

G. V. Black's Work on operative dentistry : with which his Special dental pathology is combined / revision by Arthur D. Black.

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III
TREATMENT
OF CARIES

BLACK



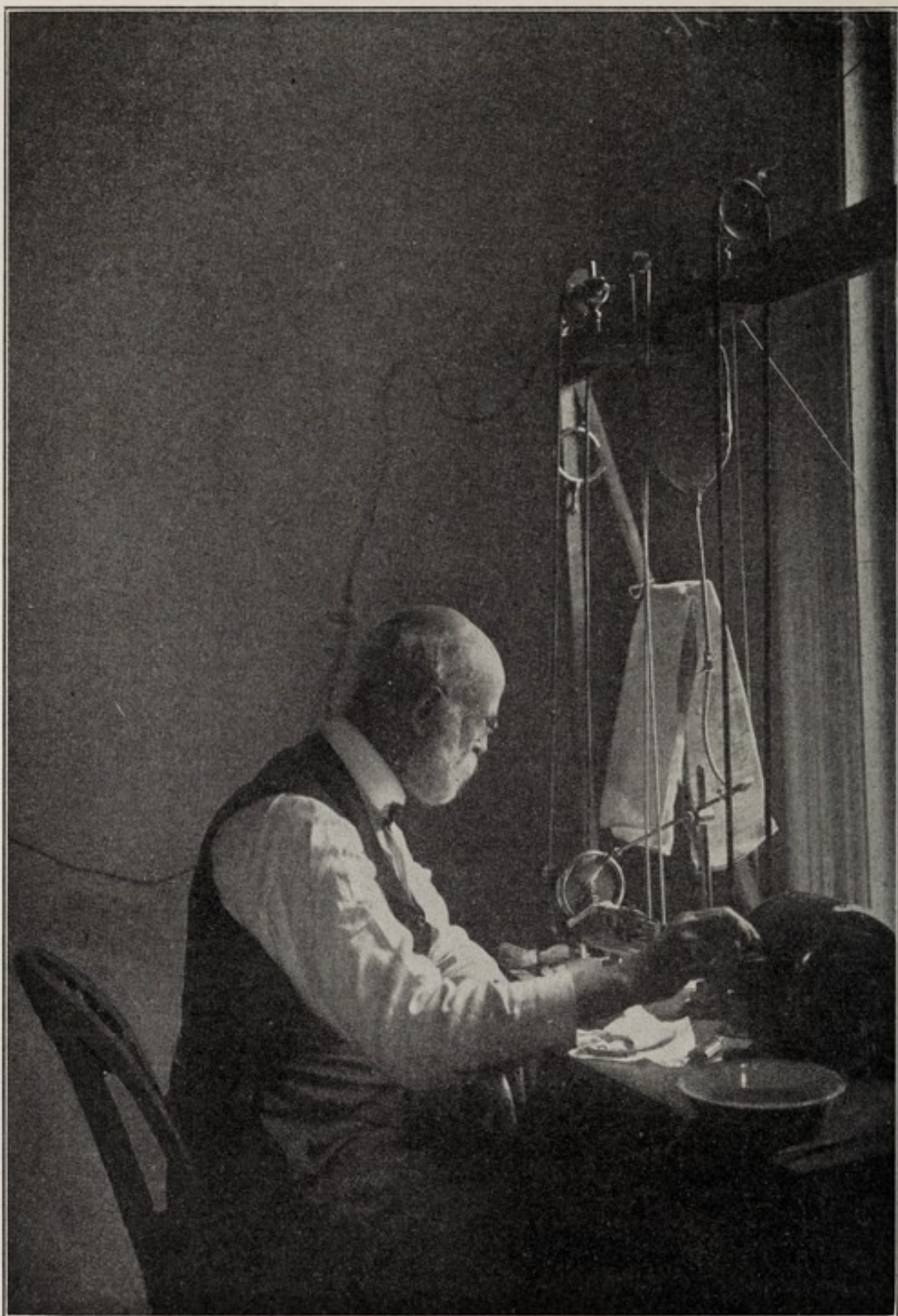
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Dr. G. V. Black at Work with the Machine which he Designed for Grinding
Microscopic Sections of Hard Tissues

