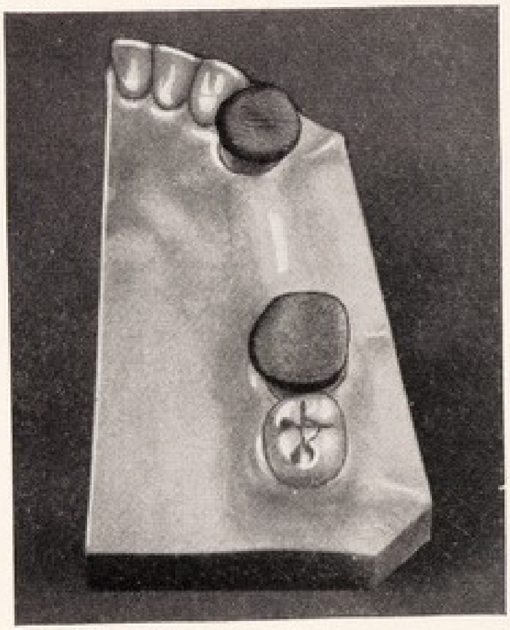


Fig. 322

Fig. 321. Use of bands in indirect inlay technique

Fig. 322. Modeling compound forced into cavities

(Fig. 321.) Modeling compound is heated to the proper consistency and forced into the cavities, being held in place by the close-fitting copper bands. (Fig. 322.) The modeling compound impressions are chilled and removed from the teeth. A wax bite is then taken. (Fig. 323.) The excess modeling compound is trimmed away from the impressions and they are wrapped with Kerr's 26 gauge wax sheets. (Fig. 324 A and B.) Metal rings are filled with soft plaster and the impressions are embedded in the same. (Fig. 324.) Soft amalgam is packed into the impressions and allowed to set overnight. After separation in hot water, the amalgam dies are chilled and then placed in the wax bite. (Fig. 325.)

Upper and lower models are prepared, and mounted on an articulator, (Fig. 326.) Inlay wax is then softened in warm water and forced into

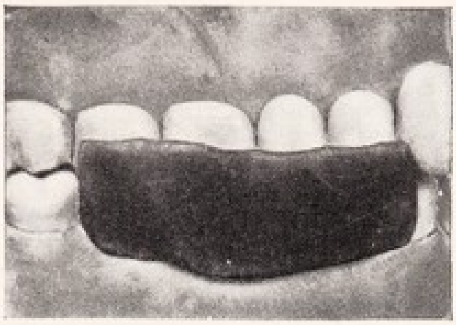


Fig. 323. Taking the bite

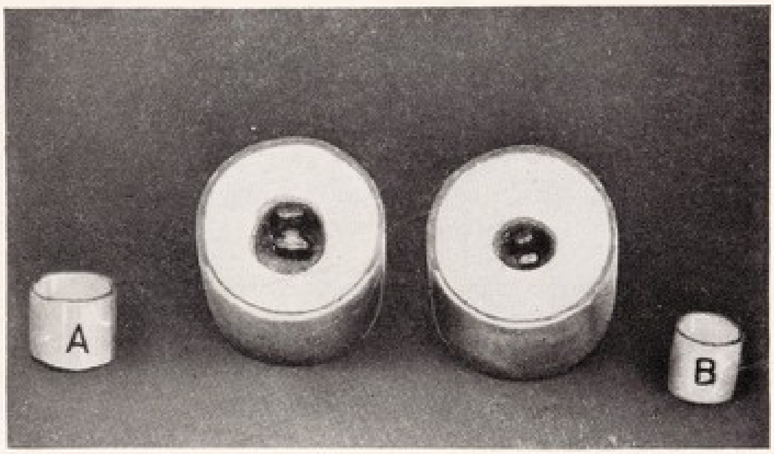


Fig. 324. Compound impressions wrapped in wax. (A and B) and invested in plaster within metal rings

Fig. 325. Amalgam dies placed in wax bite

the cavities in the amalgam dies. The wax is chilled and the occlusal and approximal anatomy is carved. To be sure of perfect occlusion, the wax patterns of the inlays are inserted in the cavities in the mouth, and the patient is requested to close in centric occlusion, and also to perform

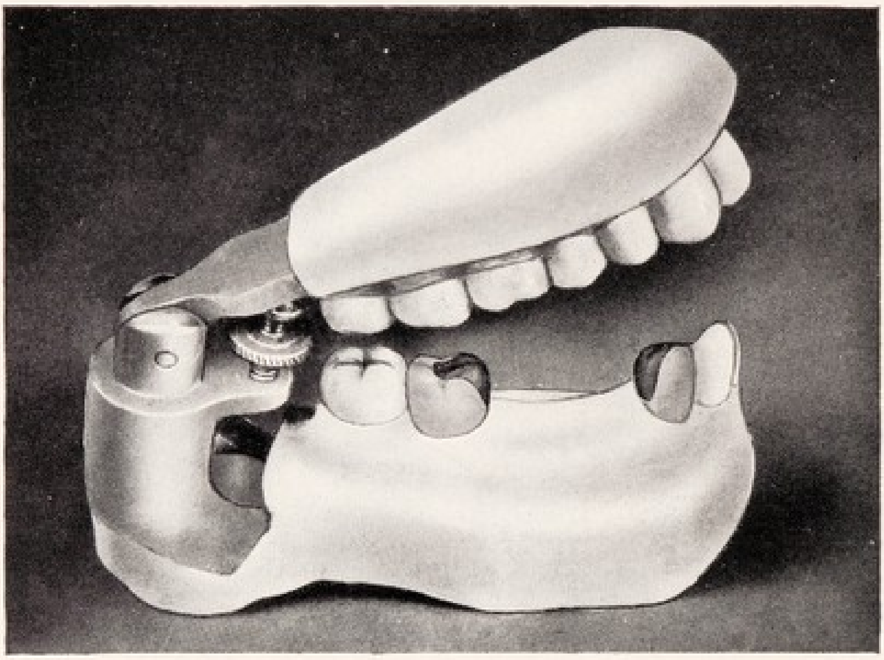


Fig. 326. Models mounted on articulator. Amalgam dies in place

the movements of mastication. It will usually be found necessary to recarve the wax patterns somewhat. The necessary corrections are made at this time, to establish correct occlusal and marginal contacts. Sprue wires are attached to the wax patterns (Fig. 327) and they are invested and cast. The inlays are then tried in the cavities in the mouth and polished.

Technique for Second Bite

Another bite is now taken, preparatory to the making of the bridge span. Failure to secure a correct bite often results in the construction of a bridge with faulty occlusal relations. When a large roll of wax or modeling compound is used in taking the bite, the patient becomes confused and when instructed to close, invariably gives a lateral, or a protrusive registration, due to the interference of the wax or compound, and any attempt to get the teeth back into centric occlusion will usually result in a distorted bite. Also the wax or compound is forced into undercuts about the necks of the teeth causing distortion and dragging when the bite block is removed. An accurate impression of the occlusal third of the opposing teeth is all that is necessary when taking the bite. Cut a piece of Kerr's impression compound wide enough to accommodate the occlusal width of the opposing teeth and soften in water at 135 degrees F. for one minute.

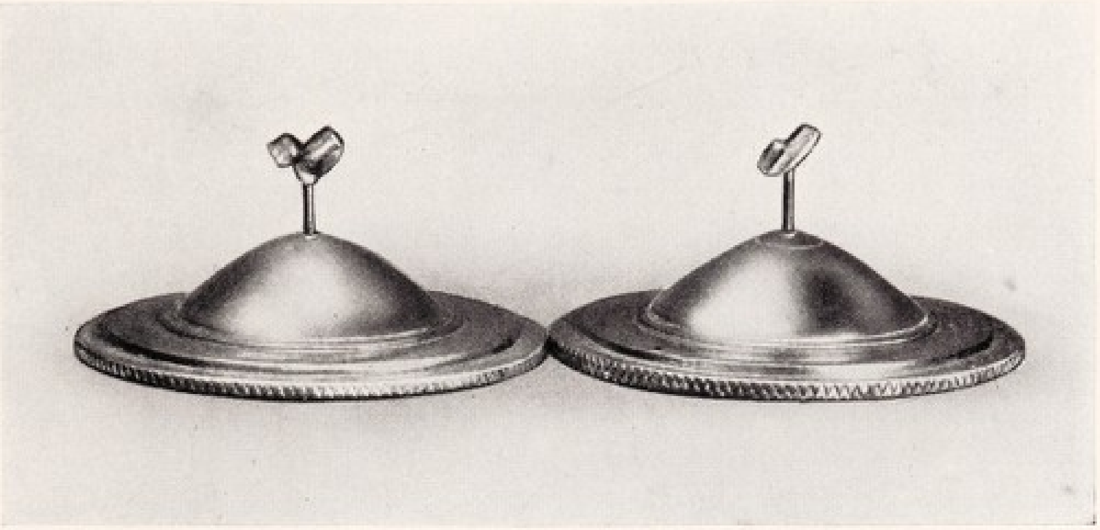


Fig. 327. Wax patterns attached to sprue wires

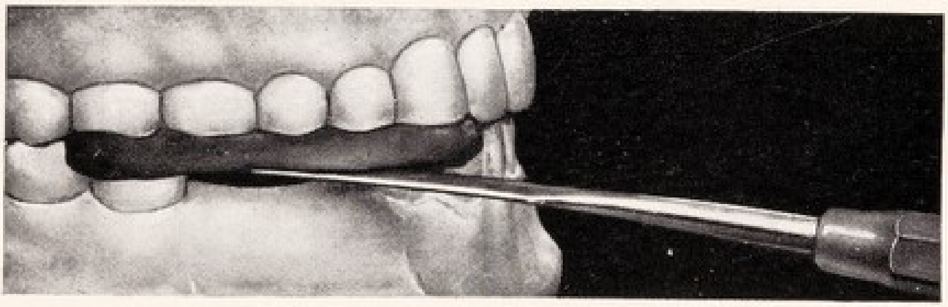


Fig. 328. Use of spatula in edentulous region, to force compound against the occlusal surfaces of the opposing teeth

Softening the compound in warm water is preferable to passing the compound over the flame. The warm water will heat the compound uniformly throughout and it will then be less apt to cause interference when the teeth are brought together in centric occlusion. Place the warm compound over the lower teeth and instruct the patient to close in centric occlusion, using a cement spatula to adapt the compound to the occlusal surfaces of the opposing teeth in the region where the lower teeth are missing. (Fig. 328.) At the same time instruct the patient to force the warm compound against the lingual cusps of the upper teeth with the tongue. The compound is then chilled and removed. A very accurate impression of the opposing teeth may also be obtained by using hard Aluwax that has been softened by immersion in water at 110 degrees for three minutes. An impression is taken with plaster. (Fig. 329.) This

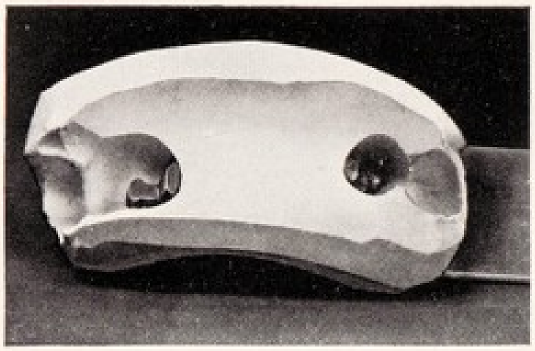


Fig. 329

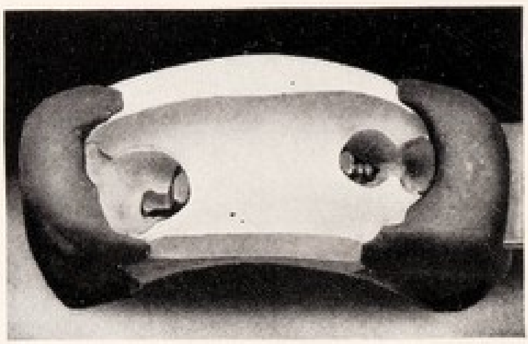


Fig. 330

Fig. 329. Plaster impression with inlays in place

Fig. 330. Impression built up with moldine

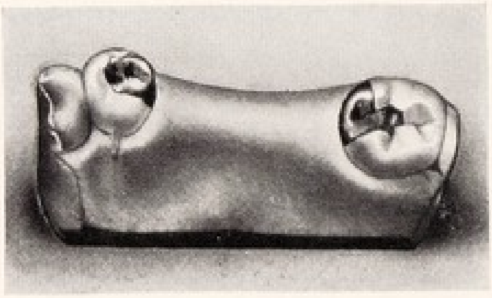


Fig. 331. Metal model with inlays in position

impression is painted with a coat of shellac and allowed to dry for 10 minutes. It is then painted with a coat of sandarac and allowed to dry for 30 minutes. It is then packed with artificial stone and allowed to set overnight.

Technique for Metal Model

When it is desirable to secure a working model immediately, Dee low fusing metal "B" may be used for the construction of the model. The fusing point of this metal is 204 degrees F. When using Dee metal, paint the gold inlays with cocoanut oil and build up the ends of the impression with Melotte's moldine. (Fig. 330.) The low fusing metal is then heated in a ladle and poured into the impression. After the metal has cooled for about five minutes the plaster and moldine are removed and the metal working model (Fig. 331) is ready for the placing of the modeling compound bite block. When using this metal for the construction of a model where gold crowns are used, any undercuts in the gold crowns must be

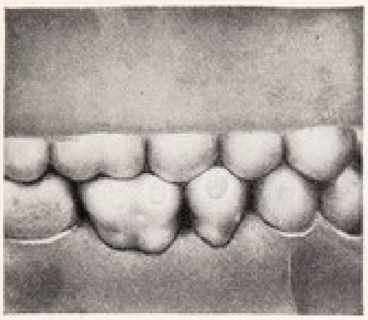


Fig. 332

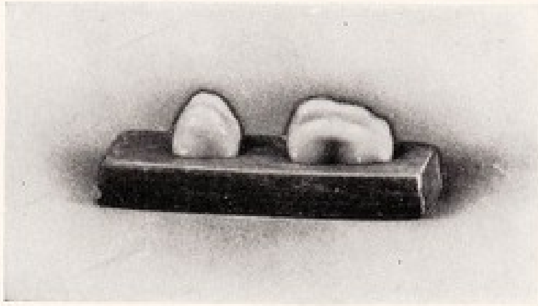


Fig. 333

Fig. 332. Trubyte teeth ground to fill space and to occlude properly

Fig. 333. Taking impressions of the occlusal surfaces of the Trubyte teeth

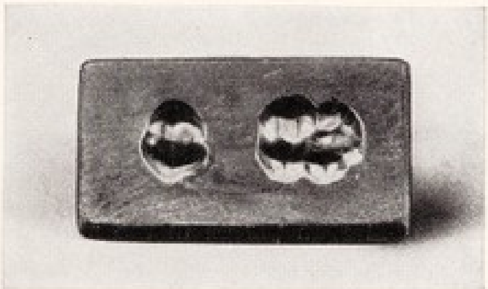


Fig. 334. Impressions of the occlusal surfaces of the Trubyte teeth

filled with moldine before pouring the metal into the impression. Unless this precaution is taken, it would be necessary to destroy the model in order to remove the crowns. This rule also applies to undercuts in gold inlays which are sometimes used to protect the tooth from thermal shock. When using any type of crown where a post is used in its construction, cut a piece of 34 gauge copper about one millimeter longer than the post. Wrap the copper around the post and cover the end of the post with moldine. This will facilitate the removal of the crown after the model is poured. The bite block is now placed in position and the upper cast is prepared, using artificial stone, or cement, to reproduce the occlusal surfaces of the upper teeth. The case is then mounted on a small adjustable articulator.

Technique for Gold Span

To secure the proper occlusal anatomy for the cast span, select Trubyte teeth of suitable size to fill the space where the teeth have been lost and

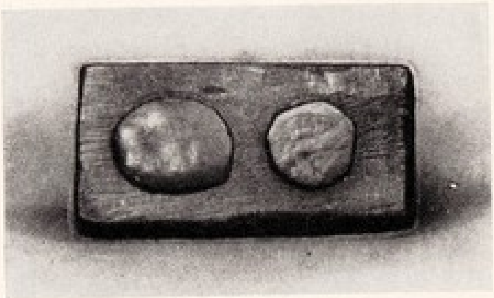


Fig. 335. Inlay wax pressed into impressions of Trubyte teeth

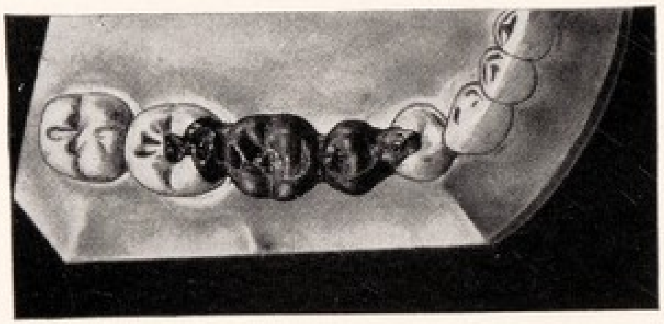


Fig. 336. Inlays and gold span placed in the mouth for final adjustment

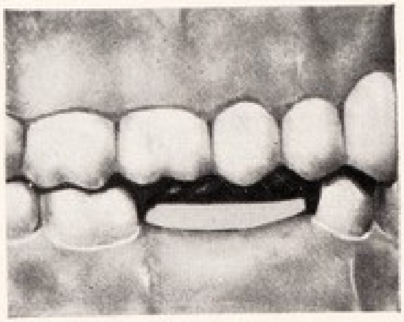


Fig. 337. The finished bridge in place

grind these teeth to an accurate occlusion with the opposing teeth (Fig. 332). Soften the surface of a piece of Kerr's modeling compound and embed the occlusal third of the teeth in the soft compound (Fig. 333).

Chill the compound and remove the teeth, thus producing in the compound a very accurate mould of the occlusal surfaces of the Trubyte teeth (Fig. 334). Cover the depressions in the modeling compound with a coat of thin oil, soften two small pieces of inlay wax in warm water and press them into the depressions in the modeling compound (Fig. 335). Chill the inlay wax, and remove from the modeling compound moulds. This procedure will give a very accurate reproduction of the occlusal anatomy of the teeth in inlay wax. The wax patterns are then assembled on the articulator, properly occluded with the opposing teeth, and the under surface of the span is made slightly convex. The separate wax patterns are then united with soft inlay wax, invested and cast. If the operator is confident that an accurate impression and bite has been secured, the cast span is next waxed to the inlays, invested and soldered to the inlays. However, if there is any doubt as to the accuracy of the impression and bite, the cast span and the inlays should be assembled in the mouth and the parts united with sticky wax. By this method the operator will be able to make the necessary adjustments to secure accurate occlusal contact and alignment. (Fig. 336.) After securing the proper alignment of the cast span which is held in position by sticky wax between the span and the inlays, take a plaster impression using a shallow impression tray and just enough plaster to engage the occlusal surfaces of the inlays and the cast span. The impression is then packed with any investment material suitable for soldering. After the investment material has thoroughly set, the plaster is removed and the inlays are soldered to the cast span. The finished bridge, with the opposing teeth in occlusion, is shown in Fig. 337.

CHAPTER XXI

The Technique for the Construction of a Movable Joint in Stationary Bridgework

Frequently it is desirable to construct a stationary bridge with a lug in, or on one of the abutment teeth. This type of attachment is indicated when a stationary bridge is constructed, supplying one of the bicuspids, and a central and lateral incisor where the cuspid is used for an abutment. A movable joint in the cuspid region will permit the independent movement of either segment of the bridge, according to the use to which the patient puts the supplied teeth.

The movable joint attachment is frequently indicated in the molar region, when the teeth are tipped in such a direction that an attempt to secure parallelism of the margins and axial walls of the cavities would necessitate the loss of considerable sound tooth substance. However, when this type of attachment is used on a tooth that is in any degree tipped from its normal position, it must be so constructed that further tipping will be prevented, in order to avoid further bone resorption.

Through the courtesy of Egon Neustadt, M.U.D., there is presented here, a résumé of his views on bone changes, particularly as they may be influenced by bridgework, or as they may influence the planning of bridgework.

Function and Bone Changes

"The bone of the alveolar process, like bone in other parts of the body, develops under the stimulus of function. Normal function, for the alveolar process, consists of occlusal stresses, which are transmitted to the bone through the medium of the peridental fibers which suspend the teeth in their alveoli. Emphasis should here be given to the thought of 'suspension,' since the teeth are supported in their sockets by the pull which they exert on the peridental fibers, and not by direct pressure contact against the walls of their alveoli. The normal stresses of the alveolar bone are thus, tension stresses. Under the influence of normal tension stresses, bone which is resorbed as the result of metabolic processes is replaced in an equal amount, thus maintaining equilibrium.

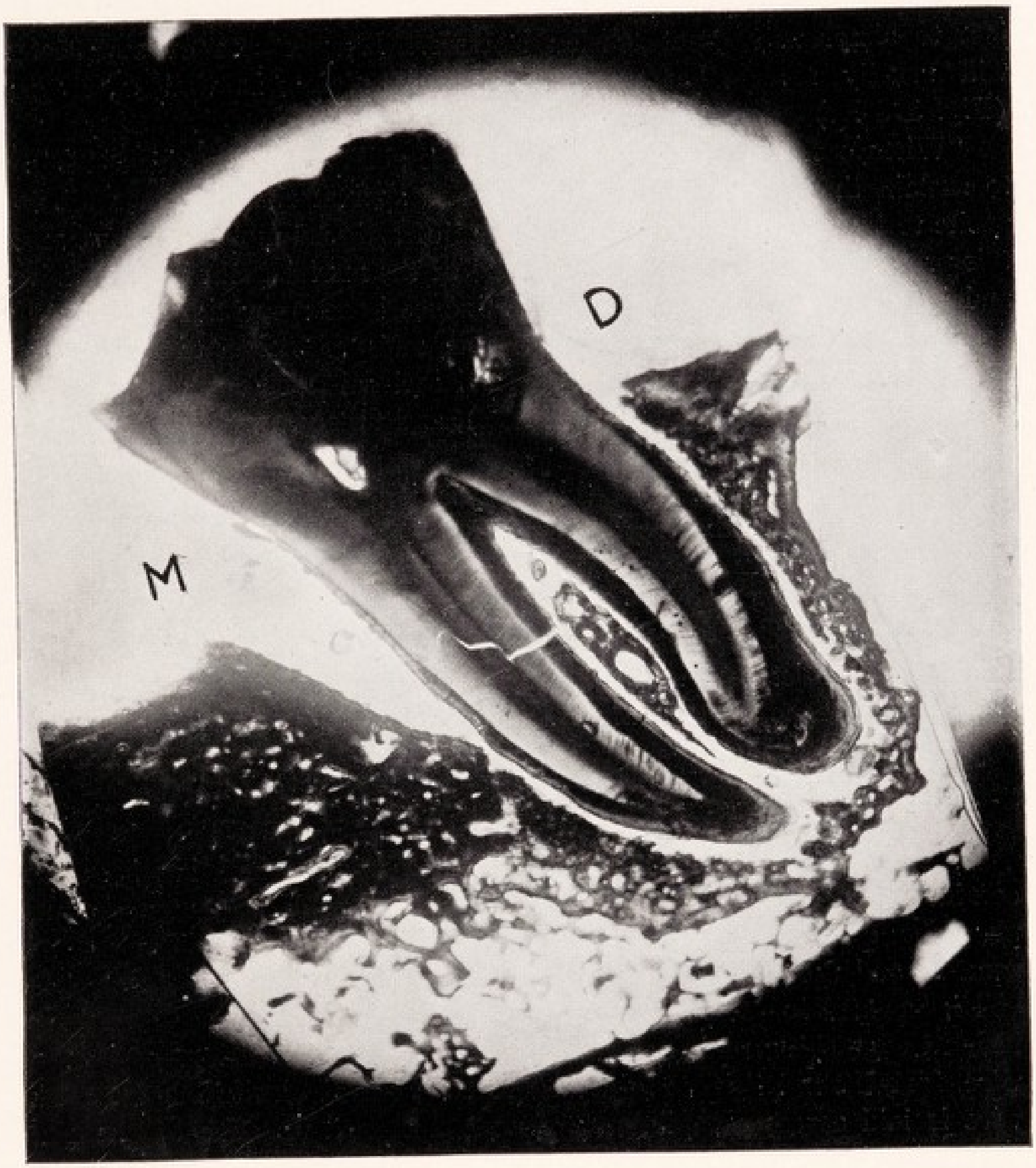


Fig. 338. Cross section, (ground) through lower second molar and alveolar process. The tooth is in mesial inclination. M. Mesial side. D. Distal side

"If a tooth is in normal position, the occlusal stresses, both vertical and lateral, are so balanced that every part of the alveolar bone functions equally. If a tooth is malposed, especially if it is tipped so as to have an abnormal inclination, the stresses are not balanced. A commonly occurring example of this is a lower second molar which tips mesially as a result of drifting after the extraction of the first molar. Here it is evident that the distal part of the alveolar wall, in its gingival third is subject to abnormally great tension stresses. Examination of such cases will usually reveal that the bone in this region is well developed. (Fig. 338 D.)

"When occlusal stresses overbalance the ability of the peridental fibers to sustain them, the tooth exerts pressure against the alveolar wall opposite to the side of tension. In the case of a tipped molar, as illustrated, this pressure occurs in the gingival third of the mesial wall of the alveolus, and is an abnormal stress, tending to induce bone resorption without the development of new bone to take its place, and predisposes to a pathologic condition. In such a case, the abnormal occlusal stresses result in a loss of bone on the mesial side (Fig. 338 M), and thus permit an even greater mesial inclination."

Orthodontic correction of this malposition would be the ideal treatment for such a tooth, preparatory to the construction of a bridge, and such treatment is usually feasible. However, the disinclination of most patients to sacrifice the time, and endure the inconvenience incidental to the placing of such a tooth in a normal position, makes it necessary for the prosthodontist to utilize the tooth as an abutment in *statu quo* and to so construct the bridge that further tipping will be prevented.

Author's Technique for Movable Joint

The author recommends the following technique which has been successful over a period of fifteen years. Cut a piece of 36 gauge platinum plate about one-fourth inch in width. One end of the platinum plate is squared and then beveled with a fine file to a knife edge. The beveled end is grasped in the jaws of a hand-vise and bent slightly upward, the beveled edge being underneath. Select a piece of Ney-Oro No. 4 round wire, from 12 to 14 gauge in diameter and about one inch in length. The wire is laid across the platinum plate, the turned up edge of the plate preventing it from rolling off.

The plate and wire are now grasped by the hand-vise and the plate is bent around the wire until the beveled edge has passed the center of the wire.

The plate with wire in position is then placed on the face of an anvil, and the end of a flat, coarse file is placed on the beveled edge of the platinum plate and pressed downward. (Fig. 339.) By a continuation of this procedure, the plate is rolled around the wire until the beveled edge is in contact with the lower side of the plate. (Fig. 340.) The wire is removed and the seam soldered with pure gold. After soldering the seam, the wire is placed in the tube, the surplus metal is trimmed away as close to the tube as possible and the lap is filed smooth and flush with the sides of the tube. One end of the tube is then filed perfectly flat. Select a small square piece of 36 gauge platinum and melt a little pure gold

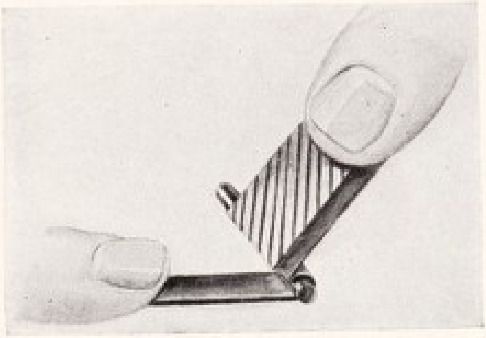


Fig. 339. Rolling a piece of plate around a wire, holding same with a coarse file

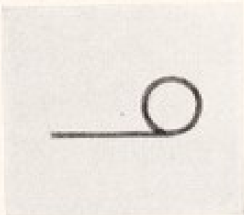


Fig. 340

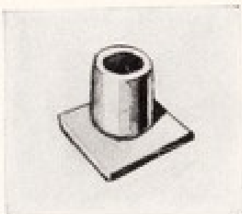


Fig. 341

Fig. 340. The plate is rolled till the beveled edge touches. End view is shown

Fig. 341. Tube set upon platinum plate ready for soldering

on the surface. The tube is then grasped with a pair of pliers, the flat end is placed on the square of platinum and it is soldered into place. (Fig. 341.)

A bridge constructed with this type of attachment is illustrated in Fig. 342. The right lower first molar had been lost and the second and third molars were still in place. The second bicuspid was badly broken down and required a cast crown. A cavity in the second molar required a large m.o.d. inlay.

To assemble the tube and round wire to make the movable joint, carve a hole in the wax pattern of the inlay large enough to accommodate the platinum tube as at B., Fig. 342. This hole should extend into the wax pattern as far as possible. The inlay is cast and the platinum tube (A, Fig. 342) is soldered into the inlay with a 22 K solder, or Ney-Oro G 3 metal. The tube is then trimmed flush with the side of the inlay. The biscuspid crown and the molar inlay are then assembled on the cast and

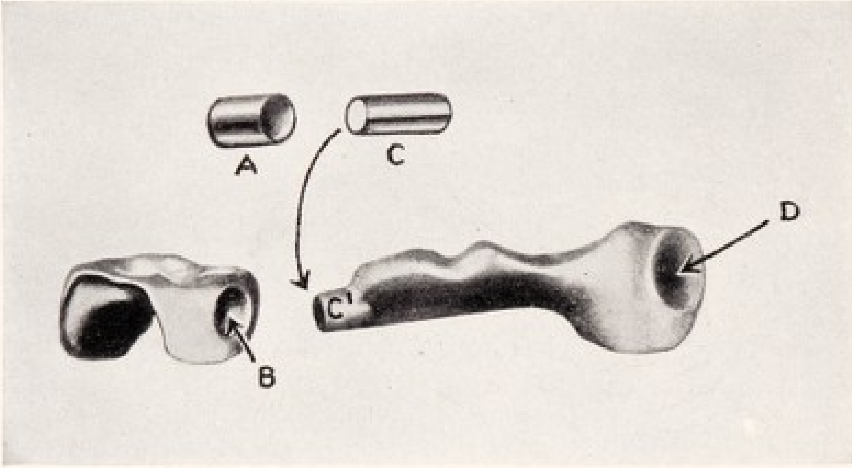


Fig. 342. Parts of a bridge constructed with movable joint

the round wire (C, Fig. 342) is inserted into the platinum tube in the molar inlay. The wax pattern for the cast span is adapted to the round wire by cutting away the wax from the under surface of the span to allow it to fit over the round wire. The wax pattern for the span is then cast. The finished casting is then assembled on the cast. The gold span is attached to the round wire and the bicuspid crown with sticky wax. The bridge is removed from the cast. The gold inlay is slipped off the round wire. The crown, cast span and round wire are invested and the parts soldered together. C′ Fig. 342 represents the round wire after it has been soldered to the gold span. If it is desirable for esthetic reasons, a porcelain inlay may be inserted in the bicuspid crown. The cavity for such an inlay is represented in the bicuspid crown. (D, Fig. 342.) This type of attachment should seldom be used when the posterior abutment is the last tooth in the arch, and it should never be used, when the tooth distal to the posterior abutment has recently been extracted. In either case there is a possibility of the posterior abutment drifting distally.

Under conditions such as those just mentioned, Dr. A. L. King's technique is recommended by the author.

Principles Involved in the Movable Joint

Before describing the King technique for the construction of a movable joint,* it will be desirable to discuss the principles involved in the movable joint as a feature of fixed bridgework. The movable joint is not a new departure in bridgework, but was introduced many years ago. Apparently the men who first used this were seeking a means of avoiding the lossening of inlays which were beginning to be used as bridge abutments. This was at a time when there was very little understanding of the relationship between fixed bridgework and periodontal disease. It is not likely then, that avoidance of fixation of the bridge abutments had anything to do with the early development of this principle.

The movable joint today is regarded chiefly as a means for avoiding the immobilizing of bridge abutments, especially where the bridge is carried by teeth whose position in the arch gives them different functions. It has, of course, the advantage previously noted, of making it possible to utilize as abutments, inlays which would be wrenched from their anchorage if solidly attached to the bridge. Another advantage is that already referred to in the description of the author's technique, namely, the utilization of tipped teeth as abutments.

By the use of the movable joint it is possible to permit for each abutment tooth, virtually the same mobility that it would have if no bridge were attached to it. The natural mobility of teeth with normal periodontal structures is very slight; in fact, imperceptible to the naked eye. Yet such mobility does exist, and is undoubtedly a factor in the normal stimulation of the pericementum, when the teeth are in function. Limitation of this movement may therefore induce tissue changes, which, under certain circumstances, may be unfavorable to health. It would probably be going too far to say that retrograde changes invariably follow the placing of bridges that are completely fixed, because in innumerable cases, such bridges have been successful over a long period of years. It is nevertheless well to bear in mind, that a nearly physiologic movement of abutment teeth is made possible by the movable joint.

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* The author is aware of the introduction to the profession of the idea of the movable joint by several clinicians at an early period in the use of the casting technique. Of these Dr. Elmer T. Sherman presented the idea of a ball and socket joint of which the technique presented in this text embodies certain refinements which make it a more practicable attachment.

Occlusal Grooves and Lugs

A technique which is very commonly used, is one in which a groove is produced in the occlusal surface of an inlay, and a lug is fitted to this groove, this lug being firmly united to the bridge span. This technique has several disadvantages. The most serious one is that it permits excessive mobility, this being more pronounced when the bridge is placed on the upper jaw. Another disadvantage is, that it permits greater torsional movement than is desirable. Moreover, if either abutment is tipped at the time the bridge is placed, this tipping tends to be increased. These disadvantages are overcome by the use of the author's technique.

Another possible disadvantage of this type of movable joint is that it may permit the drifting apart of the abutment teeth. This is especially likely to occur if one of the abutments is the last tooth in the arch, or if the abutment is immediately adjacent to the site of a recent extraction. This may be overcome in part by so planning the case that the wire or lug is at right angles to the direction of occlusal stress. This precaution may, however, not be sufficient, under the circumstances just specified, since the function of the teeth in the various movements of the mandible, especially the protrusive, may tend to induce a distal movement of the last lower molar. The same tendency may be observed on the upper jaw, especially when the third molar has recently been extracted. This tendency is so pronounced, in some cases that it may result in the opening up of contact points even where no teeth are missing. To overcome this difficulty, some means must be devised by which this drifting may be prevented.

It will be obvious that the drifting apart of bridge abutments would seriously endanger the stability of the bridge and would also tend to produce periodontal disease through the production of a traumatic occlusion which would result from the altered occlusal relations.

The technique of Dr. A. L. King represents a very satisfactory solution of this problem. It prevents distal drifting completely, and provides, in a satisfactory manner, for the prevention of torsion and excessive movement. A description of Dr. King's technique follows.

Dr. A. L. King's Technique for the Construction of a Movable Joint

"Fig. 343 A represents a 14 gauge iridio-platinum wire with a ball head C. B is a washer of 30 gauge clasp metal that will not pass over the head C.

"Fig. 344 is a three-quarter crown with a cylinder cavity D that will receive the ball C on the end of the 14 gauge wire A. B is the clasp metal washer about to go to place. The ball joint and shank of same are well coated with antiflux; also the interior of the cavity to receive the ball joint. The washer and surface of the three-quarter crown are then painted with Ney's flux, and the washer is soldered to the three-quarter

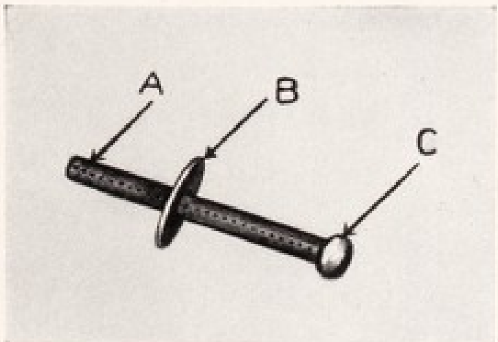

Fig 343

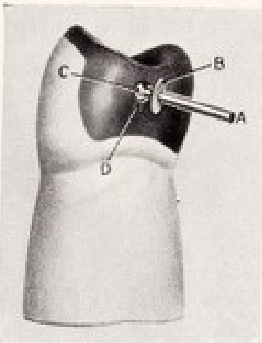

Fig. 344

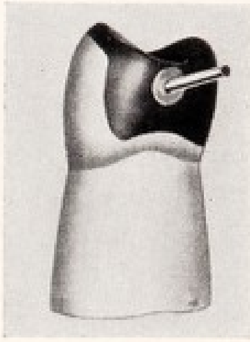

Fig. 345

Fig. 343. A, Iridio-platinum wire with ball head, C. Washer at B

Fig. 344. Shows construction of three-quarter crown with movable joint attachment

Fig. 345. Same as Fig. 344 with attachment in place

crown with 22 K. solder. This makes a perfectly movable joint, the washer holding the ball in its cavity, as illustrated in Fig. 345.

"This joint can be placed either in the abutment piece or in the body of the pontic.

"There is a possibility of solder uniting the pontic to the abutment piece when we solder the free end of the shaft to the body of the bridge. Such union may be avoided by placing a mica washer on the shaft between the mobile joint and the pontic into which the free end is to be soldered. After soldering, the mica is torn out, leaving a freely movable joint."

The Author's Application of Dr. King's Principles

For use in shallow inlays and to enable the student to readily comprehend the detailed steps in the construction of a bridge using this type of attachment the author has evolved the following technique, following the principles laid down by Dr. King:—

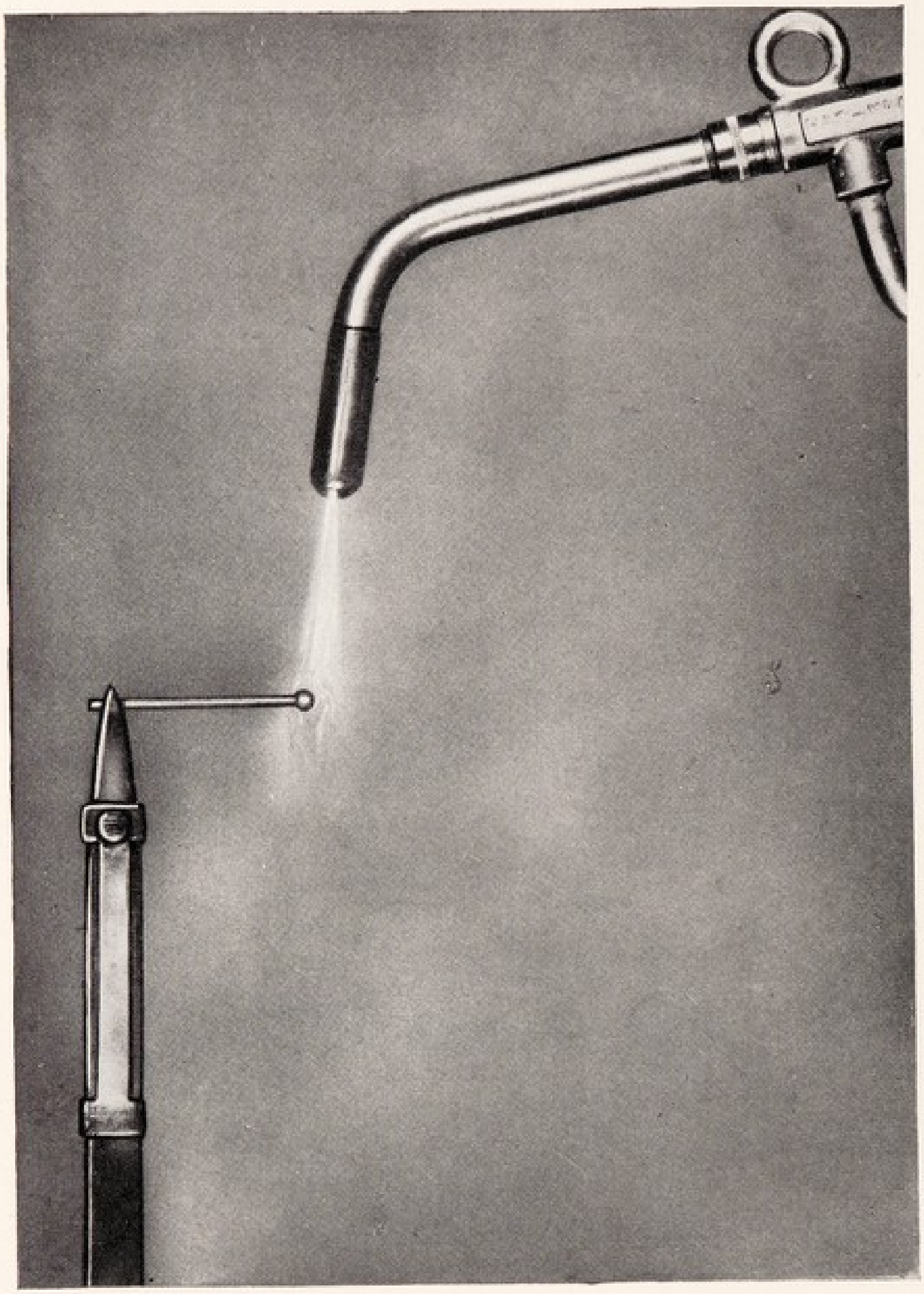

Fig. 346. Fusing ball on the end of wire with blowpipe

Select a piece of 14 gauge Ney-Oro No. 4 round wire and fuse a ball on one end with a blowpipe. (Fig. 346.) Select a flat end stone and "true" on a Stannard Diamond Facing Tool. (Fig. 347.) This stone is used to start the shoulder on the ball of the round wire. (Fig. 348.) To complete the shoulder and establish uniform thickness of the wire, select

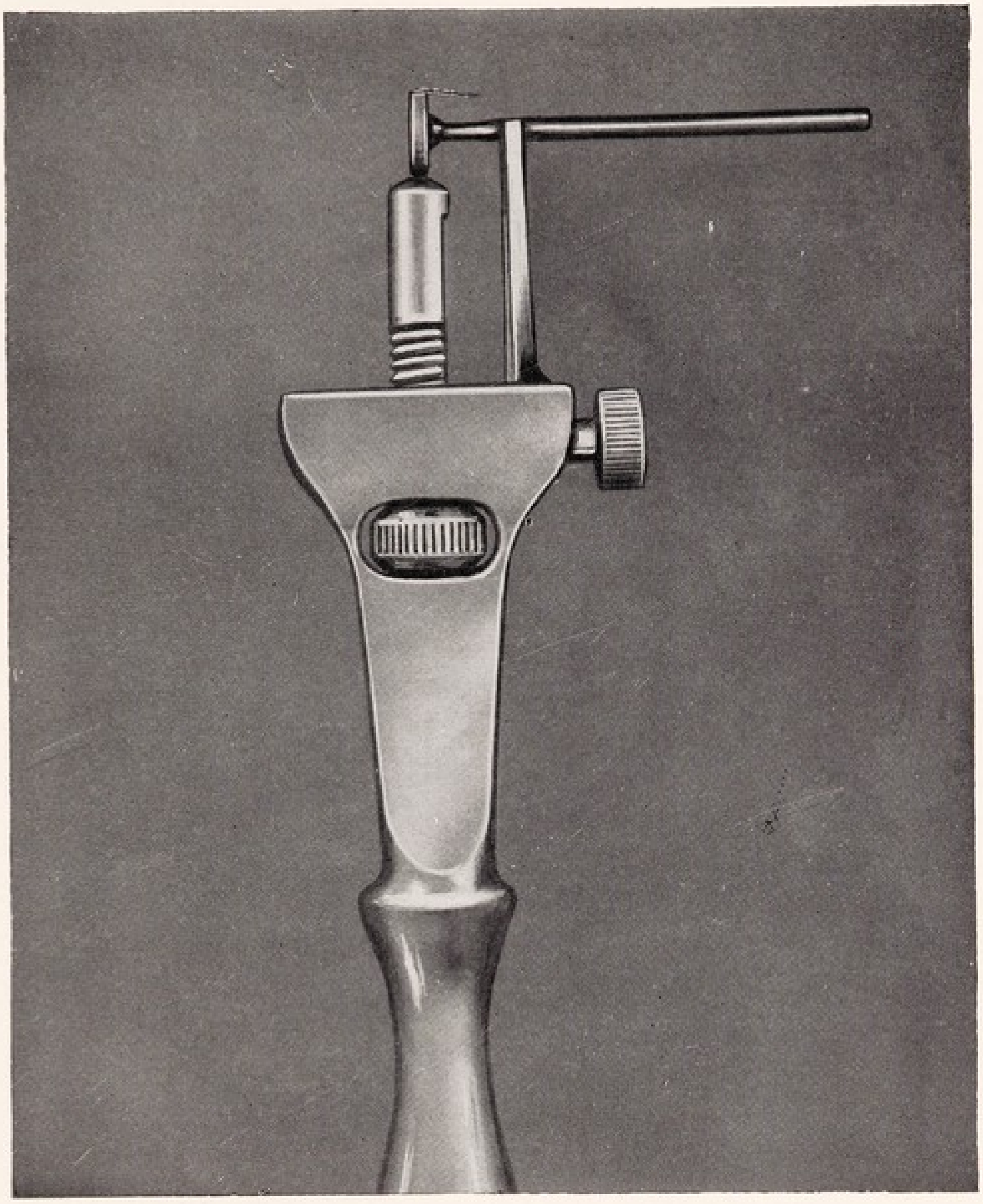

Fig. 347. Stannard Diamond Facing Tool

a fine file with a serrated edge. Holding the wire in the left hand rotate the wire to the right, at the same time passing the file lightly over the wire in the opposite direction and holding the serrated edge of the file against the ball on the end of the wire. (Fig. 349.) A pin-vise may be used for holding the wire if desired. The rounded end of the pin is then filed to a flat surface until the shoulder is about one millimeter in thickness. (Fig. 350.) Select a piece of 30 gauge Ney-Oro No. 4 metal and cut a washer about twice the diameter of the shoulder on the end of the wire. Perforate the washer in the center and enlarge the opening until

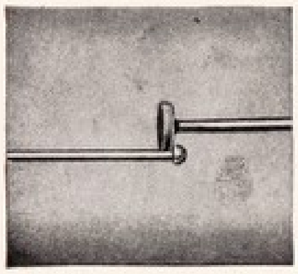

Fig. 348

Fig. 350

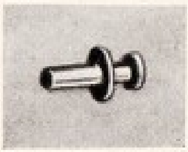

Fig. 351

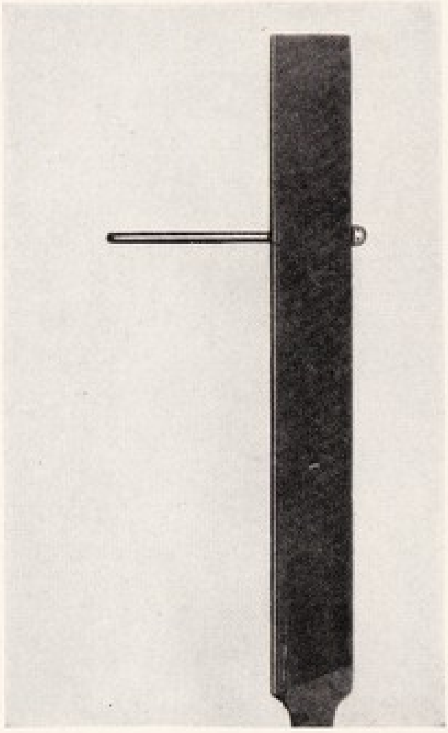

Fig. 349

Fig. 348. Trued stone grinding shoulder back of ball

Fig. 349. Perfecting the shoulder with a file

Fig. 350. Headed pin completed

Fig. 351. Pin fitted with a washer

it fits accurately over the wire. (Fig. 351.) There should be no freedom of movement between the wire and the washer. A close fit of the washer on the wire will prevent tipping of the abutment tooth if it should be out of proper alignment.

Case Suitable for King Technique

Fig. 352 represents an ideal condition for utilizing this type of attachment. The upper right first and third molars have been recently extracted and the second bicuspid and second molar have been attacked by caries. After the wax pattern for the second molar has been prepared, heat the shoulder on the round wire slightly, and force gently into the inlay wax, (Fig. 353), remove quickly, and wipe inlay wax off the wire. Repeat this operation

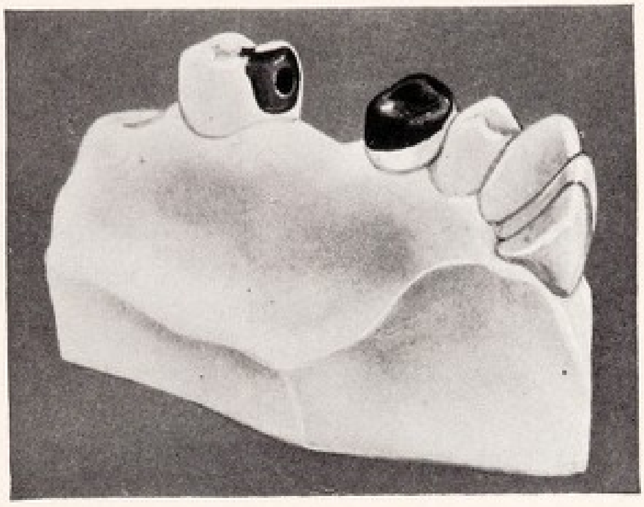

Fig. 352. Case suitable for King technique

Fig. 353

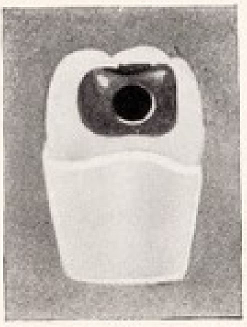

Fig. 354

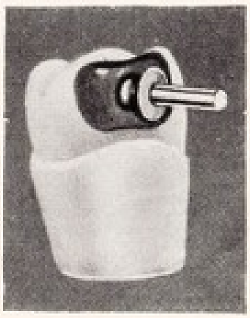

Fig. 355

Fig. 356

Fig. 353. Pin forced gently into pattern for inlay

Fig. 354. Wax pattern of inlay with hole enlarged to accommodate shoulder on the pin

Fig. 355. Shoulder of pin in the hole. Washer about to go to place

Fig. 356. Washer soldered to the inlay

until the shoulder has been imbedded into the wax pattern, so that the washer may make contact with the finished inlay and at the same time permit slight play between the washer and the shoulder of the round wire. Fig. 354 represents the wax pattern after the hole has been enlarged to accommodate the shoulder of the round wire. The wax inlay pattern is then invested and cast. Fig. 355 illustrates the shoulder of the

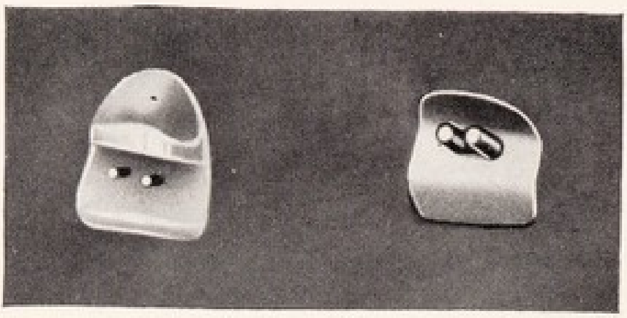

Fig. 357. "Pontopin" tooth with gold backing

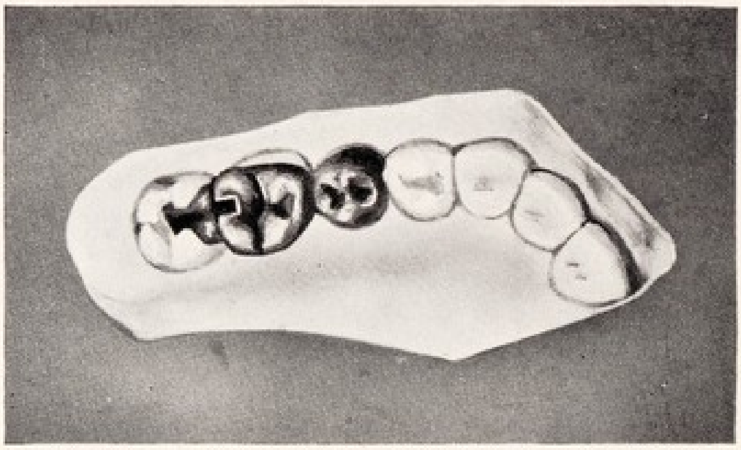

Fig. 358. Cavity cut in occlusal inlay wax, of Pontopin tooth to receive gold wire of the inlay

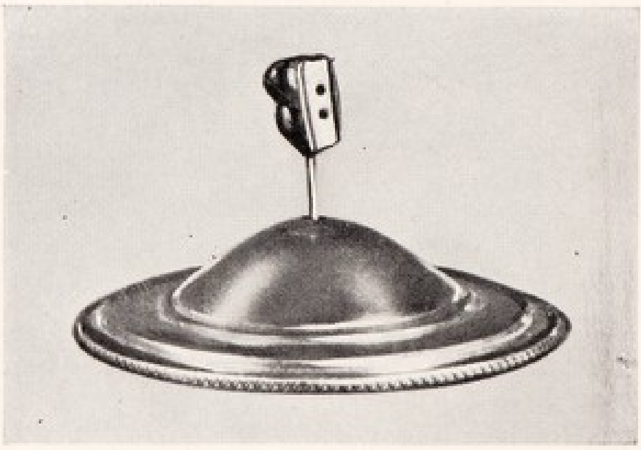

Fig. 359. Porcelain tooth removed and backing mounted ready for casting

wire in the hole in the inlay with the metal washer about to go to place. The hole in the inlay, the shoulder and shank of the pin and the back of the washer are next coated with antiflux, and the washer is soldered to

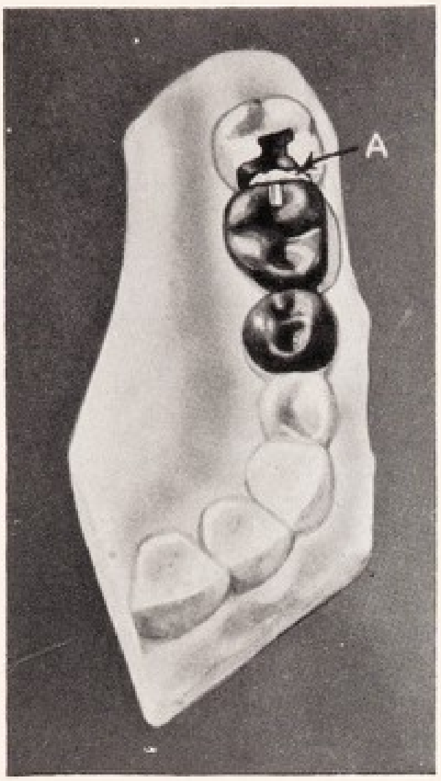

Fig. 360

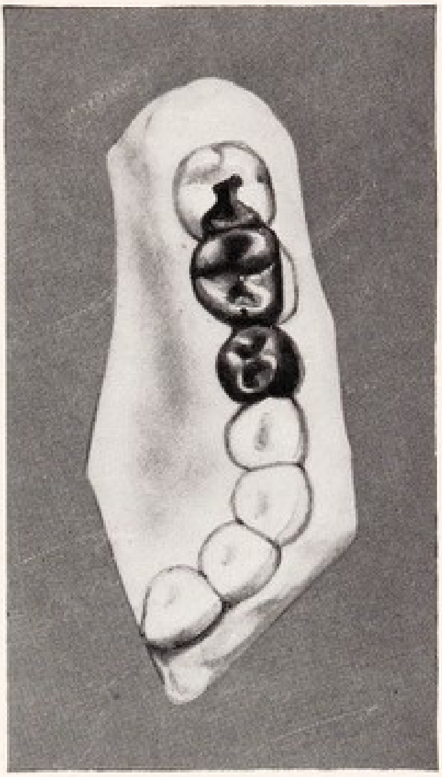

Fig. 361

Fig. 360. Position of mica washer to prevent solder from uniting the adjacent parts

Fig. 361. Finished bridge

the inlay. (Fig. 356.) A "Pontopin" tooth is next ground into position to supply the missing first molar. Fig. 357 illustrates a "Pontopin" tooth with gold backing. Soft inlay wax is attached to the gold backing and the occlusal anatomy is carved. An opening is cut in the inlay wax to accommodate the gold wire in the molar inlay as illustrated in Fig. 358. The "Pontopin" porcelain tooth is removed from the gold backing and a sprue wire is attached to the wax for casting, as illustrated in Fig. 359.