This grinding machine was designed by Dr. Black for the study of the pathology of the hard tissues of the teeth and other hard substances, such as deposits of calculus, bone, etc. It has a device which can be set in advance and the grinding is stopped automatically when the specimen has been reduced to the desired thinness. This is one of many special mechanisms which Dr. Black designed as aids in his varied research activities. These include a gnathodynamometer, for measuring the strength of the bite; a phagodynamometer, to measure the force required to chew foods; a manodynamometer, to measure the force exerted by an instrument thrust; a falling weight apparatus, for the study and measurement of the force of mallet blows; an amalgam micrometer, to measure the shrinkage and expansion of amalgams; a closed electric crucible, for compounding amalgam alloys; a dynamometer with micrometer attachment, to record the compression or shortening of a substance under a given stress; and an electric thermostat for bacteriological and other dry ovens and for water tanks.

The photograph of Dr. Black, from which the illustration was made, was taken by Dr. Frederick B. Noyes.

The grinding machine was constructed about 1905 and has been used almost daily since that time in the histological laboratory of Northwestern University Dental School. Duplicates of this machine are in use in a number of other dental colleges.



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G. V. BLACK'S WORK
ON
OPERATIVE DENTISTRY

with which his
SPECIAL DENTAL PATHOLOGY
IS COMBINED

PUBLISHED IN FOUR VOLUMES

VOLUME THREE
TREATMENT OF DENTAL CARIES

492 ILLUSTRATIONS

REVISION BY
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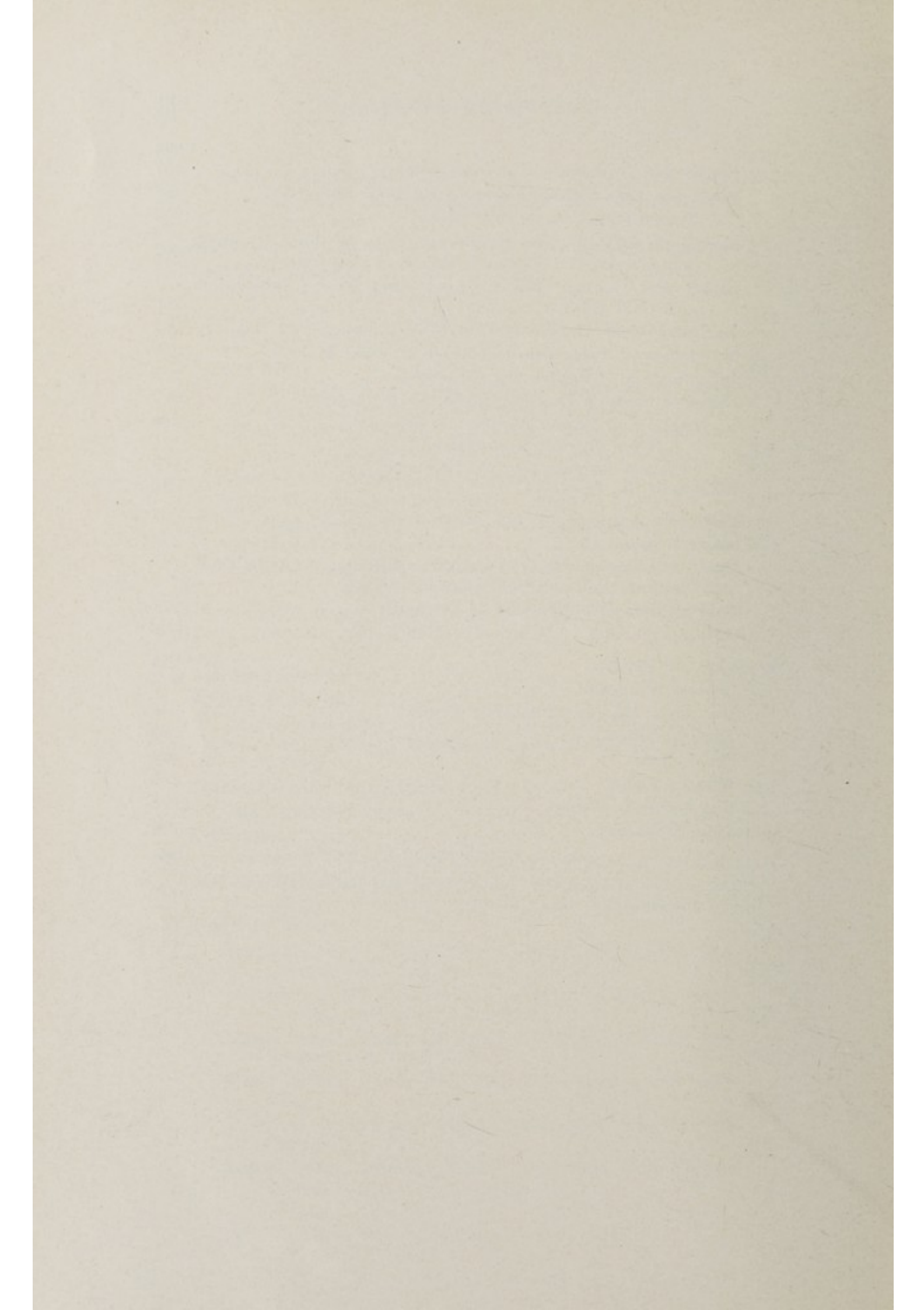
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TREATMENT OF DENTAL CARIES