After the dummy is cast the parts are assembled on the cast. To prevent solder uniting the supplied tooth to the molar inlay when the free end of the round wire is soldered to the body of the bridge, paint the mesial surface of the molar inlay with antiflux, and perforate a piece of mica to make a washer that will fit very accurately over the free end of the round wire. The molar inlay with wire and mica washer are placed in position. A, Fig. 360, illustrates the mica washer. The round wire is covered with sticky wax. The bridge is removed from the cast, invested, and the free

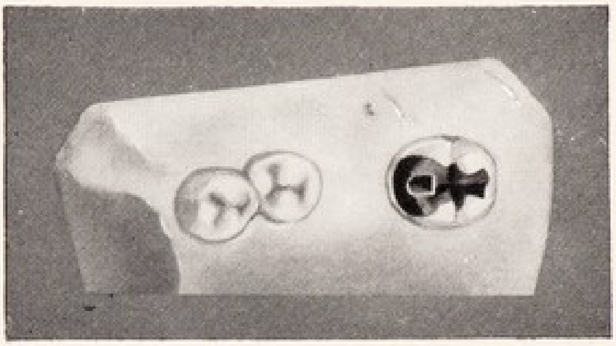

Fig. 362. A case after recent extraction of first and third molars

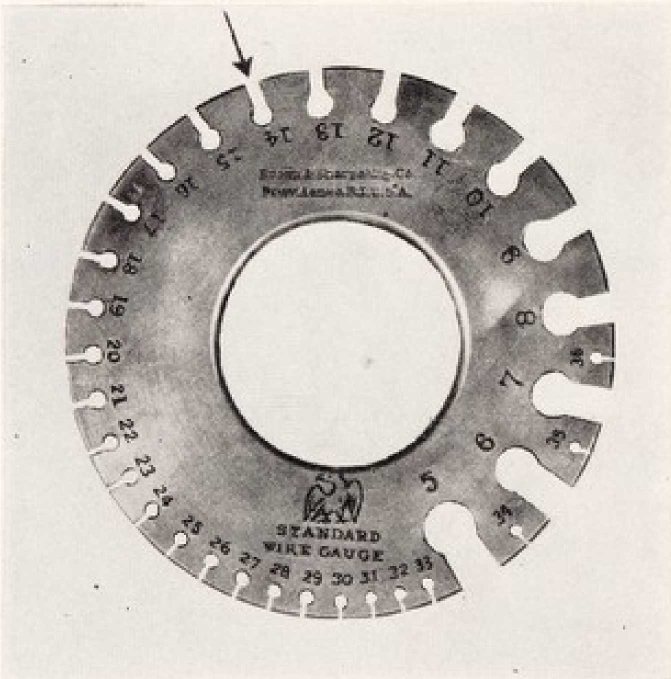

Fig. 363. Brown and Sharpe Standard wire gauge

end of the round wire is soldered to the gold dummy. After soldering the mica washer is removed. Fig. 361 represents the finished bridge.

It frequently happens that a case is presented for the insertion of a bridge in which one of the abutment teeth is found to have a well constructed approximal occlusal inlay. It is desirable in order to prevent

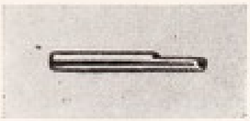

Fig. 364

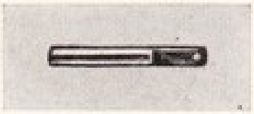

Fig. 365

Fig. 364. Surface of wire flattened with Joe Dandy disk

Fig. 365. Wire perforated near the end

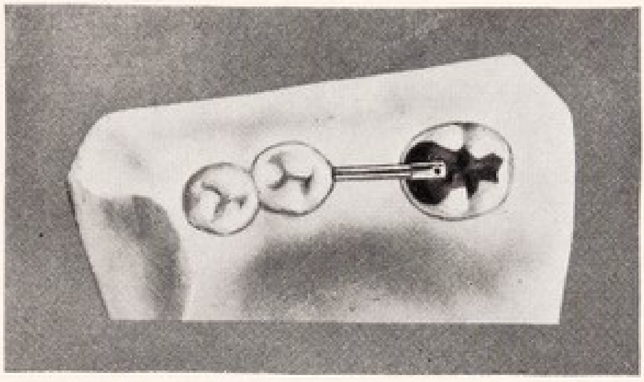

Fig. 366. Wire adjusted to position for drilling hole in inlay

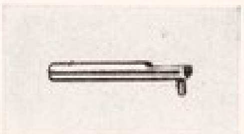

Fig. 367. Extension soldered to wire

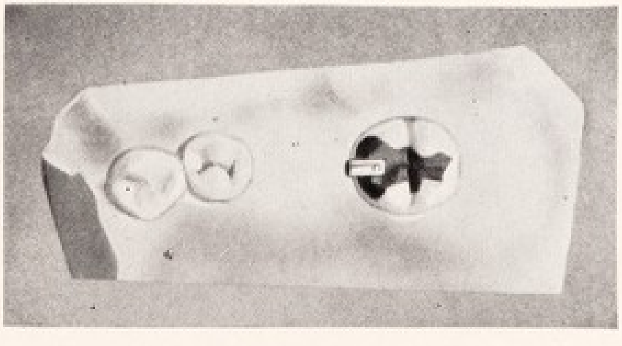

Fig. 368. Attachment in position

further cutting of the tooth to utilize this inlay. The usual procedure is to cut an occlusal slot in the inlay and to construct a lug which is to rest in this slot. If the tooth is a molar and has no molar distal to it, there is grave danger of inducing distal drifting of the tooth if this method is followed. Such an inlay may, however, be utilized if provision is made to prevent this drifting.

Another Technique To Prevent Drifting

Fig. 362 illustrates a case where the lower right first and third molars have been recently extracted. The lower second molar was in normal position and contained a well fitting inlay. To prevent the necessity of removing the inlay in the second molar and at the same time to prevent distal drifting, the author suggests the following technique:—

Select a cross cut fissure bur 14 gauge in diameter using a wire gauge as illustrated in Fig. 363. Cut a groove in the molar inlay deep enough to accommodate a 14 gauge round wire. Select a 14 gauge Ney-Oro No. 4 round wire and, with a "Joe Dandy" disk, flatten the surface of the round wire as in Fig. 364. Using a 21 gauge round bur, perforate the flattened surface of the wire near the end as in Fig. 365. Place the wire in the groove in the inlay with the flat side up. Pass a 21 gauge round bur through the hole and drill a hole in the inlay about two millimeters in depth. (Fig. 366.) Insert a 21 gauge Ney-Oro No. 4 wire through the hole in the flattened 14 gauge wire and force to the depth of the hole in the inlay. Attach the small wire to the flattened wire with sticky wax, remove and solder the parts together with Ney-Oro G 3 metal as in Fig. 367. The round part of the 14 gauge wire is then cut away, except such parts as will be needed for union with the pontic. Fig. 368 illustrates the attachment in place. This attachment is soldered to the cast span when the missing tooth is supplied.

CHAPTER XXII

Atypical Stationary Bridge Cases

In considering the subject of crown and bridgework, it is of course necessary to discuss the typical restorations, that is, those forms of bridges which the dentist is most frequently called upon to construct. It is also desirable to describe the construction of bridges in mouths presenting normal arch contours and normal relationship of teeth. It is a fact however, that in a very large percentage of cases requiring replacement of missing teeth, the position of the remaining teeth is irregular, and also that the teeth which are to be used as abutments may have been so seriously attacked by caries that they present features requiring the devising of an unusual technique in order that they may be utilized. It is of course impossible to describe all the variations which may be encountered. They may be classified, however, with very fair satisfaction.

A very important type of case is that presenting an abnormal spacing of teeth, especially the anterior teeth. Other cases will exhibit the presence of teeth too weak to use as abutments, but not requiring extraction because of disease; abutment teeth placed either to the lingual, or the buccal of the opposing teeth; and finally teeth seriously involved by caries. Conditions of excessive overbite, or of an open bite, may properly be included in this classification as well. The treatment of the latter types has been described in earlier chapters.

Patients often are seen who have anterior teeth which present spaces, either through disease, or through abnormality of eruption. The replacement of one or more teeth under these circumstances presents a problem in esthetics as well as in engineering. In most cases of this type, it is not feasible to place wide facings to obliterate the previous spaces, because of the obvious lack of harmony of tooth form thus introduced. On the other hand the problem of eliminating unsightly gold between the facings and abutment teeth requires a considerable variation in technique from that usually followed in the construction of anterior bridges. In principle the solution of this problem lies in carrying the connecting gold frame-work from the abutment teeth to the facing at a height which will make it invisible to ordinary observation.

Frequently one or both of the upper or lower central incisors are lost, the lateral incisors remaining in place and having sufficient strength to maintain themselves in the arch, if not called upon to carry any additional load. Patients dislike to have such teeth extracted, yet they cannot safely be used as bridge abutments. In these cases the problem may be solved by using the cuspids, or in a case where one central only is missing, using a cuspid and the other central incisor, as abutments. In such cases, the connection between the attachments on the abutment teeth and the facings may be carried behind and above (or below in the case of the lower jaw) the lateral incisors. This technique, if properly carried out, will not jeopardize either the lateral incisors themselves, nor their investing tissues.

Bridge cases in which the abutment teeth are out of line, either to the buccal or lingual, present no serious difficulty provided that these teeth can be relieved of any existing traumatic occlusion before the construction of the bridge. When such correction has been made, it will usually be found that the construction of the bridge will follow along the usual lines, and it only remains to suggest that the development of the cusp form of the pontics be so carried out as to present no possible cusp interference in the various mandibular movements of the patient.

Technique for Using Badly Decayed Molars or Bicuspids as Abutments

Teeth which have been deeply involved by a carious process, usually require devitalization. In addition, it will sometimes be found that the crowns are so very much weakened that they must be cut nearly, or quite to the gum line to reach sound tooth structure. In these cases it is of the first importance that a foundation structure be erected on each abutment previous to the construction of the bridge. In other words, it is a risky procedure to make dowel crowns of any type and unite these crowns with the bridge pontic as a unit. There are too many possible errors which may creep in during the construction of the case, which will tend to cause a defective fit of the finished restoration. The more satisfactory procedure is to fit suitable posts and bands to the abutment teeth, and to construct on these, individual castings representing tooth stumps. These are cemented individually in their respective roots, and the construction of the bridge is then carried on in the usual manner. One of the advantages of this method is that it avoids the difficulties encountered when the roots of abutment teeth are not parallel, as well as the difficulty of paralleling several posts. Shrinkage during soldering, if the older method is followed, would tend to interfere with the setting of the bridge, and might easily

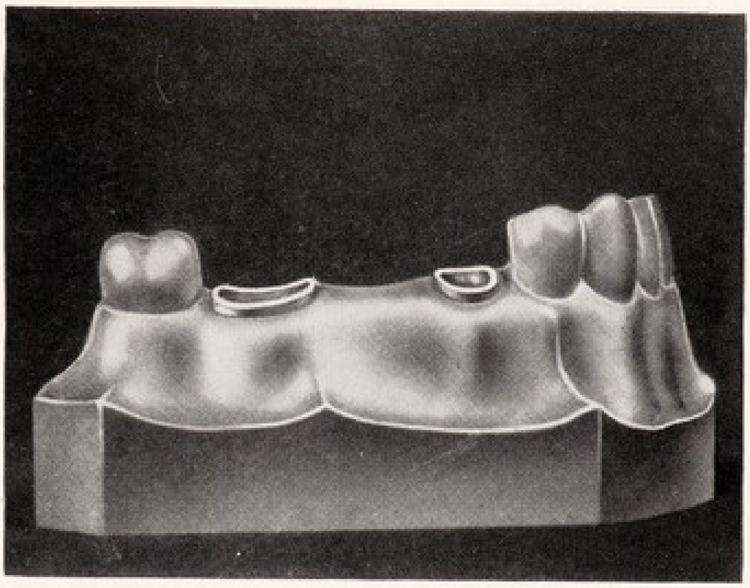

Fig. 369. Cast of case showing missing lower right first molar. The second bicuspid and second molar were very deeply involved by caries

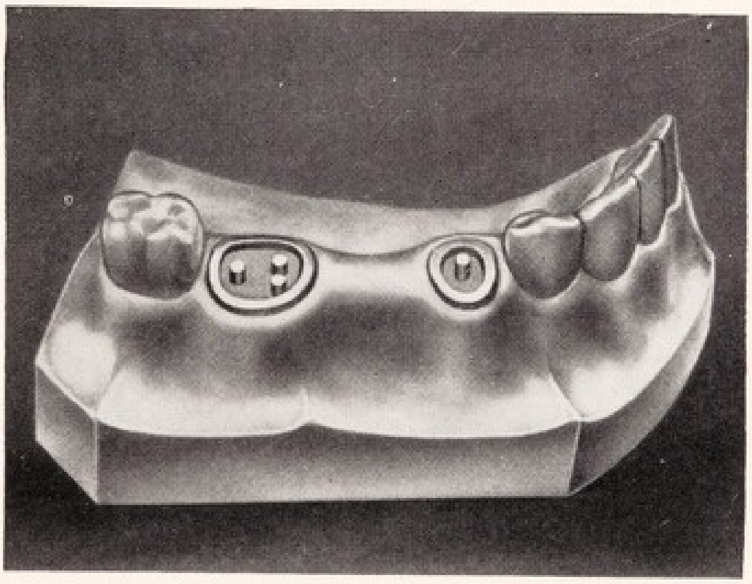

Fig. 370. Case shown in Fig. 369 with root canals filled, posts fitted to each canal, and amalgam packed in the pulp chambers. Note—the lower portion of each post has been coated with sticky wax to permit its withdrawal after the amalgam has set

lead to imperfect fit of bands, and subsequent leakage. This source of error therefore is also eliminated by adopting the procedure here suggested.

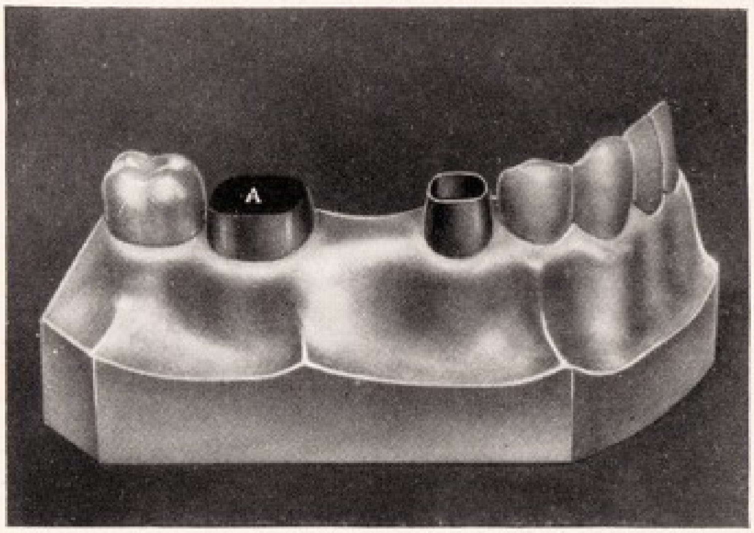

Fig. 371. Case shown in Fig. 369 with gold bands fitted to the tooth stumps A. represents inlay wax pressed into the band and around the posts

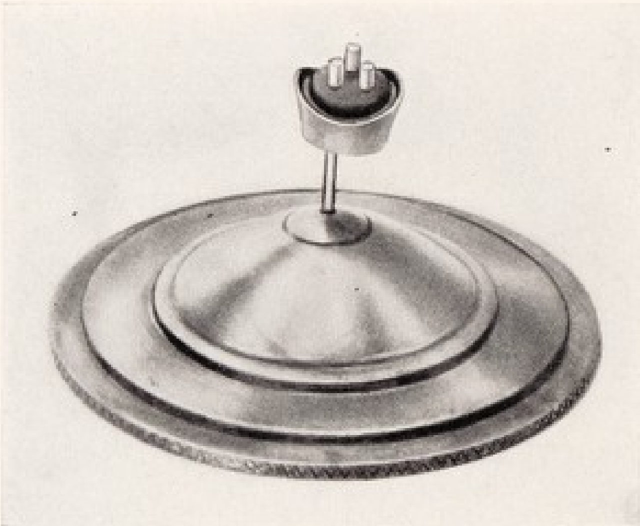

Fig. 372. Band, wax and post assembly mounted on sprue preparatory to investing

Fig. 369 illustrates a case in which the lower first molar on the right side is missing, and in which the second bicuspid and second molar have been extensively attacked by caries. Each of these teeth has been devitalized and the root canals have been properly filled. The tooth structure is so deeply involved that it must be reduced nearly to the gum line. The

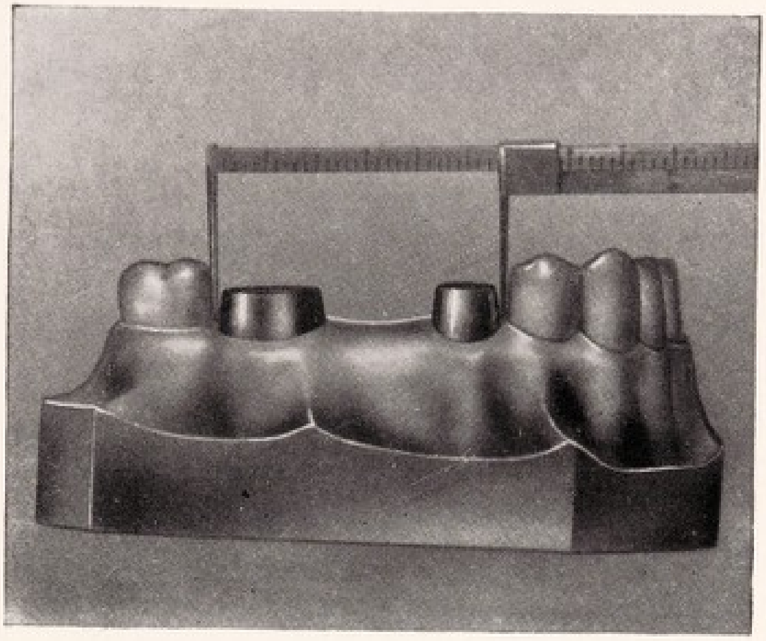

Fig. 373. Case shown in Fig. 369 with bands, after casting, assembled for testing with bridgemeter for parallelism

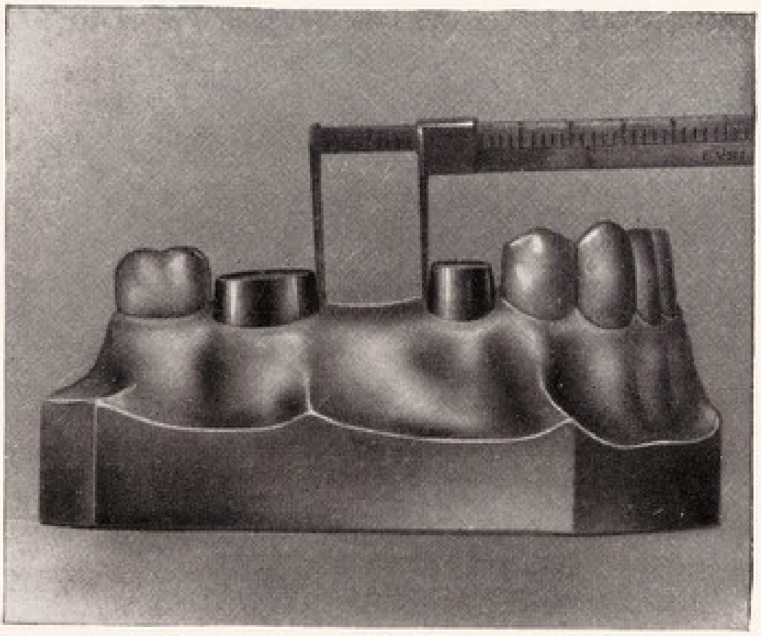

Fig. 374. Same as Fig. 373 showing no encroachment on parallelism of mesial side of the molar with distal side of the bicuspid

first step is to place pins of platinized gold and of proper size in the root canals, one for the bicuspid and three for the molar. The lower portion of the pins, extending into the canal and pulp chamber, are coated with sticky wax (Fig. 81) and after insertion the pulp chambers are filled with amalgam (See Fig. 370). On the following day the pins are heated

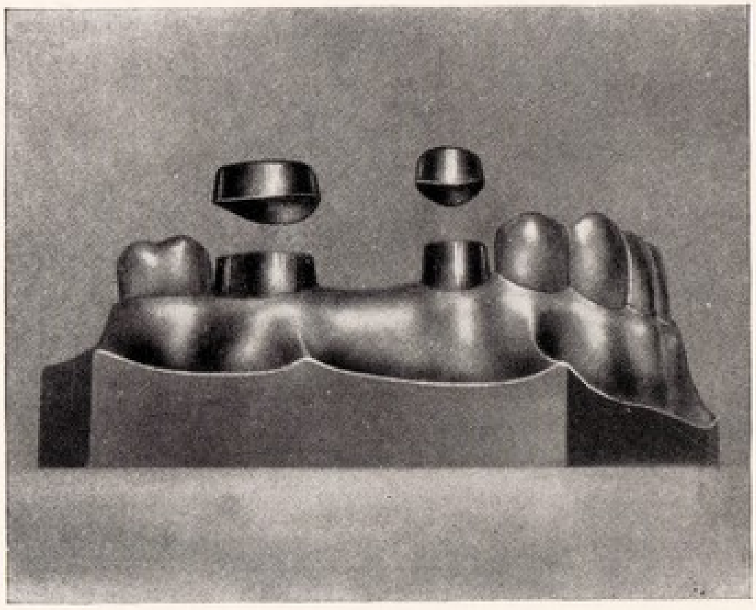

Fig. 375. Case shown in Fig. 374 with bands to which floors have been adapted and fitted over castings

so as to soften the wax, and are removed. The upper ends of the pins are grooved to facilitate the attachment of inlay wax. The enamel of the tooth stump is tapered, so that the greatest circumference of the tooth will be at the gum line. Accurate wire measurements are then taken at the gum line, and bands of 22 K, 30 gauge gold are cut with a taper, sweated together and adjusted to the contour of the tooth at the gum line. (See Fig. 371.) With the pins and bands in position, soft inlay wax is forced into each band. The bands and pins are removed en masse, (see Fig. 372), and invested and cast. The casting should be examined under a magnifying glass to ascertain if there are any minute imperfections, such as small knobs in the region of the band, or elsewhere, which might interfere with the proper placement of the band. If any imperfections are found they are removed with small burs. The castings are then placed on the root ends, and tested with the bridgemeter to insure parallelism of the corresponding parts of the gold castings. (See Figs. 373 and 374.)

Two wire measurements of the castings are now taken, one at the gum line, and one at the occlusal part and 22 K, 30 gauge, gold bands are then

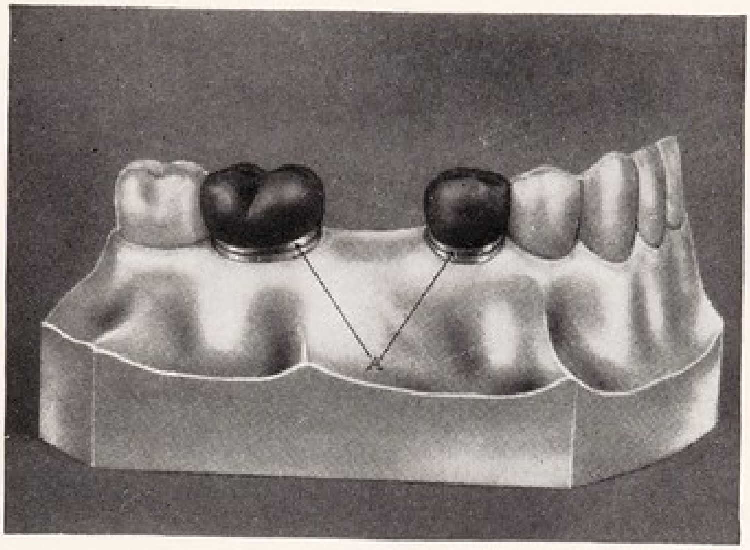

Fig. 376. Case shown in Fig. 375 with inlay wax contoured over the copings. Note that 1 mm. of the edge of the band is left exposed. (A)

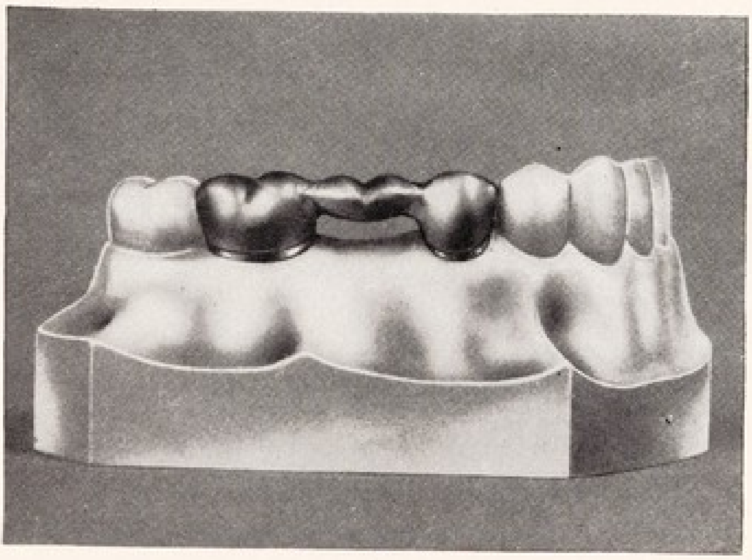

Fig. 377. Buccal view of finished bridge for case shown in Fig. 369

cut and sweated together. These bands are then fitted accurately to the gold castings, and trimmed to approximate the contour of the gum line, but not extending quite to the gum line. The occlusal edges of the bands are then filed to the same length as the gold castings, and gold floors are sweated to the bands as shown in Fig. 375. When this step is completed the gold castings are cemented to place. The gold copings are then placed in position, an impression and bite are taken and a cast poured in plaster.

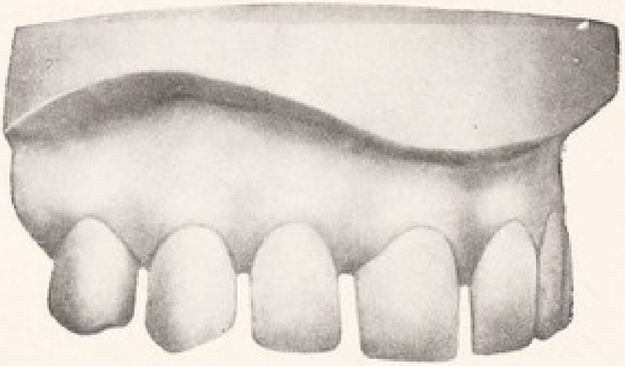

Fig. 378. Case showing marked spacing of upper anterior teeth

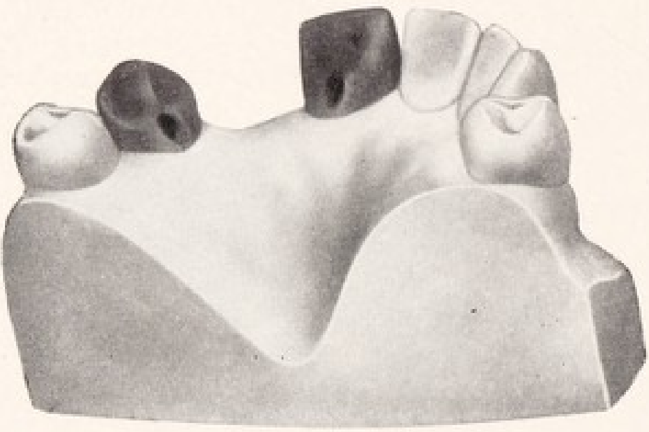

Fig. 379. Lingual view of case shown in Fig. 378 with the right lateral missing. Three-quarter crowns in inlay wax are shown for the right cuspid and central incisor, with indentations in the lingual surfaces near the gum line

Using porcelain teeth as illustrated in Figs. 53-54-55-56-57, cusp anatomy suitable for the case in hand is provided. The occlusal surface, as developed in inlay wax, is placed on the copings and the approximal, buccal and lingual surfaces are properly contoured by adding inlay wax to the copings. About 1 mm. of the band is left exposed at the cervical border. (See A, Fig. 376.) The crowns as so developed are now tried in the mouth for a check on the occlusion. The crowns are then cast, after which the exposed portion of the band is covered with 22 K solder as illustrated in Fig. 63. The cast crowns are then placed in position, an

Fig. 380. Two pieces of 16 gauge round gold wire bent to fit the depressions in the three-quarter crowns shown in Fig. 379

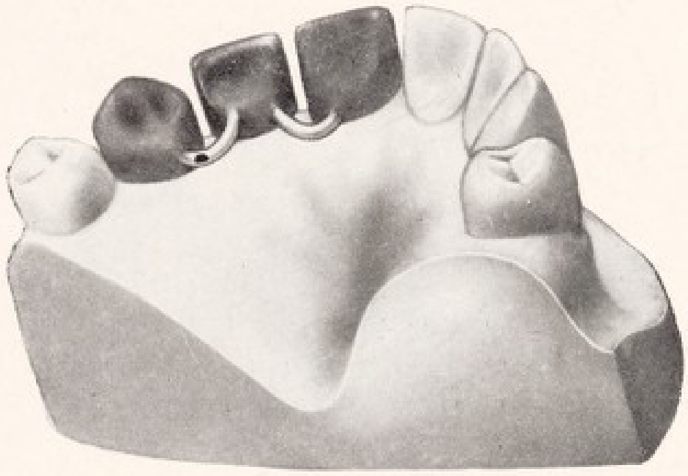

Fig. 381. Lingual view of completed bridge. Note relation of gold wires to the mucosa

Fig. 382. Labial view of completed bridge. Note that wires do not show

impression and bite are taken, and the bridge pontic is constructed as previously described. (See Chapter XX.) The finished bridge is illustrated in Fig. 377.

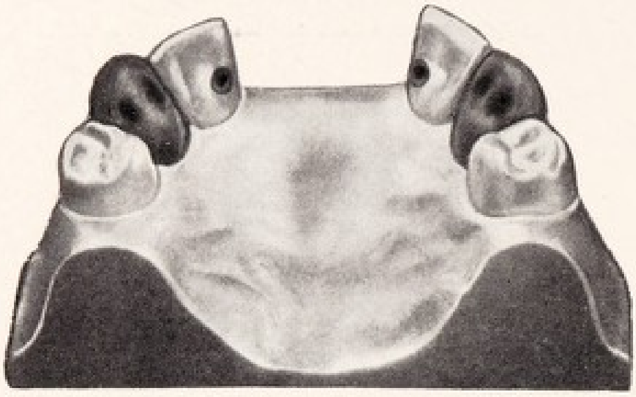

Fig. 383. Lingual view of an upper anterior case in which the central incisors are missing, and in which the lateral incisors while not strong enough to support a bridge are not in need of extraction. Inlays have been placed in the lateral incisors with a recess in each inlay. Three-quarter crowns have been constructed for the cuspids

Bridgework for Abnormally Spaced Anterior Teeth

When a case is presented with abnormal spacing of the upper anterior teeth, as shown in Fig. 378, the replacement of a tooth such as an upper lateral incisor may be accomplished as follows:— Assuming that the upper right lateral incisor is missing, the first step in its replacement is to make three-quarter crowns for the cuspid and central incisor, in the usual manner, as illustrated in Fig. 379. A Steele facing is selected which will be of the same width as the missing tooth. Indentations are made in the wax preparations, for the three-quarter crowns near the cervical border, as illustrated in Fig. 379. These are to accommodate the ends of two pieces of 16 gauge round wire shown in Fig. 380. These pieces of wire are bent and contoured so that they are not noticeable when the case is viewed from the labial side. (See Fig. 381.) The facing which has been selected is now ground to position, a backing is fitted to it, and this is soldered to the ends of the wires. The opposite ends of the wires which fit into the depressions made in the three-quarter crowns, are then soldered to the crowns. Fig. 381 shows a lingual view of the finished case. An anterior view of the finished case is shown in Fig. 382. Note the uniform spacing and the fact that no gold is to be seen.

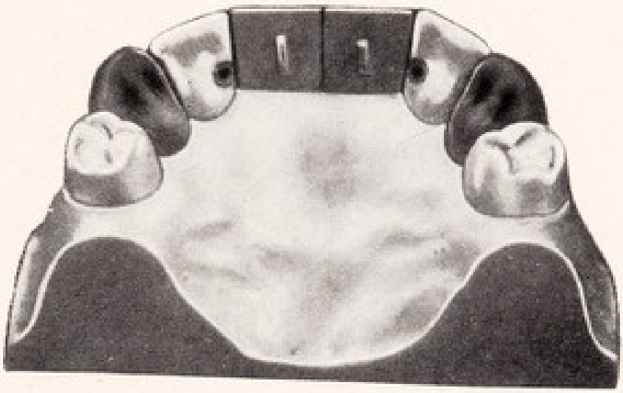

Fig. 384. Case shown in Fig. 383 with Steele's facings and backings ground to place

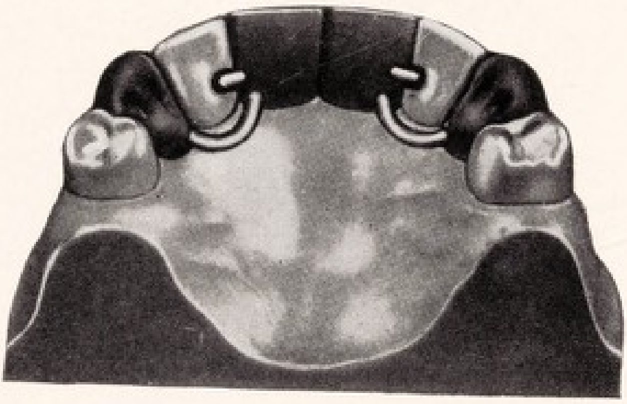

Fig. 385. Lingual view of completed bridge for case shown in Fig. 383 with round gold wires adapted from the lateral incisors, and from the cuspids to the bridge pontic

Problems in Replacement of Incisors

Another problem which frequently confronts the bridgemaker is the replacement of the upper central incisors when the investing tissue of the lateral incisors is strong enough to maintain these teeth in the arch, but entirely inadequate to withstand the additional load imposed if they are utilized as bridge abutments. The author has found the following technique a very satisfactory solution of this problem.

Three-quarter crowns are prepared for the cuspids, and inlays with recesses are placed in the lateral incisors. (See Fig. 383.) Steele's facings and backings are selected and ground to place. (See Fig. 384.) Eighteen gauge Ney-Oro No. 4 wire is adjusted to the recesses in the in-

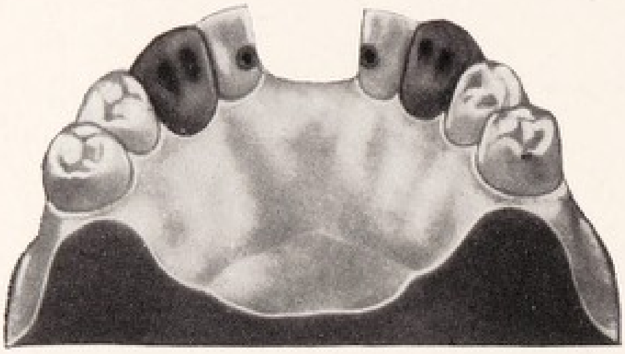

Fig. 386. Case similar to that shown in Fig. 383 in which the lower central incisors are missing

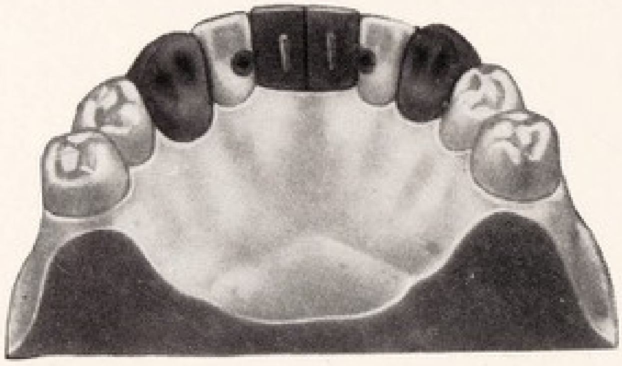

Fig. 387. Case shown in Fig. 386 with Steele's facings and backings adapted, inlays in the lateral incisors and three-quarter crowns on the cuspids as in the case shown in Fig. 384

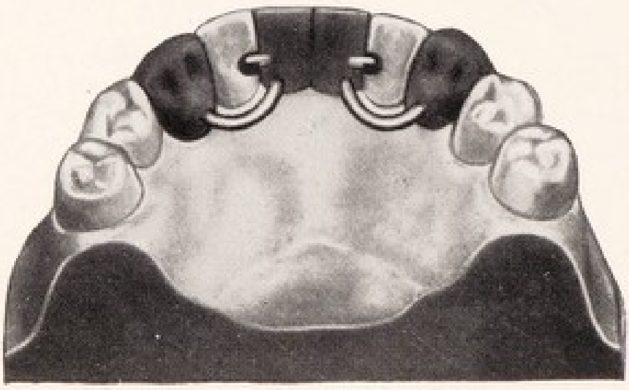

Fig. 388. Lingual view of completed bridge for case shown in Fig. 386

lays in the lateral incisors and soldered to the bridge pontic. Sixteen gauge Ney-Oro No. 4 wire is bent to conform to the outline of the gum behind

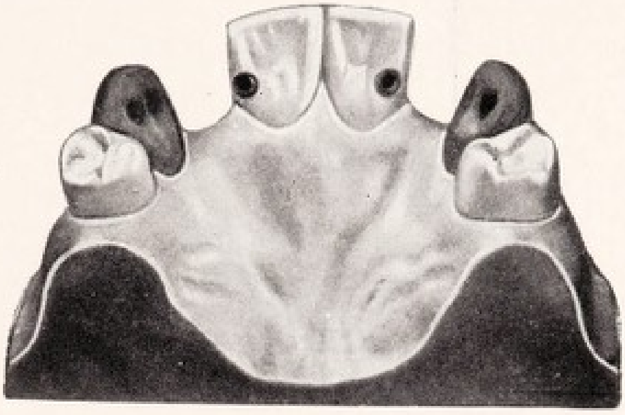

Fig. 389. Lingual view of case in which the upper lateral incisors are missing. Inlays with recesses are provided for the central incisors and three-quarter crowns for the cuspids

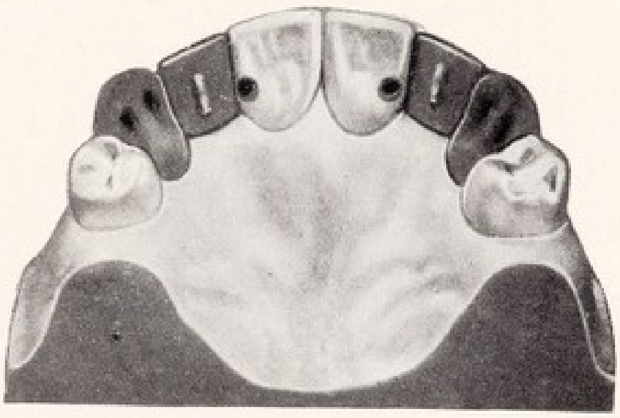

Fig. 390. Case shown in Fig. 389 with Steele's facings and backings adapted

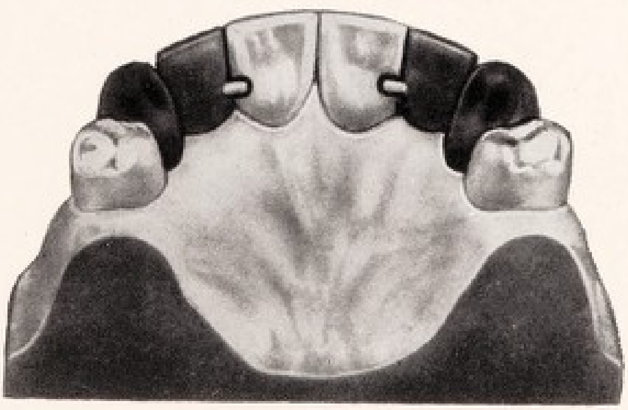

Fig. 391. Lingual view of completed case shown in Fig. 389

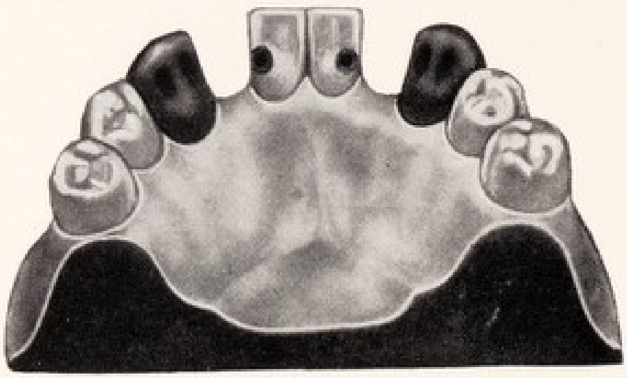

Fig. 392. Lingual view of a lower case similar to that shown in Fig. 389. Note inlays in the central incisors and three-quarter crowns on the cuspids. This technique is only indicated if the central incisors are strong

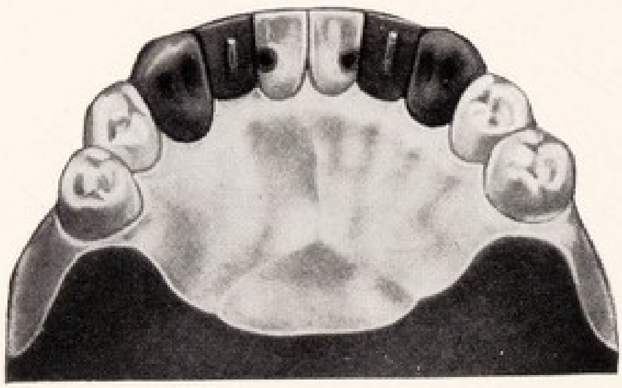

Fig. 393. Case shown in Fig. 392 with Steele's facings and backings adapted

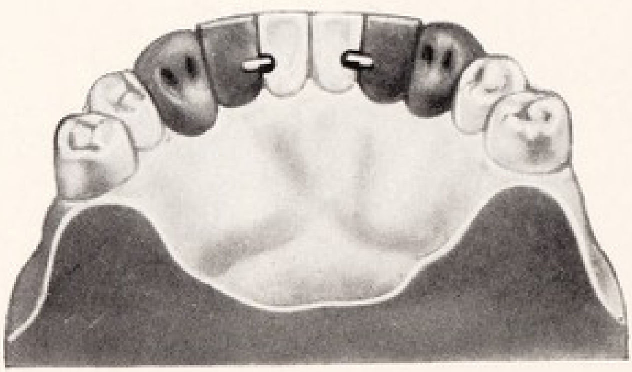

Fig. 394. Lingual view of completed case shown in Fig. 392

and above the lateral incisors. Considerable care should be exercised in placing these wires in order to avoid undue pressure on the gum. A slight contact only should be established, such as will permit the easy passage of an explorer point, or the bristles of a tooth brush. The wires are first soldered to the bridge pontic and the opposite ends are then soldered to the three-quarter crowns. A lingual view of the finished bridge is illustrated in Fig. 385.

The replacement of the lower central incisors (see Fig. 386), is a difficult problem under the most favorable conditions, as the lower lateral incisors seldom present sufficient tooth structure to permit their use as bridge abutments. As in the replacement of the central incisors in the maxillæ, the lower cuspids may be utilized as abutments. (See Fig. 387.) Small inlays may be placed in the lateral incisors to accommodate wire extensions from the bridge pontic. A lingual view of a finished bridge for such a case is illustrated in Fig. 388. Note that only half of the diameter of the 18 gauge round wires is perceptible, at the points where the wires enter the recesses in the gold inlays. This is due to the manner of formation of the recesses in the inlays in the lateral incisors. These recesses have their greatest depth directed toward the cervical area, in order to allow the wire extension to become partly embedded in the inlay in that direction. This technique affords greater stability to the bridge: most of the stress in the anterior part of the lower jaw, under normal conditions, is toward the lingual.

The replacement of the upper lateral incisors under normal conditions is a relatively simple matter. When the investing tissue is strong, considerable sound tooth structure may be saved by placing small inlays with recesses in the central incisors. Adequate anchorage for the bridge may be secured by utilizing three-quarter crowns on the cuspids. (See Fig. 389.) Steele's facings and backings are ground to position and soldered to the three-quarter crowns. (See Fig. 390.) Eighteen gauge round wire is adapted to the recesses in the inlays and soldered to the gold backings. (See Fig. 391.) A similar case for the mandible is illustrated in Figs. 392-393-394. If the investing tissue of the lower central incisors is at all questionable the author recommends connecting the gold backings of the lateral incisors with a piece of 17 gauge Ney-Oro No. 4, round wire, carrying the same below the gingivæ of the lower central incisors.

CHAPTER XXIII

Esthetic Requirements in Bridgework

When bridgework is indicated for the restoration of any of the anterior teeth, the question of esthetics becomes a matter of prime importance. Here the dentist is concerned with the elements of form and color. Frequently, however, these matters are given sole consideration, with the result that interference with function may ensue, to the detriment of the health of the abutment teeth.

Before undertaking the construction of the bridge, it is essential that a study should be made of the relations of the upper and lower teeth, overbite, and the relations of the teeth in the various occlusions.

The esthetic requirements are only to be satisfied by the use of porcelain. Many types of facings have been devised, but the great difficulty has been the question of replacement in case of accidental fracture, to which anterior facings, because of their slight bulk, are especially liable. Of the replaceable facings the Steele has been the most satisfactory. The recent development of the Steele's Trupontic makes possible the attainment of even more satisfactory results. The technique for the use of these facings has been very carefully worked out by the manufacturers and is hereby presented with certain elaborations which it is believed will assist the practitioner in the use of these facings.

Technique for Constructing Anterior Bridge

The technique for the construction of an upper anterior bridge supplying the central and lateral incisors, using three-quarter crowns as the attachments on the cuspids is as follows:—

With the three-quarter crowns in place on the teeth, an accurate plaster impression is obtained, and the cast is poured in Dee low fusing metal "B", first placing a thin coating of cocoanut oil, or vaseline, over the three-quarter crowns. The open ends of the impression are built up with Melotte's moldine in order to retain the molten metal in the plaster impression.

Steele's Trupontic Teeth

Trupontic central and lateral incisors, of a suitable size and color, are selected. The porcelain pontics of these teeth are then ground to fit the alveolar ridge. To facilitate the adaptation of the porcelain to the ridge, first cover the surface of the Dee metal with a

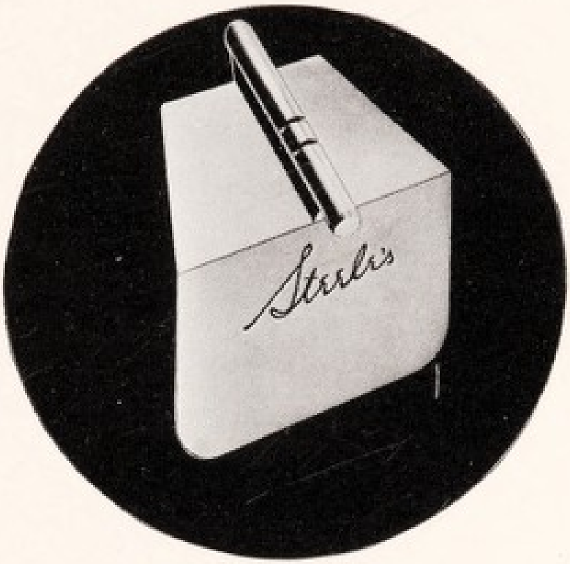

Fig. 395

thin layer of graphite. A soft lead pencil may be used for this purpose. When the porcelain pontic is forced against the Dee metal in the proper alignment, and rocked gently, the graphite will be transferred to the porcelain, indicating the point where the porcelain is to be reduced. This operation is repeated several times until each porcelain facing is in the proper position as to length and alignment with the cuspids and with the other facings. The porcelain pontics should be ground until the incisal tips of the facings are about 1 mm. longer than desired in the finished case. The surface of the cast is then scraped with a sharp instrument, such as a vulcanite scraper, at all points where the porcelain makes contact with the ridge, to a uniform depth of 1 mm. This is to insure a close adaptation of the porcelain to the mucosa of the ridge. The porcelain facings are then placed in correct position and a plaster index is made of the labial surfaces of the porcelain facings and the cast. After the plaster has hardened the index is removed and the metal backings are adjusted to the porcelain teeth.

In Fig. 395 is represented a Trupontic backing. Steele's Trupontic backings are made of clasp metal and have solid posts with sealed rivets.

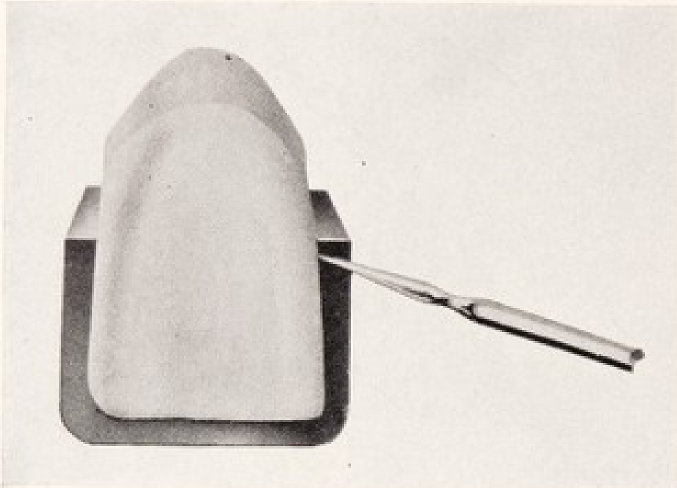

Fig. 396

Fig. 397

These backings should never be immersed, while hot, in acid, or water. Clasp metal when heated to a high degree of temperature, will become softened, if plunged into a cold solution, and as rigidity of the metal backing is desired, this error is to be avoided.

The porcelain teeth are placed on the metal backings and their contours are traced by scratching the metal with the point of a sharp instrument as in Fig. 396. The porcelain teeth are then removed from the metal

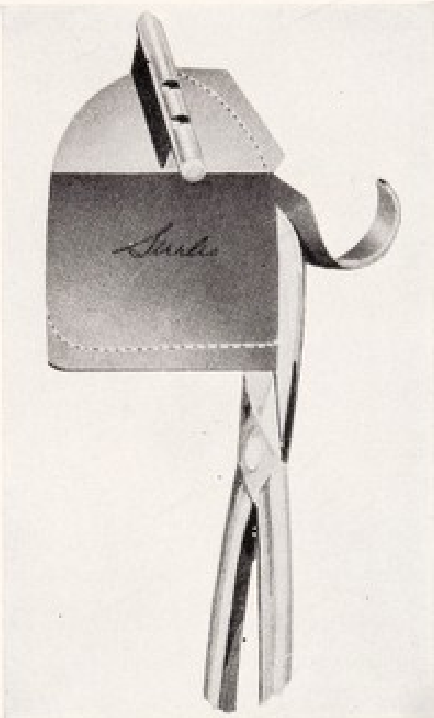

Fig. 398

backings and the backings are trimmed to the outline made by the point of the sharp instrument. Considerable care must be exercised not to distort the metal backings by attempting to cut across the angle with scissors. Before trimming any of the excess metal, first cut a slot, with a Joe Dandy disk, at the angle up to the scratched line, as in Fig. 397. The backings are then cut down to the scratched line, using small, straight-beak, sharp scissors as in Fig. 398. The backings should not be reduced at the incisal tips, as these portions of the backings are later to be reinforced with clasp metal, as an extra protection for the porcelain teeth. The porcelain teeth are next replaced on the metal backings, and a fine, gold file is used to carry the metal flush with the sides of the porcelain teeth. The file should be passed in one direction only—from the metal backings toward the sides of the porcelain teeth at all points, except the incisal tips, until the metal is in close contact with the porcelain as in Fig. 399. The metal backings are then removed from the porcelain

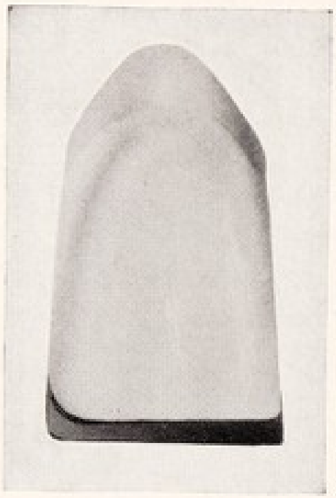

Fig. 399

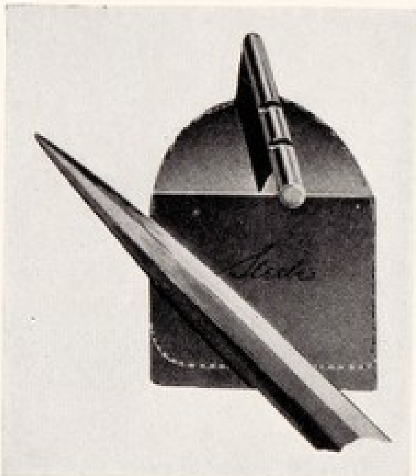

Fig. 400

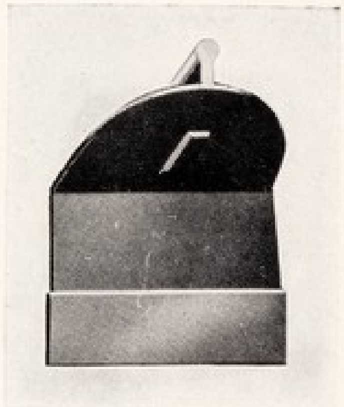

Fig. 401

teeth and the overhanging, burred edges of the metal are reduced with a gold file as in Fig. 400.

All porcelain facings should be protected at the incisal edge to as great an extent as possible from the force of the opposing teeth. Strips of 26 gauge Ney-Oro No. 4 clasp metal are next soldered across the incisal tips of the metal backings on the lingual side, using 20 K. solder, (See Fig. 401). The clasp metal may be attached to the backings by holding the parts together with a pair of tweezers and soldering in the open flame. This is a very important step in the construction of an anterior bridge when porcelain facings are employed and is a part of the technique that should never be neglected.

Fig. 402

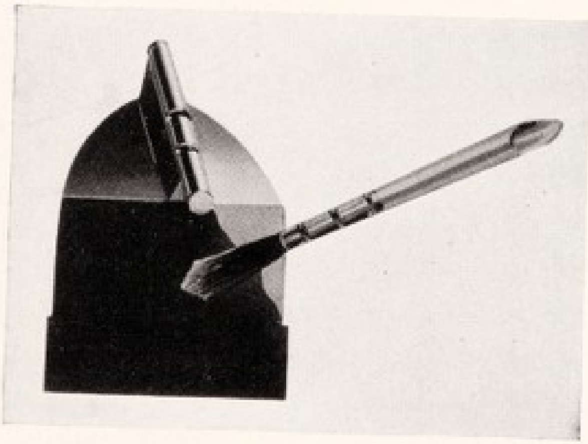

Fig. 403

After the incisal tips of the backings have been reinforced with clasp metal, the backings should be allowed to cool slowly to room temperature. The backings are then cleansed by heating in a 20% solution of sulphuric acid, care being taken not to allow the acid to become heated to the boiling point. The backings are then removed from the acid and washed in water to which a little bicarbonate of soda has been added.

The backings and porcelain teeth are then assembled on the cast and adjusted so that there is a slight space between each backing to allow for the expansion of the metal during soldering as in Fig. 402. A piece of 16 or 17 gauge Ney-Oro No. 4 wire is then bent so that it is in contact with each backing at the angle of the backings on the lingual side. Shallow

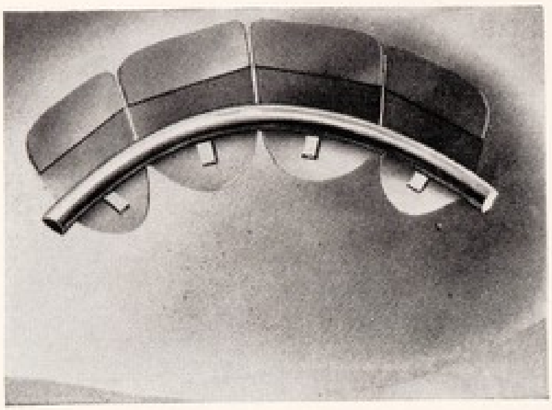

Fig. 404

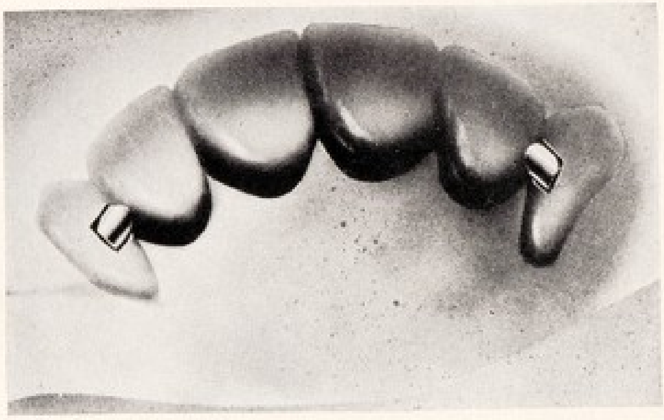

Fig. 405

grooves may be cut in the mesio-lingual surfaces of the three-quarter crowns, to accommodate the opposite ends of the clasp metal wire. The backings and wire are then united with sticky wax. The porcelain teeth are removed and the labial surfaces of the gold backings are covered with a thin coating of Steele's Anti-flux as in Fig. 403. The backings are removed from the cast and invested for soldering as in Fig. 404. Note the position of the reinforcement wire at the angle of the backings. After the backings and reinforcement wire have been soldered together, the metal should be allowed to cool slowly before cleansing as previously described. The segment of the bridge is then placed in position on the cast and attached to the three-quarter crowns with sticky wax. The lingual surface of one of the three-quarter crowns and the bridge segment is covered with plaster. After the plaster has hardened, it is removed, and the three-quarter crown and bridge segment are assembled in the impression. Terraplastica is poured into the impression and the bridge segment is soldered to the three-quarter crown. Observe the cooling and cleansing rule each time the bridge is subjected to high heat in soldering. The bridge is then transferred to the mouth and a plaster impression is taken for the final soldering of the segment to the other three-quarter crown.

If there is any doubt as to the length and alignment of the porcelain facings, the soldered segment of the bridge should be transferred to the mouth before soldering the segment to either abutment. The segment is adjusted to proper position, and attached to the three-quarter crowns with sticky wax. A small quantity of impression plaster is used to engage the lingual surface of the segment and the three-quarter crowns. The impression is packed with Terraplastica which is allowed to harden for at least one hour. The impression plaster is then removed and the segment of the bridge is soldered to the three-quarter crowns. (Fig. 405.) Note the position of the ends of the reinforcement wire resting in the grooves cut in the three-quarter crowns.

When this technique is employed, in the construction of an anterior bridge, considerable care must be exercised in the preparation of the abutment teeth for three-quarter crowns. The dentist must bear in mind that there must be sufficient metal on the mesiolingual surfaces of the three-quarter crowns to permit cutting grooves deep enough to accommodate the full diameter of a piece of 16 gauge clasp metal wire. When the "bite" will permit, this is easily accomplished by increasing the thickness of the inlay wax at these points: however, in "close bite" cases it may be necessary to remove more tooth structure on the abutment teeth at these points, or compromise by reducing the incisal and labial surfaces of the opposing teeth in order to gain sufficient clearance. As a precaution against cutting through the three-quarter crowns when the grooves are formed with burs after the crowns are cast, the author recommends that the grooves be formed in the inlay wax by slightly heating the end of a piece of 16 or 17 gauge clasp metal wire and forcing the wire gently into the wax. This procedure will soften the wax and cause it to adhere to the wire. The wire is quickly withdrawn and the wax is removed from the wire. This operation is repeated several times until the wire is imbedded to its full diameter in the inlay wax. Care must be exercised

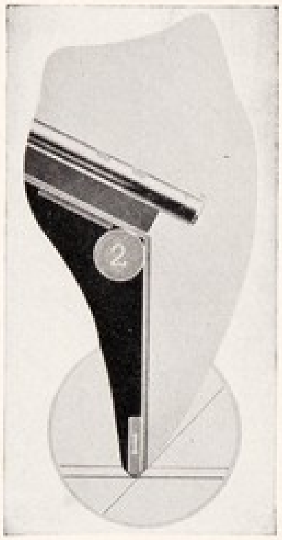

Fig. 406

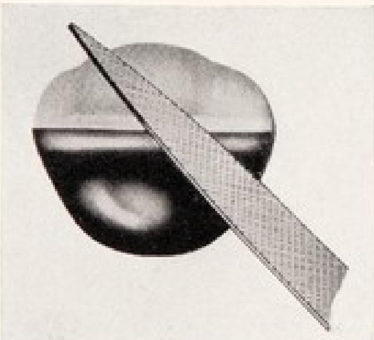

Fig. 407

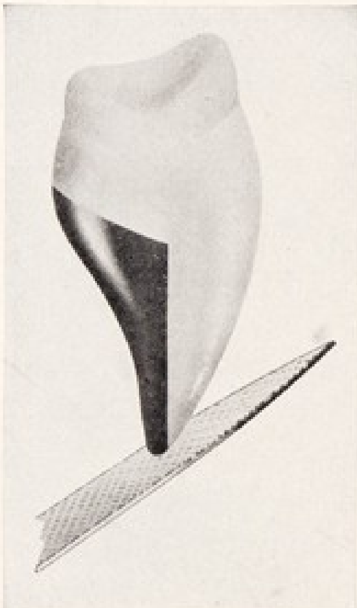

Fig. 408

not to overheat the wire, as this will tend to distort the wax pattern of the three-quarter crown. A temperature that will enable the operator to hold the opposite end of the wire comfortably with the fingers will be sufficient to soften the inlay wax.

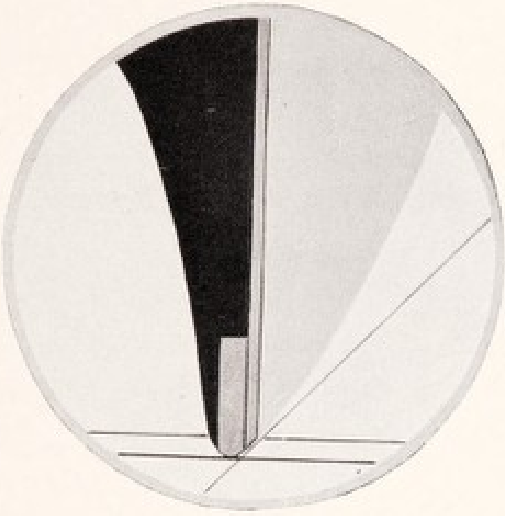

Fig. 409

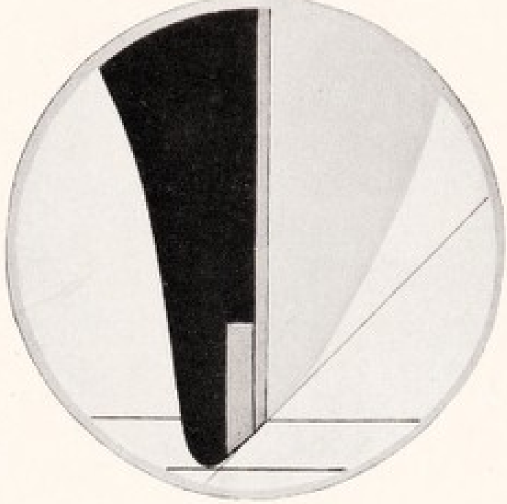

Fig. 410

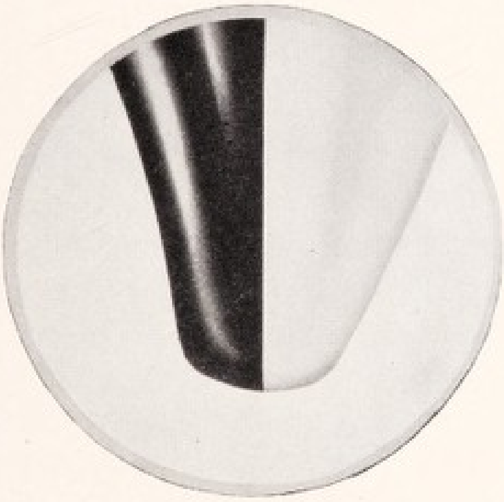

Fig. 411

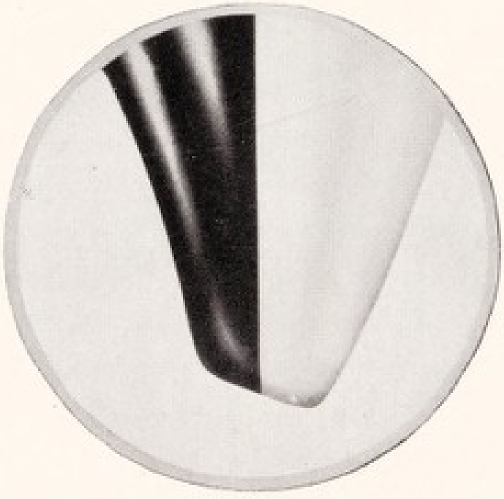

Fig. 412

After the final soldering the bridge is cleansed in acid and oven cooled. (This technique will be described later in connection with the wrought gold wire clasp in removable bridgework).

Finishing and Polishing Incisal Tips

The finishing and polishing of the incisal tips of this type of bridge is of the greatest importance. Unless the incisal tips of the porcelain facings, as finally trimmed, are adequately protected by the gold backings, the life of the bridge will be of a short duration. And in view of the fact that there will be no way of replacing this protection once it is lost, considerable time should be devoted to securing the maximum of protection consistent with esthetic results at this time. Fig. 406 illustrates a cross section of a segment of a bridge of this type, showing a Trupontic porcelain facing, with a properly reinforced metal backing. (1) 26 gauge clasp metal soldered across the lingual surface of the metal backing. (2) 16 gauge round clasp metal reinforcement wire.

The porcelain teeth are first tested for adaptation to their metal backings, and the lingual portion of the bridge is ground and polished. The correct bevel of the incisal tips of the gold backings, is produced by using a fine gold file. The file is passed obliquely across the incisal tips of the gold backings toward the porcelain, with the point of the file pointing gingivally (Figs. 407, 408). File in one direction only, from the gold toward the porcelain.

If normal protection is desired the metal tips at the incisal edges are to be reduced as shown in Fig. 409 and if greater protection is desired the metal tips at the incisal edge should be left thicker and longer as shown in Fig. 410.

In Fig. 411 the gold backing and porcelain facing have been ground until a blunt incisal tip has been produced. This is an error that should never be committed. The gold does not extend beyond the porcelain and the blunt porcelain tip will be subjected to considerable strain and may easily fracture. When the porcelain is allowed to extend beyond the gold as in Fig. 412 there will be no protection of the porcelain facing against the stresses of the opposing teeth. In order to avoid failure of the bridge, due to fracture of the porcelain facings, the incisal tips should never be finished as illustrated in Figs. 411 and 412.

When the bridge has been carried to the point described, it is then placed in position in the mouth. There should be no binding, nor springing of the bridge when it is placed on the abutment teeth, and the porcelain teeth should slide into position easily. If the bridge does not go to place easily, or if the porcelain teeth are not readily seated, endeavor to find the cause and make the necessary corrections before proceeding.

Cementing Porcelains

When cementing the porcelain teeth to their backings use a thin mix of cement. Place the index finger on the lingual surface and with thumb pressure on the labial surface press the tooth against the backing and toward the incisal area as shown in Fig. 413. Maintain this pressure until the cement has set. This will insure proper seating of the tooth and expell all excess cement.

Casting Lingual Surfaces

When it is desirable to build up the lingual surface of the bridge by the casting process proceed as follows:— Adjust and shape backings to the porcelain teeth, in the same manner as outlined for the soldering technique,

Fig. 413

up to the point of reinforcing the incisal tips of the backings with clasp metal. This step will be unnecessary when cast metal is used to build up the lingual surface of the bridge. To insure a close union of the cast metal with the metal backings flux the lingual surface of the backings with a saturated solution of boracic acid crystals and borax in alcohol. Then flow 20 K. solder over the lingual surface of the backings.

Observe the same rule for cooling and cleansing as previously described. Reflux the lingual surfaces of the backings and hold same for a few seconds above the flame of a Bunsen burner to remove all moisture. Inlay wax is then added to the desired thickness and the lingual anatomy is carved to the proper contour. Small notches are then cut in the inlay wax near the contact points (Fig. 414) to accommodate small bars of clasp metal, which, when soldered to place will unite the castings and insure greater strength to the bridge.

Sprue wires are then attached to the inlay wax as in Fig. 415 and the backings are invested and cast in a moderately heated mold. After casting, allow the metal to cool, and then cleanse it. The castings are next adjusted to the porcelain facings and assembled on the model, using a

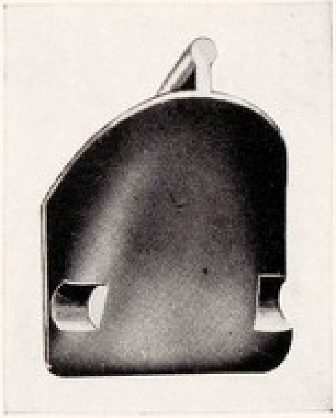

Fig. 414

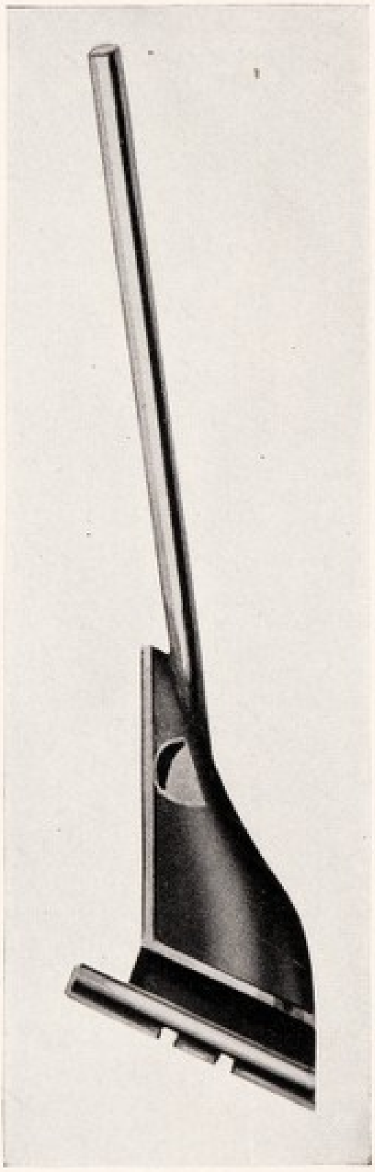

Fig. 415

plaster index as previously described. A plaster impression of the lingual surfaces of the castings and three-quarter crowns is then secured. The porcelain facings are removed and the castings and three-quarter crowns are invested in Terraplastica. After the plaster has been removed small pieces of clasp metal wire are placed in the notches as in Fig. 416. Note that small notches have also been cut in the three-quarter crowns. Antiflux is placed in the notch in one of the three-quarter crowns and the parts of the bridge segment and the other three-quarter crown are soldered together. The bridge is then transferred to the mouth as previously described before soldering to the other three-quarter crown. After the final soldering, the bridge is ground and polished, using the same

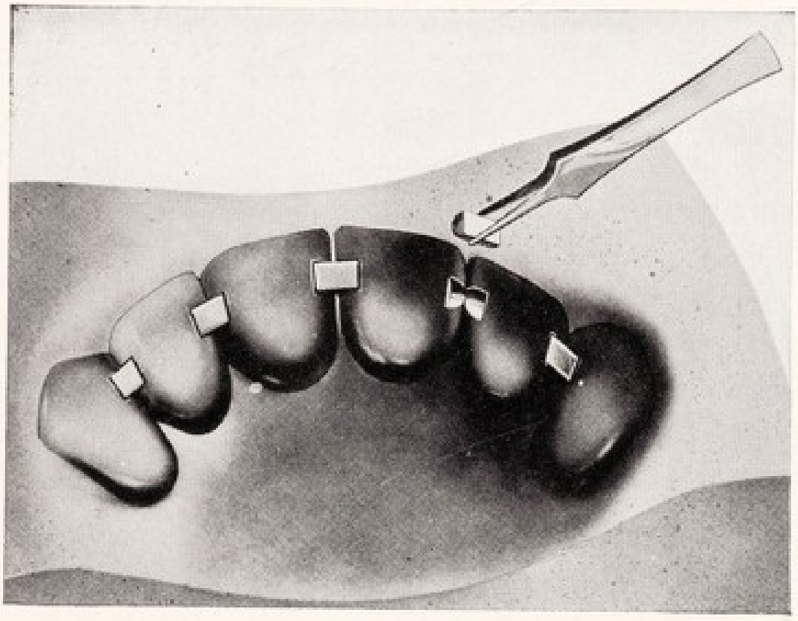

Fig. 416

technique as described in the case in which the soldering method was followed.

In Fig. 417 is shown a labial view of the completed bridge.

Securing Proper Contact With the Mucosa

When the bridge has been completed, and is tried in the mouth, it will frequently be found that the porcelain is either overfull in that part which makes contact with the mucosa, or that there is a deficiency. If the cast has been scraped too much, or if the mucosa is less yielding than usual, too much pressure will be exerted by the porcelain facing. This will be evidenced by blanching, or by pain. This will of course, require grinding of the porcelain until it produces simply a firm pressure when the bridge is in place. Particular care should be taken to avoid heavy pressure on the mucosa near abutment teeth. This tissue shows a special irritability to pressure where it overlies the border of the alveolar crest next to the abutment tooth.

If it is found, when the bridge is tried in, that there is a deficiency of porcelain, it becomes necessary to add more porcelain to the facings. This may be most conveniently and accurately done by placing a small piece of softened modeling compound on the gingival portion of the facings, and, having resoftened it in warm water, the bridge is carried

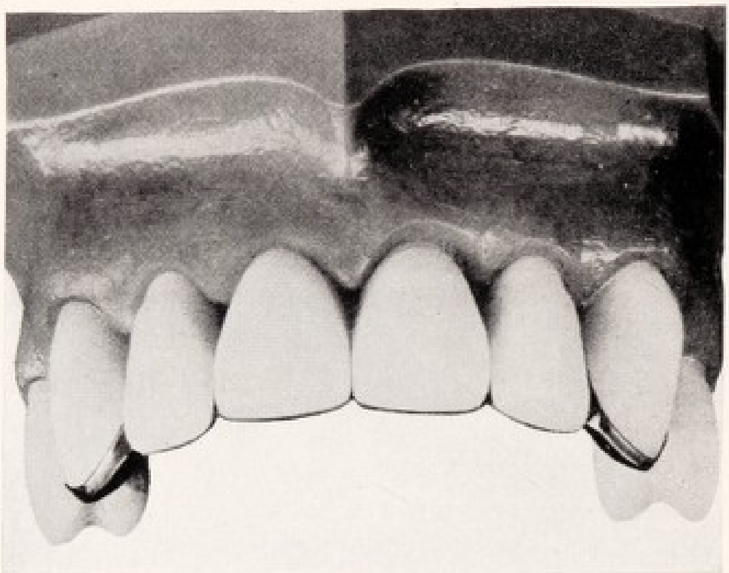

Fig. 417

to place. The compound will give an impression of the mucosa. From this run a small cast in plaster of Paris. After removing the compound this cast will serve as a guide to which to build the additional porcelain. In a similar manner porcelain may be added to facings when extreme recession of the ridge has made it impossible to secure a facing of sufficient length to make contact with the mucosa and maintain correct alignment

Correcting the Occlusion

After the completed bridge has been placed in position it is of paramount importance that the bridge should be relieved from the stresses of the opposing teeth in centric, protrusive and right and left lateral occlusions. This rule applies to the abutment teeth, as well as to the bridge segment. This may be easily accomplished by cutting a small strip of thin paper the same width as the tooth to be tested and about two inches in length. One end of the thin piece of paper is placed back of the lingual surface of the tooth to be tested and the patient is requested to close in centric occlusion. The opposite end of the piece of paper will extend over the labial surface of the opposing teeth. If the incisal contact between the lingual surface of the tooth being tested and the labial surfaces of the opposing teeth is sufficiently close to prevent the easy withdrawal of the strip of paper, a narrow strip of thin articulating paper is placed in the same position and the patient is requested to tap gently in centric occlusion. The points of contact will be indicated by the articulating paper and these points are reduced with fine stones. The contact should be relieved as far as possible on the lingual surface of the bridge. However, if there is a possibility of weakening the incisal tips of the metal backings, the necessary relief may be secured by reducing the tips of the opposing teeth. This is repeated until the narrow strip of paper will not be grasped by the teeth in centric occlusion. The same procedure is repeated for the protrusive and right and left lateral occlusions. Each tooth of the bridge segment, as well as each abutment tooth, is tested in like manner until the entire bridge is free from the stresses of the opposing teeth. This technique, though tedious, will insure a long life of comfort and usefulness for the finished bridge, and if neglected may produce disastrous results for the bridge, or develop a pathological condition in the investing tissues of the abutments, or of the opposing teeth.

Whenever porcelain pontics are used in bridgework that portion of the pontic making contact with the mucosa of the alveolar ridge must have a highly glazed surface.

Dangers of Grinding Porcelain

All porcelain teeth are porous, immediately beneath the surface glaze. If the glazed surface is ground these exposed pores afford harbors for many microörganisms; salivary deposits will also adhere to ground, or unglazed porcelain. For this reason if a pontic of unglazed porcelain is placed in contact with the mucosa an irritation is certain to follow.

These exposed pores will also cause discoloration of the porcelain. This is frequently seen where teeth have been ground at the contact point. This discoloration is due to food, or tobacco stains, that have collected and been deposited in the exposed pores. Glazing will close these pores and prevent both discoloration of the tooth and irritation to the tissues of the mouth.

Polishing will not close these pores, because porcelain cannot be polished to any finer degree than the texture of its internal structure. Porcelain, unlike gold, is not malleable and cannot be burnished. No amount of polishing will produce an unpitted surface, because as some pits are polished out other pores are broken into.

Method of Wet Grinding

Considerable care should be exercised when grinding porcelain teeth. The most satisfactory results are secured by grinding under water. If a dry stone is used to grind porcelain, the abrasive grains of the stone may and usually do become embedded in the pores of the porcelain, and, when subjected to high temperature in glazing, will cause discoloration of the porcelain.

Using a stone of medium fine grit, keep both the tooth and the stone partially submerged in water. The water acts as a vehicle and together with the agitation set up by the turning of the stone carries away the fine particles of porcelain and abrasive materials, thus preventing their lodgement in the porcelain pores. After the wet grinding operation scrub the tooth with a hard bristle brush, in running water. The tooth is then thoroughly dried with a clean dental napkin. A small amount of Steele's super-glaze dry powder is then placed on the napkin and vigorously rubbed into the surface pits and pores. Some of the super-glaze powder is then thoroughly spatulated with distilled water. The consistency of the mix should be rather thin. With a fine camel's hair brush place a thin coat of the wet mix on the ground porcelain surface. Place the tooth in a porcelain furnace and break the current when the temperature reaches 1945 F. As a precaution against inaccuracy of the pyrometer, a pellet of pure gold may be used. The current should be broken when the gold melts.

CHAPTER XXIV

Opening the Bite

Opening the bite may be defined as "the insertion of artificial structures, such as inlays, crowns, bridges and removable appliances, which increase the distance between the maxillary and mandibular teeth, when the jaws are closed."

The need for resorting to this procedure, in most cases, is due to a previous closing of this intermaxillary distance through deformity, drifting subsequent to the extraction of teeth, or excessive wear. While this operation is frequently indicated in mouths from which no teeth are missing, the larger number of cases in which opening of the bite is needed are those requiring the restoration of missing teeth with bridgework. It may be said, however, that the principles and techniques to be enunciated, are also applicable to cases with no missing teeth, and also to many partial denture cases.

When there has been excessive wear of teeth, and there has resulted a danger of pulp involvement, the need for opening the bite is fairly obvious. Also, when closing of the bite has resulted in facial disfigurement, or in functional disability and possible trauma in the condyle region, it is evident that the bite must be opened.

But there are many cases in which there is no element of possible pulp involvement, nor of disfigurement, but in which there has been interference with function due to varying degrees of closure. The need of opening the bite in these cases is not always obvious, yet failure to include this in the restorative program, may result in injury to bridge abutments and even generalized periodontal disease. This follows from the statements which have previously been made regarding the injurious influence of traumatic occlusion upon the periodontal structures of teeth, and the observed fact that traumatic occlusion very frequently comes into existence as the bite undergoes closure. For example, the bridge worker is frequently confronted with a condition, in which there has been a slight interference with normal function. In many of his cases, the damage which is being produced, at the time of the first examination may be so slight as to escape observation upon casual inspection. But, in many of these cases the insertion of bridgework, if adjusted to maintain the existing occlusal level, even if it be well adjusted to the other teeth at that level, serves to light a fuse which induces a rapid conflagration in the periodontal tissues of the teeth involved, and often of others in the mouth. This experience has been of such frequent occurrence as to carry it well beyond the range of coincidence, and has resulted in the promulgation of a definite and invariable policy, calling for the coördination of the occlusion to the maximum obtainable extent, preceding bridge construction. Occlusal adjustment, such as is here indicated, very often necessitates the opening of the bite in order that interference in lateral occlusions may be eliminated.

Notwithstanding the inconvenience involved in this procedure, it is to be regarded as a fundamental requisite to complete success in restorative work. The complexity of the operations involved, renders it a major prosthetic procedure, inasmuch as it requires the raising of the occlusal level of all posterior teeth, either upper or lower; even those not involved in the support of the bridge. The dentist naturally shrinks from extensive cutting into teeth which may have escaped even the smallest fillings, and he also hestitates to undertake a series of operations which require high accurracy in their execution, and in which the slightest lapse results in discomfort, if not failure. But these considerations cannot be urged against the merits of the proposal. In cases where opening the bite is indicated it should either be carried through in a correct manner, or the patient should be warned that the results will probably be disappointing.

Contraindications Against Opening the Bite

The foregoing deals chiefly with the indications for opening the bite; there are also contraindications which must be considered.

Perhaps the most important of these is the indication against opening the bite in young patients. In the earlier years of life the teeth are moved more readily under pressure, and consequently the posterior teeth are usually depressed in their sockets by the extra pressure induced by an appliance used for opening the bite. This results in a subsequent closing of the bite and reëstablishment of the original condition. This restriction applies not only to the patient under twenty years of age, who should in any event be referred to the orthodontist for the establishment of correct occlusal conditions, but it also applies to the patient below thirty-five years of age, in whom also depression of the posterior teeth may occur under the pressure of an appliance. For this intermediate patient orthodontia should marshall its resources, and is in fact doing so, but if orthodontia is found to be not feasible, a compromise treatment must be worked out and must be frankly recognized as such.

Cases are frequently seen, in which opening of the bite would be indicated, due to closure following extraction of posterior teeth, and in which opening of the bite offers the only means for the elimination of lateral interference. It will of course, often be found that cases exhibiting interference in lateral movement may be given sufficient functional occlusion for the maintainance of health by judicious grinding. This should be done, wherever the desired result can be obtained without unduly sacrificing tooth structure. When grinding will not serve the purpose, and when there remain in the posterior part of the mouth only such teeth as are to be used for bridge abutments, the opening of the bite on these teeth only may impose so much additional strain as to endanger these abutment teeth, and may therefore be contraindicated. As an example, there may be taken a case in which the mandibular second bicuspids and first molars are missing, and also the third molars. The first bicuspids and second molars may have adequate alveolar support for either fixed or removable restorations. In such a case it will nearly always be found that the upper and lower anterior teeth are in contact in centric occlusion. While the anterior teeth may be suffering to a slight extent from traumatic occlusion, at the same time they divide with the posterior teeth the pressure involved in the actions of the muscles of mastication, and thereby to that extent lighten the load on the posterior teeth. In such a case, opening of the bite will primarily separate the anterior teeth, at least in centric occlusion. The occlusal load will therefore fall entirely on the posterior teeth. When there is added to this the burden of supporting the bridge pontic, the result may be a dangerous breaking down of the periodontal tissues around the abutment teeth. Under such circumstances raising of the bite on the posterior teeth alone is contraindicated. The procedure in such cases will usually be to provide the degree of opening needed to relieve interference in lateral movements by means of bridgework and then to place porcelain jacket crowns on as many of the anterior teeth as may be required to provide a full distribution of stress throughout the mouth. Needless to say the porcelain jacket crowns must be so formed as not to reëstablish the original lateral interference.

A very important contraindication against opening the bite is to be found in cases in which there has been a generalized resorption of alveolar bone around the posterior teeth. On casual examination these teeth may appear to be firm and may seem capable of carrying their present occlusal load. On studying the radiographs if it is found that the absorption of bone has progressed so that only half, or a little more than half of the original alveolar support remains, opening of the bite will be a dangerous

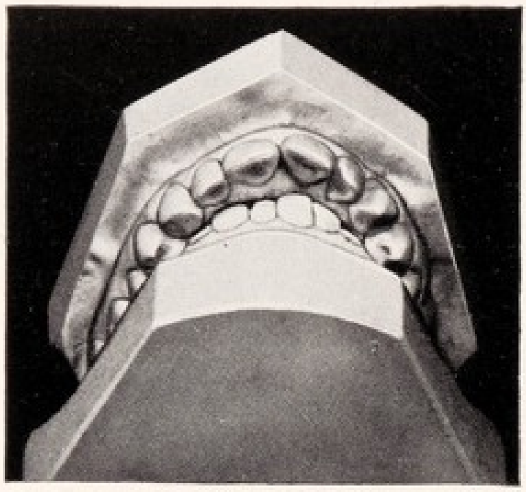

Fig. 418. Cast of upper and lower teeth, of a case requiring opening of the bite. Note the lower incisors making contact with the mucosa lingually of the upper incisors. Note also the relation of the upper and lower cuspids; such a relation produced marked interference with the lateral movements of the mandible

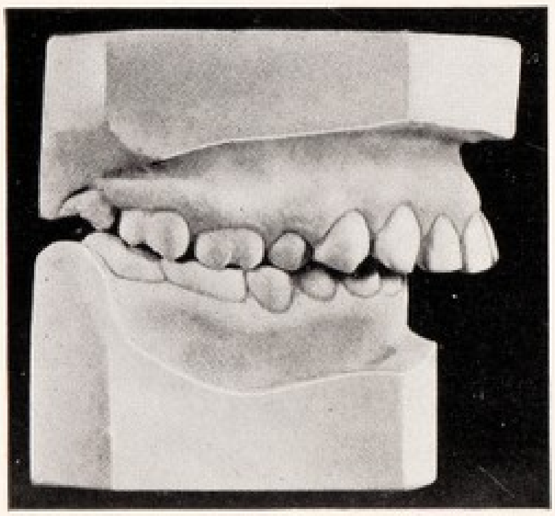

Fig. 419

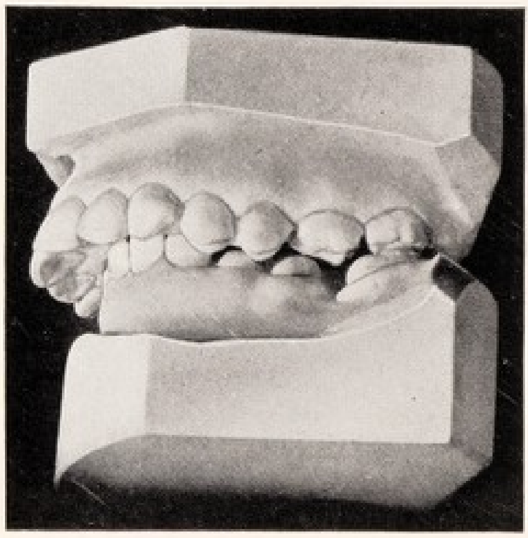

Fig. 420

Fig. 419. View of right side of case shown in Fig. 418. Note extreme overbite and overjet

Fig. 420. View of left side of case shown in Fig. 418. Note that the lower bicuspids have drifted so that they occlude completely to the lingual of the upper bicuspids and the first molar

procedure. The reason is that the clinical crown (Gottlieb) of the tooth has become so much longer in proportion to the clinical root, that the leverage on the root support will constitute an intolerable burden.

By "clinical crown" is meant that part of the tooth which extends above the crest of the alveolar bone. In the normal case it includes the anatomical crown and a slight extent of the anatomical root. The "clinical root" is that part of the tooth root which is enclosed within alveolar bone. Because of the fact that the crown of the human tooth is invariably larger in diameter than its root, it follows that the clinical root must be longer than the

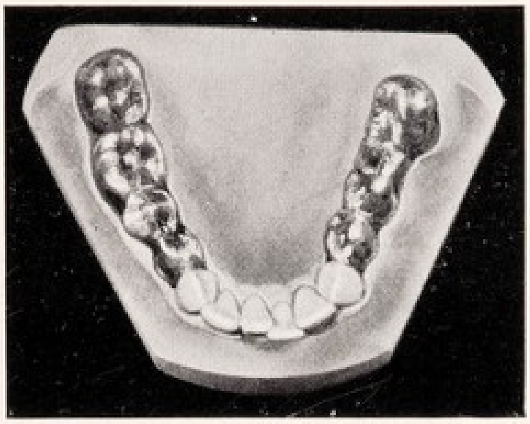

Fig. 421. Occlusal view of the cast of the lower jaw, showing tinfoil adapted to the occlusal surfaces of the bicuspids and molars and extending slightly beyond the greatest diameter of the teeth

clinical crown if adequate support against leverage is to be maintained. Nature usually provides a greater amount of alveolar support than is actually needed. Hence, even when some of this support has been lost, the alveolar bone may still provide sufficient support for the occlusal load. But, if the clinical crown has been increased in length by the resorption of alveolar bone, and if its length is still further increased by inlays, or other structures used for opening the bite, the added leverage is very likely to impose a burden which will lead to rapid periodontal destruction. If a case of this nature is encountered, and if there are missing teeth which require replacement, it is the part of wisdom to plan for dentures, either full or partial, rather than to initiate a program which is bound to lead to failure.

Technical Steps in Opening the Bite

The detailed steps to be followed in a case requiring the opening of the bite (as illustrated in Figs. 418, 419, 420) are as follows:

Accurate study casts are obtained and mounted on an adjustable articulator and all peculiarities of cusp height and occlusal interference are noted;

also the amount of opening, necessary to produce a proper occlusal level, is determined at this time. In Fig. 418 it will be noted that the lower teeth are in contact with the mucosa of the ridge lingually to the upper anterior teeth in centric occlusion. On the right side (Fig. 419) there is fair occlusal contact in centric occlusion, but on the left side (Fig. 420) the

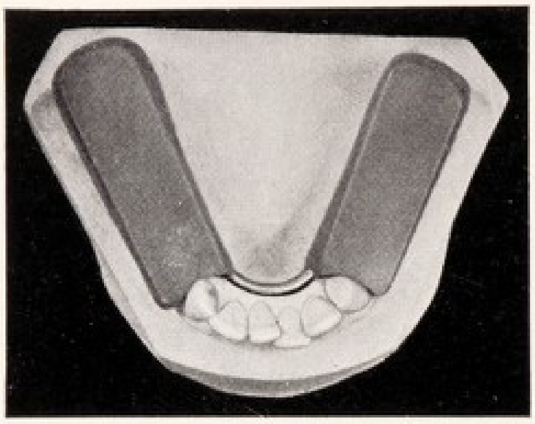

Fig. 422. Pink base plate wax adapted to the tinfoil shown in Fig. 421, and with a lingual bar incorporated in it

lower bicuspids have drifted so that they have a position lingually to the upper bicuspids, and are virtually out of occlusal contact. In a young patient such a case should receive orthodontic treatment, but in the case illustrated the age of the patient renders the feasibility of such treatment very questionable. Opening of the bite is usually the most satisfactory procedure for such cases in patients past the age of forty.

Technique for Using Dentocoll

The first step, in this technique, is the construction of a vulcanite splint. It is imperative that an accurate impression of the occlusal surfaces of the lower teeth be obtained in order that the splint may fit properly. The author has found Dentocoll an ideal material for securing such an impression. It is necessary, however, that the material be properly used to secure satisfactory results. Briefly the technique of its use is as follows:

A stick of Dentocoll is placed in the syringe. If the stick does not completely fill the space in the syringe this is an indication that moisture has evaporated from the Dentocoll. Fill this space with water, in order to provide for the proper consistency of the material after boiling. The Dentocoll is boiled with the syringe immersed, but held at such a height that the water will not come over the barrel of the syringe. After boiling, for four minutes, remove from the water and mix with the mixing rod. Replace in the water and boil for one minute. Remove and work the mixing rod up and down vigorously ten or twelve times. Place the syringe in tepid water for about twelve seconds, and mix vigorously. Repeat this operation three times. The cooling is terminated when the syringe can be held against the cheek without discomfort. Open the syringe and if the material does not pour out and if it has a glossy surface it is of the proper consistency to be placed in the impression tray.

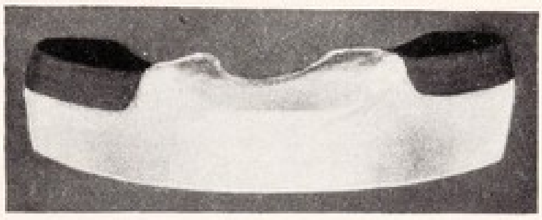

Fig. 423. Artificial stone poured into the tinfoil and wax after its removal from the cast and made ready for vulcanizing

Place a small mass of the Dentocoll in the tray and press the material through the openings; then fill the whole tray with the material. While inserting the material in the impression tray, have the patient rinse the mouth with ice water. Place the tray filled with Dentocoll in the mouth, in the same manner as for a plaster impression. When the impression material is properly seated, release the pressure and hold it gently in place. Using a large syringe, flush the mouth with ice water for three minutes, using a pus tray to receive the water as it flows from the mouth. The material must be thoroughly and completely cooled for satisfactory results.

To remove the impression from the mouth, place the index finger of your right hand against the distal lower border of the tray on the left side, and exert pressure upward, until the seal is broken. Repeat on the opposite side of the mouth; then remove the tray from the mouth by the stem. The impression should be washed under the cold water tap and poured immediately. If this is not possible, it should be placed in the Dentocoll Hygrophor, or a receptacle filled with water. The impression must not be left exposed to the air, or there will be a loss of water content, causing contraction.

Construction of Bite-Raising Splint

A cast of artificial stone is poured. The separation of the cast from the impression is facilitated by dipping it in cold water before any attempt is made to remove it. After separation, tin foil is carefully

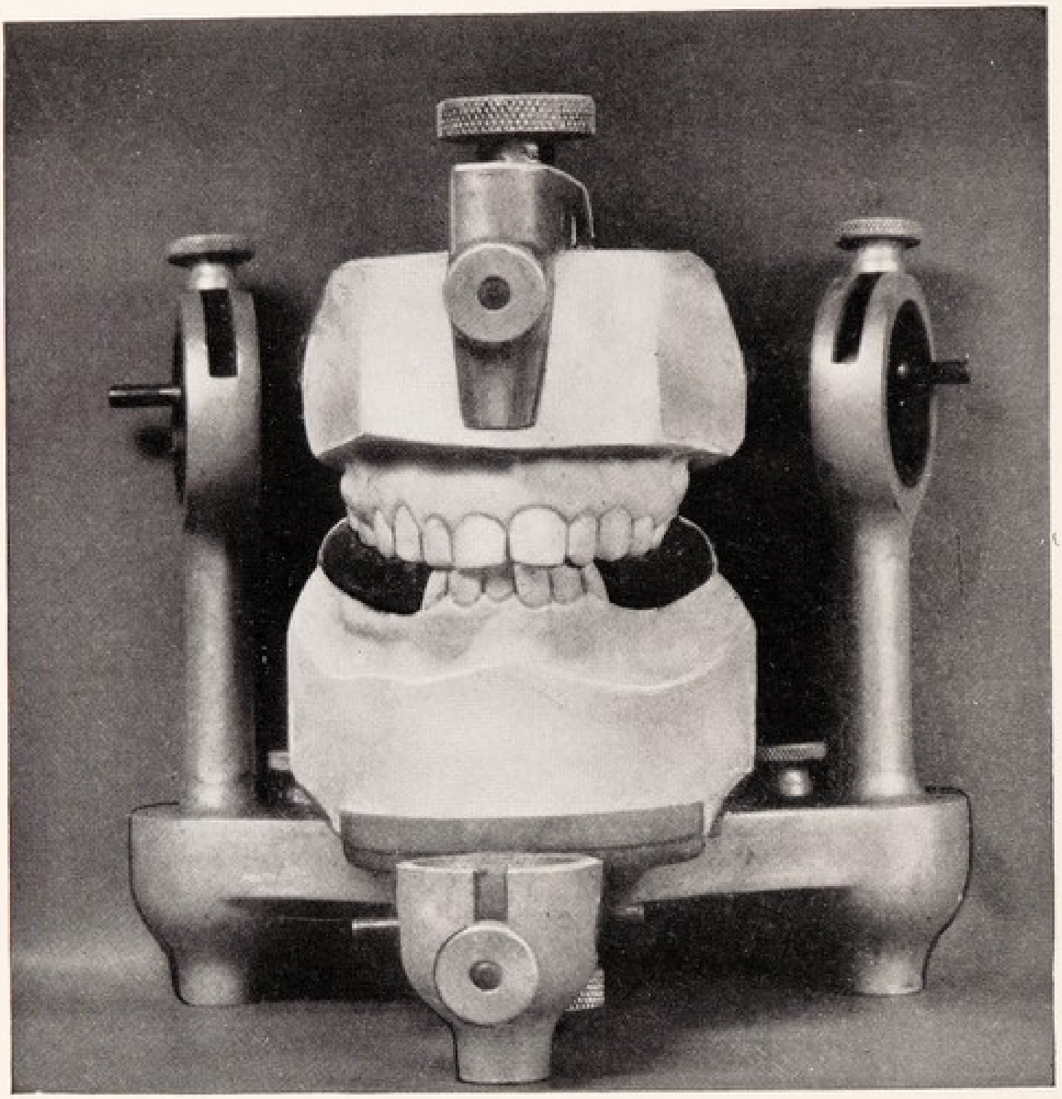

Fig. 424. Modeling compound added to the vulcanite splint in place on the artificial cast. In practice, this step is performed in the mouth

burnished over the bicuspids and molars. (See Fig. 421.) A lingual bar is constructed to fit the case. Pink base plate wax is carefully adapted to the tin foil, over the occlusal surfaces of the teeth, carrying the wax down the sides of the teeth just to the point of greatest diameter. The wax covering the occlusal surface of the teeth should be made very thin. (See Fig. 422.) The pink wax is joined to the lingual bar, and the wax and bar are then carefully removed from the cast. This procedure will indicate whether the wax has been carried below the greatest diameter of the teeth. If such is the case, adjustment should be made at this time, until the wax is easily re-

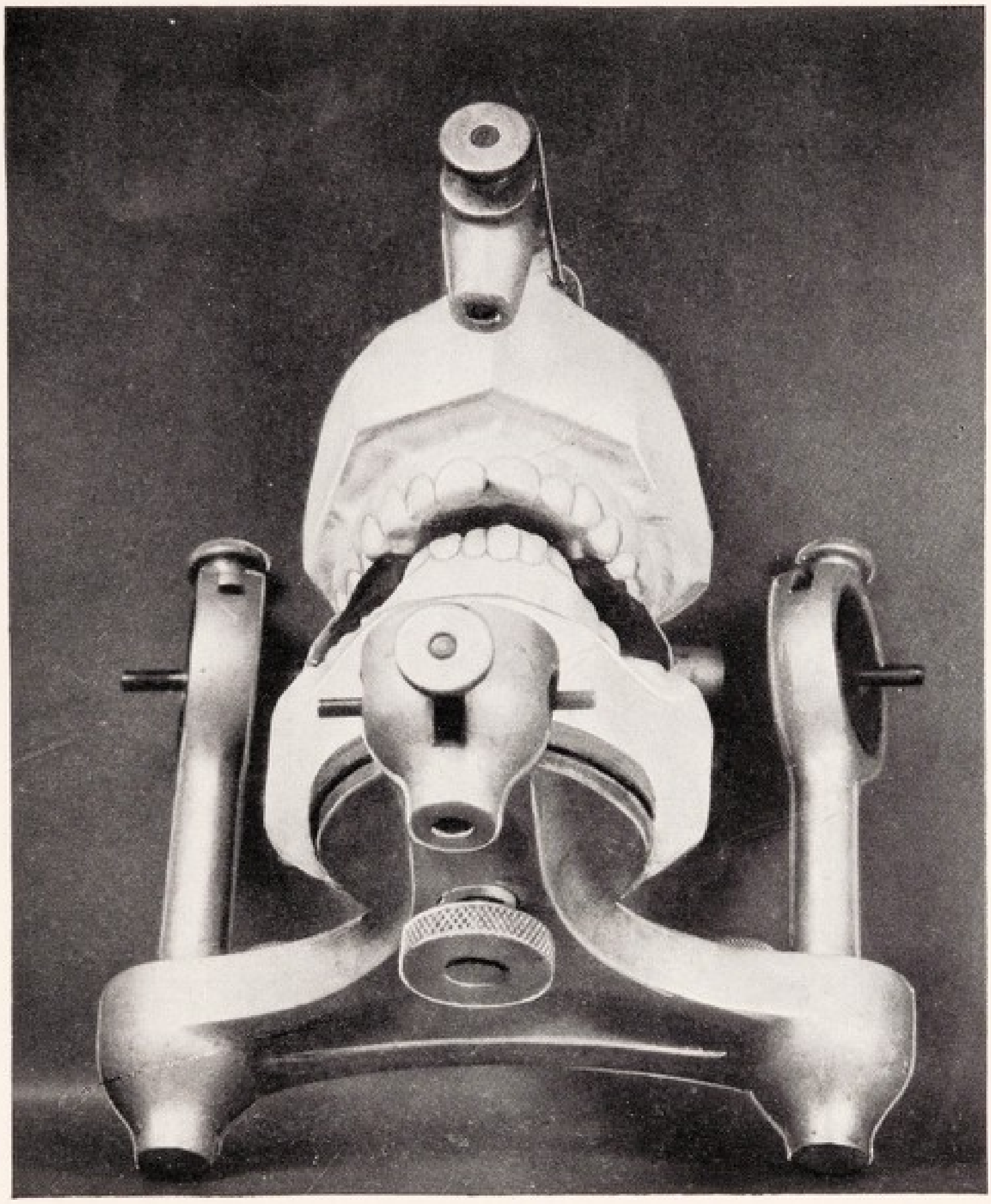

Fig. 425. View of the vulcanite splint, with compound added, showing the extent of opening of the bite

moved from the cast without distortion. A small quantity of impression plaster may be placed over the pink wax and lingual bar, to insure stability, if desired. Vulcanizing the splint on the artificial stone cast is not recommended, as the vulcanite may be carried below the greatest circumference of the teeth, thus making proper adjustment to the teeth after vulcanization a tedious procedure.