DENTAL caries must be regarded as a disease to which the large majority of persons are susceptible in varying degrees from the time the temporary teeth erupt throughout their entire lives. The period of greatest susceptibility is during childhood and most persons whose mouths receive average, or somewhat less than average attention develop a decided improvement toward immunity before the age of thirty. Neglect of the temporary teeth increases susceptibility during the childhood period of the permanent teeth, as a result of the uncleanness of the mouth and lack of normal use of the teeth in chewing. Vigorous use of the teeth in mastication is considered an essential in any program of preventive treatment, as caries is thus definitely limited to certain areas and the extent of these areas is reduced in relation to the force regularly exerted in mastication.

There is ample evidence that caries may be limited in considerable measure by proper attention to the health and nutrition of the child, as discussed in the chapter on that subject. The best mouth hygiene technic by the patient, and frequent cleanings by the dentist are recognized as effective aids in better control of caries. The systematic use of ammoniated silver nitrate appears to be proving very helpful in immunizing proximal surfaces, which are, of all classes of cavities, the most difficult to control. Silver nitrate is also used to immunize caries in other surfaces.

The gradually better understanding of the pathology of caries, particularly in its beginnings, surface extensions and penetration of enamel, the logical application of extension for prevention in cavity preparation, the restoration of proper contours and the maintenance of good contacts, all with due regard for the pulp and the periodontal structures, have done much to promote mouth health and the establishment of earlier immunity.

The education of the people of most civilized countries to an understanding of the health relationships of the mouth has progressed to the point where an ever increasing number are concerned regarding the care of the teeth, and recognize the need of attention to the temporary teeth.

In medicine the effective application of prevention for a given disease has proven of advantage to both patient and physician; advantageous to the patient in the enjoyment of better health at less expense; advantageous to the physician by lessening the arduousness of his services while increasing his income. This situa-

tion, as discussed elsewhere, results from that necessary combination of a simple and effective preventive service, available for and sought by a large number of persons, which can be administered in a short time at small expense to each person, but altogether amounts to a larger income for the physician than he might possibly receive from treating persons sick with the disease.

It has been pointed out that prevention in dentistry must progress along the same general lines. As there are evidences of greater success in conserving the teeth, more and more persons will seek dental service.

An analysis of this situation, as it confronts the dentist should, in the first instance, be considered from the possible effectiveness of the most systematic and thorough application of the measures at hand to individuals, rather than to the mass of people in any community, state or nation. Mass figures applied to the dental field are appalling, as they are in the consideration of many systemic conditions, yet steady progress has been made toward the eradication of a considerable number of the most devastating diseases. Whatever may be accomplished for a large number of individuals to prove the practicability of a program, may eventually be applied to the majority of persons.