After removing the wax and tin foil from the cast, artificial stone is poured into the tin foil imprints of the teeth as well as covering that part of the tin foil which extended beyond the greatest circumference of the teeth up to the edge of the wax. (See Fig. 423.) This will give the

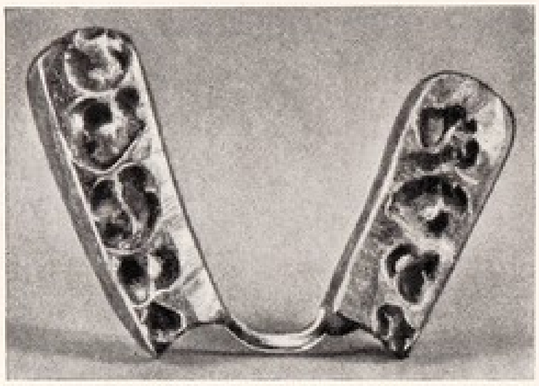

Fig. 426. Splint after the addition of the second portion of vulcanite, showing the imprints of the upper bicuspids and molars. Note that the imprints are shallow, and therefore produce no locking of the mandible and maxillæ when the jaws are closed

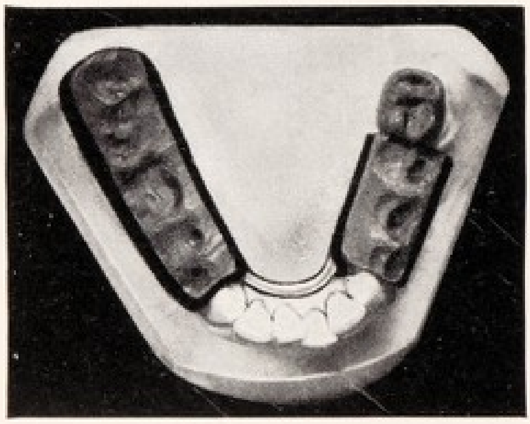

Fig. 427. Occlusal view of lower jaw, with vulcanite cut away from the last molar on the left side. This molar shows inlay wax formed to be reproduced as an onlay

stone a firm grip on the tin foil and hold it in proper position when packing the vulcanite.

After vulcanizing, the splint is adjusted to the teeth in the mouth. The occlusal surface of the splint is covered with soft modeling compound (see Figs. 424 and 425) and a bite is taken in centric occlusion, using the Hickok Bite Check. (See Fig. 444.) At this time, the bite is tested in the various occlusal relations, and the proper height for the vulcanite splint is established, being sure that the anterior teeth occlude in the protrusive bite. The splint is again flasked, and vulcanite is added to replace the modeling compound. The splint, showing the imprint of the upper teeth after vulcanization, is illustrated in Fig. 426. The splint is then placed in

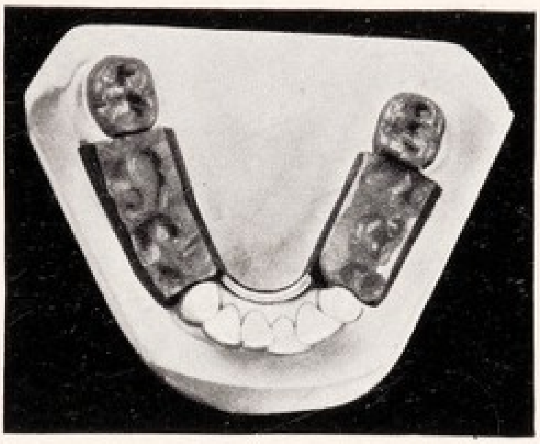

Fig. 428. Cast of the lower jaw showing procedure similar to that illustrated in Fig. 427 for the last molar on the right side

the mouth and tested to see that there is no interference in the various mandibular movements. If such interference is found, it must be eliminated at this time. There should be only a slight imprint of the cusps of the upper teeth on the vulcanite splint.

The patient is instructed to wear the splint as long as possible each day, until the jaws become accustomed to the new position. In the case of the neurasthenic, it is advocated that the splint be retained on the first day, for thirty minutes only, gradually increasing the time until the splint can be worn for several hours daily without discomfort.

The length of time that the splint should be used, before beginning construction of the permanent restorations, will vary with different individuals. In extreme cases several months may well be allowed to elapse before the jaws become accustomed to the new relationship. When it is necessary to raise the bite perceptibly, it is advisable not to open the bite completely at once. The bite may be opened slightly at first, and when the patient becomes accustomed to this position, more vulcanite may be added to the splint, this being continued, from time to time, until the desired opening has been established. When the desired degree of opening has been obtained, the patient is allowed to wear the splint until it can be retained for at least 12 to 14 hours daily, without causing discomfort.

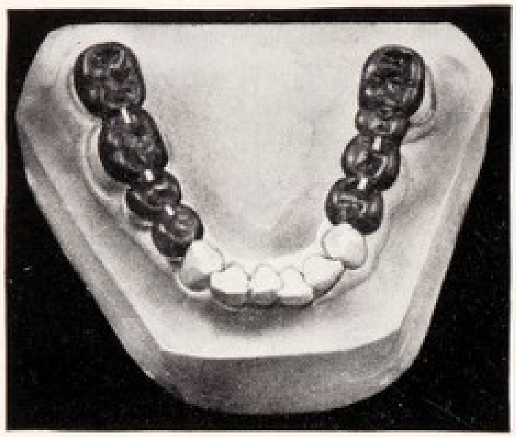

Fig. 429

Fig. 430

Fig. 429. Onlays for bicuspids and molars, with occlusal rests as described in the text. Note the full carving of occlusal form

Fig. 430. Enlarged view of occlusal onlays for two adjacent molars. A piece of 15-gauge Ney-Oro No. 4 wire has been fitted and soldered into the posterior onlay, and a groove prepared for the reception of the wire in the adjacent onlay

Sequential Construction of Onlays

When the patient is ready for the construction of the permanent restoration a portion of the vulcanite splint is cut away, exposing the distal tooth on one side. The desired preparation is performed on the tooth. When onlays are used on molar or bicuspid teeth the author recommends the preparation illustrated in Figs. 258, 259, 260, Chapter XVI. A modeling compound impression of the tooth is secured and a wax bite is taken with the vulcanite splint in position, using the Hickok Bite Check. (Fig. 444.) The amalgam die is prepared in the usual manner and the wax pattern of the onlay is curved to proper outline. (See Fig. 427.) This pattern is taken to the mouth and tested in the various mandibular relations with the vulcanite splint and the Hickok Bite Check in position. This test of the wax pattern in the mouth, with the Hickok Bite Check in position, is of paramount importance, if satisfactory results are to be obtained.

A great many patients who require opening of the bite have developed a habit of masticating in a protrusive position, and, unless the proper centric relation is secured, the patient will always have a feeling of discomfort. It is important that the patient should make the right and left lateral excursions, as well as the protrusive excursion, several times, with each wax onlay or wax bridge abutment preparation in place. When the proper

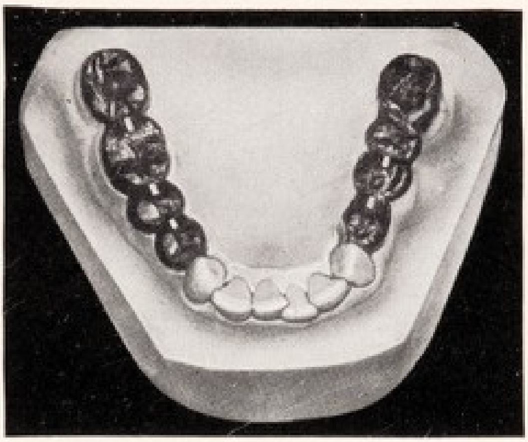

Fig. 431. Occlusal view of onlays, as shown in Fig. 429, after they have been tested and adjusted for the various mandibular movements to secure full occlusal coördination. Note the modification of occlusal anatomy necessary for the elimination of interference. In practice, this modification of form is made on the individual wax patterns as they are successively produced

occlusal relations have been thus established the wax pattern is invested and cast.

A section of the vulcanite splint is then cut away on the opposite side of the mouth and the procedure is repeated. (See Fig. 428.) There is no objection to completing the restorations on one side before beginning the preparation of the teeth on the opposite side of the mouth. When occlusal rests are used on the onlays, and soldered to the distal onlay, this method is preferable, as it is necessary under such conditions to cement the most anterior onlay first, before inserting the onlays distally. Under such circumstances, the onlays are cemented to place when the preparations on one side are completed.

When the occlusal rest is soldered to the mesial onlay, two teeth may be prepared on one side, and inserted before going to the opposite side for the construction of the two corresponding onlays. Under such conditions the groove for the reception of the rest of the next onlay anteriorly on each

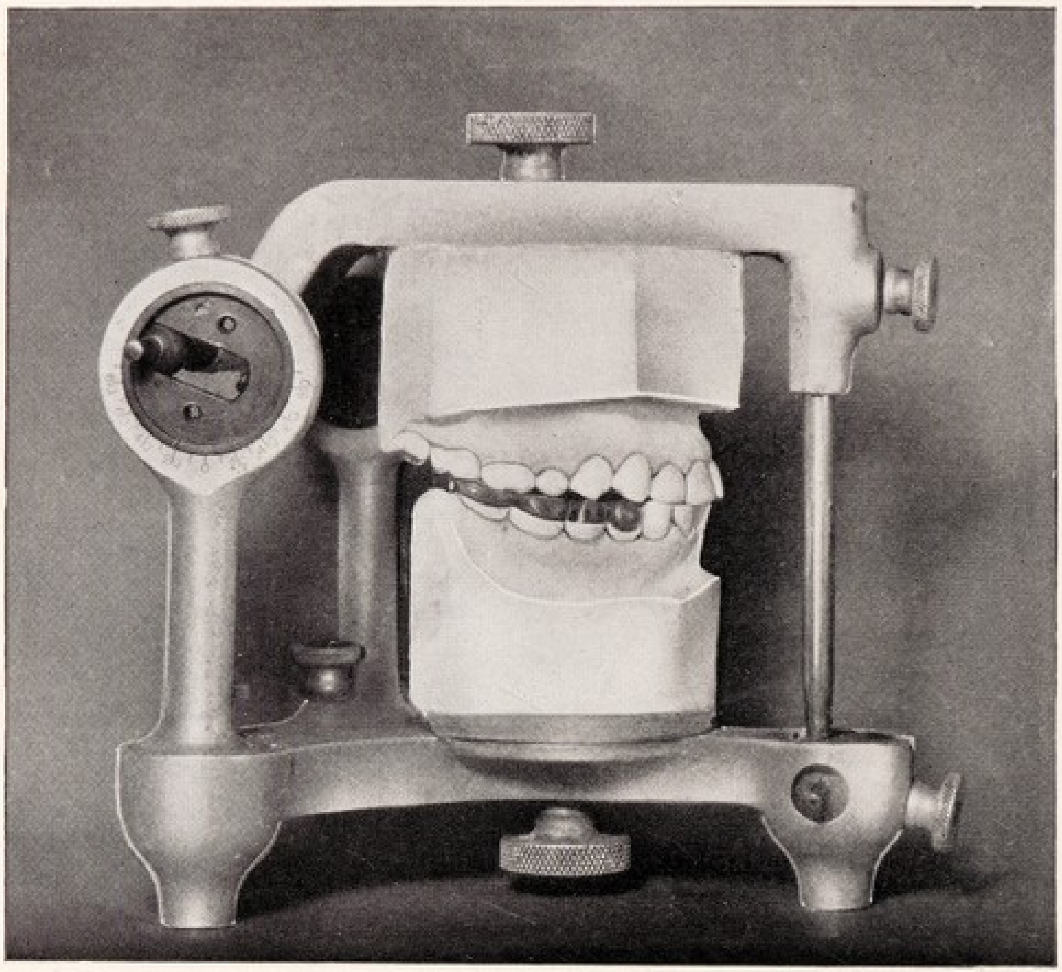

Fig. 432. Completed onlays assembled on the cast and illustrating the protrusive occlusion. Note anterior posterior functional harmony

side, must be prepared in the mesial surface of the onlay already constructed, before cementation. A study of Fig. 429 will help to make this detail clear.

Technique for Occlusal Rests

The occlusal rests should be soldered to the onlays on the teeth that have the greatest alveolar support. On the left side, as shown in Fig. 429 it will be noticed that the left lower first molar is missing and that the second molar has drifted forward. In this case the occlusal rest has been soldered to the bridge segment, and fits into a groove in the onlay on the second bicuspid.

The author recommends the type of occlusal rest herein illustrated, on all cases requiring the opening of the bite, as it tends to give the teeth uniform support against occlusal stresses from all directions. It is important however, that the pins should accurately fit the grooves in the onlays in

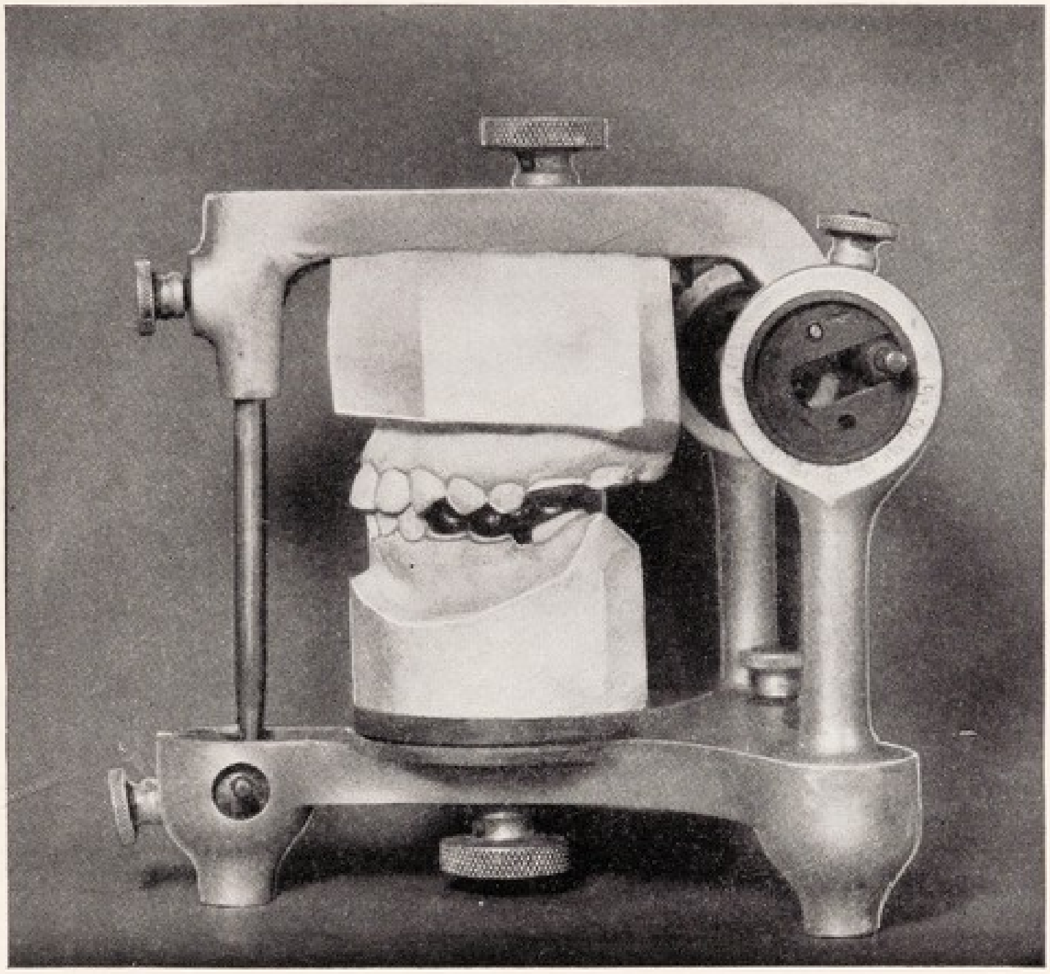

Fig. 433. Left view of case showing protrusive occlusion

which they rest. To secure this accuracy of fit, select a piece of 15 gauge 20% iridio-platinum round wire, or clasp wire such as Ney-Oro No. 4. Heat it slightly and press it into the wax pattern of the onlay in which it is to rest. Remove it quickly and wipe off the inlay wax that adheres to the wire. Repeat this operation until the wire is embedded to its full diameter in the wax pattern. A groove is cut in the mesial surface of the distal onlay to accommodate the opposite end of the wire. The onlays are cast and tried in the mouth. The round wire is placed in position in the groove in the mesial onlay and the opposite end is attached to the groove in the distal onlay with sticky wax. The distal onlay is carefully removed, invested and the wire is soldered to the onlay, with Ney-Oro G 3 metal, or 22 K solder, according to the type of gold used in the onlay. (See Fig. 430.)

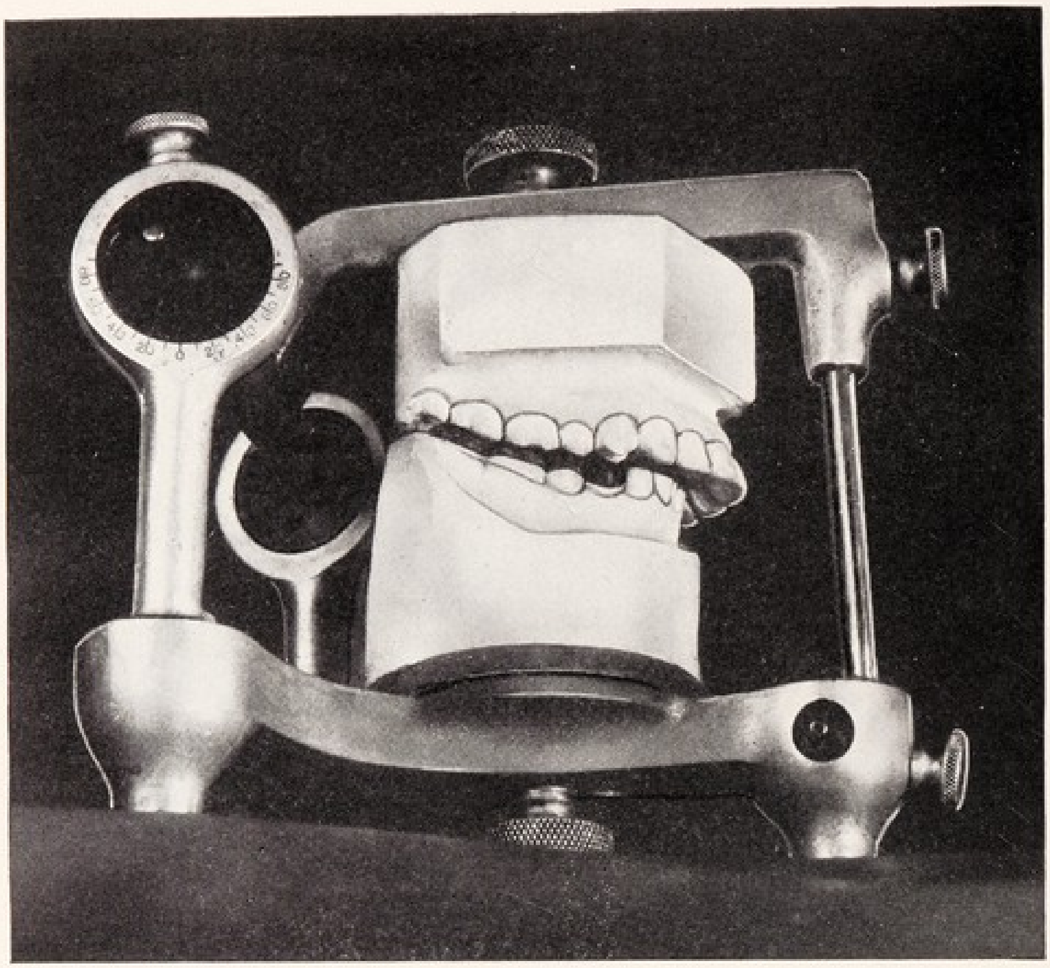

Fig. 434. View of right side of case with mandible in the right lateral occlusion

Causes of Failure

Most of the failures, in cases where an attempt has been made to open the bite, have been due to a failure to establish proper occlusal coördination. If centric occlusion only is considered, and this is often the case, we usually find nicely contoured occlusal anatomy as illustrated in Fig. 429. Whereas, if the onlay patterns had been tested for the various occlusal relationships previous to casting we would have a modified condition, similar to that found in Fig. 431. After this correct occlusal anatomy has been secured, the wax pattern may be further grooved, and supplementary sluice-ways may be cut lingually through the marginal ridges, in order to permit the escape of food. The occlusal surfaces are to be so rounded that the occlusal portion will be smaller in diameter than the greatest circumference

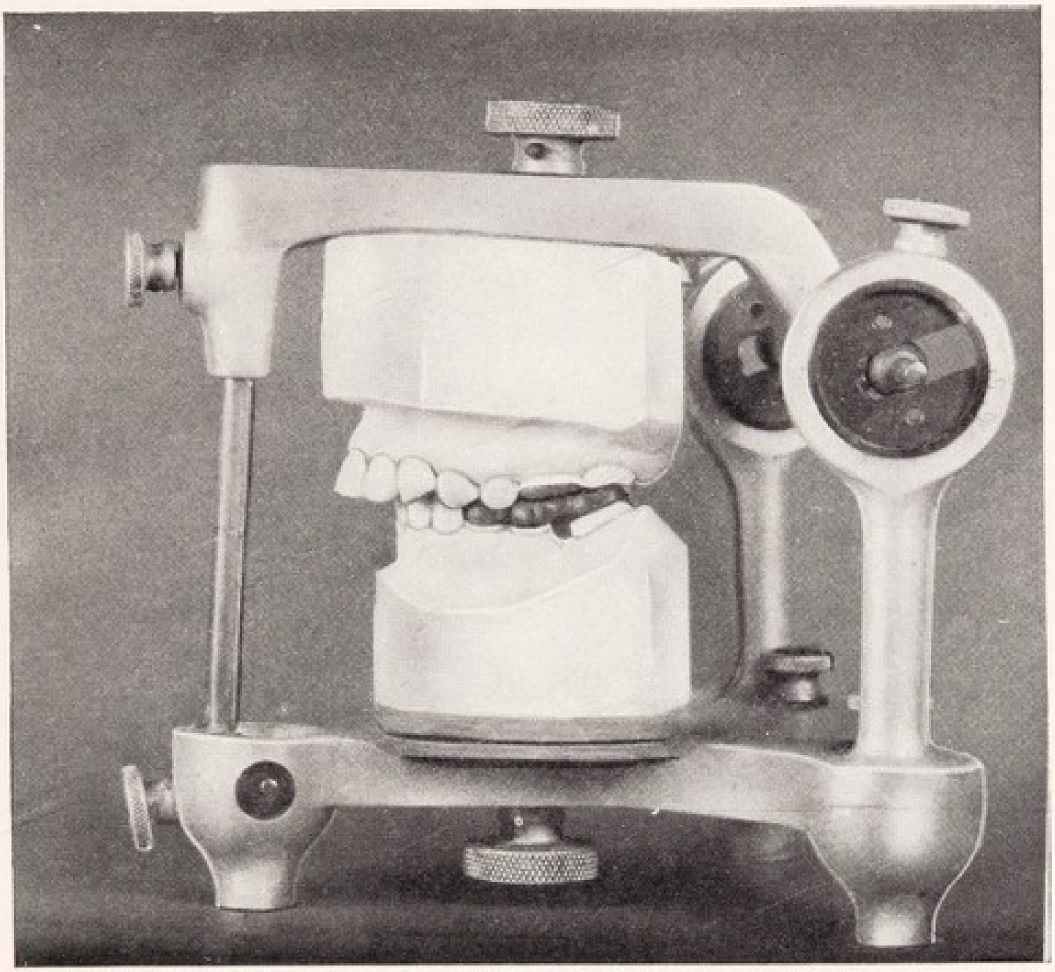

Fig. 435. Occlusal relationship of the teeth on the left side with the mandible in right lateral occlusion

of the tooth. Otherwise too much strain will be placed on the teeth. However, no wax is to be added to the occlusal height at any point in making these alterations.

The occlusal relationships of the teeth in the various mandibular movements are shown in Figs. 432 to 437 inclusive.

Technique when all Maxillary Teeth Have Been Extracted

When the supporting structure of the teeth in the maxillæ is such that extraction of all remaining upper teeth is indicated, the establishment of the proper intermaxillary space by the construction of an upper denture becomes a relatively simple matter. However, if the denture is to be worn with any degree of comfort, it is necessary that a uniform curve of Spee be established in the lower arch, in order to procure the greatest possible perfection of occlusal coördination in the finished case,

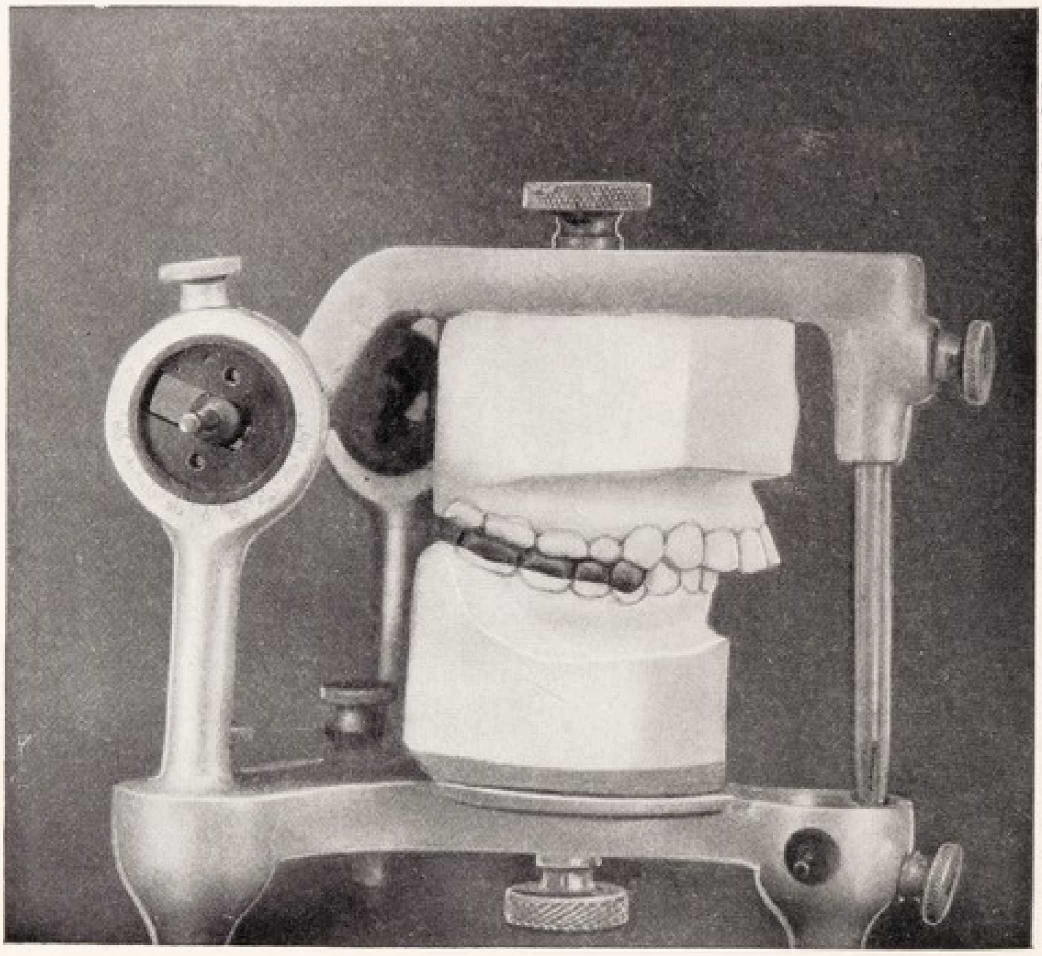

Fig. 436. View of the right side of the case with the teeth in left lateral occlusion

thus serving to maintain the upper denture in position, and prevent resorption. Such cases frequently present with the teeth in the mandible malposed and the curve of Spee decidedly irregular, as illustrated in Fig. 438. The first step in the treatment of such cases, after the upper teeth have been extracted, is to reduce any pronounced high cusps on the remaining teeth. The Monson Balanced Occlusion Guide Plate (see Fig. 439) is very useful in securing this harmonious cusp outline. The teeth are ground until the buccal cusps make uniform contact with the plate. If it requires only a slight amount of grinding, the lower anterior teeth may also be adjusted to conform to this outline. In cases where this procedure would require harmful sacrifice of sound tooth structure of the anterior teeth, the upper anterior teeth on the denture may be so arranged as to avoid interference in the various mandibular movements. These "Balanced Occlusion Plates" are also made with an anterior opening that allows the plate to

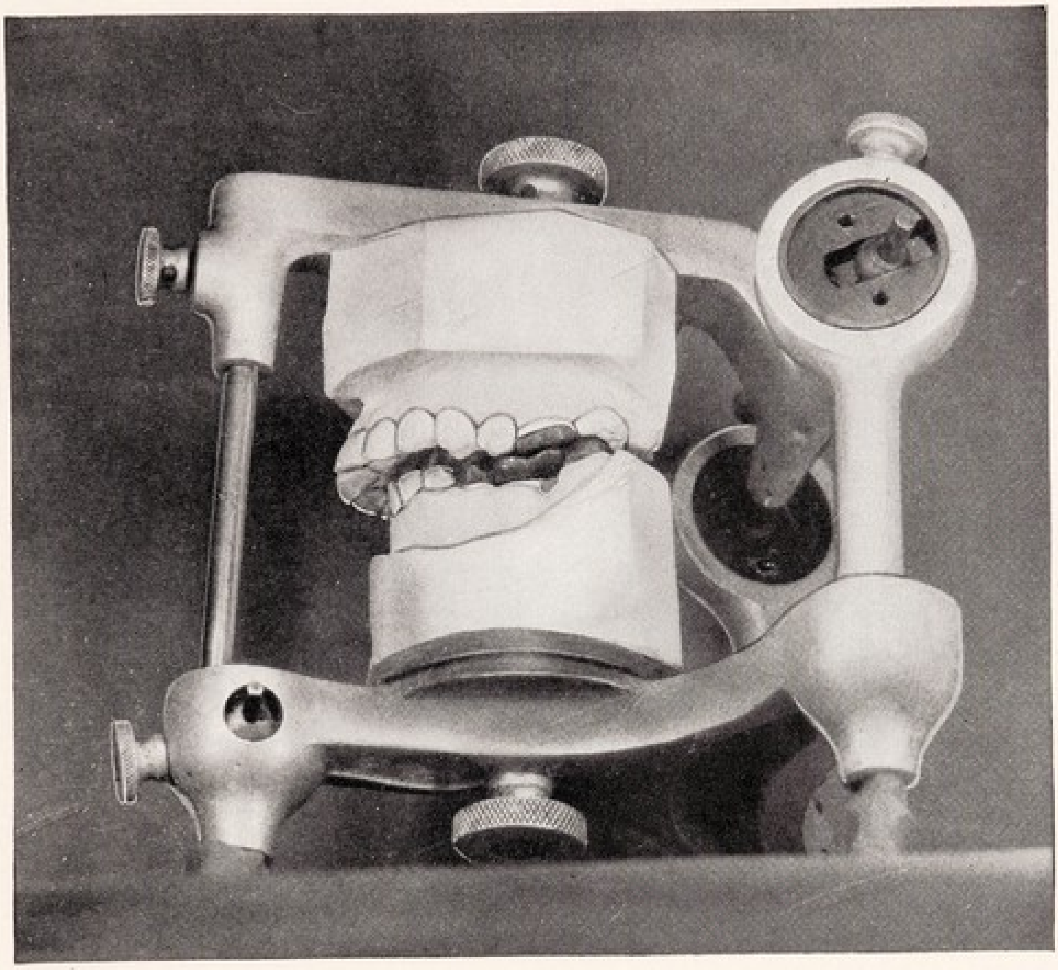

Fig. 437. View of the left side of case with the teeth in left lateral occlusion

make contact with the posterior teeth without touching the anterior teeth. The operator should not, however, resort to the use of this latter plate, until he is satisfied that he cannot safely shorten the anterior teeth sufficiently to bring them into full harmony with the posterior teeth, as previously described.

Those teeth that are below the curve of Spee which has been established by reducing the high cusps, are then built up with onlays, or crowns, to the proper occlusal level. The anatomy of the occlusal surfaces of these teeth should be so formed that they will function properly with the corresponding teeth on the upper denture. The desired preparation for the retention of the onlays on the teeth to be built up is performed. In the case illustrated in Fig. 441, the right lower molars were prepared for onlays, with accessory anchorage secured by sinking pits in the occlusal surfaces of the teeth. The second bicuspid was prepared for a gold crown. Mould 32, Trubyte

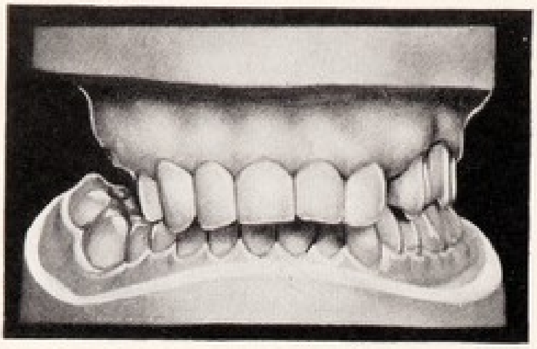

Fig. 438. A case in which, largely through traumatic occlusion, the upper teeth have lost much of their alveolar support, the lower teeth, however, remaining firm, although malposed. Opening of the bite is indicated, but should be accomplished with a full upper denture after the extraction of the upper teeth

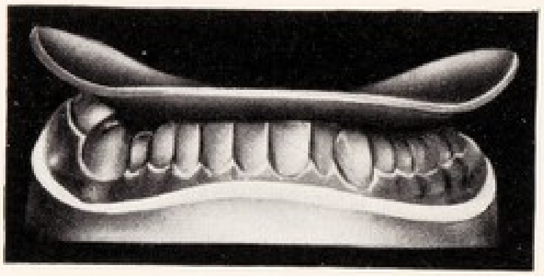

Fig. 439. Cast of the lower jaw shown in Fig. 438 with Monson Balanced Occlusion Guide Plate. Note that the lingual cusps of the molars have been reduced so that the guide plate makes contact with the buccal cusps and with the anterior teeth. The lower right second bicuspid and second and third molars will afterwards be built up by means of onlays and a crown to the established level

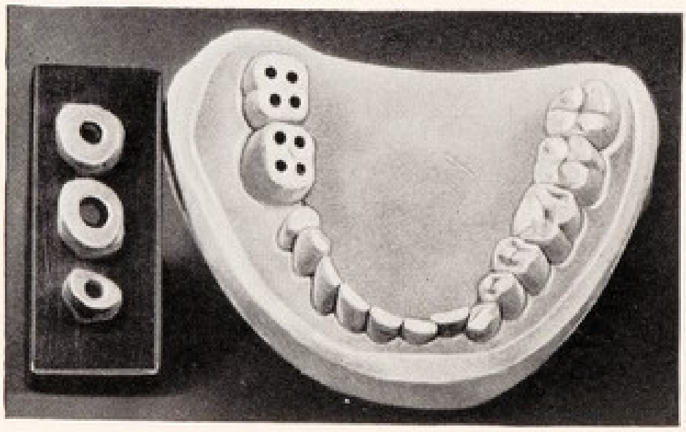

Fig. 440. Cast of the lower jaw showing accessory anchorage pits prepared in the right molars which are to be restored with onlays. The second bicuspid is to be restored with a cast gold crown. At the left are shown porcelain teeth, of a mould giving correct occlusion with the teeth of the upper denture, pressed into softened compound

teeth, were selected as the teeth most suitable for the posterior teeth on the upper denture. Two lower molars and a second bicuspid of the same mould were selected, their occlusal surfaces oiled and forced into a piece of soft modeling compound. (See Fig. 440.) The imprints of the teeth in the compound were oiled and soft inlay wax was forced into the imprints. (See A, B, C, Fig. 441.) These wax occlusal patterns were

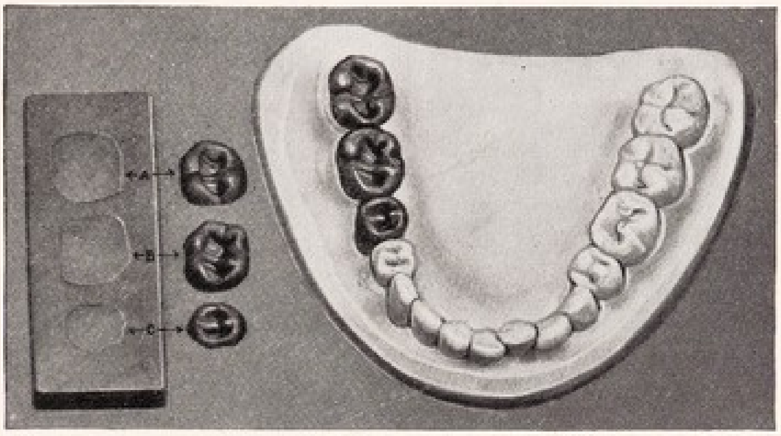

Fig. 441. A, B, C, shows inlay wax patterns pressed into the impressions made in the modeling compound block shown in Fig. 440. At the right these patterns are shown in place on the cast

used to form the occlusal anatomy of the right lower molars and second bicuspid. After preparing the molars and bicuspid, as previously described, modeling compound impressions were taken of the lower molars, and amalgam dies were prepared. A gold coping was constructed for the lower right second bicuspid. With the gold coping in place a modeling compound impression was taken of all the lower teeth. The amalgam dies for the molars, and the gold coping for the bicuspid, were placed in proper position in the compound impression, and a cast poured in plaster. The wax patterns were then adjusted to conform to the occlusal outline of the Balanced Occlusion Guide Plate. (See Fig. 442.) The onlays and crown were cast and cemented to place and the upper denture constructed.

Fig. 443 illustrates the upper denture in proper occlusion with the lower teeth.

Hickok Bite Check

At this point it may be well to describe briefly the Hickok Bite Check to which reference has already been made. This instrument was designed for the purpose of assisting the dentist in the securing of correct maxillo-mandibular relations. The difficulties of securing correct relations through complete dependence on voluntary muscle control on the part of the patient is well known. The importance of accuracy in this step, in prosthetic procedure, is equally well known to the profession.

These difficulties are at their maximum in full denture prosthesis and at a minimum, although not necessarily absent in partial denture cases, where natural teeth occlude with each other. In a case requiring partial

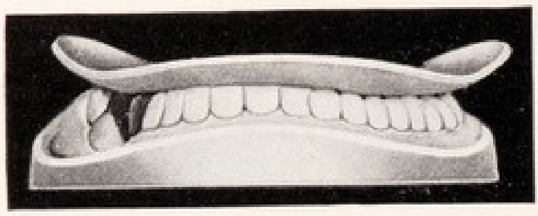

Fig. 442. View of lower cast showing onlays and crown conformed to the occlusal level established by the Monson Balanced Occlusion Guide Plate

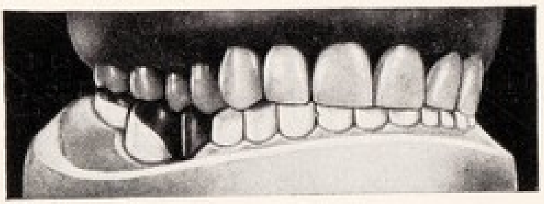

Fig. 443. Occlusal relationship of case shown in Fig. 438 as established by upper denture and restorations of lower right posterior teeth, together with grinding of the lower anterior and lower left posterior teeth

restoration, with opening of the bite, the situation regarding maxillo-mandibular relations is analogous to that in full denture prosthesis. The first complication, and one not always appreciated, is that the patient, through improper habits of mastication may have developed a false centric occlusion, the perpetuation of which in the restored teeth might cause permanent discomfort. Furthermore, it may be nearly, or quite impossible, for the patient having a true centric occlusion to register it for the proposed restoration.

The Hickok Bite Check is a mechanism which will forcibly induce a natural retruded position of the mandible, during the operation of taking the bite for the construction of the vulcanite splint, and during the try-in of the various units which go to make up the finished restoration.

The Hickok Bite Check consists of a head gear which is provided with semilunar metal plates encircling the ears, on which are located buttons

Fig. 444. Hickok Bite Check in place for taking record

which approximate the location of the head of the condyle. The other part of the apparatus consists of a chin rest, or yoke, (see Fig. 444) to which is attached at either end, a drum carrying a flexible tape controlled by spring tension. An eyelet is attached to each of the tapes. In operation, the head gear is adjusted so that the metal buttons are in the proper location; the tapes are drawn out about three or four inches, and held by set screws until the eyelets are placed over the buttons and the yoke seated on the patient's chin. The set screws are then released, with the result that firm pressure is exerted on the chin and the mandible is thereby forced back to its proper position, with the condyles seated in the deepest part of the Glenoid fossæ. While the patient may be able to protrude the mandible, this movement will require considerable effort and the retruded position is soon accepted. When this point is reached the records are made as required.

PART THREE

THE TECHNICS OF REMOVABLE BRIDGEWORK

CHAPTER XXV

Early Examples of Removable Bridgework

It is of historical interest to review the literature dealing with bridgework and to find that the attachments which are in use today have their prototypes in attachments devised many years ago, even as far back as the eighties. These attachments show the great ingenuity of their inventors and command our admiration because of the difficulties under which they were brought forth. They exhibit conceptions which link them very closely to the attachments in use today. One of the earliest of these is illustrated in Fig. 445. It will be understood that these attachments are not presented with the idea of advocating them for present day use, but to show the evident direct ancestry of the present day technique.

In Fig. 445 there is exhibited a bridge as constructed by Dr. Parr in the eighties. To quote from his technique, as found in *A Practical Treatise on Artificial Crown and Bridge-Work,* by George Evans, 1888, "cuspid and molar gold crowns are constructed. A gold and platinum bar (A, Fig. 446) is then formed between the cuspid and molar crowns. The two ends of the bar are then fitted in sockets of platinum (B.B.). The sockets are next soldered to the sides of the crowns (A.A. Fig. 445). A piece of thin platinum, or gold, is then perforated and slipped over the ends of the bar, which is placed in position on the crowns, and the platinum, or gold, adapted to the form of the attachments, and to the immediately adjacent surfaces of the crowns. To the bar the teeth constituting the bridge are fitted and soldered. Bending either end of the bar slightly, (B.B. Fig. 445), or sawing a slit in the cuspid end of it, (Fig. 448), affords the means of holding the bridge firmly in position, although it may be removed and reinserted at the option of its wearer. Fig. 447 shows the inserted bridge."

"A removable gold crown with a porcelain front is frequently used in connection with removable bridgework. This attachment is called the "cap and tube" crown. It consists of a cap for the end of the root, with a tube attached extending up the root canal, and on the cap, the crown, with a post fitted tightly to the tube, is adjusted. The constructive details of the crown are as follows: The root is first prepared and capped, the same as for a collar crown. The collar can be formed of gold and the cap section of platinum. (Fig. 448 A.) A piece of gold and platinum wire is

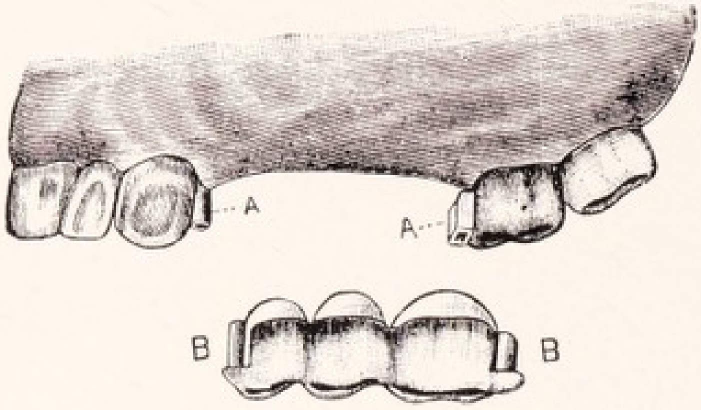

Fig. 445. An early removable bridge devised by Dr. Parr. Means for the retention of the bridge are provided by attachments soldered to gold crowns on the cuspid and second molar

Fig. 446. The attachments for Dr. Parr's bridge (BB) and a bar (A) fitted to engage the attachments

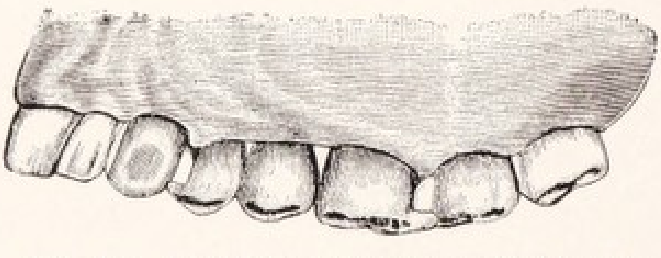

Fig. 447. Dr. Parr's completed bridge in place

slit, about one eighth of an inch, to form a spring post. This is done by placing the wire in a vise, and cutting it downward from one end, through the center, to the required depth, with a saw edged strip of very thin steel. (Fig. 448.)

"The wire is then tapped together at the slit, burnished smooth, and rounded just at the end. (B, Fig. 448.) The tube for this post is formed by once encircling the post with a piece of iridio-platinum plate, No. 34 gauge, the edge of which is beveled and cut to meet the plate even and

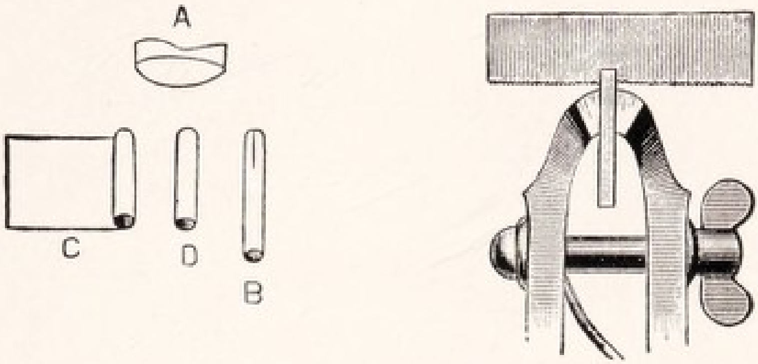

Fig. 448. Details for the construction of a spring post attachment to be used with a tube. An early attachment for removable bridgework

Fig. 449

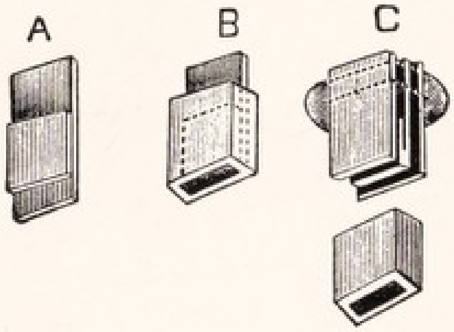

Fig. 450

Fig. 449. An early attachment for removable bridgework consisting of a socket and a spring flange

Fig. 450. Details for the construction of the socket and spring flange attachment illustrated in Fig. 449

close. (C, Fig. 448.) The post is then withdrawn and the seam is soldered with pure gold, in a Bunsen flame. The post is then inserted, and the tube trimmed (D, Fig. 448) and gauged in a gauge-plate.

"Fig. 449 shows another method of forming a socket attachment. In the figure, the socket section of the attachment is seen projecting from the side of the molar crown. The other section consists of the cap, having a spring flange. The flange enters the socket which the cap encloses on the top and at the sides. The spring is made by bending open a little the part of the flange marked A.

"This form of attachment is constructed as follows:—To make the *spring flange,* two pieces of clasp, or spring gold plate, . . . one of them

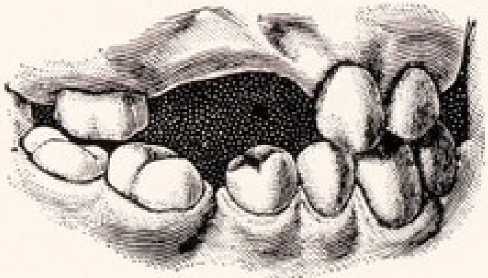

Fig. 451

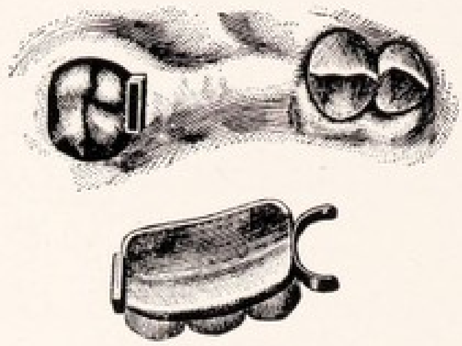

Fig. 452

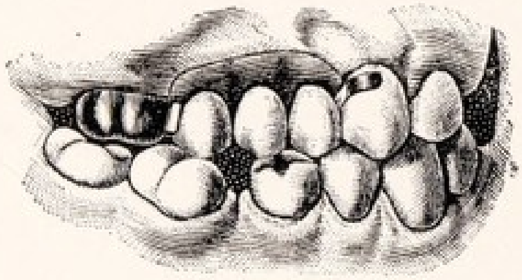

Fig. 453

Figs. 451-452-453. A case for a removable bridge, illustrating the original case, the details of the socket attachment combined with a clasp, and the completed bridge in place

one-half and the other one-fourth of an inch long and from one-eighth to one-quarter of an inch wide, . . . are laid together, so that one end of the short piece is nearer one end of the larger piece than the other. The edge of the short piece nearest the end of the longer one is then soldered to it, with a hard-flowing solder, . . . and the end is trimmed square. . . . The short piece of plate is to form the spring, and is left unconnected at one end for that purpose. (A, Fig. 450.)

"*To form the socket:*—The spring flange is first enveloped once around with a thin piece of platinum. . . . The platinum is then enveloped with one thickness of coin gold plate, . . . about the depth the socket is to be, leaving a ledge of the platinum projecting. The platinum and gold are next removed and soldered. . . . The sides and ends of the socket are then filed level, and the socket given a square form. (B.)

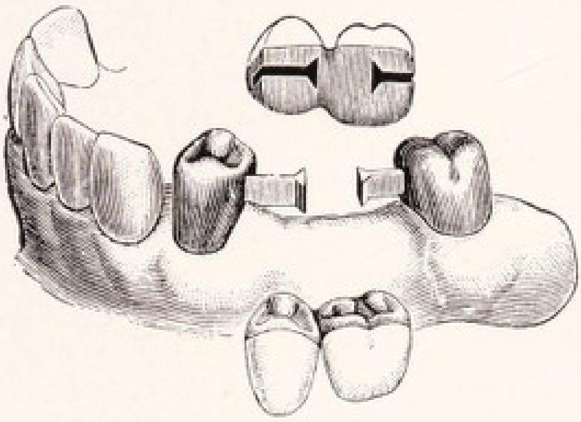

Fig. 454

Fig. 455

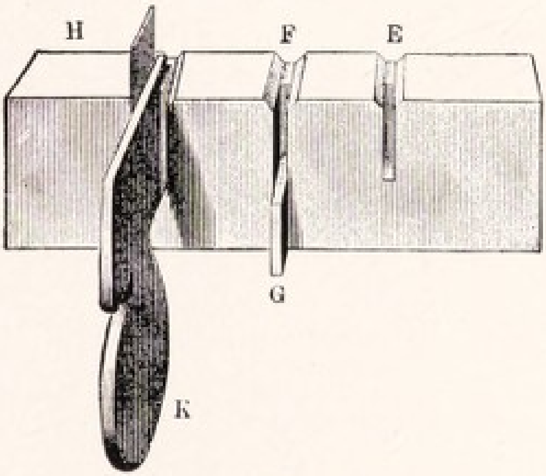

Fig. 456

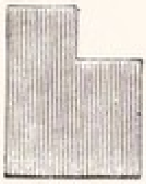

Fig. 457

Figs. 454-455-456-457. A case for a removable bridge in which the sockets are placed in the removable part, the flanged attachment being soldered to the gold crowns. The details are described briefly in the text

"*To form the cap:*—The spring flange having been inserted in the socket, two pieces of the spring gold plate, of the same length as the socket, are adjusted along its sides, the pieces being cut a little wider than the depth of the socket, so that when adjusted they shall project slightly above it. A piece of thin platinum plate is then adapted to the end of the flange, to the socket, and to the pieces of spring plate, first being perforated to allow the projecting ends of the latter to pass through it. The spring plates and the flange plate are then attached to the platinum plate with wax, removed from the socket, invested, and soldered. (C.)

"Fig. 451 represents the articulated cast of the case in which a simple form of attachment and a clasp were used. This is illustrated in Fig. 452 which needs no description.

Fig. 458

Fig. 459

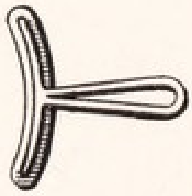

Fig. 460

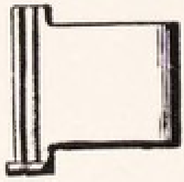

Fig. 461

Fig. 458, illustrates a form of attachment closely resembling the female part of the modern internal attachment. Patented by Dr. Morgan in 1901.

Figs. 459-460-461. The male part of the Morgan attachment illustrated in three views

"Fig. 453 shows the bridge in place. It was constructed of vulcanite and made for and placed in the mouth of a patient exhibited at a clinic of the Odontological Society of Pennsylvania in Philadelphia in December, 1888."

The construction of a type of removable bridge very similar to that used at the present time, is described by Dr. G. L. Curtis in Evans's *Artificial Crown and Bridge-Work*—Edition of 1900; it is illustrated in Fig. 454.

"The arm B, Fig. 455, is made of a strip of clasp-metal, No. 16 gauge in thickness, and of any desired width or length. The strip is placed in a slot like E, Fig. 456 and the projecting end hammered to form a solid head, as shown. A longer or shorter arm may be formed in the slot F, wherein the adjustable limit, G, may be set to mark the length of the arm, while the hammered head is being formed. A piece of 20 carat gold plate, or preferably clasp metal No. 33 gauge, is cut to the size and shape of Fig. 457 and by means of a former, (K, Fig. 456) is forced into a suitable slot. The place of the former, K, is then taken by the arm (B, Fig. 455) and the part (H, Fig. 456) bent and delicately hammered over the head of the arm. The socket so formed is then removed, soldered from the outside, and finished as at A, to exactly fit the arm (B, Fig. 455)."

An extremely interesting device, designed as an attachment for removable bridgework, was patented by James P. Morgan in 1901. This attachment presents for the first time the essential features found in the internal attachment of today. It consisted of a female part called in the patent specification the "keeper," (Fig. 458), and a male part called the "anchor" shown in three views, Figs. 459, 460 and 461. Many other forerunners of the internal attachment are to be found in the literature of the latter part of the last century. It is not necessary to describe these devices in detail, but it should be recognized that the dentists of that period saw clearly the nature of the mechanical problem which they were attempting to solve.

CHAPTER XXVI

The Technique of Removable Bridgework

When the failures in fixed bridgework, which were so common years ago, drew the attention of the dental profession to the need for developing a technique which would be free from the disadvantages of the older type of bridge, removable bridgework was ushered in as a panacea for all bridge ills. Mention has already been made of the fact that removable bridgework, because of the simple fact that it is removable, does not solve all bridge problems. And it has also been said, in an earlier chapter, that removable bridges are in many cases less desirable than fixed bridges. Nevertheless removable bridgework carries with it certain possibilities in technique, which make it the outstanding choice in several types of cases.

Stationary bridgework, as it was constructed in the early days of this art, was first condemned because of its unsanitary features. When removable bridgework was introduced, it was put forth largely as an answer to the outcry against the unsanitary features of the fixed bridge of that day. The fact that the bridge itself could be completely cleansed outside of the mouth, and also that it was possible to clean completely around each abutment tooth, constituted the early claim of the removable bridge to superiority. Later on, it was found that there is another advantage, at first considered as less important than that of sanitation, but which now constitutes the only essential advantage of this type of work. That is the fact that in removable bridgework, it is possible to utilize the tissue of the alveolar ridge for auxiliary support. Today much of the effort in this field is devoted to developing the correct relationship between tissue support, and tooth support, in these cases, and planning for continuous maintenance of this relationship throughout the life of the bridge.

The first name to be mentioned in connection with removable bridgework is that of Peeso. To him must go the credit for working out two forms of attachment, which would provide the necessary stability and strength, and for devising a technique which makes it possible to secure the necessary precision in the construction and assembly of the various parts. One of these attachments is the split pin and tube, the other the telescope crown. Each of these served admirably for the purpose intended, and while today the telescope crown has been discarded, as has the gold shell crown, for general use, the split pin and tube still finds a place in practice to meet certain conditions which are occasionally encountered. While devitalization of teeth, once looked upon as correct routine practice is now avoided wherever possible, and while the Peeso attachments are therefore forced into the background of modern practice, under suitable conditions the split pin and tube has no superior in this field.

When we review the Peeso technique in general, and realize that it was developed before the days of the casting process, with the refinements which have accompanied this wonder of modern dentistry, we may well pay tribute to the brain and the hand which brought forth this technique. Peeso found bridge prosthesis floundering in a maze of uncertainty and established it on a firm foundation of a precision technique. So exacting is the technique of the Peeso bridge, that the construction of one of these bridges is really an education in this field. The dentist who will master the various steps required in making a properly fitting Peeso bridge, will find that the time spent has been well worth his while, and that it forms an excellent introduction to the production of later types of removable bridgework.

Peeso Telescope Crown Attachment

The first attachment to consider is the telescope crown. This is used chiefly on molars but sometimes on bicuspids. When it is decided to use the telescope crown, the tooth is first reduced on all its contours including of course the occlusal. Enamel extending below the gum line is removed so that the band may be fitted accurately and without impinging on the gingival attachment. The tooth is trimmed until the stump assumes a slightly tapered shape as shown in Fig. 462 A. The greatest diameter should be slightly below the gum line. The occlusal area of the tooth is cut away enough to allow for the extra thickness of metal required on the occlusal surface of the double crown.

After taking the measurement of the stump, cut a piece of 30 gauge, coin gold, whose edges shall not be quite parallel, but providing for the greatest diameter in the finished band at the gingival edge, as in B. One end of the band is beveled to a knife edge, and the other end is brought around and lapped over it. The band is then sweated together. After this it is shaped to conform to the stump and the gingival edge is trimmed to correspond to the curvature of the gum line. An impression is taken

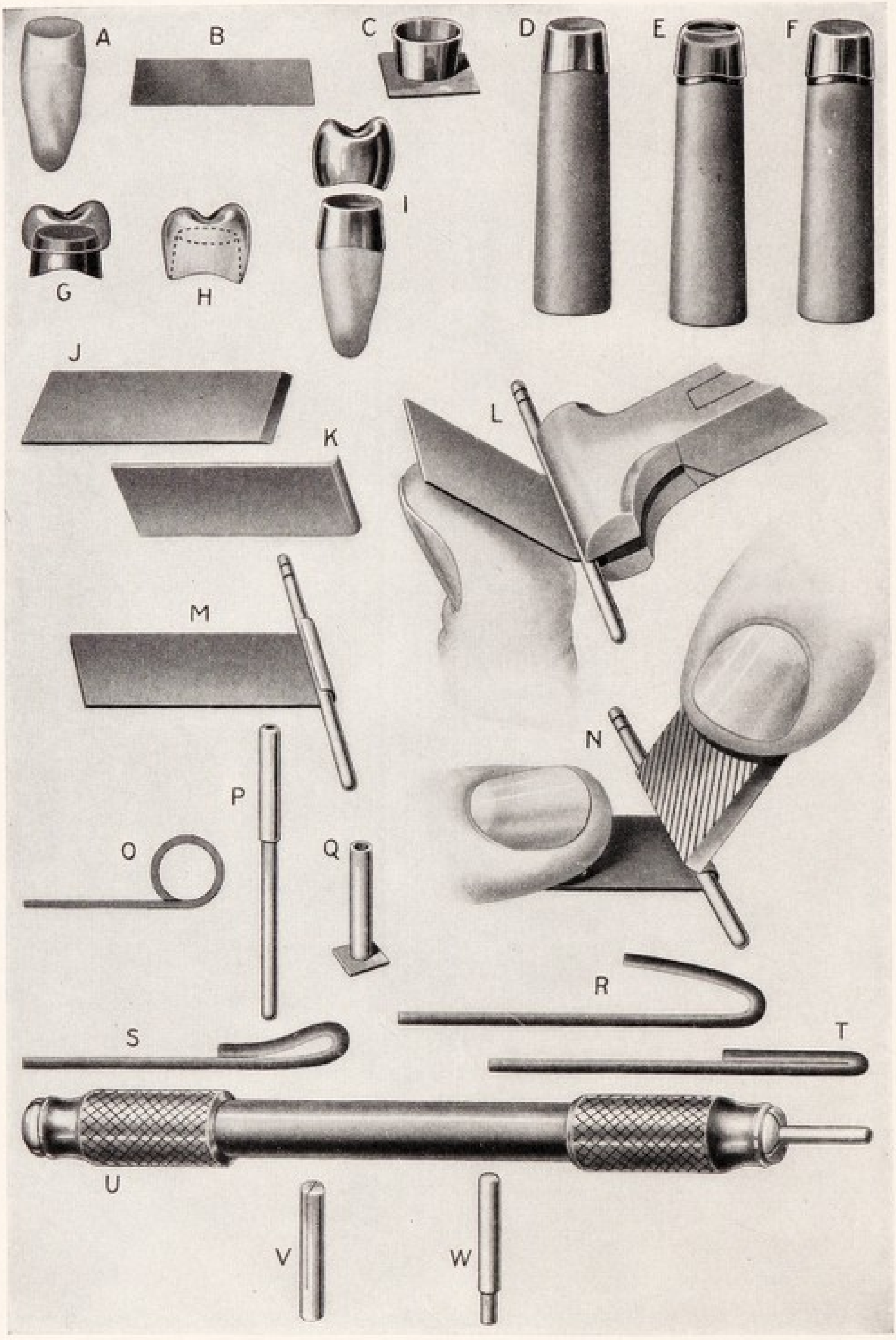

Fig. 462. Technique for construction of Peeso telescope crown and split pin and tube, after illustrations in "Crown and Bridgework"

and a cast prepared. Enough of the band is cut away from the occlusal end to provide room for a thick cusp, and the occlusal edge of the band is turned slightly inward. During this step, its circumference and the contour of the band is to be kept within the line established by the contour at the gingival portion, so as to permit the insertion and removal of the outer crown. Accuracy in this technique may be assured by carefully testing with the bridgemeter, both the tooth stump and the band, during its construction. This instrument also assures parallelism with other abutments in the case.

The occlusal end of the band is now filed perfectly flat, and the band is then returned to the mouth to make sure that it is the same height as the tooth stump. A floor of 28 gauge coin gold is then flattened in a Peeso swager and sweated to the band as shown in C. The excess material of the floor is then trimmed until it is flush with the band, and the side and floor of the cap are polished.

The inside of the cap should now receive a very thin coating of wax and the cap should be passed through the Bunsen flame to distribute the wax evenly.

A tube of paper is then made, and the cap is pushed down into it until the gingival edge is about an inch and a half below the upper end of the tube. The paper tube should fit the cap tightly and should be held in place by a rubber band, or a piece of wire. The tube is now filled with a low fusing metal and allowed to cool.

The metal used for this purpose is composed of

Tin	20 parts
Lead	19 parts
Cadmium	13 parts
Bismuth	48 parts
	100 parts

This formula was originated by Dr. Peeso. The metals are melted in the order in which they are given, but when the cadmium has melted, the crucible should be taken from the fire and the bismuth added in pieces and stirred in with a pine stick, until it is entirely melted. If the crucible is left on the fire after the cadmium has melted, the fusing point of the mass is lowered so rapidly that the metal will burn. This metal fuses at 160 degrees Fahrenheit, and can be removed from the gold cap by placing it in hot water. After the metal filled cap has become quite cold, the paper is removed, leaving the inner cap with the metal handle as in D.

The measurement of the inner cap is taken just below the point where the occlusal end has been rounded, and the outer band is cut from 30 gauge coin gold on an angle slightly greater than the inner band. The outer band is then beveled and sweated together, the same as the inner band. The outer band is now annealed and the inner cap is driven into it by placing the occlusal end of this band on the anvil and tapping the fusible metal stump with a small hammer.

The band will now fit the inner cap so tightly as to necessitate the manipulation of a steel burnisher on the sides of the band to remove it. This burnishing will stretch the metal very slightly, but sufficiently to allow its removal from the inner cap. The band is then trimmed to the same line as the gingival edge of the inner cap. The occlusal end is trimmed very nearly to the floor of the inner cap, and then pressed in, all around, over the rounded edge of the inner cap.

The occlusal end is then filed flush with the floor of the inner cap. The outer band is now seen to be shaped as in E. The outer band is then removed and is immersed in a bath of nitric acid. Care should always be taken to keep the gold from contact with the base metal. Any precious metal fitted upon base metal dies should always have a bath in nitric acid, before annealing, or soldering.

The outer band is then removed and a floor of 30 gauge coin gold is sweated to it. We now have the outer cap shaped as in F. At this stage the inner and outer caps are placed on the stump in the mouth, an impression and bite are taken in plaster, and a cast is made. Inlay casting wax is placed on the occlusal surface of the outer cap, and is carved and contoured to give the proper anatomy to the crown.

To reduce the possibility of traumatic occlusion to the minimum, the inner and outer caps, with the cusps carved in wax, are tried in the mouth, and given any adjustment necessary to insure perfect occlusion and contact. The casting wax is allowed to extend only part way toward the gingival edge of the outer cap, as in G. The wax cusps are then removed from the outer cap and cast in coin gold. Do not cast direct to the cap, or the fit of the crown will be destroyed. After casting the cusp in coin gold refit it to the outer cap and fill in the space toward the gingival area with 21 K coin solder. The gingival edge of the outer crown should be blunt and never tapered to a feather edge, as the patient may drop the bridge while cleaning it and bend the edge of a crown constructed with a thin gingival edge.

To make 20 K coin solder use

Coin gold	24 parts
18 K solder	10 parts
Copper (fine)	2 parts

To make 21 K coin solder use

Coin gold	1 part
20 K solder	1 part

These are also Dr. Peeso's formulas.

We now have the outer crown shaped as in H, and I shows the outer crown and inner cap completed.

Peeso Split Pin and Tube Attachment

The split pin and tube attachment is used on anterior teeth. It requires devitalization and also reduction of the tooth to, or nearly to, the gum line. It is sometimes used, however, in conjunction with an inlay in a devitalized tooth, without the complete reduction of the crown. The first step is the making of the tube.

The tubes are made of 32 gauge iridio-platinum plate about seven-sixteenths of an inch wide. The plate is first annealed and the end squared and beveled, with a fine file, to a knife edge as in J (Fig. 462). The beveled end is grasped in the jaws of the hand-vise and bent slightly upward as in K, the beveled edge being underneath. A steel mandrel, the size of the tube to be constructed, is then selected and laid across the iridio-platinum plate, the turned up edge of the plate preventing it from rolling off.

The mandrels are made from steel wire in six sizes, .075, .072, .069, .066, .063, and .058 of an inch in diameter. They are cut in lengths of one and one-half inches and the ends rounded. They are numbered from one to six, according to the size of the mandrel, beginning with the smallest.

The plate and mandrel are now grasped by the hand-vise as in L and the plate is bent around the mandrel until the beveled edge has passed the center of the mandrel as in M.

The plate with mandrel in position is then placed on the face of the anvil and the end of a flat, coarse file is placed on the beveled edge of the platinum and pressed downward as in N; the plate is thus rolled around the mandrel until the beveled edge is in contact with the lower side of the plate as in O. The mandrel is then removed and the seam is soldered with pure gold. Select a mandrel a size larger than the one over which the tube was first rolled, and drive it through the tube. Trim away the surplus metal as close to the tube as possible and file the lap perfectly smooth and flush with the sides of the tube.

The end of the tube is then bent over the rounded end of the mandrel with the side of a smooth, flat file, until it is partly closed as in P. Roll the tube under a smooth file on the anvil until the metal is stretched sufficiently to allow the removal of the mandrel.

Close the end of the tube by melting a little pure gold on the surface of a small square piece of iridio-platinum. Then grasp the tube with a pair of pliers, and its partly closed end is placed on the square of platinum as in Q, and soldered into place. The mandrel is then driven into the tube again and the surplus metal of the floor is cut away and the edges filed flush with the side of the tube.

The split pins are made of high fusing, half round, clasp wire, Nos. 12, 13 and 14. The wire should be slightly larger in diameter than the inside of the tube. This is to allow for filing to fit the tube. No. 14 gauge can be used for Nos. 1 and 2 tubes, No. 13 gauge for tubes Nos. 3 and 4, and No. 12 gauge for tubes Nos. 5 and 6.

The half round wire is annealed and bent on itself, the flat side innermost as in R. Anneal again and bend until the end is in contact with the flat surface of the wire as in S. Grasp at the point of contact, with a pair of pliers, and hold in the flame of a Bunsen burner until it reaches a red heat. The ends are held together until the metal has chilled. Have the ends in contact about one-eighth of an inch. The parts in contact are then soldered with a small piece of coin gold.

After the pin has been soldered the extending wire is grasped in the pin-vise and the sides of the pin hammered together as in T.

The pin is then grasped at the soldered end in the pin-vise as in U. The pin-vise is then rotated to the right with the thumb and fingers of the left hand and the file is passed lightly over the pin in the opposite direction. Start with a coarse file and finish with a very fine file, one side of which is perfectly smooth and polished for burnishing. This is the last and a very important step in the making of the split pin. V shows the split pin completed.

The pin should fit the tube easily and touch the sides of the tube for its entire length. W shows split pin inserted in the tube.

Ash Split Bar Attachment

Another important attachment which has greatly influenced the development of accurate and satisfactory removable bridgework is the split bar devised by Ash. This also requires the devitalization of the tooth on which it is to be placed, and is therefore to be avoided unless devitalization is required for reasons other than the construction of the bridge. This attachment has strength and adaptability to varying conditions met in cases requiring removable bridgework. Its technique, like that of the Peeso attachments is exacting, and its mastery provides a sound founda-

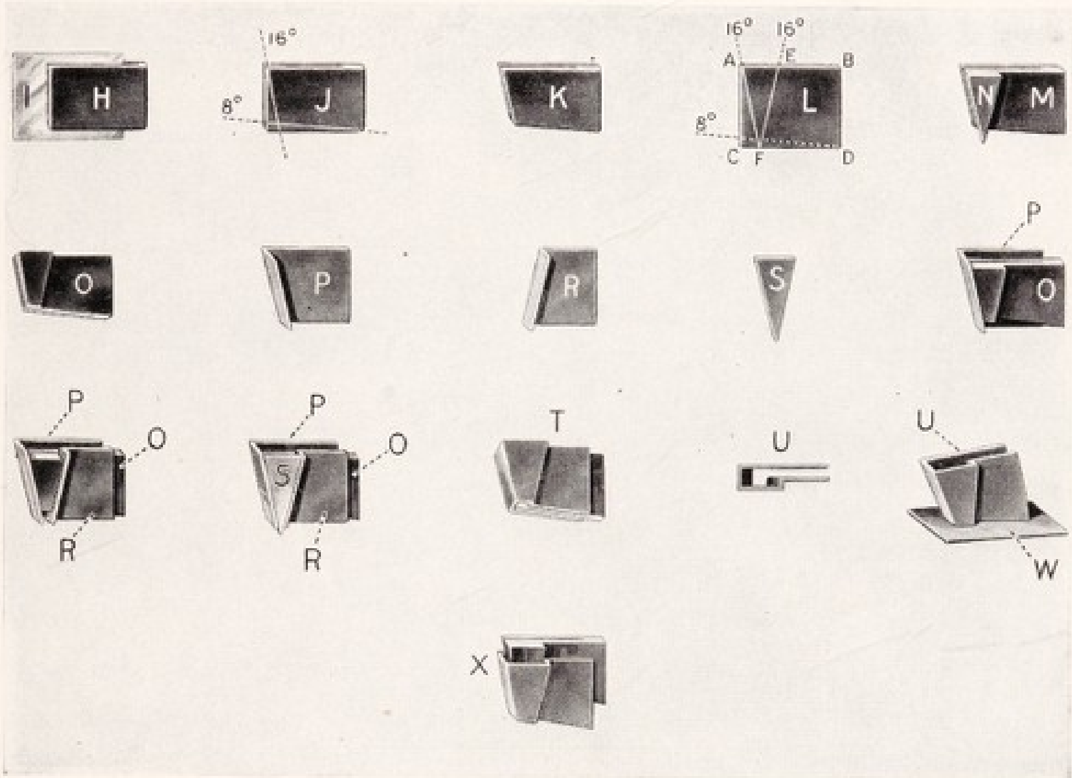

Fig. 463. Technique for construction of the Ash split bar

tion for success in this field. Ash's contributions, including many ingenious devices in addition to the split bar, entitle him to a place beside Peeso as a pioneer in the development of removable bridgework.

In making the Ash split bar attachment, select a piece of 23 gauge iridio-platinum, three-quarters of an inch long, anneal and bend double as in Fig. 463 H. Place a piece of mica (I) about three-quarters of the distance into the space and cut away excess mica. Mark off a 16 degree angle at the end of the bar, and an 8 degree angle on the bottom as in J. Place the metal in a vise and file down to the marks, leaving the metal shaped as in K. To make the locking lug, select a square piece of 23 gauge iridio-platinum, A, B, C, D as in L and mark off a 16 degree triangle, A, F, E. Cut out the triangle and file down to the marks, producing a piece of metal shaped as in N, the apex of which will extend beyond the floor of the split bar, the latter having been filed to an angle of 8 degrees. At this point cut and file a piece of 30 gauge platinum to the exact size of N, as in S, to be used later in making the box. Solder N, to the split bar M, with platinum solder, and file off the extending portion. This gives the split bar completed, as in O.

Bend a piece of 30 gauge platinum at a right angle, as in P, and another piece at a right angle, as in R. Place the piece of platinum P, against the split bar O, and burnish to a 16 degree angle at the end of the bar. Then place the piece of platinum R, against the opposite 16 degree angle of the locking lug, and burnish to place. Next place the piece of platinum S, against the face of the locking lug, and burnish to place. Attach the parts with sticky wax. Remove the split bar O, and solder the parts of the box together with platinum solder. Replace the box on the split bar, and cut away any excess platinum. File the top and bottom of the box even with the split bar. Burnish and swage until the box fits the split bar perfectly, as in T. The box is now shaped as in U. To make the floor, place the partly made box U, on a perfectly flat piece of 30 gauge platinum as in W, and solder with platinum solder. X shows the split bar and box completed.

CHAPTER XXVII

Technique for the Construction of a Removable Bridge

The difficulties encountered by the early workers in the field of removable bridgework were, in large part, due to lack of suitable gold and platinum alloys for the various purposes required in the construction of their bridges and to the lack of accurate investment materials, etc. Furthermore these dentists were handicapped by the necessity of having to make their own attachments, whereas today these may be purchased ready made, constructed in machines of the highest accuracy. The casting process has, of course, been a boon to the bridgeworker of today. Too much credit cannot be given to Taggart for his work in this field.

The technique of the construction of a removable bridge of the modern type, using internal attachments, is presented herewith. The case chosen is that of a two tooth bridge for the lower jaw. For this case a cleansable fixed bridge might be preferable, but the case serves to illustrate, in a concise way, the principles of construction of the removable bridge. In this way it is possible to concentrate on the essential features to be found in any removable bridge, and thus not only conserve space, but avoid the confusion possibly attendant on the description of a more complicated bridge. The principles illustrated in this bridge are of course, applicable to the construction of larger and more complex pieces.

Prepare cavities as in Fig. 464, securing sufficient depth and marginal extension to accommodate the platinum box of the removable attachment. Copper bands are cut to fit the teeth and are allowed to extend below the gingival margins of the cavities (Fig. 465). Modeling compound is heated to the proper consistency, and forced into the cavities, being held in place by the close fitting copper bands (Fig. 466). The modeling compound impressions are chilled and removed from the teeth. The excess modeling compound is trimmed away and the impressions are wrapped with Kerr's, 26 gauge, wax sheets (Fig. 467, A and B). Metal rings are filled with soft plaster and the impressions are embedded in the same (Fig. 467). Soft amalgam is packed into the impressions and allowed to set over night. A wax bite is taken (Fig. 468). The amalgam dies are placed in the wax bite (Fig. 469) and a cast is prepared. (Fig. 470). To be sure of perfect occlusion, the wax patterns of the inlays are inserted in the cavities in the mouth, and the patient is requested to close the jaws and perform the various movements of mastication. After establishing perfect occlusion and

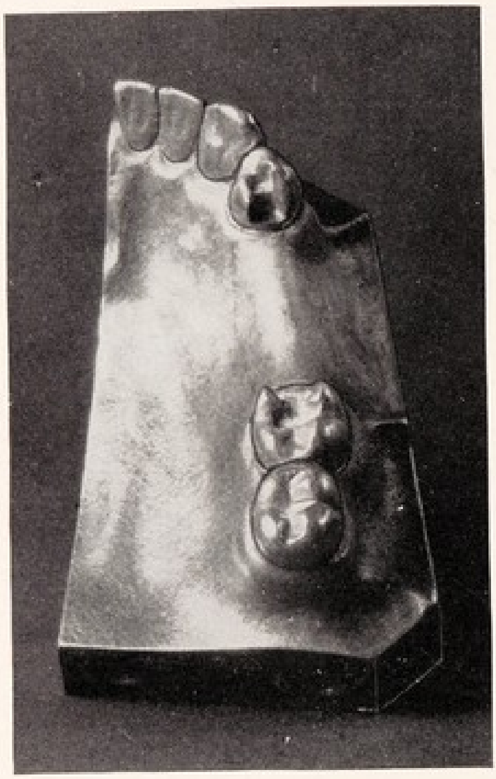

Fig. 464. Case for a removable bridge extending from the lower right first bicuspid to the lower right second molar. Approximal occlusal cavities have been prepared in the abutment teeth

marginal contact, the space necessary for the reception of the attachments is cut out of the wax patterns (Fig. 470). To be certain that no distortion has taken place, the wax patterns are again inserted in the cavities in the mouth, and, if correct in every detail, they are invested (Fig. 471) and cast. The inlays are then placed in the cavities in the mouth and polished. An impression is taken with plaster with the inlays in place, (Fig. 472) and a cast of artificial stone is made. (Fig. 473).

Mark the outline for the saddle and build a wall of plasteline, enclosing the area marked off (Fig. 474). Oil the artificial stone cast and pour

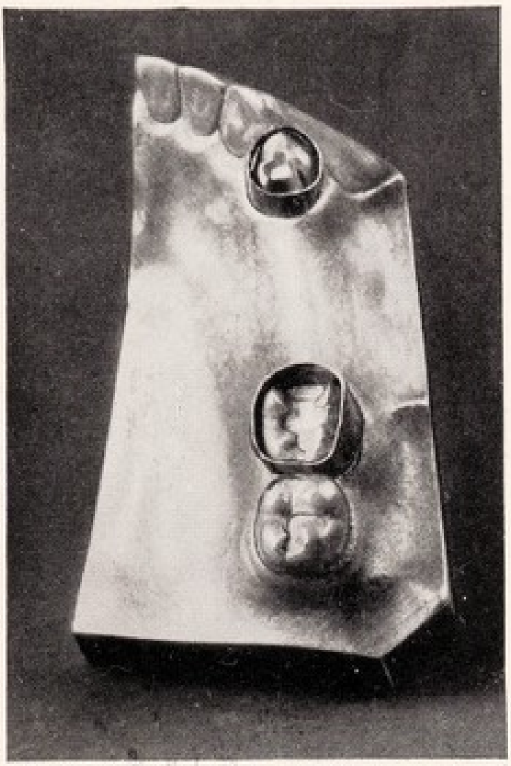

Fig. 465

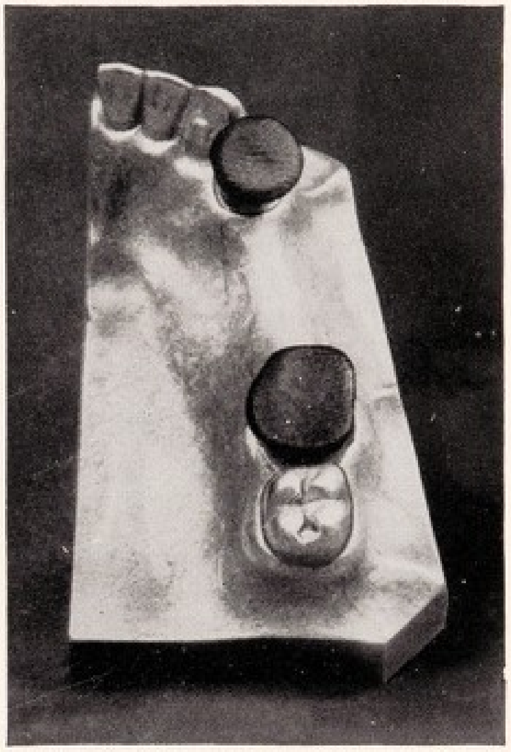

Fig. 466

Fig. 465. Copper bands fitted around the abutment teeth and extending below the gingival margins of the cavities

Fig. 466. Modeling compound forced into the copper bands

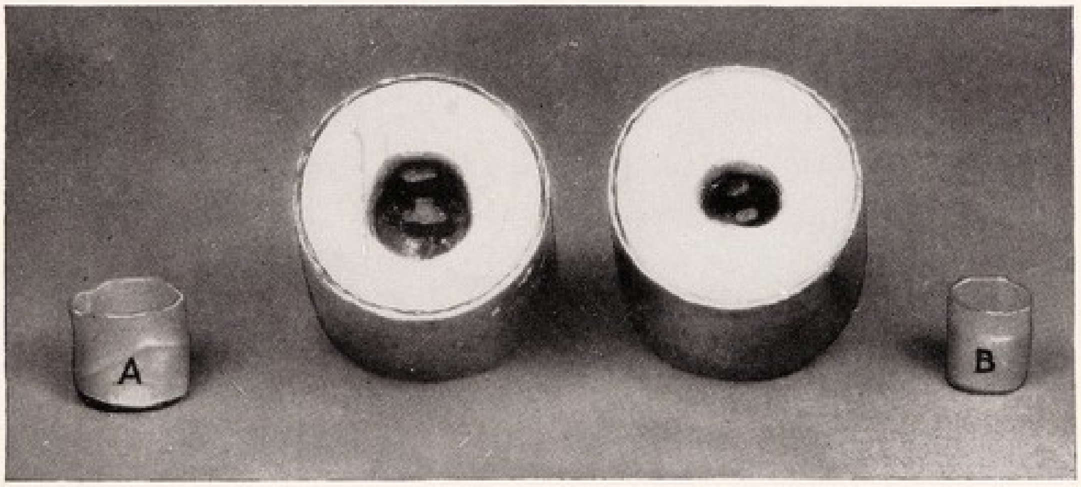

Fig. 467. The modeling compound impressions and copper bands embedded in plaster after having been wrapped in sheet wax as shown in A and B

plaster into the opening made by the plasteline. When the plaster has set it is removed, showing the outline for the saddle (Fig. 474, A). Partly

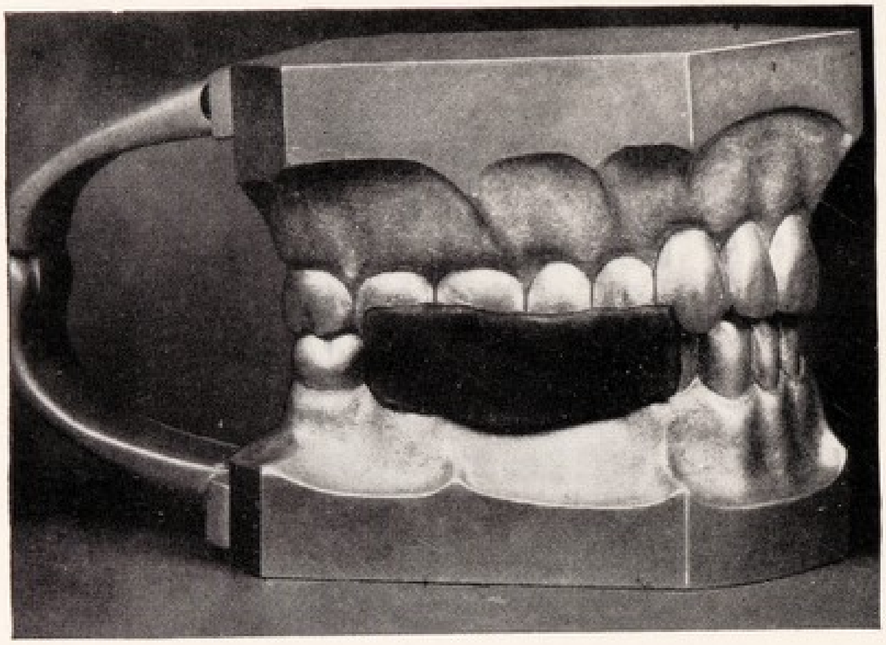

Fig. 468. Wax bite giving an impression of the occlusal surfaces of the opposing teeth

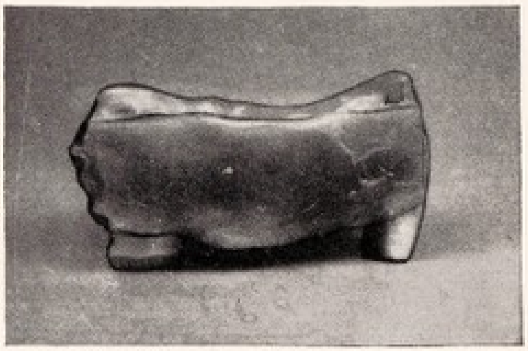

Fig. 469. Wax bite with amalgam dies in place

fill a rubber ring with moldine and embed the plaster cast for the saddle as at A, Fig. 475. Pour Ney's dialoy into the rubber ring. When cool it is separated; this provides one part of the swaging die, as seen at B, Fig. 475. Paint the surface of this die with alcohol and whiting and pour counter die, C, Fig. 475. Cut a piece of 28 gauge 22 K gold, or 30 gauge platinum,

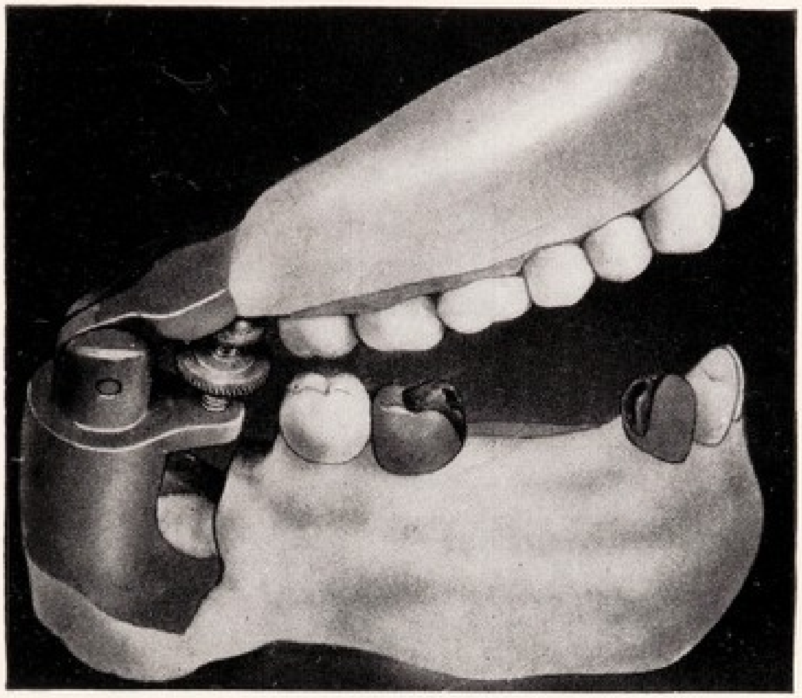

Fig. 470. Articulated upper and lower casts with amalgam dies and inlay wax in the cavities. Recesses have been prepared in the wax inlay patterns to receive the attachments

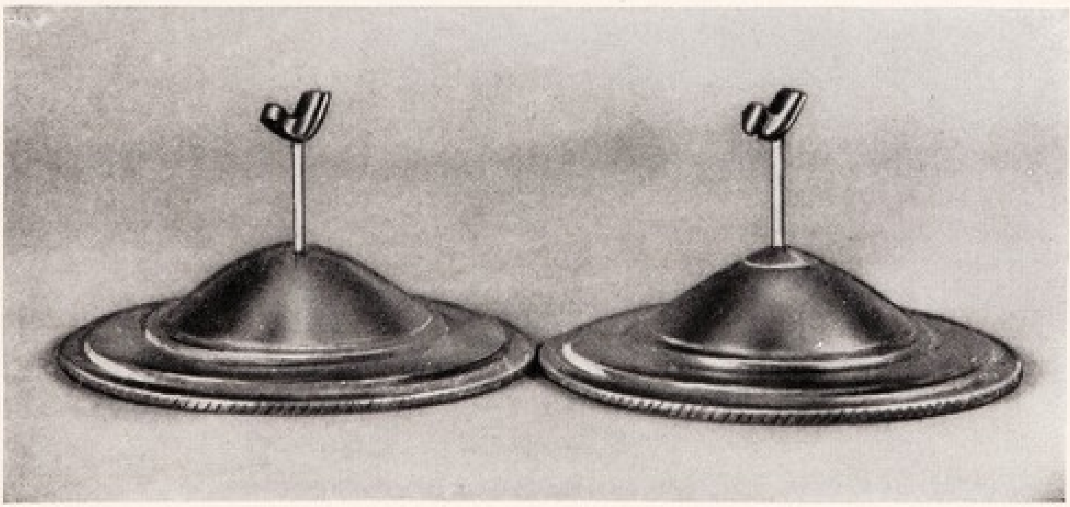

Fig. 471. Wax inlay patterns mounted for investing

and swage to fit the outline of the saddle, as shown in Fig. 476. Place a thin layer of modeling compound on the under surface of this saddle and

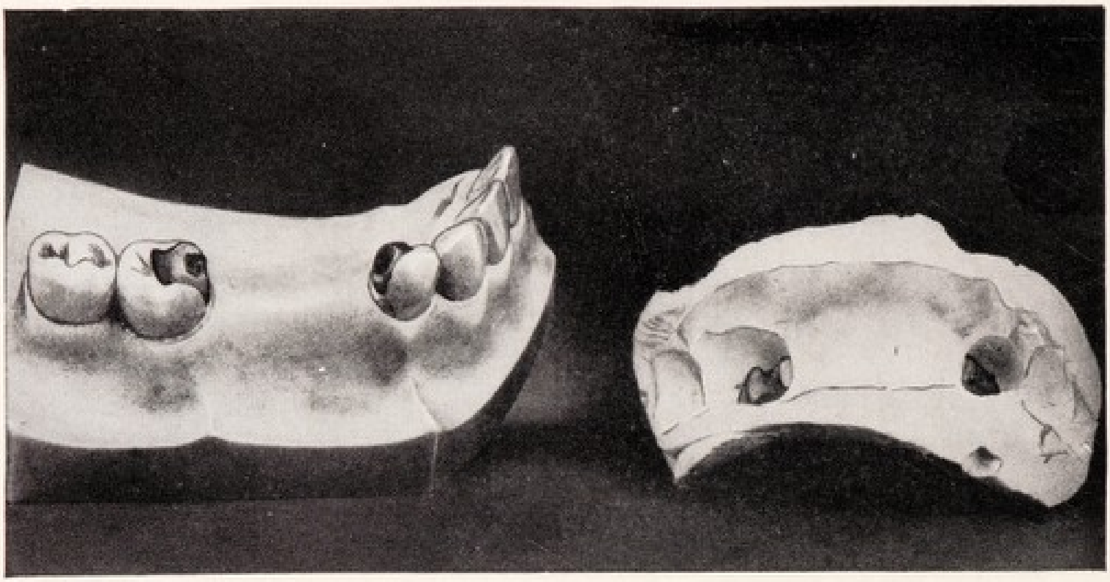

Fig. 472. Cast inlays in place in the cavities. In this figure is shown also the plaster impression with the inlays in place. This impression is taken in the mouth

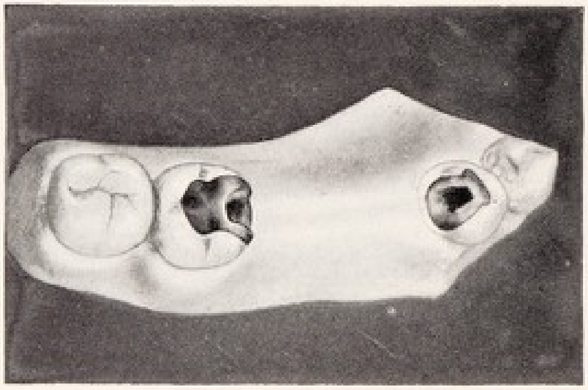

Fig. 473. Artificial stone cast with gold inlays in place

take a new impression in the mouth, having the compound heated to 135 degrees F. Mark any high, or hard spots on the ridge with indelible pencil. Dry the compound and replace the impression over the ridge; the indelible pencil markings will be transferred to the modeling compound. Relieve these spots by scraping the impression. Pour a new cast of artificial stone, and reswage the saddle to this cast. To prevent trauma of the tissues at the gingival margins of the saddle, place a small piece of wax, of about 19 gauge thickness, over this area on the cast, before making the plasteline wall

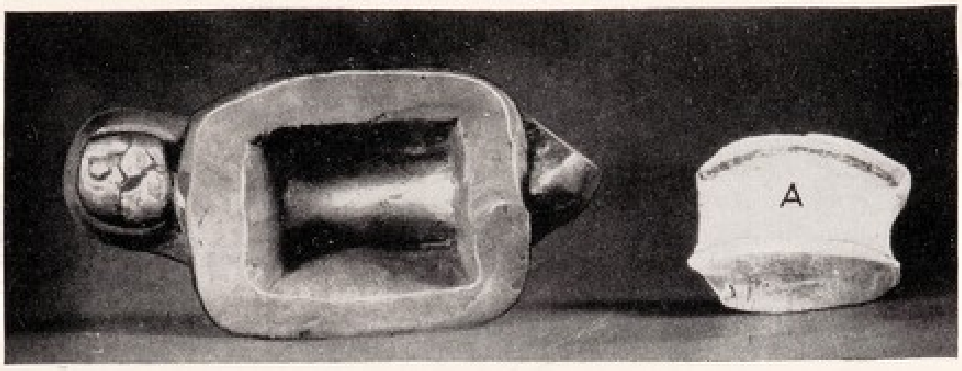

Fig. 474. Artificial stone cast with plasteline in place. A, is the plaster cast of the ridge area which has been poured in the plasteline mould

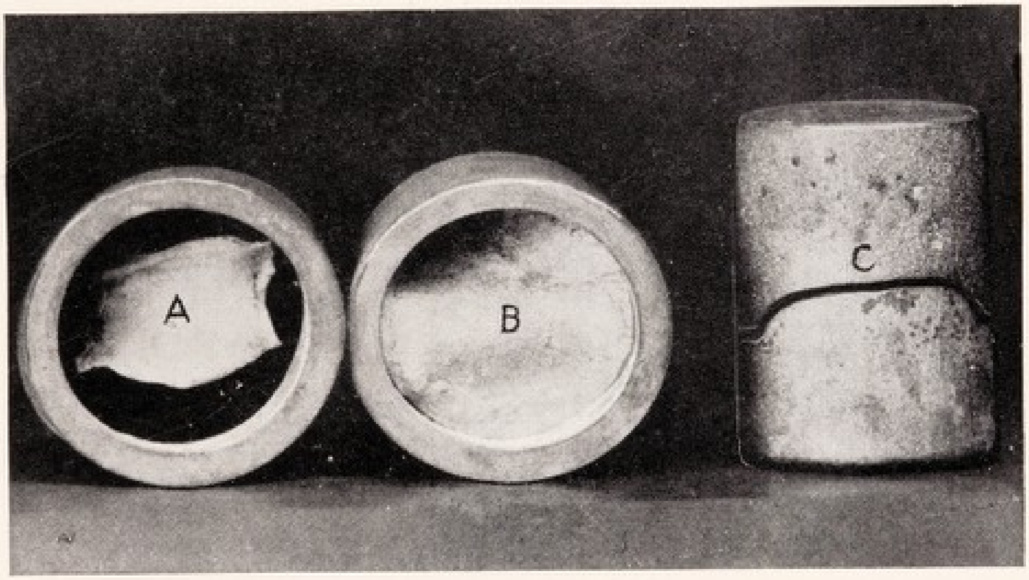

Fig. 475. A. Plaster cast of the ridge area embedded in moldine in a rubber ring. B. Fusible metal die poured in A. C. Counter die secured by pouring fusible metal over B

to secure plaster counter die for final swaging. The saddle and inlays are then taken to the mouth, and the saddle held in position, with just enough pressure to seat it properly. Using a small impression tray, cover the anterior abutment and the anterior portion of the saddle with plaster. Repeat this procedure for the posterior abutment and the posterior portion of the saddle, as seen in Fig. 477. After the latter mix of plaster has set, remove the small trays; the saddle will be held in position. Using a larger tray, take an impression covering the small impressions already

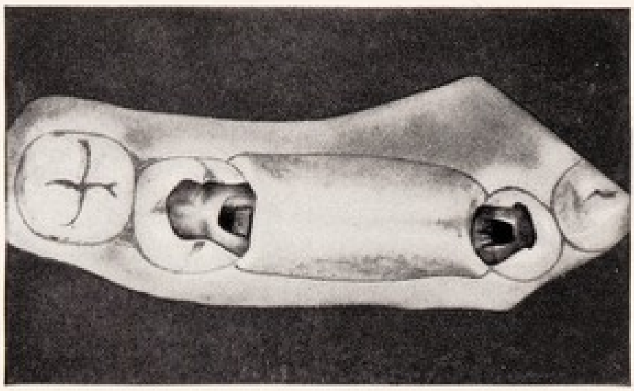

Fig. 476. Swaged gold saddle fitted to the cast

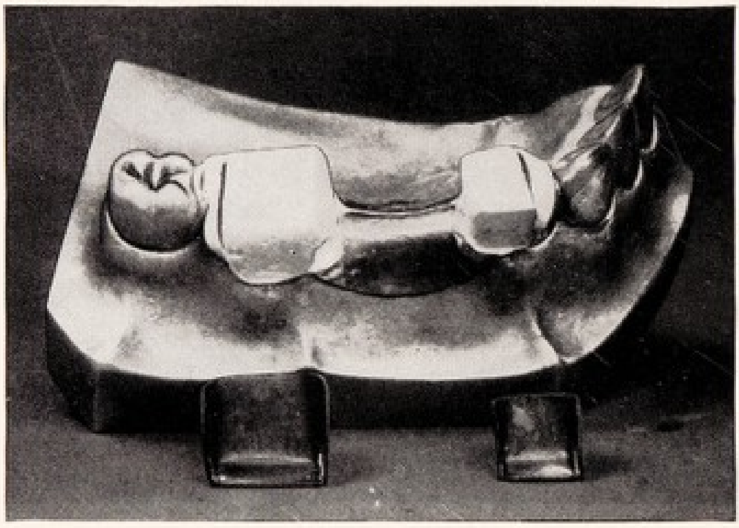

Fig. 477. Swaged gold saddle shown as in the mouth with separate plaster impressions giving the relations of the inlays to the saddle

in place, over the anterior and posterior abutments as in Fig. 478. The combined impressions are then removed *en masse* and a cast of artificial stone is poured. (Fig. 479). The attachments used in this bridge are Gollobin spring bars. Fig. 480 is an enlarged picture of the spring bar and platinum box. The cast with inlays in place is waxed onto the movable serrated plate of the parallelometer, (J, Fig. 481). Select a mandrel as F, that fits the platinum box and attach to horizontal arm D, of the parallelometer by the thumbscrew E.

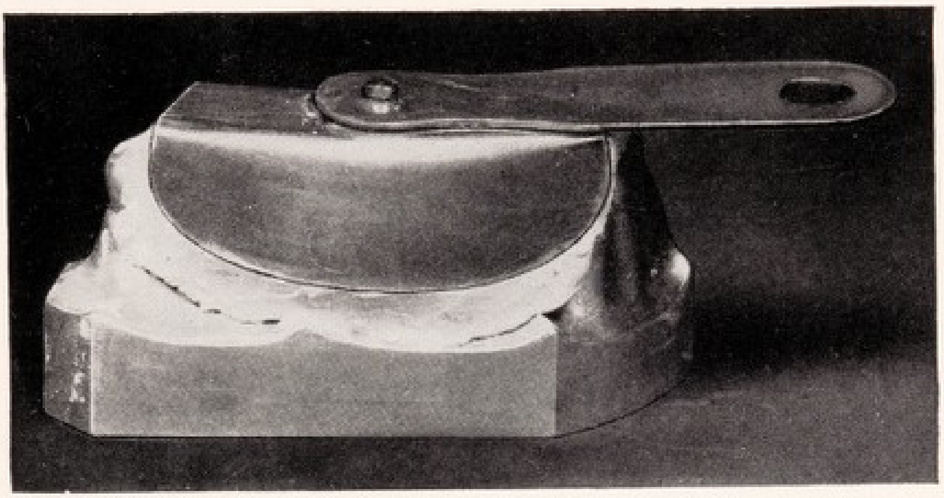

Fig. 479. Artificial stone cast poured in impression shown in Fig. 478. The case is

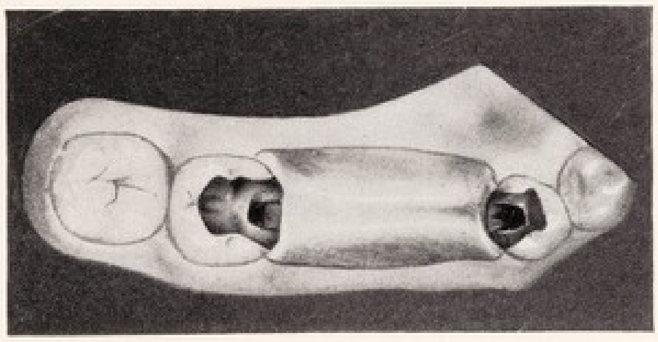

Fig. 479

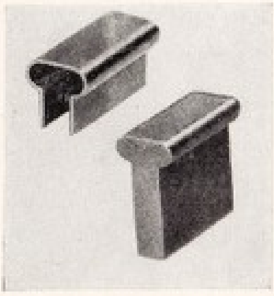

Fig. 480

Fig. 479. Artificial stone cast poured in impression shown in Fig. 478 The case is now ready for placing the attachments

Fig. 480. The Gollobin spring bar and platinum box

Description of the Parallelometer

A. Head of the carrier to which horizontal arm D is attached by the knurled nut C.

B. A thumbscrew for adjusting tension on the carrier A. By releasing this screw the horizontal arm D may be raised or lowered.