Fortunately records are available of the success attained in the conservation of the teeth by means less efficient than are now available. Some of these refer to groups of persons in institutions, others to the patients of dentists in private practice over periods of twenty-five years or more, and justify the contention that it is practicable to conserve the teeth of most persons, who are inclined to cooperate, throughout their lives. Fortunately the gospel of mouth health has become rather widespread and patient cooperation is much easier to secure today than it was a quarter of a century ago.

PROGRAM FOR TREATMENT

ILLUSTRATIONS: FIGURES 601-602.

It is the intention to discuss briefly the part which these matters may logically play in a program which can easily be applied as a part of the dentist's daily routine. The actual application of the various measures are presented in considerable detail, and will receive special consideration in the discussion of the methods of treatment of the several classes of cavities.

The time of greatest susceptibility to caries and the most critical period in the care of the teeth of most persons is from six to about sixteen years—the childhood period of the permanent teeth. However, this period is made much more critical by neglect of the temporary teeth. There is therefore, no question whatever

but that the beginning should be made early in the life of each individual — as soon as the baby has a tooth. Mothers should be taught that the home care of the teeth should begin then. It has been the rule in the author's practice to arrange the first appointment for each child at about the time of its third birthday, and it has been only rarely that one or two small pit decays have been found at that age. It therefore seems safe to set the third birthday as the logical time for the first appointment. Thereafter the program of patient management, particularly from the service viewpoint, should be carried out, whenever the cooperation of the parents and the patient may be secured. This calls for what has been termed periodic general care, and is absolutely essential to the attainment of the objectives.

Practically all children should be carried through the childhood period without the loss of a permanent tooth and with all pulps vital, except for accidents to which the upper incisors, particularly, are subject. The frequency of the recalls for periodic care should be determined for each child, but on the average should be four times a year for several years — possibly until the child is six, then three times per year during the childhood period, after which twice each year should be sufficient.

Management of Patients

In dentistry there is nothing more important than the development of skill in the management of people, or in so managing patients as to gain the opportunity to do that which is necessary and best for them and to do operations in the best way. Patients will have prejudices and notions which interfere with their comfort and with the performance of necessary operations for their benefit. The dentist should learn to appreciate these quickly and develop the tact to smooth them away. Men of widely different temperament and trend of thought seem to manage people equally well. But in all there is a feeling of profound respect for people in suffering and an earnest desire to aid them, which serves as the basis of thought and action. With such a basis, and a careful study of mental states and qualities of mind, of conditions and impulses that influence people's thought, one should succeed. It sometimes seems to be more important that the dentist should begin his professional work with a well grounded understanding of the humanities and of the psychic nature of man, than the devotees of any other profession. The dentist needs information about people, and the impulses that move them to action, in order that he will be able to read in their actions the manner of approach that will influence the particular person best, or place him or her in a state of mind that will give the opportunity to do dental operations to the best advantage and with the greatest good to the patient. This requires a close sympathy of mind with mind, a development of confidence

on the part of both operator and patient, a matter that every dentist should cultivate with great care.

The dentist has a duty also as a teacher while performing his duty as an operator. His professional life should be an exhibit of the helpfulness that earnest dentistry can be to his community. This gives him power for good. This he can do best in his professional intercourse with patients in his own office by giving judicious and careful advice that will be helpful on any points that may come up. That which proves helpful to one person will gradually be disseminated to others, and, in time, the whole community will be benefited and will make a wiser and better use of dentistry. Much more is accomplished through information thus given in a careful manner at proper times than can be imparted in any amount of printed matter, however wisely written, intended to give the people information as to the care of their teeth.

The Patient Cycle

A very simple plan of practice management, as applied to individual patients, has been arranged for convenient presentation under the title of the "patient cycle." For this purpose, a "patient cycle card" provides for certain records relating to both service and fees, which include all essential patient contacts throughout the cycle from one examination of a patient until the patient returns for the next examination. This card serves to so record and properly relate all data to the end that the teeth and their supporting structures may be best conserved, under conditions which will promote in greatest degree the general health of the patient. The health, nutrition and hygiene, the home care of the teeth and the preventive care by the dentist, together with treatments for immunization and restorations, all become parts of a correlated program.