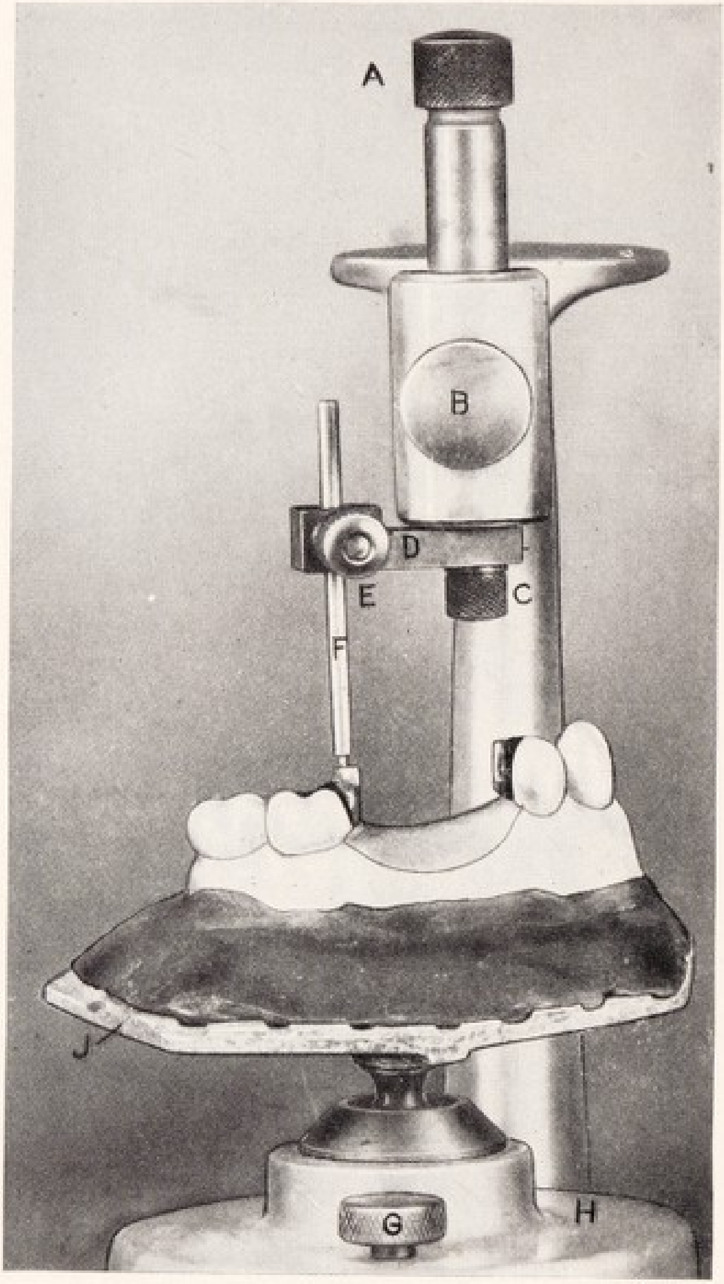

Fig. 481. Artificial stone cast with saddle and inlays in place mounted on Ney Parallelometer. A mandrel carrying the molar attachment is in position

C. A thumbscrew for adjusting tension on the mandrel F. By releasing this screw the mandrel F may be raised or lowered. By releasing the knurled nut C, the horizontal arm D, may be moved laterally.

J. A movable serrated plate.

G. Angle adjustment screw in the base of the survey table H. This screw controls the ball and socket mechanism by means of which the serrated plate J is held in the base at any required angle. Loosen the angle adjustment screw G, and begin to manipulate the plate J, until the box of the attachment is seated in one abutment in the cast to as great a depth as possible and in proper alignment with the other abutment.

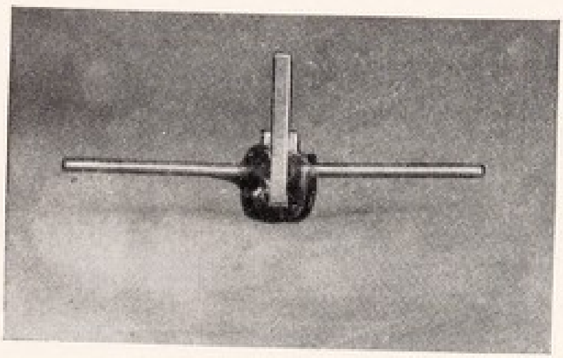

Fig. 482. Platinum box with graphite inserted and 17 gauge clasp wire attached with sticky wax preparatory to investing

Tighten the angle adjustment screw G, and seal the box into the inlay with sticky wax. Loosen the thumbscrew E, and remove the mandrel F. Select a mandrel for the other attachment if it is of a different size and attach it to the horizontal arm D, by thumbscrew E. To bring the other abutment under the point of the mandrel, simply slide the survey table H, on the floor of the parallelometer, but do not loosen the angle adjustment screw G, as this has been set at the angle to which the attachments are to be paralleled. Raise, or lower the mandrel by releasing the thumbscrew E, until the box is properly seated in the other abutment; then seal with sticky wax. Remove the mandrel and solder the boxes into the inlays.

Soldering Technique

To prevent contraction, or expansion, in soldering, fill the platinum box with soft inlay investment material and then place a piece of graphite in the box and wax two pieces of 17 gauge clasp wire against its sides (Fig. 482). Invest and solder with 22 K solder. After soldering the platinum boxes into the inlays, trim away that part of the platinum which extends out of the inlays; place the inlays on the cast, select a mandrel with a

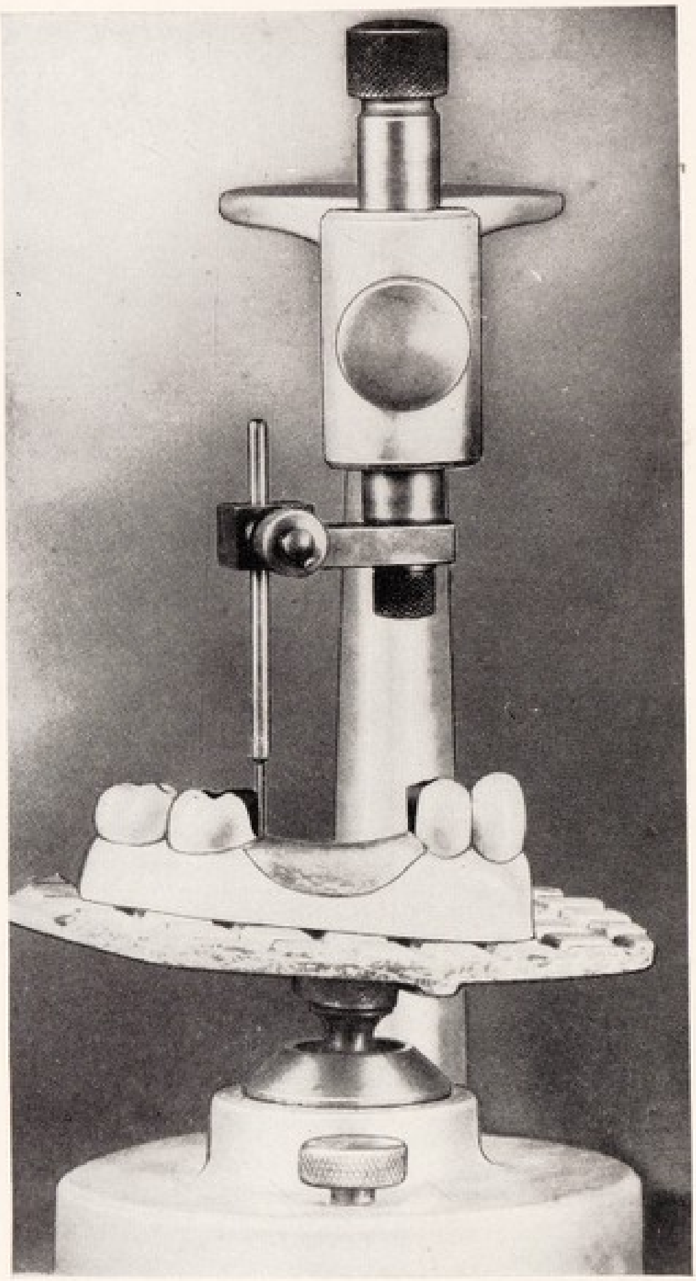

Fig. 483. Cast mounted on Ney Parallelometer with guide to assist in paralleling the approximal surfaces of the inlays

flat side, and, using this as a guide, continue to trim the approximating sides of the inlays until they are parallel (Fig. 483). Remove any sharp edges of the platinum box with fine disks, and force the spring bar into the box. Grasp the spring bar with a pair of pliers and, holding the inlay

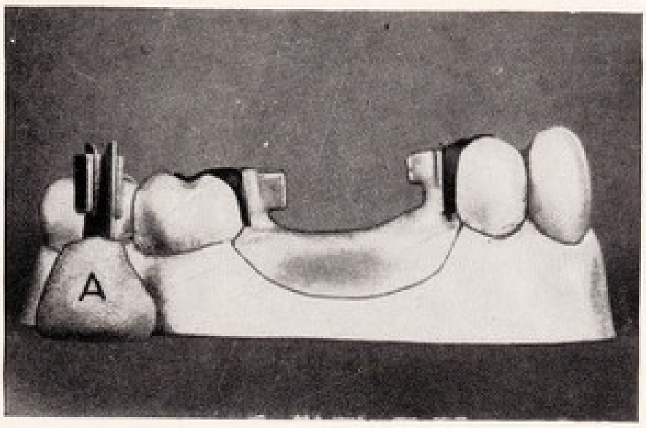

Fig. 484. Cast with saddle in place together with spring bars reinforced with clasp metal plate as shown in A

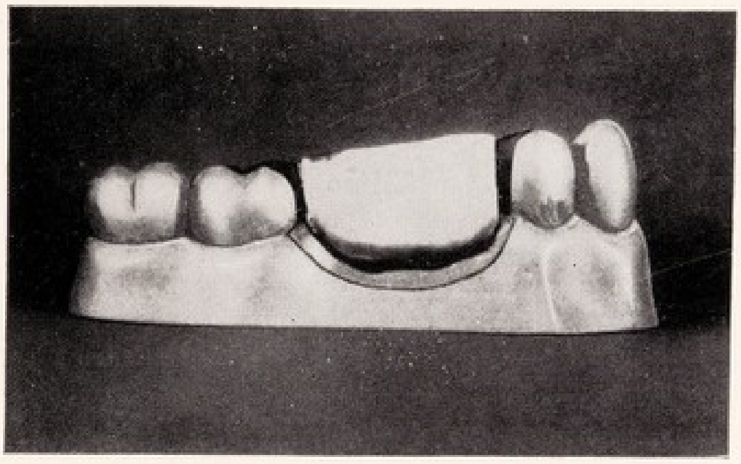

Fig. 485. Plaster impression of saddle and spring bars as shown in Fig. 484

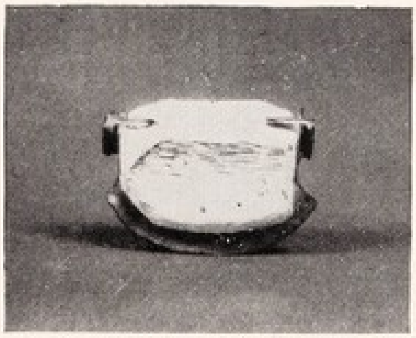

Fig. 486. Saddle and spring bars removed in plaster impression preparatory to investing

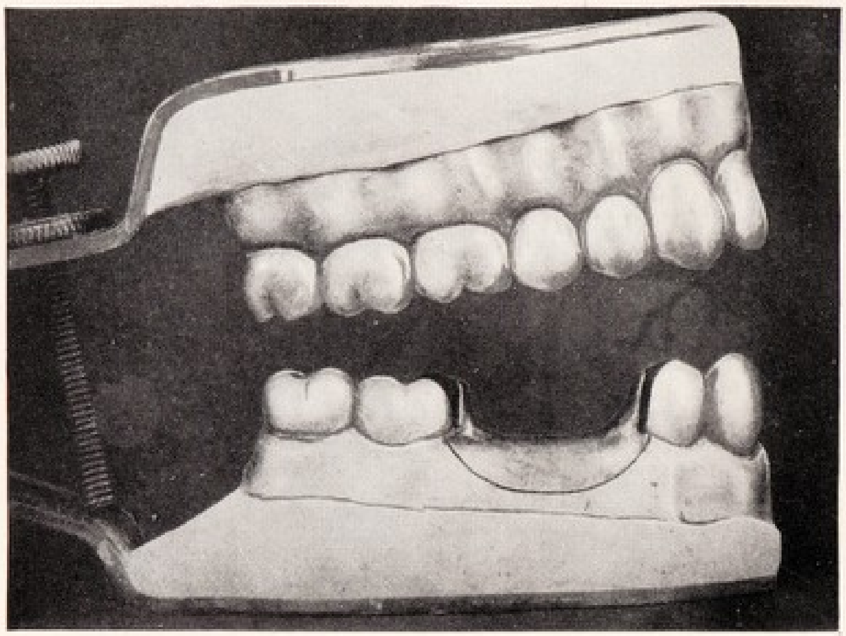

Fig. 487. Saddle with spring bars soldered to it and excess of the bars trimmed away, shown as tested for fit and occlusion in the mouth

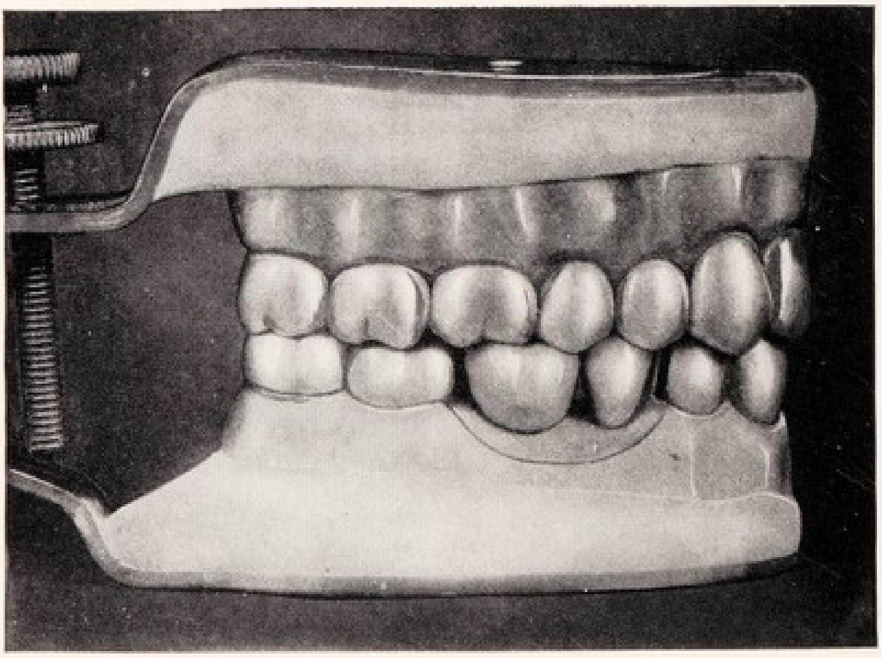

Fig. 488. Porcelain teeth ground to occlusion with their antagonists. A slight space is left between the porcelain teeth and the saddle

in the left hand, remove and replace the spring bar until it slides into the box with very little friction.

To attach the spring bar to the saddle, cut a slot in a piece of S. S. White clasp metal No. 1, wide enough to accommodate the spring bar and long enough to reach the saddle (Fig. 484 A). With the saddle and inlays in place on the cast, slide the piece of clasp metal with slot over the spring bar, until the clasp metal is in close contact with the sides of the inlay

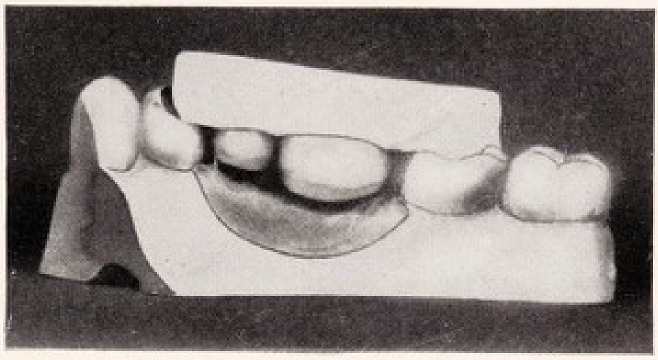

Fig. 489. Plaster impression of the occlusal surfaces of the porcelain teeth and abutments to be used as an index of the proper seating of the porcelain teeth after boxing

(Fig. 484). Attach the clasp metal to the spring bar with sticky wax. Remove the inlay from the cast and slide the spring bar out of the inlay. Invest and solder the clasp metal to the spring bar, using 23 K solder (1 dwt. of 22 K solder plus 1 dwt. of S.S. White clasp metal).

After soldering the clasp metal forks to both of the spring bars, place them in the inlays and replace on the cast. Wax the clasp metal forks to the saddle (Fig. 484), and cover with plaster (Fig. 485), leaving part of the saddle exposed. Remove the inlays and saddle from the cast and slide the inlays off the spring bars (Fig. 486). Invest and after the investment has hardened, cut away the plaster and solder the clasp metal forks to the saddle with 22 K solder. Assemble all parts on the cast and trim away the spring bar extensions. (Fig. 487.)

At this stage in the construction of the bridge it is advisable to call in the patient. Place the inlays in the cavities and see that the saddle and spring bars fit accurately. Test the occlusal surfaces of the inlays and spring bars to see that no traumatic contact has been produced during the soldering in of the platinum boxes and spring bars. If the boxes and spring bars are in excessive contact with the opposing teeth, grind them down until perfect occlusion is established. Take a new bite and grind

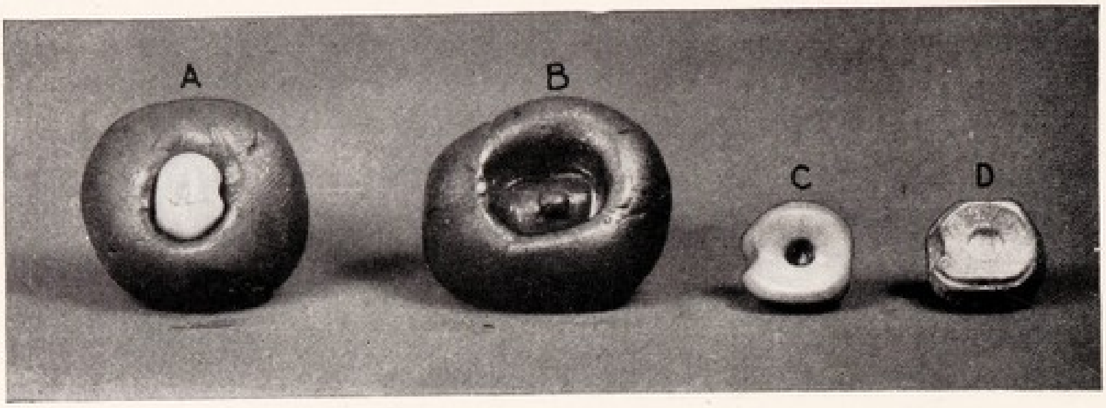

Fig. 490. A. Bicuspid porcelain tooth embedded in moldine to give impression of ridge area. B. Moldine impression of molar porcelain tooth. C. Molar porcelain tooth after removal from the impression. D. Metal die secured by pouring fusible metal into B

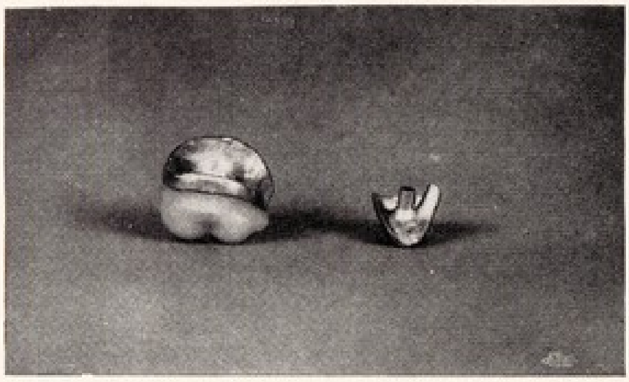

Fig. 491. Porcelain molar tooth with completed platinum box in place, and platinum box adjusted for porcelain bicuspid

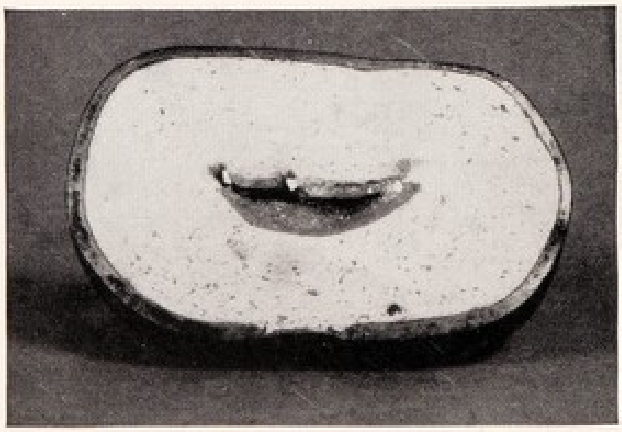

Fig. 492. Platinum boxes and saddle invested in a metal ring preparatory to soldering

in the porcelain teeth (Fig. 488). After the teeth are ground into position, allowing sufficient space for boxing with platinum, make a plaster index (Fig. 489). The teeth are then embedded in S.S. White moldine (Fig. 490, A and B). Pour Ney's dialoy, or any low fusing metal, into the impression to secure a metal die for swaging the platinum to fit the porcelain teeth as D, Fig. 490. This is a duplicate of the porcelain tooth C, Fig. 490. Swage 36 gauge platinum, or pure gold, to fit the metal dies, then burnish over the porcelain teeth and perforate the platinum, or gold,

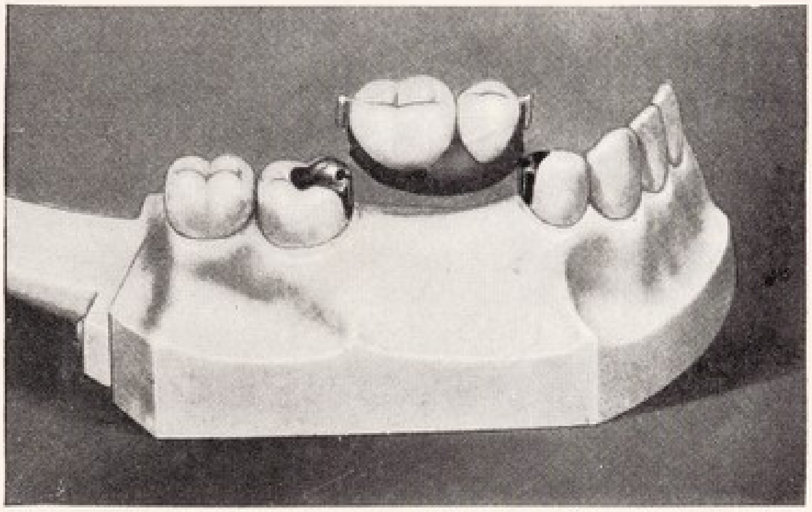

Fig. 493. Completed bridge ready for insertion

over the holes in the teeth. Insert clasp metal pin and solder to the platinum or gold floor (Fig. 491). Place teeth on the cast and see that the pins do not interfere with their proper seating. Grind the pins until the plaster index will go completely to place. Attach the copings to the saddle with sticky wax, remove the inlays, invest, and solder the copings to the saddle with 18 K solder.

By investing the case in a metal ring, the investment on the opposite side may be cut down until the saddle and copings are exposed as seen in Fig. 492. The case may then be soldered in one investment, as the solder will flow through to the opposite side. It may, however, be necessary to turn the case over and flame the opposite side with the blowpipe, adding a little solder if necessary.

Use of Condensite Materials

On the lower jaw the weight involved in this method of attaching the porcelain teeth to the bridge saddle is a matter of little importance. On the upper jaw, however, the weight of such appliances is often considerable, especially in the more complicated bridges which are sometimes required. It seems advisable then to use vulcanite for attaching the teeth to the bridge saddle in upper removable bridge cases. If this is done, the use of a condensite material is recommended on the labial or buccal portion, for the sake of esthetics. The materials now available for this purpose have the disadvantage of not being lasting as to appearance and texture. These facings can of course, be changed with little difficulty. Eventually it seems safe to predict that a material will be evolved which

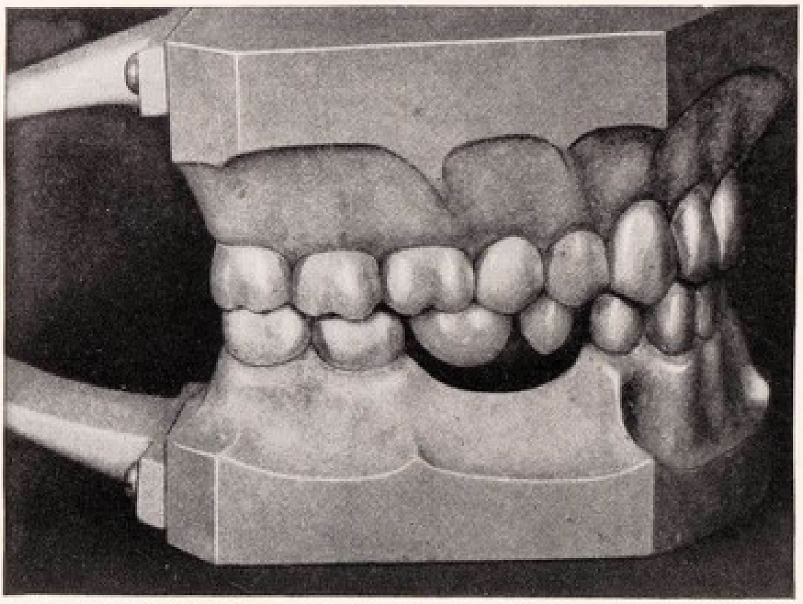

Fig. 494. Completed bridge in place

will have the desired qualities of strength, appearance and permanence, and which may be used for attaching the porcelain teeth to the saddle without the need of using a separate facing material.

It seems well to add a word of caution regarding dependence on condensite denture materials in bridge construction. It is extremely important in the making of removable bridges that the saddle and the attachments be united in a rigid assembly. This is only to be accomplished with entire satisfaction when the saddle is made of metal with the attachments soldered directly to it.

Perfecting the Occlusion

Figs. 493 and 494 show the bridge completed. When inserting the bridge in the mouth, one tooth is tried in at a time, and proper occlusion established with the opposing teeth. After the inlays are cemented into position, and the bridge inserted, carborundum powder, mixed with glycerine, is placed on the cusps of the teeth and the patient is requested to close the mouth and perform the movements of mastication to wear down any remaining points having slight incoördination.

In cases requiring one bridge of two or three teeth, where the other teeth are in functional occlusion, full casts of all the remaining teeth are not necessary when constructing the bridge. If the teeth are not in functional occlusion when the case is undertaken, full casts of both jaws are secured and the teeth are ground to functional occlusion. A small adjustable articulator can then be used for the construction of the bridge. In all other cases, where large upper and lower bridges are to be inserted, or bridges involving both sides of the mouth, full casts of all the remaining teeth should be used when constructing the bridges.

Correcting Faulty Parallelism

While every effort is made in the preliminary stages of bridge construction to secure parallelism of the approximal surfaces of the inlays or crowns in the abutment teeth, the beginner may occasionally find, when trying in the completed bridge, that these surfaces are not quite parallel. This will be evidenced by a binding of the reinforcing plates on the sides of the inlays, or crowns, as the bridge is being inserted. For this reason it is imperative that the abutment inlays or crowns be not cemented until the bridge has been completed and tried in. To force home a bridge in which even a slight binding is discovered, would inevitably bring about periodontal disease in the abutment teeth, to say nothing of discomfort each time the bridge is inserted.

If it is found that the bridge binds as stated above, this situation may be corrected as follows:—With the inlays, or crowns, in place in the teeth, but not cemented, insert the bridge until it begins to bind. Take a plaster impression of the bridge and its abutments. The abutment inlays or crowns should be withdrawn with the bridge in the impression. Paraffin wax is next moulded over the ridge area of the saddle of sufficient thickness to represent the amount of space which existed under the bridge when it was tried in the mouth. A cast is now poured in artificial stone. The bridge is removed from the cast and the wax is discarded. The approximal surfaces of the abutments are now coated with graphite from a soft lead pencil and the bridge is tried in. Where the contact of reinforcing plate with the abutment is made the graphite will be rubbed off. This spot is now trimmed slightly and the process repeated until the bridge goes to place.

CHAPTER XXVIII

The Repair of Broken Removable Bridge Attachments

One of the most unhappy experiences to which the bridgeworker may be subjected is the breakage of the male attachment of a removable bridge. The experience may be less embarrassing if it happens that the bridge has been made by another dentist. But, in either case, it is his desire to repair the damage without making an extra new bridge provided the bridge is satisfactory in other respects.

The repair of these cases is essentially a simple procedure, but one which must be carried out with quite as much attention to accuracy of detail as in the making of a new bridge. The natural desire of the dentist is to make this repair as quickly as possible. The shortest way however, in this, as in other techniques, is likely to lead to errors which may jeopardize the entire bridge. Short cuts in technique are therefore not advised.

A removable bridge with one attachment broken is shown in Fig. 495. The first step is to remove the porcelain teeth from the saddle by boiling in 50% Hcl. Assuming that the bridge was originally made without a reinforcing plate, the next step is to grind away sufficient gold to provide room for the new attachment with a reinforcing plate.

A male attachment of the type and size used in the original bridge is then selected and placed in the platinum box in the inlay, or crown, in the mouth. (See Fig. 496.) With a sharp instrument mark the male attachment at the point where it extends above the platinum box. The male attachment is now removed from the mouth and a new platinum box is fitted to it. This platinum box is trimmed to the mark made on the male attachment. A clasp metal reinforcing plate is then prepared for the male attachment. (See Fig. 497.)

Replace the male attachment in the platinum box in the mouth, with the bridge saddle in place. Place the reinforcing plate over the male attachment, making such adjustments as are needed to secure an accurate fit.

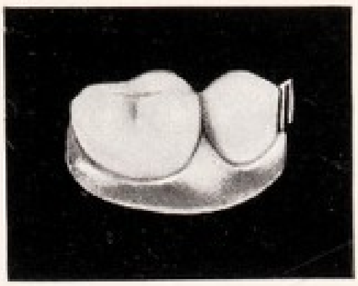

Fig. 495. Right lower removable bridge with distal attachment broken

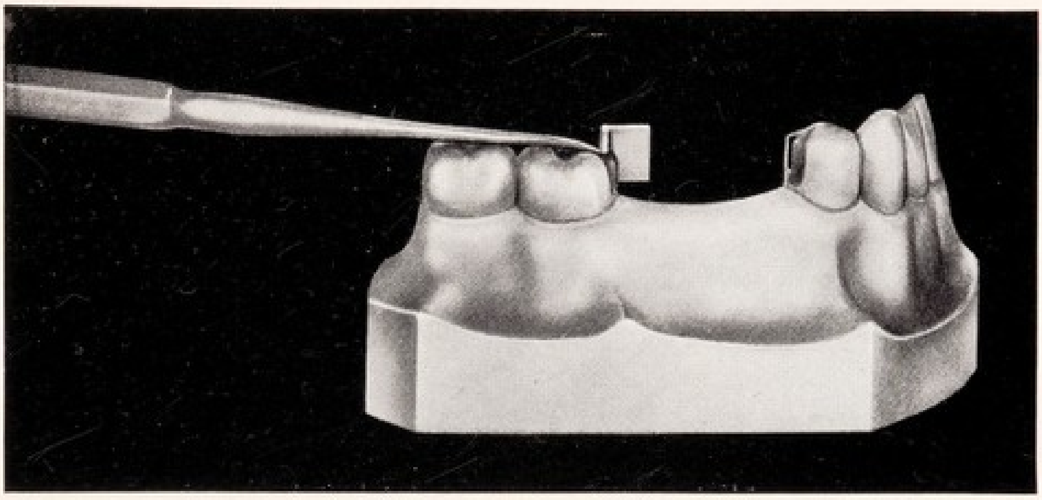

Fig. 496. New male attachment of same size as the original, shown as in place in the molar box in the mouth. A sharp pointed instrument is used to mark the attachment where it extends beyond the box in the mouth

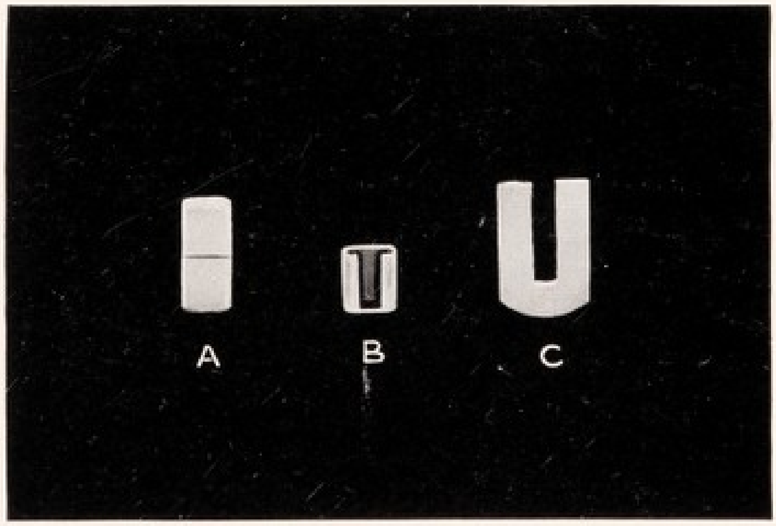

Fig. 497. A—View of male attachment marked to show the height of box. B—Platinum box cut to height indicated by mark on the male attachment. C—Clasp metal reinforcing plate

The reinforcing plate is to be brought into contact with the approximal surface of the abutment inlay. (See Fig. 498.) Attach the reinforcing plate to the male attachment with sticky wax, and remove if possible without distortion. If this has been accomplished these parts, as shown in

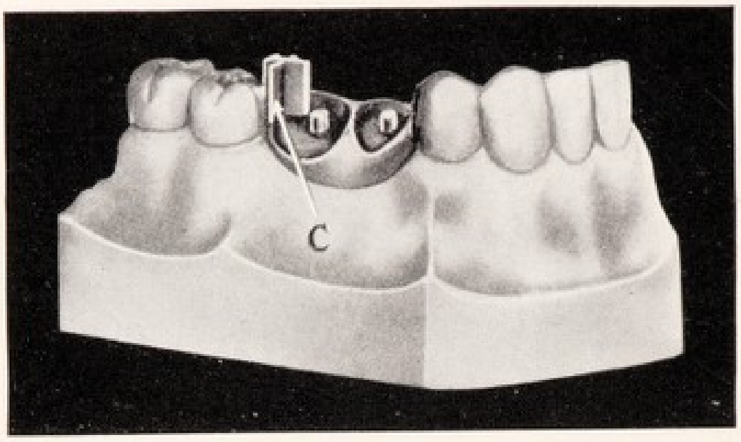

Fig. 498. Bridge with porcelain teeth removed as in place in the mouth. The male attachment is placed in the inlay and the clasp metal reinforcing plate C is passed over it making contact with the approximal surface of the inlay. The reinforcing plate and male attachment are united with sticky wax

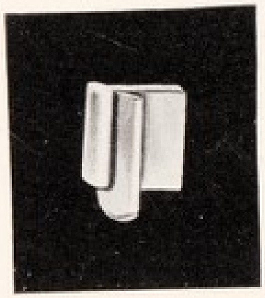

Fig. 499. The male attachment and reinforcing plate removed from the box preparatory to investing for soldering

Fig. 499, are to be invested and soldered together with 22 K solder. If there is any doubt in the mind of the operator as to his ability to remove the reinforcing plate and male attachment without distortion, a safe procedure is to take a small impression of these parts in plaster in the mouth. The impression is removed, breaking the plaster if necessary, and reassembling outside of the mouth. It is then invested and soldered as just described. The new platinum box is now tried on the soldered male attachment assembly and is trimmed to just avoid contact with the reinforcing plate so that it will go to place in the plaster impression which is to be taken next.

After soldering, the male attachment assembly is carried back to the mouth with the saddle in place and a plaster impression is taken as shown in Fig. 500. After this impression is removed the platinum box (B Fig. 500) is placed on the male attachment (A). (The platinum box

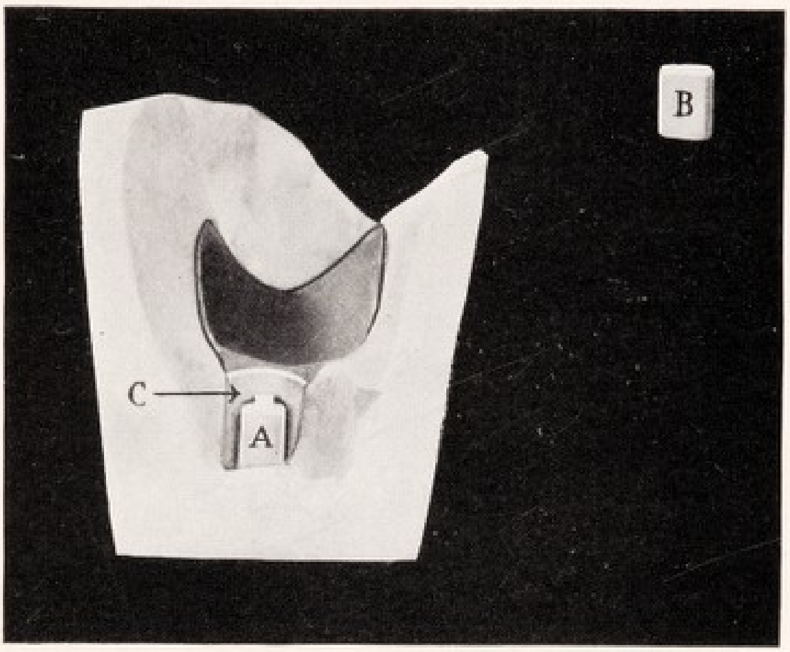

Fig. 500—Impression of the saddle and male attachment assembly as taken in the mouth. A—Male attachment. B—Platinum box. C—Reinforcing plate

B Fig. 500 is the same as was shown in reverse position in Fig. 497 B.) An artificial stone cast is then poured which, after separation, appears as in Fig. 501. The next step is to take a small plaster impression of the male attachment and that part of the saddle immediately adjacent to it, as in Fig. 501 A. The saddle and male attachment are now removed together from the cast, the relations being maintained by the plaster impression as shown in Fig. 502. This assembly is now invested and the reinforcing plate is soldered to the saddle with 20 K solder. After soldering, the bridge is replaced on the cast, and the excess of the male attachment and the reinforcing plate is trimmed away approximately as shown in Fig. 503.

The patient is now recalled and the bridge is tried in the mouth for fit and occlusion. Any points on the new attachment which make excessive occlusal contact with the opposing teeth are trimmed, so as to avoid traumatic occlusion. The porcelain tooth adjacent to the new attachment is now tried in. If it fails to go to place the new attachment is marked

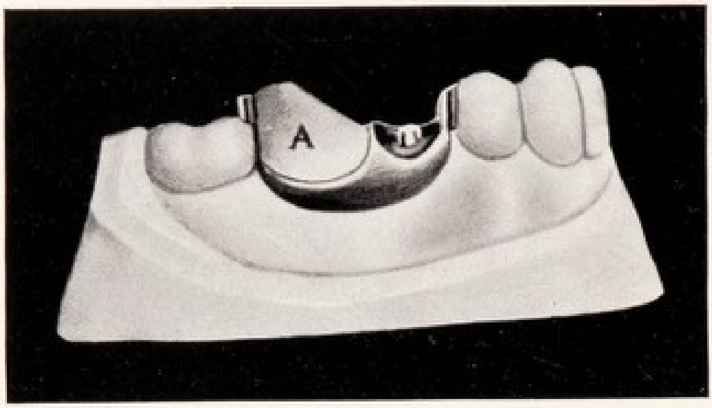

Fig. 501. Artificial stone cast poured in impression shown in Fig. 500. A—Small plaster impression establishing the relation of the new male attachment assembly to the saddle

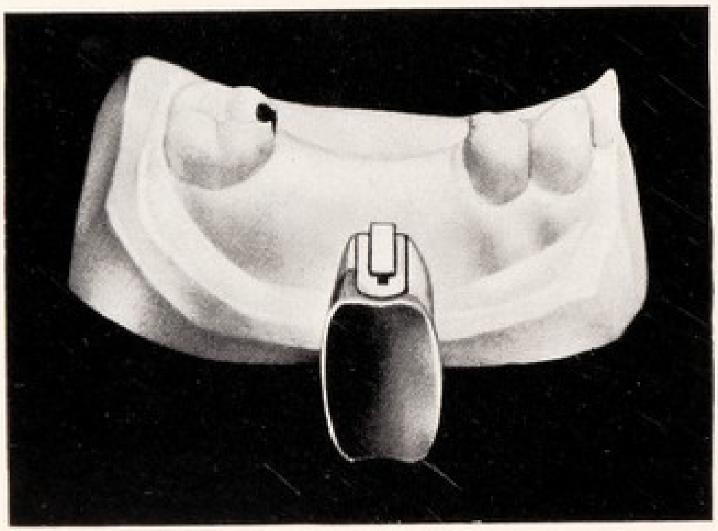

Fig. 502. Saddle and male attachment removed from cast ready for investing preparatory to soldering reinforcing plate to saddle

with graphite and the tooth again tried in. Points of contact will be indicated by a transfer of the graphite to the porcelain. The porcelain is then ground and the process is repeated until it goes to place perfectly. It is to be understood that the new attachment is not so bulky but that the porcelain tooth may be replaced without requiring so much grinding that it would be weakened. Cementation of the porcelain teeth and a final check on the occlusion completes the repair.

If it is found that the bridge, as originally made, has a properly fitting reinforcing plate the repair is then made by cutting a slot in it, in direct line with the opening in the platinum box in the abutment. A new male attachment is then fitted to the box and to the slot so prepared. A plaster impression is now taken as shown in Fig. 500.

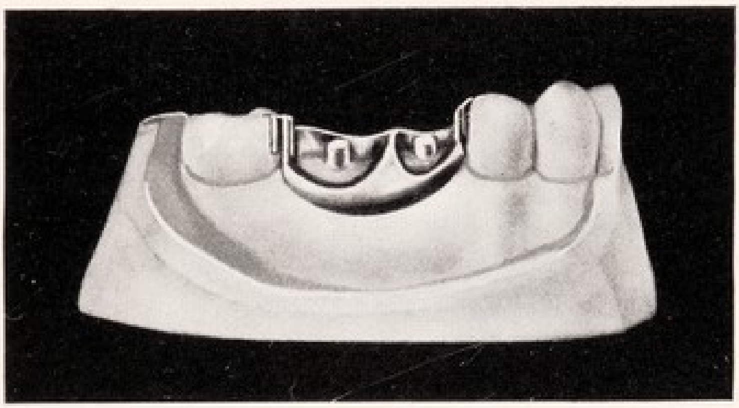

Fig. 503. Saddle with male attachment and reinforcing plate on cast after soldering. The excess material of the male attachment has been trimmed away

The case may now be invested and the attachment soldered to the bridge. It is then placed in the mouth and the excess occlusal portion of the male attachment is ground down to the level of the platinum box.

If the patient is nervous and objects to the grinding in the mouth the case may be carried through in the manner already described in the preceding paragraph. This procedure is also recommended for the student since it provides safeguards against distortion. In either case the male attachment should be seated in a platinum box during the grinding.

Replacing a Defective Inlay

Occasionally it will be found that, either through decay or insufficient retention, one of the inlays used for the retention of a bridge must be replaced. Assuming that the other inlay attachment is in satisfactory condition and that the bridge fits properly, the replacement of the defective inlay may be accomplished without making over the entire bridge.

The cavity is prepared according to accepted principles and a wax pattern is formed for it, using the indirect method. The wax is then cut out on the approximal side so that it will accommodate the male attachment and will, in addition, have sufficient space to receive a platinum box. The wax pattern is now tried in the mouth and the bridge is inserted. If it is found that the relations of the male attachment to the inlay pattern are correct, the wax pattern is removed, invested and cast. The cast inlay is now placed in the mouth and the bridge inserted. A plaster impression is taken and a cast poured in stone, having first placed a platinum box on the attachment which goes in the sound inlay. After separation, the bridge is removed from the cast and a platinum box is fitted to the other male attachment. It is replaced on the cast with any necessary adjustments to insure proper seating in the new inlay. The platinum box is now attached to the inlay with sticky wax and the bridge is removed from the cast. Place a piece of graphite of proper size in the platinum box and invest the inlay. The platinum box is now soldered to the inlay.

Should the patient lose a bridge a new bridge may be made by attaching reinforcing plates to two new male attachments as previously described. Platinum boxes are then cut to conform to the markings on the male attachments, and to just avoid contact with the reinforcing plates. A plaster impression is taken, the platinum boxes are placed over the male attachments and a cast is poured in artificial stone. After separation a new saddle is constructed and soldered to the reinforcing plates. The case is then taken to the mouth and the necessary occlusal adjustments are made. A bite is then taken and the bridge completed.

CHAPTER XXIX

Technique for Rebasing a Removable Bridge

Theoretically it should never be necessary to rebase a properly constructed removable bridge, but, practically, the need for this arises rather frequently. The most common cause for this is the construction of a removable bridge within a few months after the extraction of the teeth. The early insertion of a bridge is often necessary for esthetic, or other reasons, and it is also frequently needed as a part of the programme for the treatment of periodontal disease in the mouth.

It has been stated by some, that when a bridge is inserted a short time after extraction, the saddle of the bridge acts as a mould to which the tissues of the ridge conform without later settling. Experience has shown that while this may occur in a few cases, in the majority of instances absorption, and settling of the ridge progress in spite of the presence of the bridge saddle.

Even when a considerable period of time has elapsed after the extraction of the teeth before the bridge is constructed, some resorption of the ridge may be found after the bridge has been in service for several years.

No matter what the cause of the resorption may be, it results in a disbalance of the supporting members in the bridge case, throwing disproportionate stress on the bridge abutments, and, in addition, permits an annoying accumulation of food débris under the saddle. Bridges should be inspected at regular intervals, to determine whether such absorption has occurred. It is imperative that rebasing be performed whenever such resorption is detected. Unless this is done, the strain on the abutment teeth may, and usually does result in the development of periodontal disease, with inevitable loss of one or more abutment teeth.

The correct procedure for rebasing a removable bridge, i.e., one with a gold saddle, involves the expenditure of considerable time and it may not therefore be feasible, in every case, to rebase the bridge in this manner. If time will not permit this method of rebasing, it is possible to rebase with vulcanite. While not ideal, this latter method will at least serve to restore the proper distribution of stress as between the abutments and the

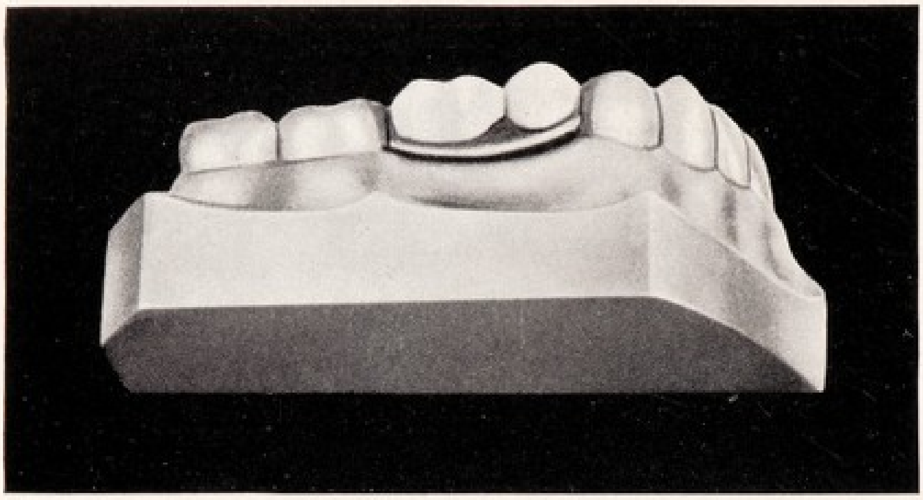

Fig. 504. A bridge requiring rebasing, in place as in the mouth, after the trimming of the lower surface of the saddle

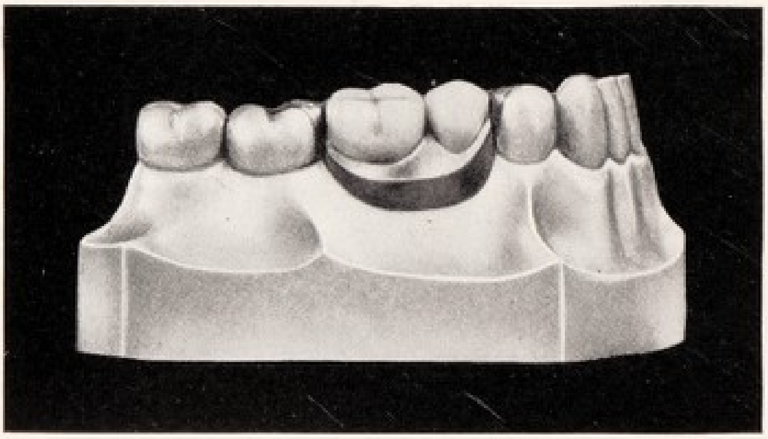

Fig. 505. Modeling compound attached to the bridge and carried to place, as in the mouth

ridge. It is therefore preferable to use this method rather than to allow the case to go on indefinitely, with an imperfect ridge relation.

The first step in the rebasing of a removable bridge with gold, is to grind the lower surface of the bridge saddle with suitable stones so that when placed in the mouth there will be a uniform space of approximately

1 mm. between the saddle and the ridge. (See Fig. 504.) This is to provide sufficient room for making a suitable saddle to be united to the bridge.

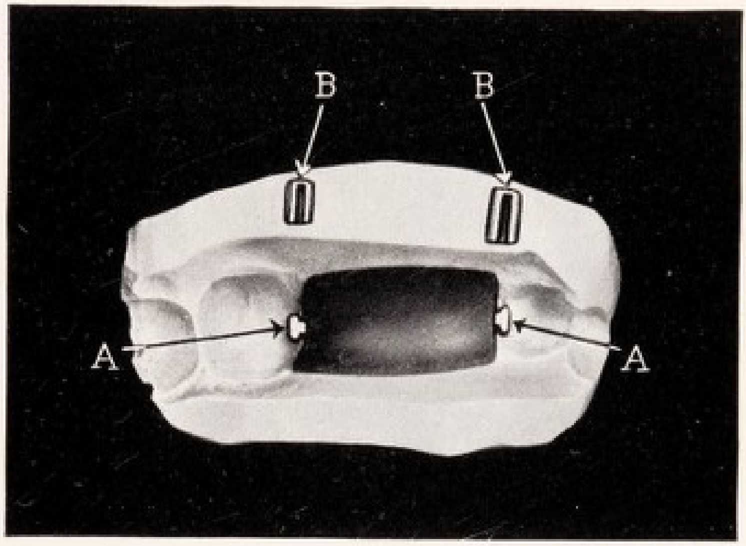

Fig. 506. Plaster impression with bridge and modeling compound as removed from the mouth. AA—Spring bars. BB—Platinum boxes which have been trimmed to fit the spring bars

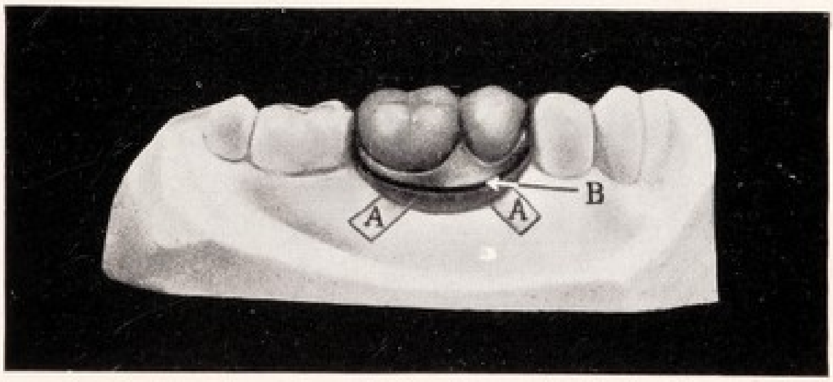

Fig. 507. Bridge in place on cast, with inlay wax trimmed to desired outline. AA—Wax tabs. B—Groove between wax and gold

When this has been accomplished, modeling compound is flamed so that it will adhere to the bridge saddle. The bridge and compound are then placed in water, brought to about 135 degrees F. and carried to place in the mouth (Fig. 505). Be sure that the bridge is completely seated, and that any compound which has penetrated into undercuts is trimmed away. If the bridge is not properly seated remove it, reheat in warm water and carry to place once more.

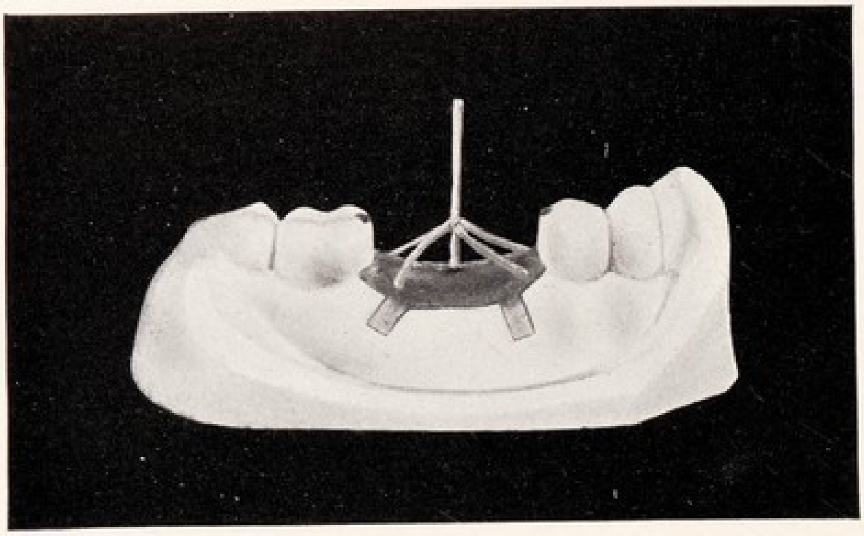

Fig. 508. Wax saddle on cast with sprues attached

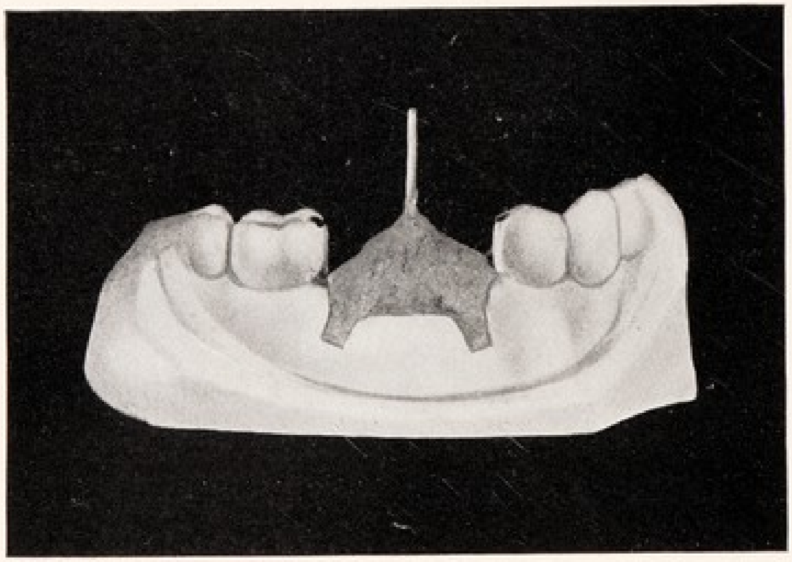

Fig. 509. First coat of investment applied to saddle and sprues

With the bridge in place, take an impression in plaster. Two platinum boxes (Fig. 506 BB), which have previously been fitted to the spring bars (Fig. 506 AA), are now placed on the spring bars, and a cast is run in artificial stone. After separation, the saddle area on the cast is oiled and inlay wax is formed over it to the approximate thickness and shape desired. The bridge is then replaced on the cast, the under surface of the saddle having been oiled. It is then placed in warm water to soften the wax and

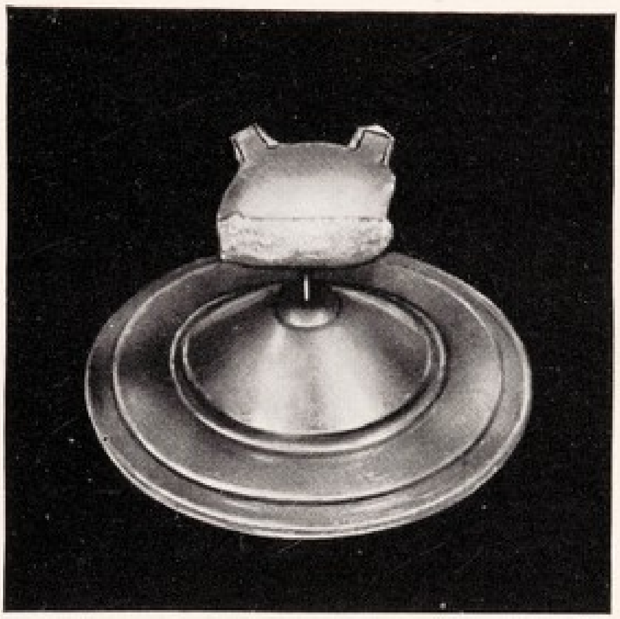

Fig. 510. Partly invested wax saddle in place in crucible former

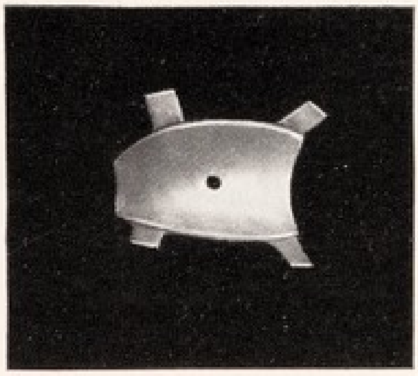

Fig. 511. Saddle after casting, showing hole drilled in the center

the bridge is pressed firmly to place so that the spring bars are completely seated in the platinum boxes. The wax is trimmed to the desired outline and two wax tabs are attached to its edge on both buccal and lingual sides (See Fig. 507 AA). These tabs will be held by the investment and will

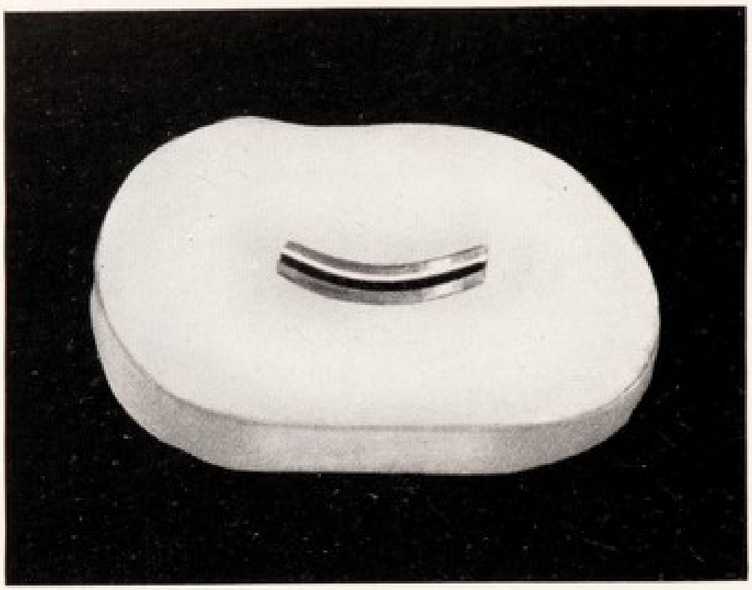

Fig. 512. New saddle attached to the bridge and invested in a metal ring ready for soldering

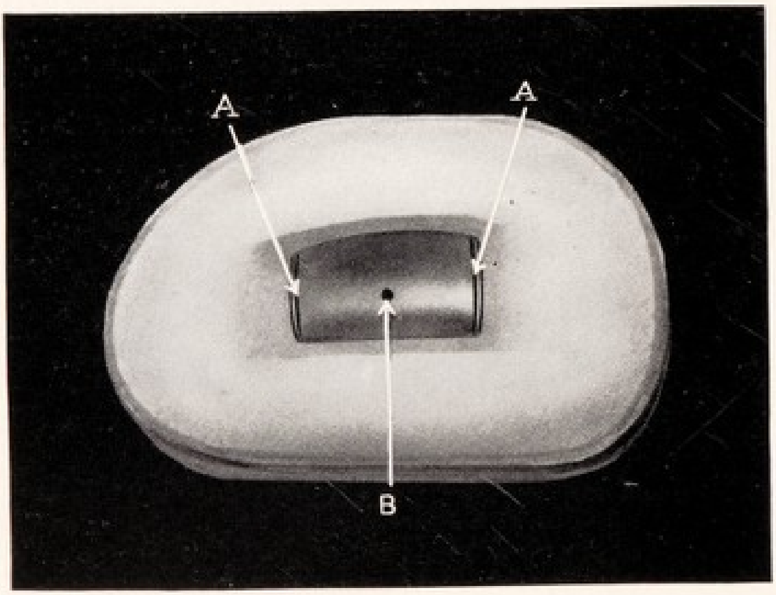

Fig. 513. Saddle reinvested after the first soldering to permit filling deficient spots at the margins. AA—Grooves cut at the ends of the saddle for additional solder. B—Hole in the center of the saddle to be filled with gold foil

thus aid in preventing movement of the saddle during soldering. A slight groove is cut in the wax where it meets the gold saddle; this facilitates the soldering after the saddle has been cast (Fig. 507 B).

The bridge is removed, leaving the wax saddle on the cast. Sprues are now attached as shown in Fig. 508. A central sprue and at least four accessory sprues are used to insure accurate casting. With the wax still in place, cover the upper surface and the sprues with investment material. (Fig. 509.) After this has set the assembly is removed from the cast, and placed in a crucible former (Fig. 510). The investment is now completed and the saddle is cast in a suitable gold. After the saddle is cleansed in acid a hole is drilled through its center. This is to provide an air vent to facilitate the flowing of the solder (Fig. 511).

After the porcelain teeth have been removed from the bridge as described in the preceding chapter, it is placed on the cast with the new saddle and this is examined to detect any irregularities which might interfere with the proper seating of the bridge. It is imperative that the bridge should go to place so that the spring bars are completely seated in the platinum boxes. The two saddles are then joined with sticky wax, removed from the cast and invested (Fig. 512). The saddles are now soldered on both sides and the case inspected to see that the periphery is completely sealed with solder. It will usually be found that at some point, especially at one or the other end of the saddle, there will be a deficiency of solder. If this occurs, a groove is cut along the margin with a fine round bur and the saddle is invested so as to permit access to this point (Fig. 513 AA). A lower carat solder is now used to remedy the deficiency and will be found to flow more satisfactorily when a groove has been cut as described. After the soldering is completed the hole in the center of the saddle (Fig. 513 B) is filled with gold foil. The tabs are now cut off, the bridge is polished and the porcelain teeth are recemented.

CHAPTER XXX

The Wrought Gold Clasp in Removable Bridgework

The partial denture constituted, in effect, the first removable bridge, and many of the devices which were later modified for use in removable bridgework were first brought out in connection with partial denture construction. The clasp was the first practical means for retaining partial dentures, and it has now come into use as a means for the retention of certain types of removable bridgework.

The early clasps were made from gold plate so alloyed as to provide strong resiliency. When it was found that in many mouths the flat clasp of gold plate induced caries, the profession began to experiment with gold wire, both round and of other shapes. With the advent of the internal attachment the clasp was temporarily abandoned. The reason for this was that even the round wire clasp seemed to cause decay, in certain cases. When, however, it was found that internal attachments were not always applicable with safety to the dental pulp, experiments were again made with the clasp.

At this juncture the cast clasp received the greatest attention, but it was found in time that this was subject to the same disadvantages as the plate metal clasp, namely• that it frequently caused decay in the tooth surface which it covered. Furthermore the element which at first seemed to be in its favor, namely, the rigidity which promised superior strength, was in fact a point of weakness, because of the frequent fractures due to its brittleness, and the fatigue of the metal.

Wire Clasps

Present day practice has brought back the wrought clasp, constructed of drawn gold wire, in which the metal is much less subject to fatigue. The element of support is now provided by suitable lugs, the clasp being used simply for the purpose of retention. The question of caries is still to be considered, but it is usually possible to determine quite accurately the caries susceptibility of a mouth, and to decide, by a preliminary diagnosis, whether clasps may safely be used, or not. Where indicated, the wrought gold clasp has been found to give entire satisfaction. With the opportunity to choose between the clasp and lug, for immune mouths, and the internal attachment for those mouths which show susceptibility, or in which the patient's care is likely to be unsatisfactory, the bridgeworker may plan his restoration with every prospect that it will give satisfaction.

The literature of today is replete with methods and techniques for the construction of various types of clasps. The clasp to be described here is a modification of older forms, containing certain features originated by the author. It has been employed with great satisfaction for more than five years. Perhaps the most important feature of this clasp is the fact that it permits carrying the clasp metal wire around the tooth almost completely in one plane. The freedom from bends which are not essential to the clasping function gives it the maximum effectiveness with the minimum likelihood of metal fatigue. The occlusal rest feature is so designed as to provide also for maximum strength, having no bends at any point. While in some cases other types of clasps may be indicated, the clasp here described has a nearly universal application.

One of the fundamental requisites for removable bridgework, using clasps for retention, is positive resistance against occlusal stress. This is best provided by means of lugs seated in recesses prepared in inlays which have been designed for this specific purpose. Such design provides for adequate strength in the clasp and lug assembly, and also gives the greatest possible protection against caries. Where a high immunity to caries exists, and where sufficient room can be gained without cutting into the enamel of the abutment tooth, an occlusal lug may be constructed to rest on the marginal ridge of the enamel. This occlusal lug is to be made of round clasp metal wire (in the shape of a loop) which will provide strength with the minimum contact of metal on the tooth (See Fig. 530).

Whether an inlay is used, or whether the clasp is placed on the tooth surface, it is essential for success that the supporting piece should be aligned at right angles to the direction of occlusal force. Otherwise there will be a tendency to movement of the tooth under the wedging effect which is produced when the occlusal lug, or occlusal rest, has any inclination. If the round wire loop is used it should be carried over the marginal ridge, so as to guard against any tendency to displacement toward the approximal surface of the tooth. When the loop is used, the ends of the wire are carried along the approximal surface of the tooth and soldered to the clasp which encircles the tooth. If there is any doubt as to the immunity of the teeth to decay, the decision should be in favor of the inlay with recess and lug, fitted in a manner to be described. If it is decided to use the round wire loop the enamel of the tooth which is to be utilized should under no circumstances be ground. Space for the loop will often be found to be available. If not however, the opposing tooth may be ground slightly to provide the necessary room.

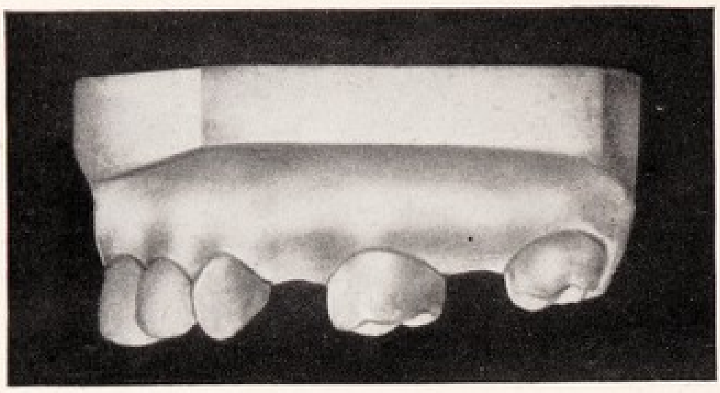

Fig. 514. Cast of a case in which a removable bridge is to be constructed for the upper left side. Note that the teeth are short

Technique for Bridge Using Wire Clasps

A typical case for employing this type of bridge is shown in Fig. 514. The first step in the construction of the bridge is to prepare inlays for the teeth which are to be clasped. When the wax pattern has been satisfactorily adapted to the tooth, it is again placed in the amalgam die, and a piece of 17 gauge, Ney-Oro No. 4, round wire, is heated slightly and pressed gently into the occlusal surface of the wax. It is removed, cleansed, heated again, and again pressed into the wax, being careful to avoid any distortion of the wax pattern. This is continued until the recess is as deep as the diameter of the wire. The inlay pattern is again tried in the cavity in the mouth. If the fit has not been altered the inlay is then cast.

With the inlays in place in the mouth, a separate plaster impression is taken of each abutment tooth, and these impressions are poured in artificial stone, or packed with cement (Fig. 517). A full plaster impression is then taken in which the inlays will be placed and a cast is poured in artificial stone (See Fig. 515).

The cast is now placed on a Ney Clasp Surveyor, as shown in Fig. 516. This instrument is unique, in that it is the first instrument by which correct and definite clasp outline may be established by a precision method. It eliminates guess work, and the errors to which the human eye is liable. When employed, it should face the operator, whose right hand rests on the top of the Standard B, with the fingers grasping the head of the carrier C,

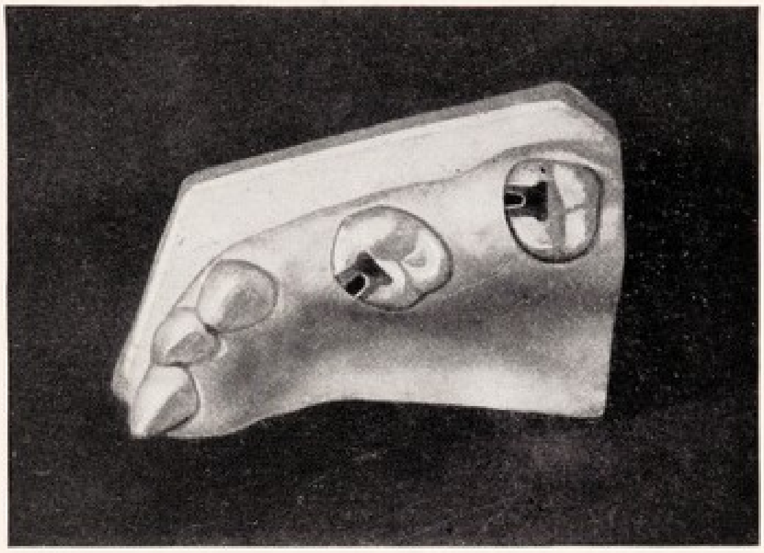

Fig. 515. Occlusal view of the case shown in Fig. 514. Inlays have been constructed for the mesial occlusal surfaces of the molars with depressions to receive 17 gauge round wires

for operation, and with the left hand moving the survey table I, about the floor A, in this manner bringing the convex surfaces of the teeth on the cast in contact with the graphite indicator F.

Description of the Clasp Surveyor

(A) The floor of the instrument, all parts of which are at right angles to the vertical, sliding and rotating spindle (E), which holds and carries the graphite indicator (F). This spindle will hereafter be termed the carrier (E).

(B) A standard attached to the floor (A), with a horizontal arm extending over the floor and carrying the vertical carrier (E).

(C) The head of the carrier (E). This is knurled, to facilitate manipulation.

(D) A thumb-screw at the end of the arm, projecting from the standard (B) for adjusting tension on the vertical carrier (E).

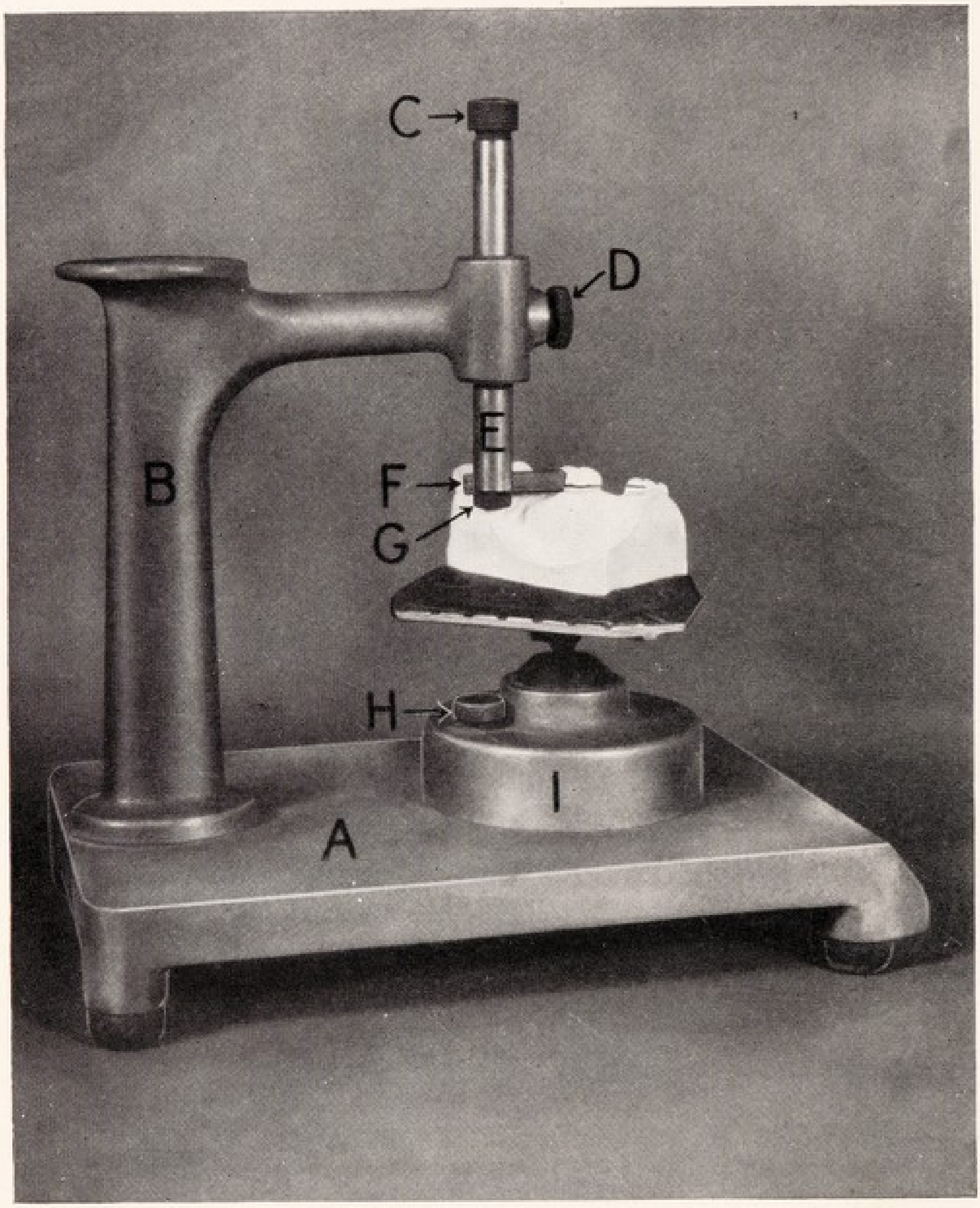

Fig. 516. Cast mounted on Ney Clasp Surveyor and with graphite markings indicating the location for the clasps

(E) The carrier. It is held vertically in relation to the floor (A), and can be moved up and down, or rotated.

(F) The indicator. A rectangular piece of grahite held in the end of the carrier (E), for charting and marking the convex surfaces of the

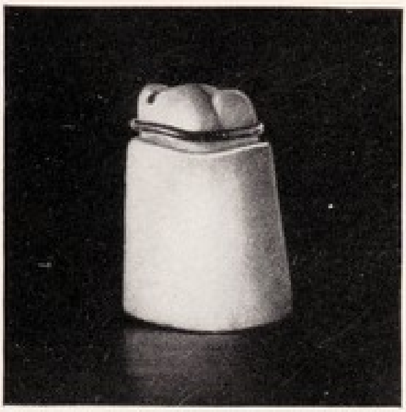

Fig. 517

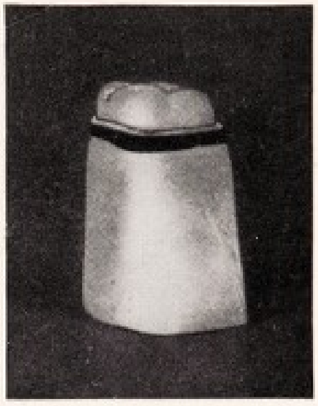

Fig. 518

Fig. 517. Artificial stone tooth prepared from a separate impression taken in the mouth. The location for the clasp as indicated by the survey instrument has been copied on this tooth form and a lead wire pattern of the same gauge as the clasp is adapted approximately 2 mm. below this guide line

Fig. 518. The plaster tooth shown in Fig. 517 with paraffin wax adapted to fill the space between the lead wire and the gingival line

teeth being surveyed. The ends of the graphite must always be square and the edges sharp.

(G) A knurled nut for tightening the graphite indicator (F) which is held horizontally in a rectangular slot at the end of the carrier (E).

(H) Angle adjustment screw in the base of the survey table (I). This screw controls the ball and socket mechanism by means of which the model table top is held in the base at any required angle.

(I) The survey table. Its base is flat, which permits movement about the floor (A), while the carrier (E) is being raised or lowered, and rotated. The serrated plate to which the survey case is attached by wax or modeling compound may be tilted at any angle, readjusted and firmly held in any required position.

It is important that the survey cast should be made of a harder and more durable material than plaster, in order that experimental survey lines may be erased from the surfaces of the teeth marked by the indicator, and other lines substituted until the position of the survey cast in its relation to the graphite indicator is such that the guide lines will be in such position on the teeth as to afford the greatest possible degree of retention for the clasps.

The position of the clasp as already determined, is then copied on the original tooth form, and a lead wire, of the gauge which is to be used for

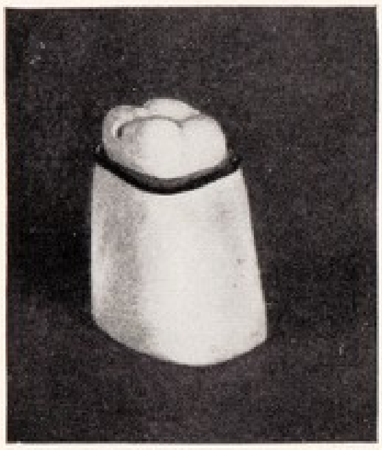

Fig. 519

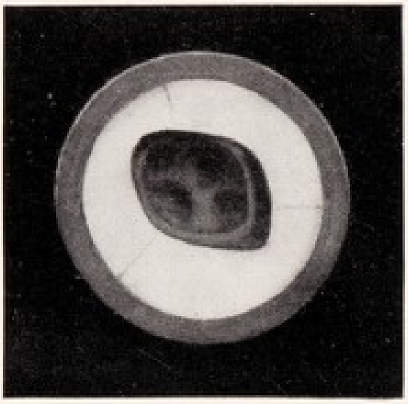

Fig. 520

Fig. 521

Fig. 519. Same as Fig. 518 with the lead wire removed

Fig. 520. Plaster impression of the tooth shown in Fig. 519

Fig. 521. Fusible metal die made of Ney's Dialoy, from impression shown in Fig. 520

the clasp, is conformed about 2 mm. below this line (See Fig. 517). Paraffin wax, or inlay wax, is now adapted to fill any space existing between the lead wire pattern and the cervical line of the tooth (See Fig. 518). The lead wire is removed as shown in Fig. 519 leaving the wax in place. A plaster impression is now taken in a rubber ring. It is split and then assembled as shown in Fig. 520. Ney's Dialoy is poured into this impression, producing a die as shown in Fig. 521. Round wire, clasp metal, of the desired gauge is now shaped and swaged on this die to the shoulder. The clasp wire is then placed in proper position on the cast, approximately 2 mm. below the guide line.

A piece of flat, 26 gauge, Ney-Oro No. 4 plate, is selected and a hole is drilled in it near one end, of a diameter to receive a No. 17 gauge, Ney-Oro No. 4, round wire, as shown in Fig. 522. A piece of round wire as specified, is placed in the hole which has been drilled and the assembly is carried to the cast and the round wire is seated in the groove in the inlay.

The plate is brought flush with the approximal surface of the tooth and inlay, and attached to the wire with sticky wax. This is now invested and

Fig. 522

Fig. 523

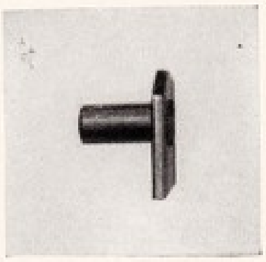

Fig. 524

Fig. 525

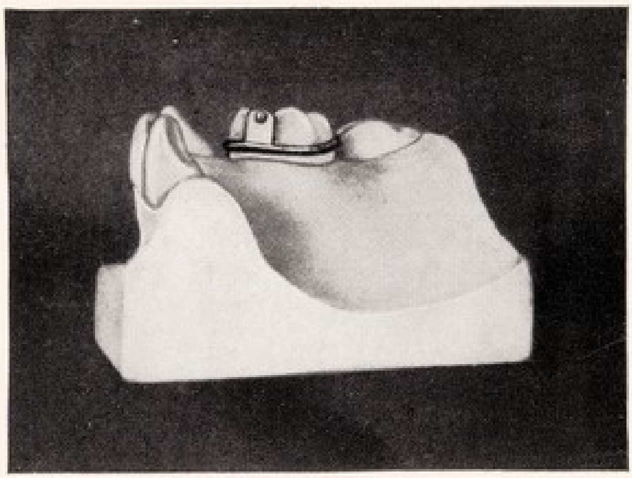

Fig. 526

Fig. 522. 26 gauge Ney-Oro No. 4 plate with hole drilled to receive No. 17 gauge Ney-Oro No. 4 round wire

Fig. 523. 17 gauge Ney-Oro No. 4 wire placed in hole in plate shown in Fig. 522 and soldered to it with Ney-Oro G-3 metal

Fig. 524. Side view of plate and wire assembly shown in Fig. 523

Fig. 525. Plate shown in Fig. 523 trimmed at the occlusal end so as to be flush with the top of the round wire. Note that by this manner of trimming, the plate maintains an adequate grip on the wire. The plate is trimmed at its gingival aspect so as to just reach the clasp which has been swaged to fit the metal die shown in Fig. 521

Fig. 526. Clasp in place on the cast with plate soldered to it

soldered with Ney-Oro G-3 metal, after which the excess wire is trimmed away (See Figs. 523 and 524).

After soldering, the occlusal portion of the plate is trimmed away to the level of the round wire. It is imperative that the round wire should fit

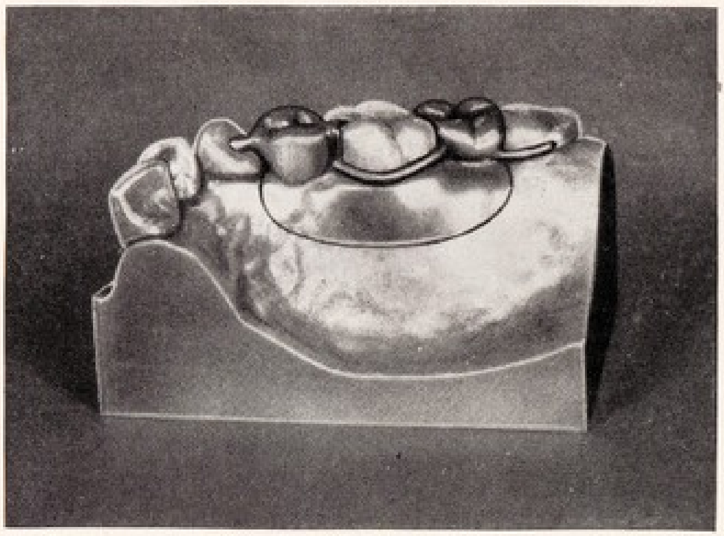

Fig. 527. Saddle swaged to desired form to receive pontics. In this case because of the lack of space due to the short teeth the pontics have been carved to proper anatomical form in inlay wax, cast and soldered to the saddle. Note the lingual rest on the cuspid tooth

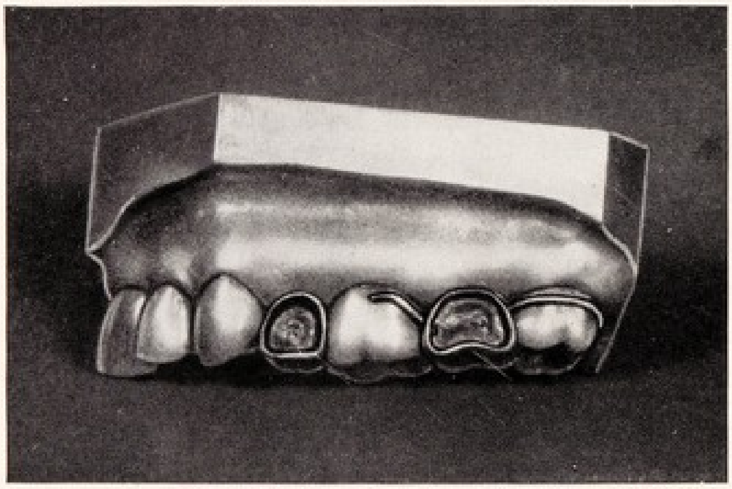

Fig. 528. Buccal view of the case as shown in Fig. 527. For the sake of esthetics recesses have been carved in the wax pontics before casting, to receive porcelain inlays. Note that the clasp on the first molar does not extend to the mesial side of the tooth, thus avoiding undue display of gold

the hole accurately, and that when the plate is trimmed it shall not be trimmed to such an extent as to weaken the grip of the plate on the wire.

(See Fig. 525.) The gingival end of the plate is now trimmed so that it just makes contact with the wire clasp when the round wire is fully seated

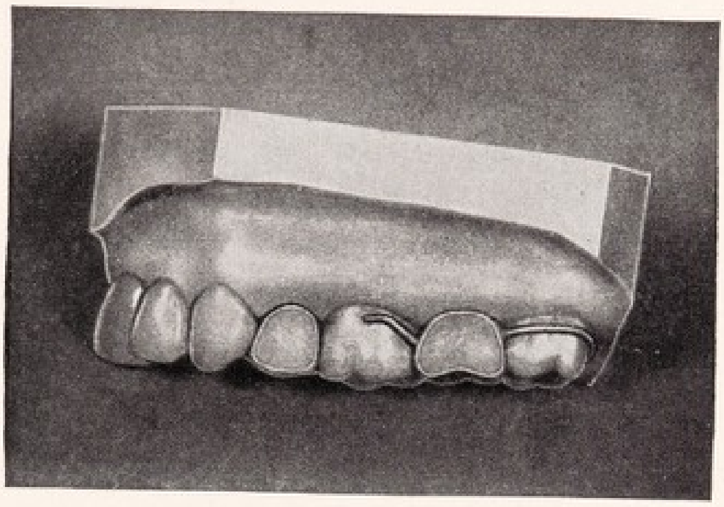

Fig. 529. Completed case as shown in Fig. 528 with porcelain inlays cemented into the pontics

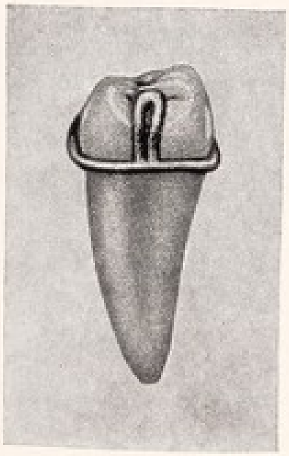

Fig. 530. Occlusal rest in the form of a loop. Note that the ends of the loop are soldered to the encircling wire

in the recess in the gold inlay (See Fig. 526). An impression is taken in which the clasp and plate will be removed. This is poured with investment material and the clasp is then soldered to the plate with Ney-Oro G-3 metal.

A saddle of the desired outline is now swaged and the clasps and saddle are assembled in the mouth. A plaster impression is taken as described in Chapter XXVII. The bite is taken after the clasps have been soldered to the saddle, and the case is finished in the usual manner. In the case illustrated, because of the shortness of the natural teeth, it was found impracticable to use porcelain pontics. Inlay wax was carved to the proper anatomical form for the teeth to be supplied. For the lingual rest on the cuspid, thin platinum was burnished to the lingual surface and a piece of clasp metal wire was soldered to it. This was so formed that it could be soldered to the cast pontic in the final assembly (See Fig. 527). The buccal surfaces of the wax pontics were cut out to provide recesses for the reception of porcelain inlays as indicated in Fig. 528. For the sake of esthetics the buccal clasp on the first molar did not extend to the mesial portion of the tooth.

After the final soldering the bridge should be oven cooled to increase the tensile strength and life value of the bridge. The bridge is placed in a Ney's electric oven and heated to 900 degrees F. and permitted to cool gradually in the oven to 450 degrees F. over a period of fifteen minutes.

If Ney-Oro Elastic Wire No. 4 has been used in the construction of the bridge, the tensile strength will be increased from 115,000 if quenched to 172,000 if oven cooled. From 125,000 if air cooled to 172,000 if oven cooled.

The fit and occlusion of the case is then verified and porcelain inlays are constructed for the pontics and cemented to place. The buccal view of the completed case is shown in Fig. 529.

CHAPTER XXXI

The Porcelain Jacket Crown in Removable Bridgework

The porcelain jacket crown has a place in the construction of certain types of removable bridgework. Its application is not universal but when indicated it may be utilized with every expectation of satisfaction.

The main consideration pointing to the use of a porcelan jacket crown on an abutment tooth in a removable bridge case is that of esthetics and health of the surrounding tissues. It may appear that it would be suitable for use on teeth which have been attacked by caries in which it is desirable to afford protection from future caries and at the same time to conserve vitality. While this is very desirable and may be accomplished in occasional cases, it usually is found that it is impossible to provide adequate bulk of porcelain for strength and at the same time avoid dangerous encroachment on the pulp during preparation of the tooth. It is therefore a fact that the usual cases in which the porcelain jacket crown is indicated for removable bridgework are those in which the abutment tooth, or teeth, are so badly broken down that devitalization is required, or pulpless teeth which either are, or may be rendered, innocuous. In these cases the condition of the tooth is frequently such that it may properly be cut down to the gum line and have a cast gold dentin-form core, which may be given the desired shape and size. This makes it possible to provide the desired bulk of porcelain, and to insure that distribution of porcelain which will give the necessary strength.

The construction of a removable bridge, employing porcelain jacket crowns as abutments, may be described by assuming a typical case. A satisfactory case will be one extending from the lower first bicuspid to the lower second molar. These teeth are supposed to have been devitalized and the roots properly filled. The teeth are next cut down to the gum line, the pulp chambers are squared up and the floors made horizontal. If decay has invaded the tooth to any extent it may be necessary to pack amalgam into the area so attacked to provide a pulp chamber of the desired shape.

This will be packed around a pin or pins, coated with sticky wax, temporarily inserted in the root canals (See Fig. 531).

After the amalgam has set the pins are removed, softening the wax by touching a hot instrument to the pins (See Fig. 532). The pins are now

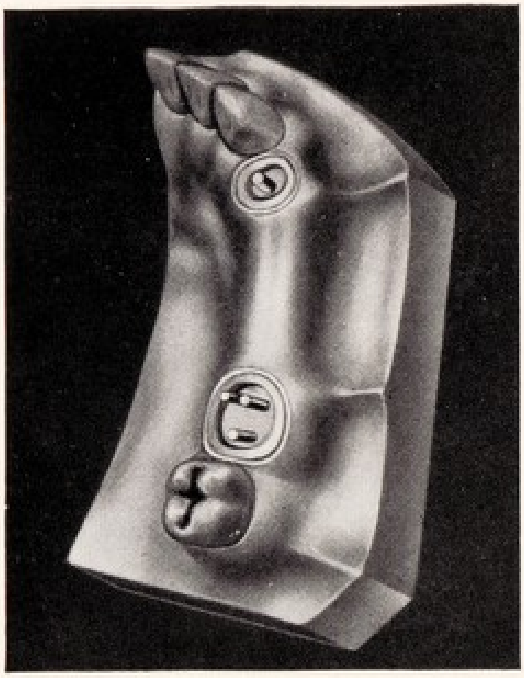

Fig. 531

Fig. 532

Fig. 531. Case for a removable bridge using porcelain jacket crowns for abutments. Gold wire posts coated with wax have been placed in the canals and depressions in the pulp chambers have been filled in with amalgam. The teeth have been trimmed to the level of the gum margin

Fig. 532. Case illustrated in Fig. 531 with posts removed

cleansed, nicked at the occlusal end, and reinserted in the canals. Inlay wax is then forced over them so as to completely fill the pulp chambers. This wax is now carved to the desired form to provide a core for the porcelain jacket crown. A recess is carved in each wax core to provide an extra bulk of porcelain at the point where the occlusal rest will later be placed. It is necessary in carving the wax to leave a broad shoulder of tooth structure around the circumference of the tooth. This insures adequate bulk of porcelain on all aspects of the crown (See Fig. 533). The

Fig. 533. Inlay wax forced into the pulp chambers of teeth shown in Fig. 531 and carved to produce a dentin-form core. The posts have been notched and replaced in the canals. Note the depressions on the mesial side of the molar and the distal side of the bicuspid to provide extra porcelain for the seating of gold wire lugs. Note also the broad margin of tooth structure exposed at the gum line

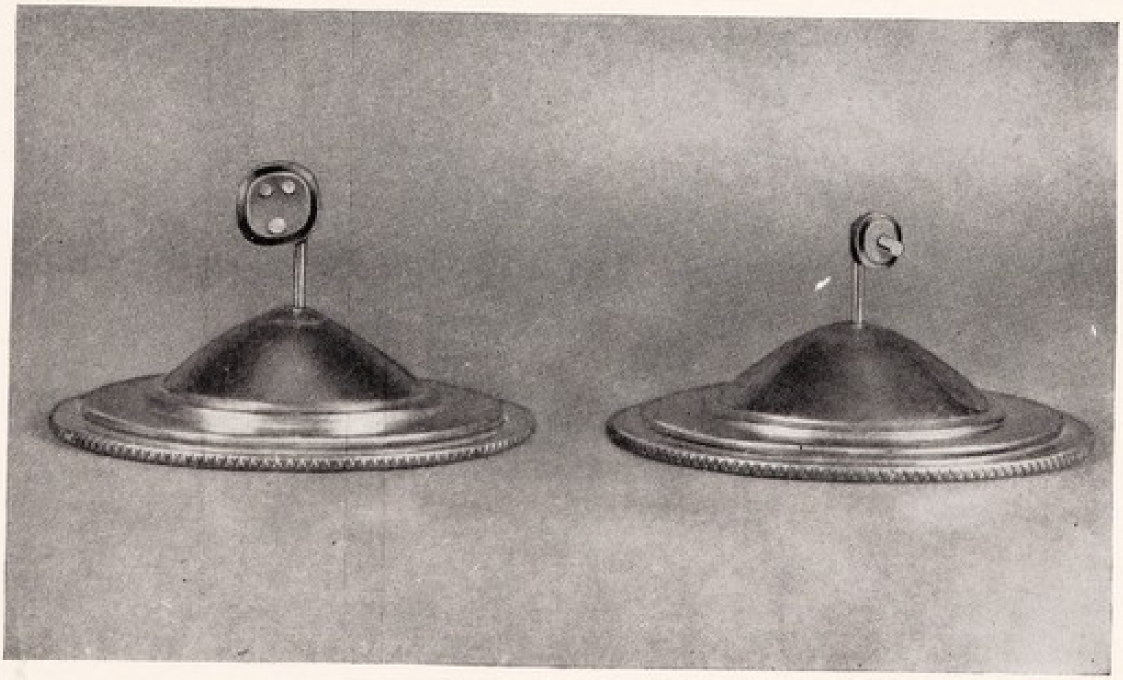

Fig. 534. Wax dentin-form cores mounted ready for investment

wax cores are now removed, sprues are attached and they are invested and cast (See Fig. 534).

After casting, the gold dentin-form cores are polished, the anatomy improved on if necessary, and they are cemented into the teeth (Fig. 535).

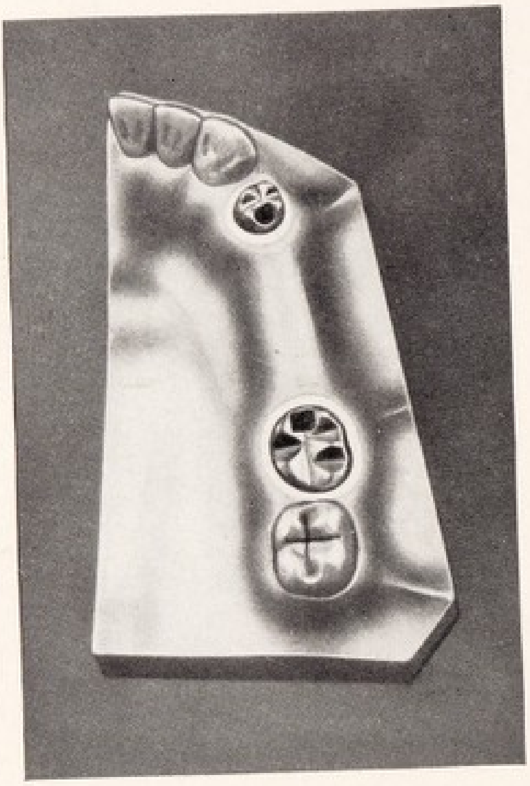

Fig. 535. Cast showing gold dentin-form cores as cemented in place in the mouth

Technique for Diverging Roots

The construction of the cast gold dentin-form core for maxillary molars, or for mandibular molars having diverging roots, is accomplished in a somewhat different manner. For a maxillary molar, for instance, the root canals are filled and the pulp chamber is squared. The lingual canal is enlarged for about two-thirds of its length, to accommodate a pin of 17 gauge, Ney-Oro No. 4 wire. The wire is removed and the opening of the lingual canal is temporarily closed with gutta percha. Inlay wax is then forced into the pulp chamber and carved to the desired shape for a dentin-form core. (See Fig. 536.) Remove the wax core and then the gutta percha which had been placed in the opening of the lingual canal. Replace the inlay wax core and, with a round bur, drill a hole through the wax in line with the lingual canal. Heat a piece of 17 gauge wire slightly and carry

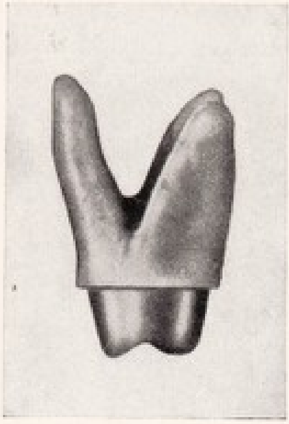

Fig. 536

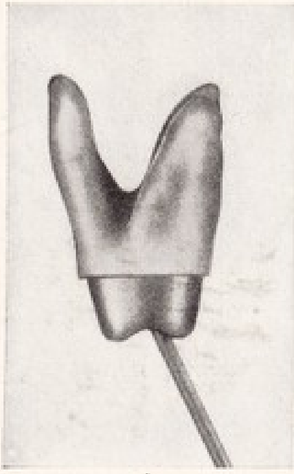

Fig. 537

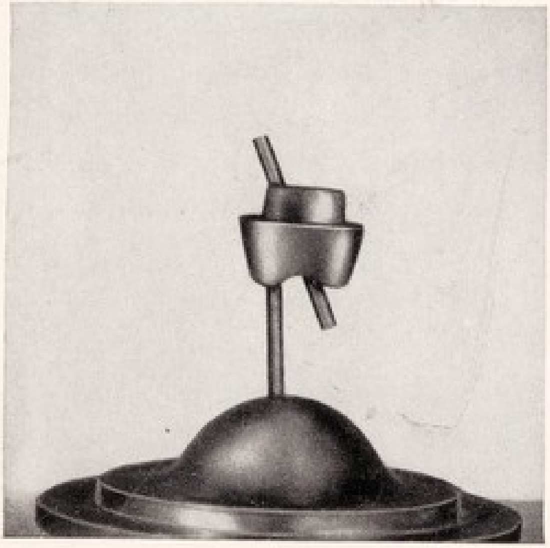

Fig. 538

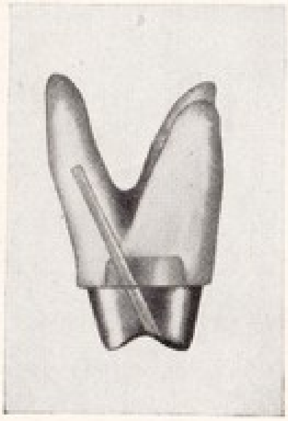

Fig. 539

Fig. 536. Wax dentin-form core in an upper molar

Fig. 537. Gold wire passed through wax dentin-form core (shown in Fig. 536) and entering the lingual root canal

Fig. 538. Wax dentin-form core with graphite replacing the gold wire (shown in Fig. 537) mounted ready for investment

Fig. 539. Diagrammatic view of cast gold dentin-form core cemented to place in upper molar with gold wire inserted into lingual canal

it through the hole in the wax core until it enters the lingual canal. Rotate it and remove it quickly to prevent the wax sticking to it. Remove any adherent wax. Heat it again, and again pass it through the wax core into

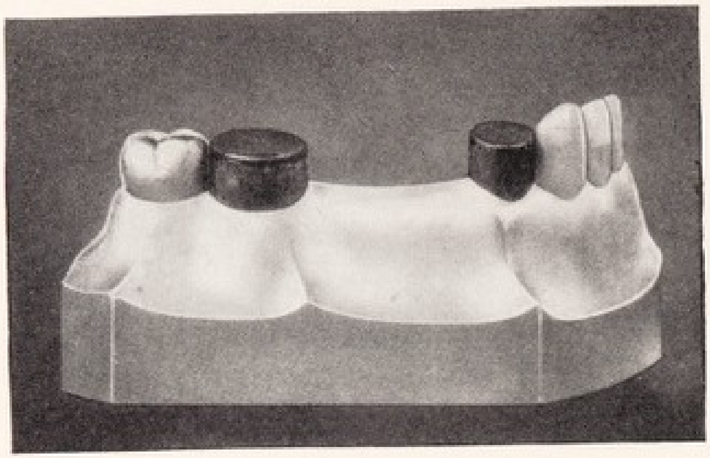

Fig. 540. Modeling compound impressions (in copper bands) of cast gold dentin-form cores shown in Fig. 535

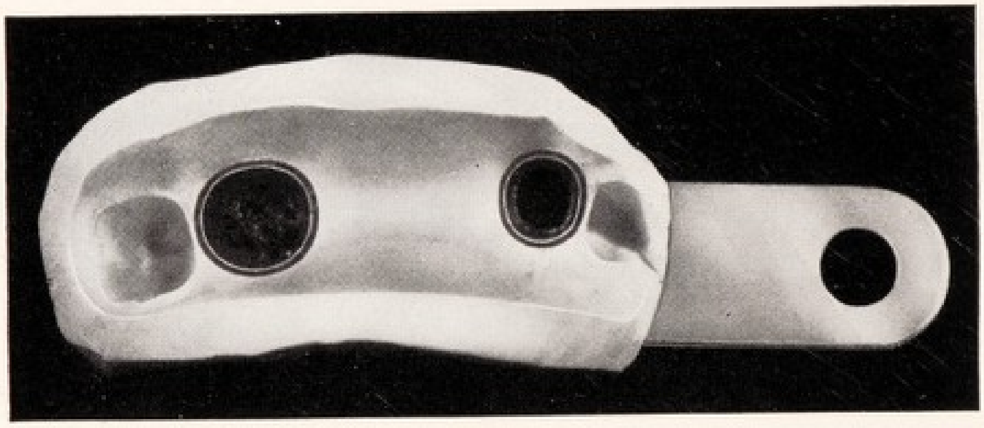

Fig. 541. Plaster impression of case shown in Fig. 540. In this impression are seated paraffin wax impressions of the dentin-form cores, the modeling compound impressions having been utilized to make amalgam dies

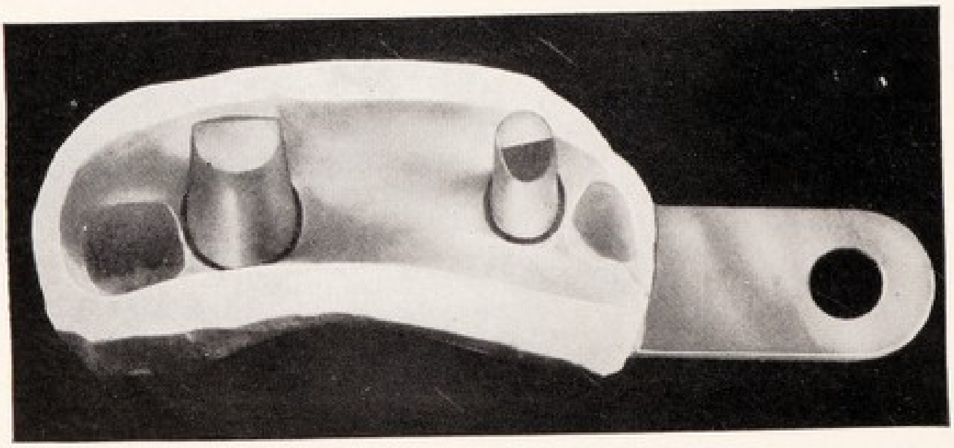

Fig. 542. Amalgam dies in place in impression shown in Fig. 541

the canal, repeating this procedure as described until the wire can be passed to the extremity of the enlarged portion of the canal (See Fig. 537).

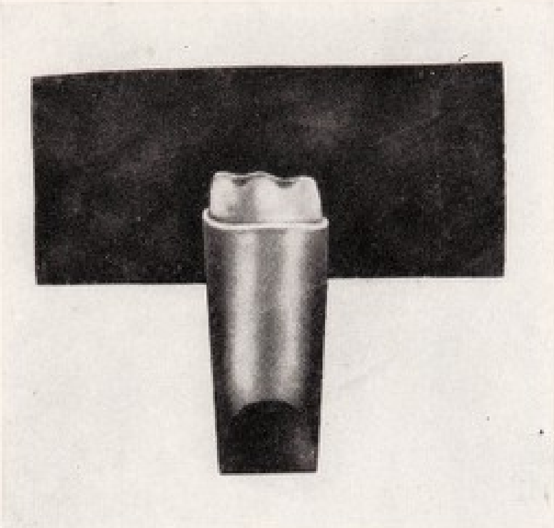

Fig. 543

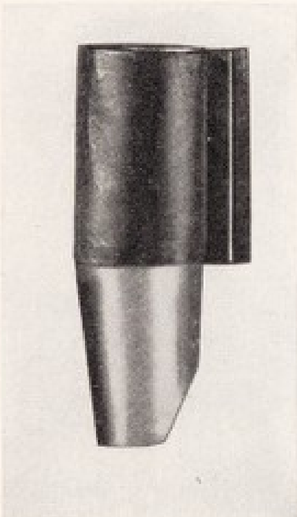

Fig. 544

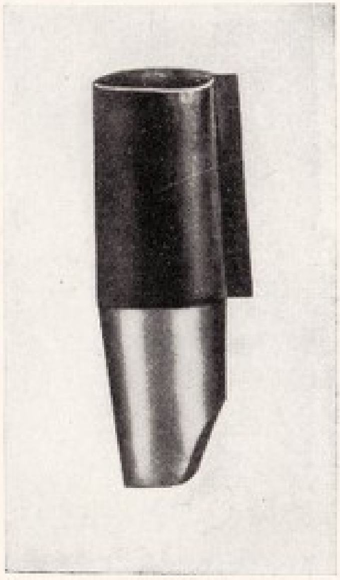

Fig. 545

Fig. 543. Platinum foil 1/100th of an inch thick cut approximately 3 mm. longer than the circumference of the amalgam die

Fig. 544. Platinum foil shown in Fig. 543 wrapped around the amalgam die. Note that one end is about 1 mm. longer than the other

Fig. 545. The long end of the platinum foil shown in Fig. 544 folded over the short end to make a tinner's joint

Remove the pin and then the wax core from the tooth. A piece of 17 gauge round graphite is now placed in the hole in the wax and the wax is attached to a sprue, invested and cast (See Fig. 538).

After the casting has been polished a piece of 17 gauge wire is tried in the hole. If it binds the hole may be slightly enlarged with a fissure bur until the pin passes freely. The base of the core is examined with a

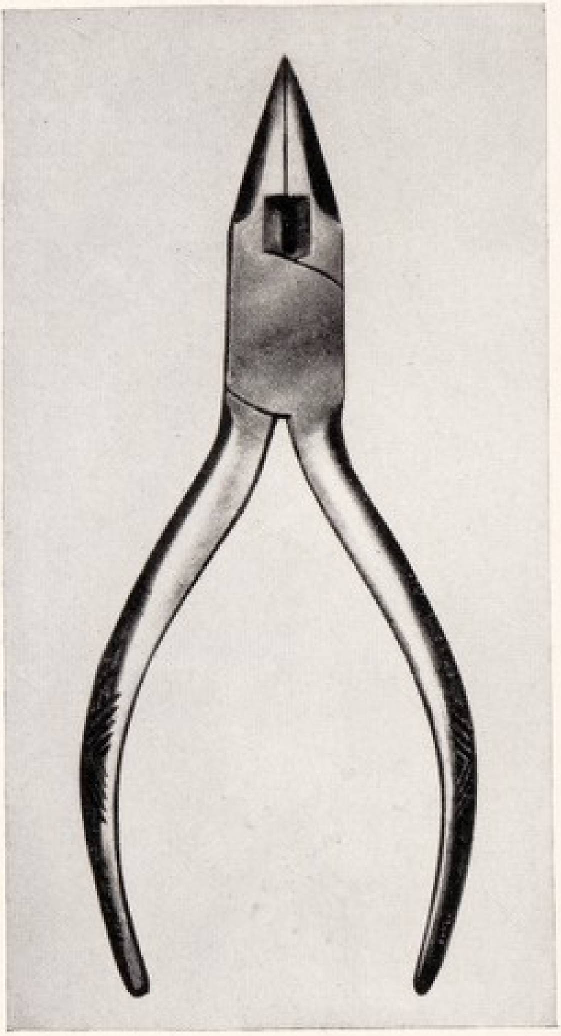

Fig. 546. Pair of flat beak Kraeuter pliers shaped to a point for forming tinner's joint in platinum foil matrix

jeweler's magnifying lens to see if any irregularities or elevations are present due to bubbles in the investment material. If such are found they are dressed down with small burs. It is essential that the cast gold dentin-form core should go accurately to place in the tooth. When ready for cementation a thin mix of cement is prepared and carried into the pulp chamber, and also into the lingual canal. A little cement is placed in the hole in the gold dentin-form core. As soon as the core is carried to place the gold wire is inserted, this having been previously trimmed to the correct occlusal length (See Fig. 539).

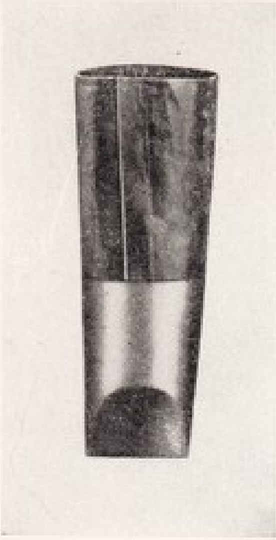

Fig. 547

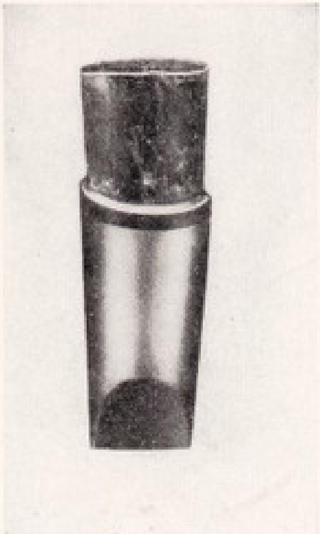

Fig. 548

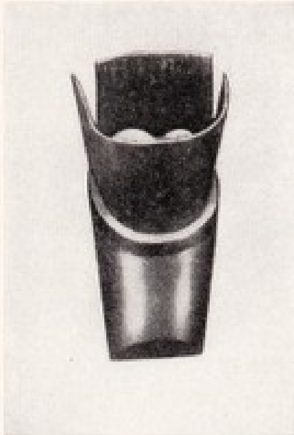

Fig. 549

Fig. 547. Platinum foil matrix shown in Fig. 545, with tinner's joint folded down to the die

Fig. 548. Platinum foil matrix burnished to the shoulder of the die with orange wood sticks. The tinner's joint has been dressed down with a small stone

Fig. 549. Platinum foil matrix with slits cut to facilitate burnishing to the die

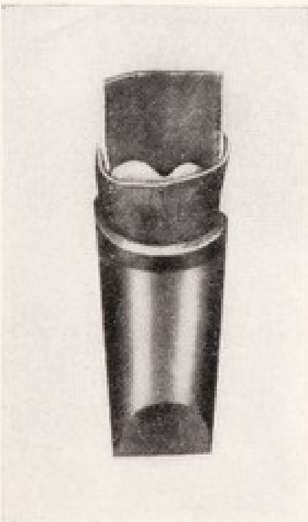

Fig. 550

Fig. 551

Fig. 552

Fig. 550. Platinum foil matrix trimmed on three sides slightly higher than the occlusal surface of the die tooth. Note that the platinum is left higher on one side: this is where the depression, (already noted), occurs in the die

Fig. 551. The long flap of the platinum foil has been burnished over the occlusal surface of the die

Fig. 552. The remaining portion of the platinum foil burnished to the die, overlapping at all points the flap shown in Fig. 551. Note the depression on the right side of the occlusal surface

After the cementation of the dentin-form cores, copper bands are fitted and compound impressions are taken (See Fig. 540). Amalgam dies are prepared in the usual manner. Copper bands are again fitted to the teeth and filled with paraffin wax. With these in place a plaster impression is

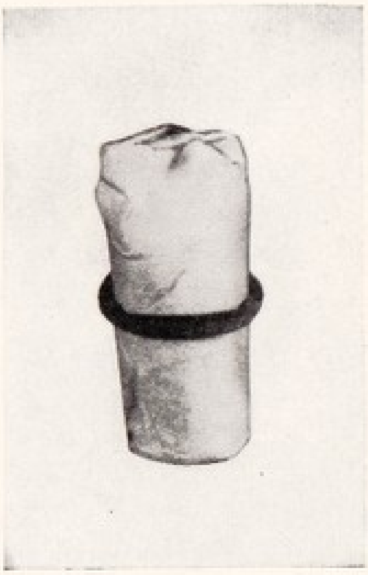

Fig. 553

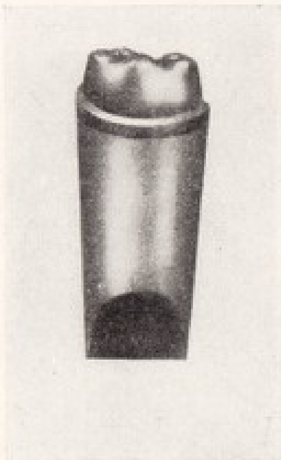

Fig. 554

Fig. 555

Fig. 553. Platinum foil matrix and amalgam die shown in Fig. 552 wrapped in tissue paper, secured with rubber band, ready for swaging

Fig. 554. Platinum matrix shown in Fig. 552 after swaging

Fig. 555. Sticky wax attached to the platinum matrix to facilitate removal from the die

taken (See Fig. 541). A bite is taken at the same time. The amalgam dies which have been prepared are now placed in the wax impressions as shown in Fig. 542 and a cast of artificial stone is poured.

The amalgam die is removed from the cast and a piece of platinum foil 1/1000th of an inch in thickness is cut approximately 3 mm. longer than the circumference of the die to permit the formation of the tinner's joint. (See Fig. 543.) The platinum foil is wrapped around the die, one end extending 1 mm. beyond the other (See Fig. 544). The longer end of the foil is then folded over the shorter end as shown in Fig. 545. A pair of Kraeuter flat beak pliers are ground to a point as shown in Fig. 546. These pliers, thus modified are suitable for forming a tinner's joint.

The seam in the platinum foil which has been formed by the pliers is now folded over and burnished to the side of the die (See Fig. 547). The

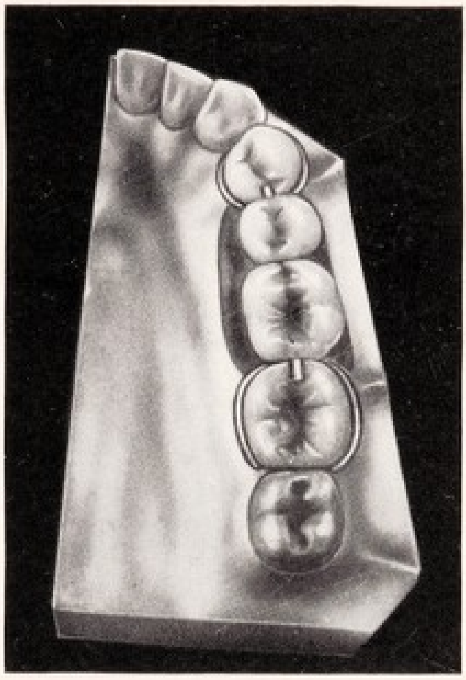

Fig. 556

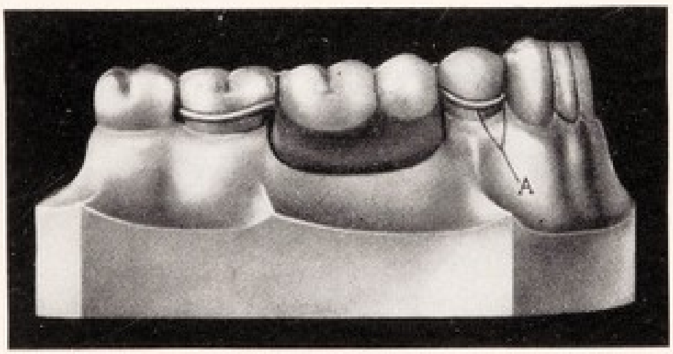

Fig. 557

Fig. 556. Occlusal view of completed bridge for case shown in Fig. 531. Note round wire lugs fitting accurately in recesses in the porcelain jacket crowns

Fig. 557. Buccal view of bridge illustrated in Fig. 556. A—indicates portion of clasp which may be cut away, if desired, for esthetic reasons

platinum foil is burnished to the shoulder on the die with polished orange wood sticks and the tinner's joint at the shoulder is reduced with small stones (See Fig. 548).

The tinner's joint may be made after burnishing the platinum matrix to the shoulder and burnishing the occlusal flap to position, and one thickness of platinum may be secured at the shoulder by cutting the extra platinum off at this point before the final lap is made to form the tinner's joint in the platinum. Make a cut about 1 mm. below the shoulder and as close to the die as possible. Then fold the platinum gingivally to the shoulder to form the tinner's joint. Reburnish the shoulder and approximate the two wings of platinum tightly with pliers. Then make a second cut approximately 3 mm. nearer the occlusal end. The platinum is then cut so that the two edges come exactly together. The tinner's joint toward the occlusal end is then completed. (See Figs. 139, 140, 141 and 142.)

The method first described in which the tinner's joint is made through the entire width of the platinum is recommended to students and beginners in porcelain jacket technique. The latter method, briefly summarized above, may be used after the operator has had sufficient experience to perform this technique with confidence.

Two parallel slots are cut in one side of the platinum foil to permit adaptation of the matrix over the occlusal surface (See Fig. 549). The platinum is now trimmed slightly higher than the occlusal surface, except for that part which is to be lapped over the occlusal surface. The part of the matrix which comes opposite the depression in the die is left a little longer than the rest, in order to insure complete covering of this area when burnished. (See Fig. 550.) The occlusal flap of platinum is burnished first, (see Fig. 551), and the remainder of the matrix is then burnished, and, if it has been properly trimmed, it will overlap the edge of the occlusal flap on all sides. The burnishing is accomplished with polished orange wood sticks, or other suitable burnishing instruments. (See Fig. 552.) The matrix and die are then wrapped in tissue paper and placed in a swager to insure the closest adaptation of the matrix to the die. (See Figs. 553 and 554.) To remove the matrix from the die a piece of sticky wax is attached to the occlusal surface of the matrix. By gentle traction on the sticky wax the matrix may be removed without distortion. (See Fig. 555.)

The porcelain jacket crowns are now constructed as described in Chapter XIII. During the building up of the porcelain a depression is made where the occlusal rest is later to be placed, by cutting the moist porcelain out of this area before the first and second bake. After the second bake this area is partly filled with porcelain and the crown is carried to the final glaze at a temperature of approximately 2450 degrees F. The depression is then completely filled with porcelain and the wire which is to form the occlusal rest is imbedded in the porcelain to its full diameter. This porcelain is then fused at about 2400 degrees F. or a little less.

The bridge is now constructed in the same manner as described in Chapter XXVII, or the teeth may be attached with vulcanite. Fig. 556 shows an occlusal view of the completed bridge. Fig. 557 shows a buccal view of the same bridge.

CHAPTER XXXII

Examples of Removable Bridgework for Various Types of Cases

In planning the construction of a removable bridge there are several points which should be taken into consideration. The first has to do with the type of attachment which it is proposed to use. The second is the question of the periodontal strength of the remaining natural teeth. The third is the matter of esthetics.

In deciding what type of attachment is to be used, it becomes necessary to study both the abutment teeth and the other natural teeth in the mouth, to determine the susceptibility of the teeth to caries. The conservation of tooth substance is of course implied in this study. In other words, while it is always desirable to select a type of attachment which will involve the least cutting of sound tooth structure, it is also necessary to study the tendencies to caries exhibited in the mouth in general. This latter consideration may sometimes dictate a course which might not appear to be conservative at the outset.

To make this point specific, it may be said that the type of attachment which requires the least cutting of tooth structure is the external attachment. It is particularly desirable to use this type, where the abutment tooth has had no previous cavity of decay, and, where such is found to be the case, the external attachment is nearly always indicated. But it occasionally happens that a sound abutment tooth is found in a mouth which is otherwise quite susceptible to caries. In such instances it may seem at times to be better policy to use an internal attachment.

The internal attachment is naturally indicated in teeth which have already suffered from approximal-occlusal caries and in which we find the recession of the pulp, which usually accompanies this type of caries. In arriving at a decision to use the internal attachment, the most important consideration is the pulp recession just mentioned. No extensive cutting should be planned in any tooth in which it is evident from the radiograph that the resultant preparation will approach the pulp closely.

With regard to the periodontal condition of the abutment and other remaining natural teeth, it will be obvious that, where any weakness is found, the problem of the distribution of stress is of prime importance. If there is a question as to the strength of abutment teeth, it will be the part of wisdom to gain supplementary anchorage on other teeth in the arch to avoid overburdening any one tooth. This precaution, in some cases may be extended to the point of utilizing a number of adjoining teeth by means

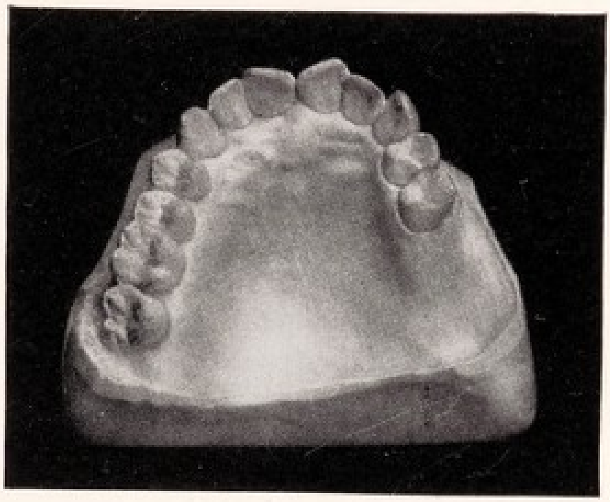

Fig. 558. Case for a removable bridge to supply the upper left first and second molars. Note that the crowns of all teeth are short and tend to be conical in shape

of the continuous lingual clasp. (The author's technique for the construction of a continuous lingual clasp is to burnish 1/2000th platinum to the lingual surface of the teeth which it is proposed to include, then swage No. 19 gauge Ney-Oro No. 4 wire to these lingual surfaces, and solder the wire to the platinum with Ney-Oro G 3 metal.)

Consideration of Esthetics

In considering the question of esthetics in removable bridgework it is necessary to take into account the type of attachment from the standpoint of whether there will be a resultant display of gold. The clasp type of attachment involves a display of gold except where it is possible to limit the clasp to the lingual or approximal, or lingual and approximal, surfaces of the tooth. Clasps with a buccal extension should therefore be used only on posterior teeth, the location selected being dependent on the tendency of the individual patient to expose the buccal surfaces of the abutment teeth. On the lower jaw clasps may usually be used nearer the front of the mouth than on the upper jaw. In some cases, it may be possible to use a buccal clasp as far forward as the upper cuspid, if the patient does not show the entire crown of the tooth in smiling and talking. The decision as to this point may best be made by engaging the patient in conversation and inducing him to smile and laugh without revealing the object of the test. If, for

Fig. 559. First piece of saddle for case illustrated in Fig. 558. A piece of half round 13 gauge gold wire is tacked to this piece

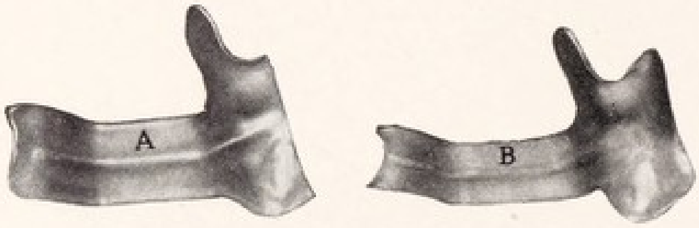

Fig. 560. A—Second piece of gold saddle for case illustrated in Fig. 558. Note that it is cut larger than B so as to overlap it, but that it extends only to the summit of the ridge. B—First piece after the solder has been completely flowed around the reinforcing wire

Fig. 561. Saddle illustrated in Fig. 560 after the two pieces have been soldered together. A piece of 18 gauge round soft gold wire is tacked to the buccal anterior border of the saddle, as a preliminary to adapting it to the periphery as a border for the vulcanite attachment

instance, the patient is given a mirror and instructed to smile, even if not informed as to what is desired he will invariably draw back the lips in an unnatural grin, showing an abnormal extent of tooth surface.

Technique for Internal Attachments

The accompaning illustrations give an idea as to how various situations arising in the field of removable bridgework may be met, using either internal or external attachments, or both in combination. The technique

Fig. 562. Saddle illustrated in Fig. 561 with border for vulcanite completed, and with loops for the vulcanite attachment

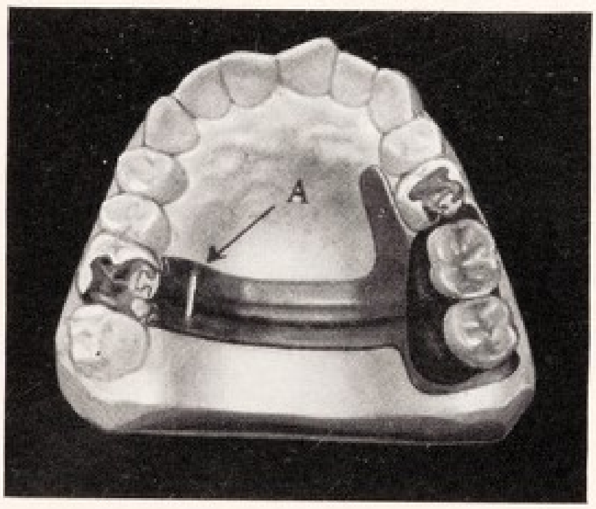

Fig. 563. Removable bridge for case illustrated in Fig. 558 complete. A—Piece of clasp metal soldered to the palatal bar which the patient may engage with the fingernail to assist in removal

for the case shown in Fig. 558 is as follows:—First it will be noted, that this case has teeth which are quite conical in their general conformation and which are therefore not suitable to use with external attachments. The cavity preparation for the inlays which are to receive the internal attachments is carried out in the manner previously described. The making of the saddle is the next step. The saddle is swaged in a suitable press.

For making the saddle use 29 gauge metal for the first layer; reinforce this with 13 gauge half round wire of high platnum content. This wire is caught with solder in three places for the try-in. (See Fig. 559.) After making any necessary adjustments, completely solder the wire to the metal plate (B Fig. 560), then make a cover piece (A Fig. 560) of 30 gauge metal. The cover piece is made larger than the first piece, but is not

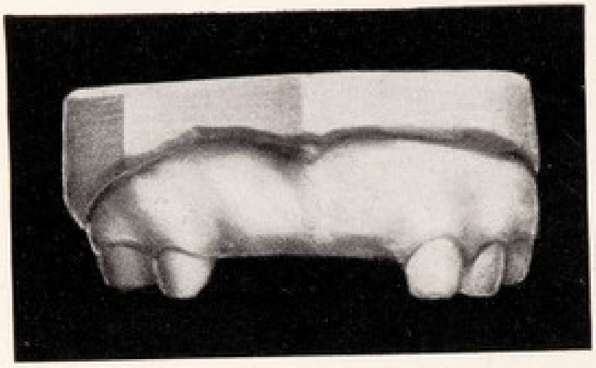

Fig. 564. Case for a removable bridge to supply the upper right central and lateral, and left central, incisors. Note the short conical crowns of the remaining teeth

carried over the ridge. The two pieces are invested, and soldered together from the palatal side. The cover piece is then cut down to approximately the same size as the first piece. Next tack one end of a piece of 18 gauge, soft, round wire, to one end of the metal plate, in the open flame. (See Fig. 561.) Then bend this wire around the peripheral edge and tack with solder, at every quarter inch, using the blowpipe. Tap the wire to close contact with the saddle. Place whiting on the inner side of the wire, and then flow solder all around the outer surface. The whiting prevents the solder flowing through and thus leaves an undercut which will help retain the vulcanite. Then solder loops for attaching the vulcanite in the ridge area. (See Fig. 562.) At the same time solder a piece of 30 gauge plate metal, one side of which should be left 1/2 mm. from contact with the plate, as in A Fig. 563. This will enable the patient to insert the fingernail at this point to assist in removing the internal attachment from the platinum box. The internal attachments are then soldered to the saddle, and the teeth attached with vulcanite.

Technique Where Teeth are Short

In Fig. 564 there is shown a case in which the upper central incisors and the right lateral incisor are to be supplied. The noticeable feature of

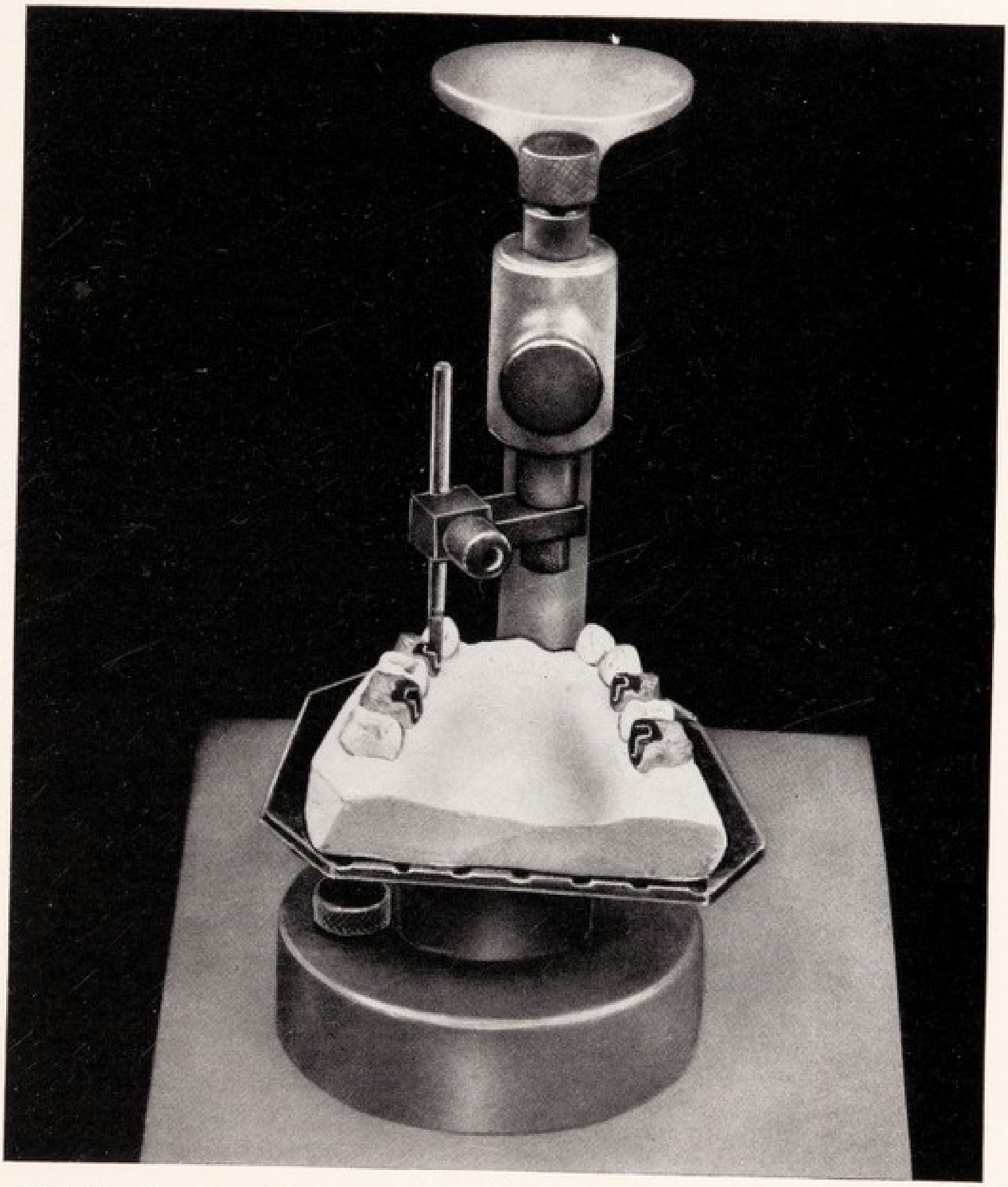

Fig. 565. Cast of case illustrated in Fig. 564, mounted on parallelometer for placing of platinum boxes of internal attachments. The cavities having been prepared and amalgam dies made, as shown, the bicuspids are tested first to see if alteration of cavity form is needed to assure proper placing of the platinum boxes

this case is that the crowns of the teeth are unusually short, thus making them unsuitable for use with three-quarter crowns; the roots being also short, and the periodontal structures of inferior strength, the case is entirely unsuitable for fixed bridgework. Continuous lingual clasps are unsatisfactory for such a case, because of the shortness and conical shape of the crowns of the teeth. The first bicuspids and first molars have inlay cavities cut to receive internal attachments, as shown in Fig. 565. After

Fig. 566. Saddle for case illustrated in Fig. 565. Note that the backings for the Steele's facings are first attached to the saddle by means of short lengths of 22 gauge round gold wire. This permits trying the case in the mouth and altering the position of the backings, if necessary, before the final soldering

the cavities are prepared, analgam dies are made, an impression taken and a cast made. This is then placed on the parallelometer and the cavities tested to see if sufficient depth and width has been secured to accommodate the platinum boxes for the internal attachments. Particular attention in this respect, is given first to the bicuspids, the greater size of the molars permitting greater leeway with regard to the placing of these boxes. If necessary, alterations in the original cavities are made at this time, before any of the inlays are cast. The construction of the case is then continued in the usual manner. For this type of case Steele's facings are used. In order to guard against possible discrepencies in position, which may occur in adjusting the backings on the cast, they are first attached to the saddle by means of 22 gauge gold wire, soldered as shown in Fig. 566. The case may then be tried in the mouth with the facings in place and any necessary adjustments in their position made at this time. The case is then invested, the tips of the gold backings reinforced and they are soldered to the saddle in the usual manner.

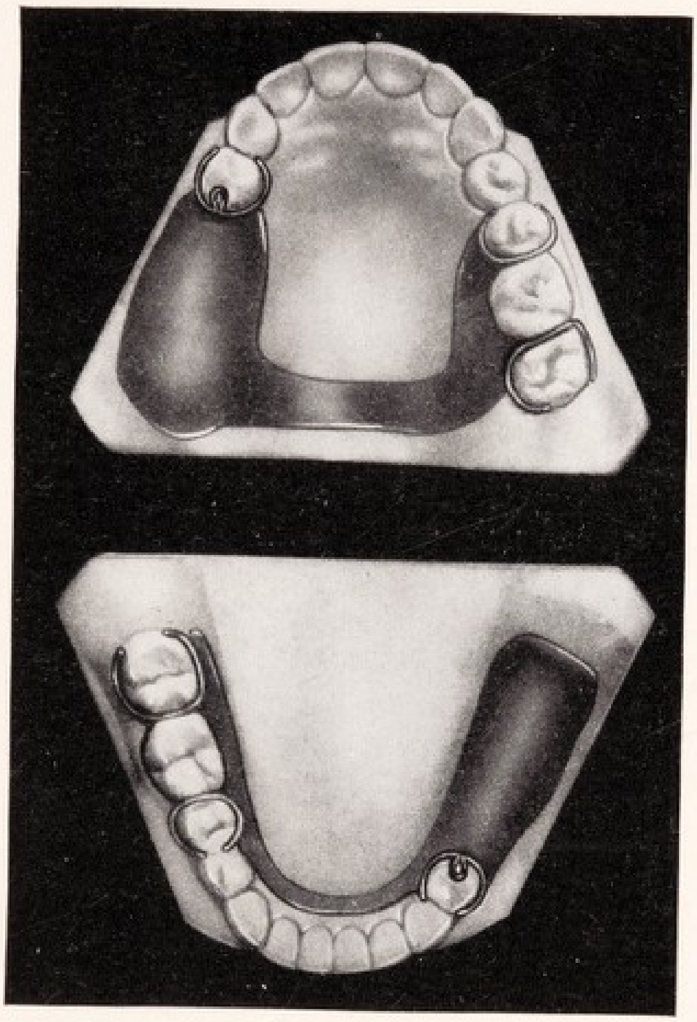

Fig. 567. Case for removable bridges in which the upper molars and second bicuspid are to be supplied on one side, and the lower molars and second bicuspid are to be supplied on the opposite side. If the remaining teeth are sound, external attachments are commonly used. Note the application of an occlusal rest on the saddle side and two clasps on the opposite side. Note another method of anchorage, illustrated in Fig. 568

Unilateral Cases

Unilateral cases present some difficulty, especially if the upper posterior teeth are missing on one side, and the lower posterior teeth are missing on the opposite side. In the case illustrated in Figs. 567 and 568, the second bicuspid and the first and second molars on the lower left side are missing, and the second bicuspid and first and second molars on the upper right

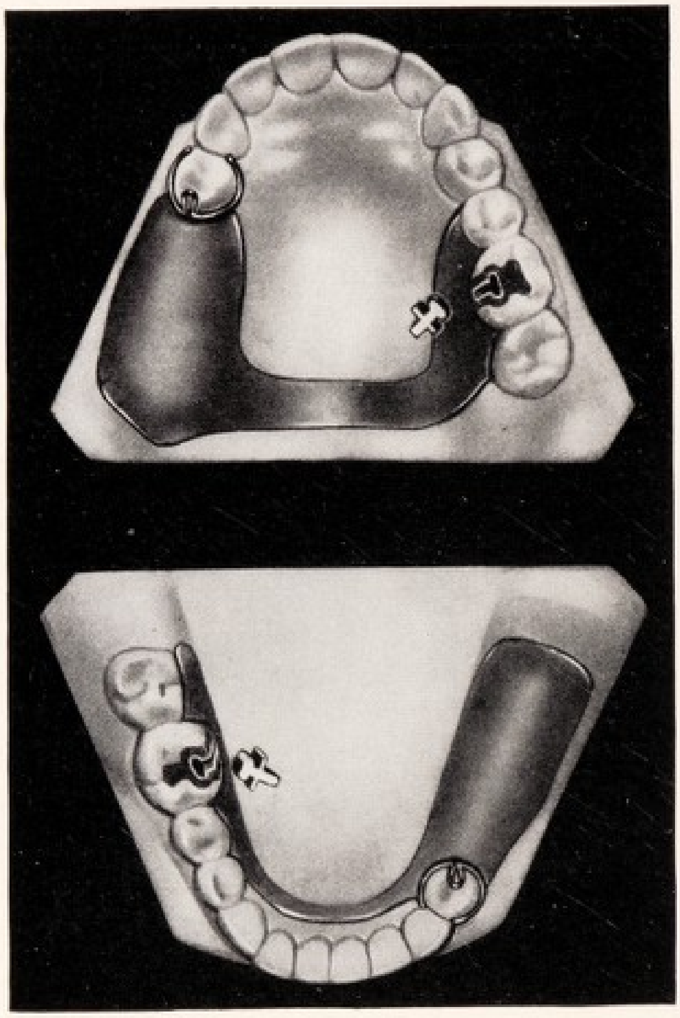

Fig. 568. Another method of anchorage for case illustrated in Fig. 567. One internal attachment is used on the side opposite the saddle. The use of the internal attachment on either one side, or on both, may be resorted to if the shape of the teeth renders them unsuitable for use with clasps

side are missing. All other teeth are in place, and the third molars are unerrupted, or missing.

This type of case may be successfully treated in two ways. The easiest method, and the one that will be most successful in the hands of the average practitioner is illustrated in Fig. 567. Secure a good plaster impression and make a cast of artificial stone. Place the cast on a clasp surveying instrument, and outline the position for the clasps, allowing the clasps to cross the bite between the second bicuspid and first molar, and between the first and second molars. Use 19 gauge, Ney-Oro No. 4 round

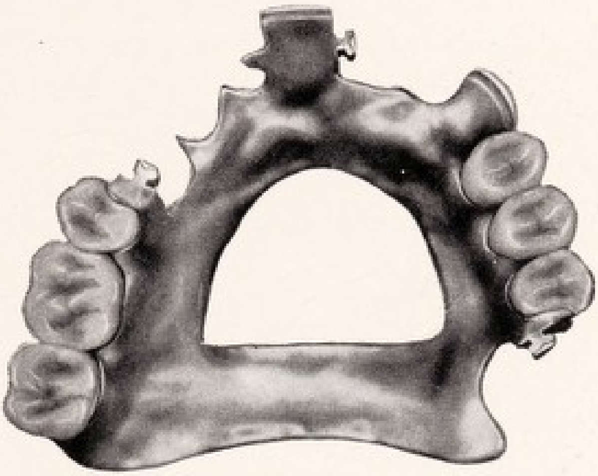

Fig. 569. A completed removable bridge for the upper jaw supplying posterior teeth and a central incisor. An internal attachment for the anterior tooth as illustrated, is permissible if the abutment tooth has been deeply attacked by caries, or is devitalized

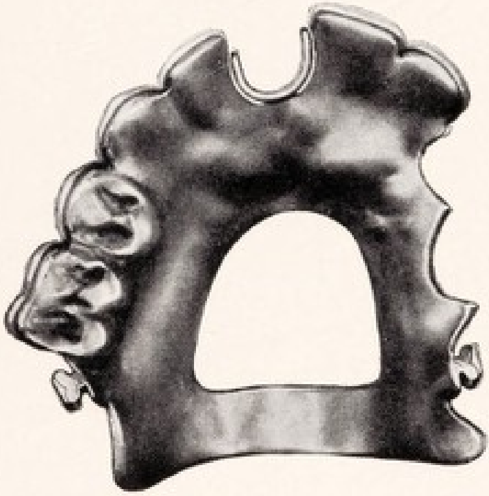

Fig. 570. A completed removable bridge for the upper jaw, for a case in which an anterior abutment is unsuitable for use with an internal attachment. The internal attachments are paralleled with the clasp, to avoid undue stress in insertion and removal

wire, for these clasps, and 18 gauge wire for the clasp on the first bicuspid on the side where the teeth are missing. An occlusal rest is also necessary on this clasp.

The author has found that Palladent is a very satisfactory metal for the construction of the saddles in such cases. Success will depend in a large degree, on the proper placement of the saddles on the underlying tissues.

The abutment teeth cannot be expected to carry a load greater than the supporting tissues can withstand. For this reason, great care must be exercised in properly placing the saddle on the ridge.

Patients frequently complain that small particles of food and berry seeds become lodged under the saddles of removable bridges. This is

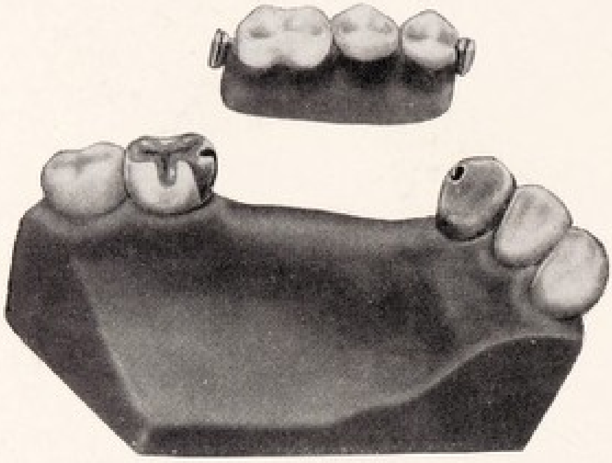

Fig. 571. A completed removable bridge. Note that the cuspid is prepared for a three-quarter cast crown, to receive the internal attachment, a form of restoration which frequently involves less deep cutting of the tooth than an adequately retained inlay

usually due to the fact that the resilient tissue was not properly compressed when the impression was taken, and the saddle not held in proper position on the ridge before soldering the clasps to the saddle.

After the clasps have been constructed, and the saddle has been swaged, and before the saddle has been reinforced, the clasps and saddle should be taken to the mouth and tested for accuracy of fit. If it be found that the saddle is not in close proximity with the tissues throughout, place a thin layer of modeling compound on the under surface of the saddle, heat to 135 degrees F. and take a new impression, using gentle force. The degree of pressure to be used cannot be stated in terms of pounds, or ounces, but must be gauged by the final result. If the correct pressure is applied, there will be no blanching of the tissue at the border when the completed saddle is again placed on the ridge.

A new cast of artificial stone is poured and the saddle is reswaged to fit this cast, and reinforced. The saddle and clasps are then placed in the mouth and the saddle is held in position with just enough pressure to seat it properly. Using a small impression tray, cover with plaster the two clasps and the saddle on the side where the teeth are in place. After this mix of plaster has set, take an impression covering the other clasp and part of the saddle on the side where the teeth are missing, holding the saddle in place with any suitable instrument until the latter mix of plaster has set. The impressions are then removed and a cast is poured with

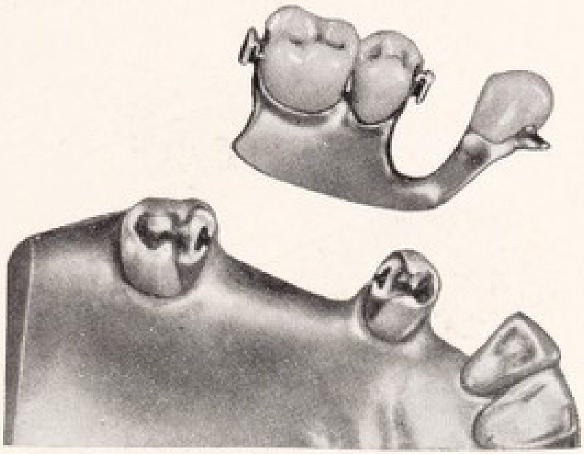

Fig. 572. A completed removable bridge illustrating an extension from the posterior segment to supply a cuspid. Note the lingual rest to provide support for the supplied tooth

Fig. 573. A completed removable bridge similar to that illustrated in Fig. 572. A central incisor is supplied by means of an extension from the posterior segment. Note lingual rests for the supplied tooth

"Terraplastica," or any material suitable for soldering. The clasps are soldered to the saddle, which is then placed in the mouth and a bite is taken preparatory to the placing of the artificial teeth.

To maintain the teeth and investing tissues in a state of health, the highest possible degree of functional occlusion must be established when the artificial teeth are ground into position. This is especially important in the type of case being described. In the right lateral bite, contact must be established between the buccal inclinations of the buccal cusps of the right lower molars and bicuspids, and the lingual inclinations of the buccal cusps of the right upper molars and the bicuspids. When in this position, there should also be contact between the buccal inclinations of the lingual cusps of the left upper molars and bicuspids, and the lingual

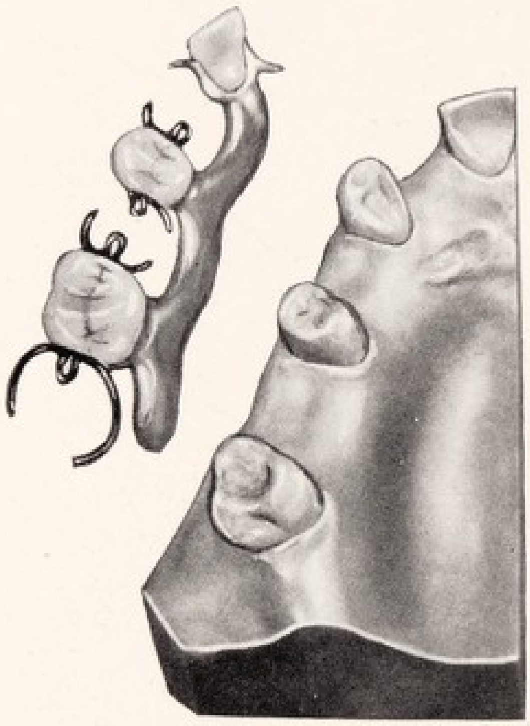

Fig. 574. A completed removable bridge for a case with several alternate teeth missing, and with remaining teeth free from caries. Note distribution of clasp arms to provide retention and to avoid, as far as possible, the display of gold

inclinations of the buccal cusps of the left lower molars and bicuspids, and vice versa for the left lateral bite.

If the occlusion is adjusted, as outlined, there will be an equal distribution of stress on the natural and artificial teeth, and the tissues supporting the saddles. This will tend to maintain a state of health for the natural teeth and the surrounding tissues. On the other hand, if this degree of occlusal harmony is not established, and if the artificial teeth are allowed to carry a greater load than the natural teeth, there will be resorption of the ridge under the saddles as well as excessive strain on the teeth used as abutments, which condition will soon tend to produce a pathological state and the loss of the abutment teeth.

Use of Clasps in Combination with Internal Attachments

Another method for the treatment of this type of case is illustrated in Fig. 568. In the hands of an experienced removable bridgeworker very

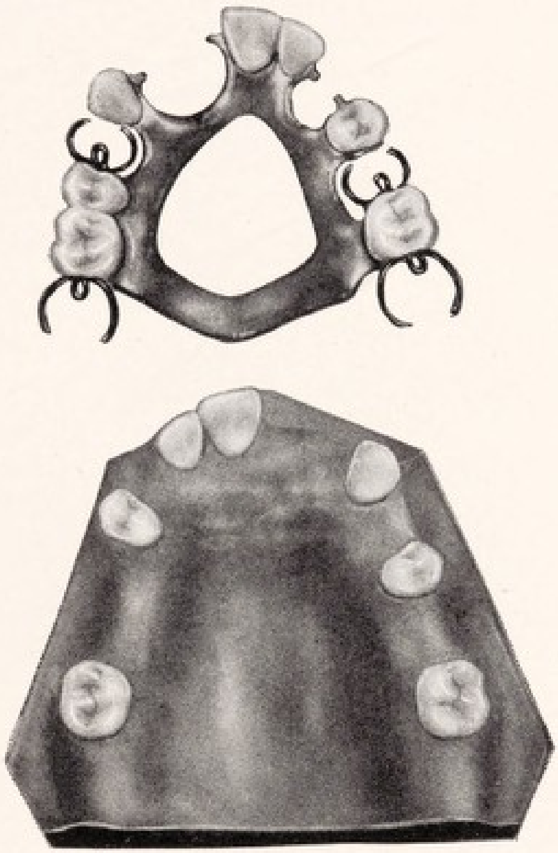

Fig. 575. A completed removable bridge for a case in which teeth are missing at several points in the jaw. Note form and width of saddle and distribution of clasps. Note lingual rests for all restored anterior teeth

satisfactory results may be expected by this method. The same careful attention to saddle placement and occlusal harmony as outlined for the case shown in Fig. 567 must be carried out, and special care must be taken in both upper and lower to secure parallelism between the clasp used on the first bicuspid and the internal attachment which is inserted into the inlay in the first molar. The position which will give the greatest retention for the clasp is first ascertained and the internal attachment is then placed into the inlay so as to maintain parallelism with the clasp. Internal attachments may be required on both sides in such a case, if the shapes of the teeth to be used as abutments render them unsuitable for clasps.

The male attachment should fit the platinum box in the inlay with uniform contact at all points. There should be no binding when the saddles

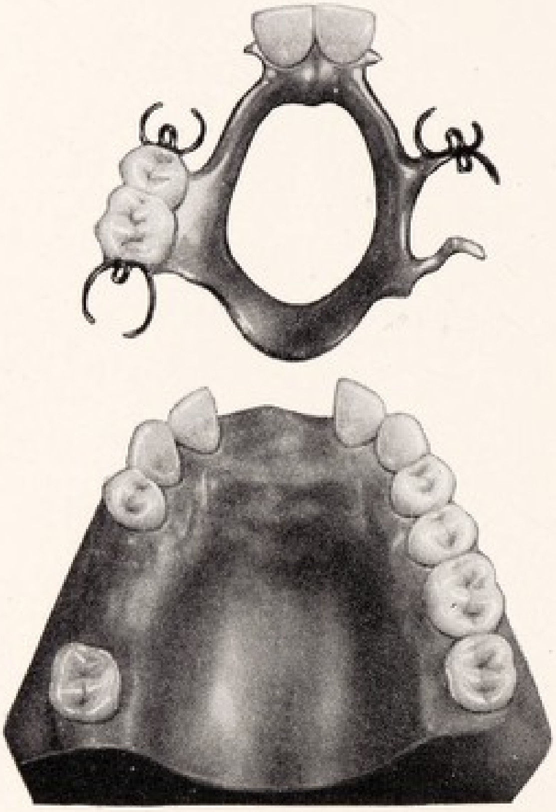

Fig. 576. A completed removable bridge for a case with upper second bicuspid and first molar missing, and two anterior teeth missing. Note supplementary stabilizer in upper left molar region. Note that the palatal portion of the saddle which is needed for reinforcement, is carried back so as to avoid the hard part of the palate which, in this case, extended unusually far back

are removed or inserted; neither should there be any excessive, or free movement when the male attachment is at rest in the platinum box.

Indications for and Against Internal Attachments

In Fig. 569 there is illustrated a case in which the teeth to be used as abutments have previously been attacked by caries. Internal attachments are therefore indicated. An internal attachment is needed for the anterior abutment for the same reason. Attention is called to the width of the saddle, which assures ample tissue support. This is a very important feature for any removable case. Many removable bridges and partial dentures fail to give the desired service through the effort of the operator to keep the saddle area small, the result being absorption of the ridge, disbalance and ultimate damage to the abutment teeth.

A case having features somewhat similar to those of the case just described is shown in Fig. 570. Here, however, the anterior tooth which

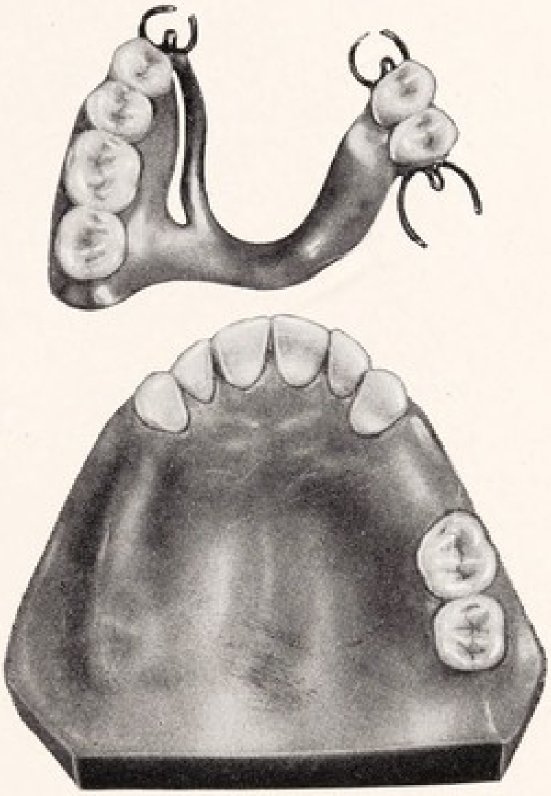

Fig. 577. A completed upper removable bridge supplying two bicuspids and molars on the right side and two bicuspids on the left side. Note resiliency provided for the cuspid attachment on the right side

is to be used for retention has not suffered from caries, and is therefore unsuitable for use with the internal attachment. In such a case 19 gauge round clasp wire is conformed to the tooth, this being done before the internal attachments are placed in the posterior inlays. The attachments are aligned by the aid of the parallelometer, so that the bridge may be inserted and removed without submitting the anterior tooth to injurious strain.

Ordinarily the upper cuspid, if vital, is not a suitable tooth in which to place an internal attachment. If however, there is a distal cavity in the tooth it may be possible, by enlarging this slightly, to provide room for the attachment without encroaching unduly on the pulp. It then becomes necessary to decide whether an inlay preparation with a deep lock shall be used, or whether a three-quarter crown is to be preferred. In many instances the preparation for the three-quarter crown involves less deep cutting and this technique then becomes the method of choice. Such a case is illustrated in Fig. 571. Aside from this the case presents no unusual features.

In the cases illustrated in Fig. 572 and 573 an upper second bicuspid and first molar are to be replaced, together with one of the anterior teeth. Internal attachments are placed in the first bicuspid and second molar as illustrated. The anterior tooth in such a case may be supplied on an extension from the posterior saddle, and is supported by suitable lingual rests on the adjoining natural teeth. This method of support is feasible in such cases because of the fact that the bridge is removable and the supporting teeth and the mucosa on which the extensions rest, are readily cleansed, as is also the bridge itself.

When the abutment teeth are sound and vital, and the mouth is not highly susceptible to caries, it is preferable to use external attachments and thus avoid cutting into the abutment teeth. Figs. 574-575-576 and 577 illustrate cases falling in this category. Clasp attachments with occlusal rests are used in each of these cases, together with lingual rests for the support of the anterior teeth. When sufficient clasp area for retention has been utilized additional stability may be gained by an occlusal extension on one of the molar teeth, as illustrated in Fig. 576. In Fig. 577 another variation is illustrated. Here it is desired to avoid all possible strain on the upper right cuspid. This is accomplished by attaching the clasp to an extension arm which extends forward from the palatal bar. While this area is fairly rigid in construction, it provides a slight resiliency.

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