However, this is not an extra card to be added to the recording system which may be in use, but is an examination card, with provision for the convenient addition of the other data necessary to complete a patient cycle. This card, and its use in recording examinations, is fully explained in the chapter on oral diagnosis in Volume I. There are also a number of illustrations—records of examinations—in this volume in connection with the treatment of dental caries. This card is designed to record all data pertinent to the examination, to assemble other information from time to time, and to be in several ways useful in connection with the service rendered for the patient throughout one patient cycle—from one examination to the next examination. The term "periodic general care" has been applied to the service of the dentist on each occasion when a patient returns for an examination of his mouth. The object of this phrase is to emphasize the broader scope of the service which should be, and usually is, rendered by most dentists

on such occasions. The word "general" is included to carry the idea that this appointment is made for care and consideration of the general condition of the mouth, rather than for a specific operation. The various features of this service, which include the examination, will be discussed.

The uses of the cycle card are listed under seven headings, which are illustrated by the diagram, Figure 601. Brief comment will be made regarding each of these. It should be understood that this card is used, not only for the procedures in treatment of dental caries, but for all services performed by the dentist. The relation of the cycle card to other services is apparent from the entries shown in the several illustrations accompanying the chapter on oral diagnosis in Volume I. In the present consideration, reference will be made to the general use of the card in patient manage-

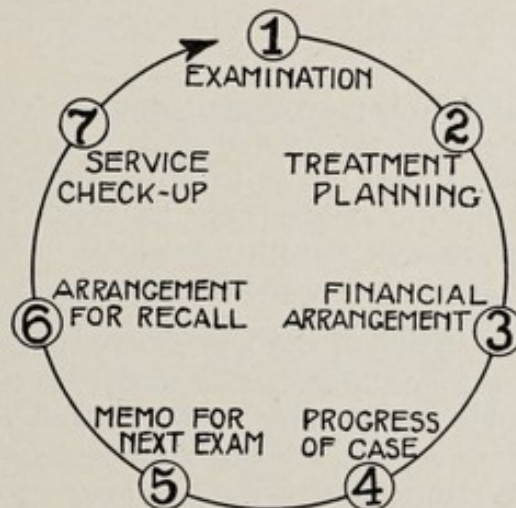


FIG. 601.

ment, but with particular attention to the procedures in the treatment of dental caries.

THE APPOINTMENT FOR PERIODIC GENERAL CARE. The following features of the program for periodic general care will be mentioned here. It should include:

The examination of the teeth for caries and conditions of the supporting structures related to caries.

Watchfulness of the occlusion.

Study of contours, contacts and occlusal wear.

Estimate of susceptibility to caries.

Estimate of the general condition of the gingivæ.

Watchfulness of and instruction in mouth hygiene.

Cleaning of the teeth.

Inquiry and advice as to the health, nutrition and general hygiene, particularly for children.

Inquiry as to nose, throat and other physical conditions, particularly for children.

Habits which might be related to mouth conditions.

It is obvious that there would be no advantage in making inquiry into all of the items listed, on the occasion of each visit of a patient. The list is rather a suggestion of a routine to be followed in as much detail as each case requires, skipping over items which may not be pertinent at the time.

For the child of three or four years, with a beautiful set of teeth and healthy gums, there would likely be nothing to do but examine for caries and record the occlusal relations of the molar teeth. If at the age of four there should be several cavities, suggesting a high degree of susceptibility, inquiry should be made as to the diet with particular reference to the health and nutrition of the child. If the occlusion is not normal, inquiry should be made as to habits, breathing, etc. Watchfulness of the occlusion is of great importance in relation to caries, because vigorous mastication with teeth in proper occlusion is such an important factor in the limitation of caries.

For young children, the proximal contours and contacts of the temporary molars should be studied with great care. If the surfaces are rather flat, so that the embrasures are narrow, the enamel of the buccal and lingual angles may be disked off sufficiently to greatly reduce the areas of liability to decay. This is naturally of special importance if the index of susceptibility is high.

As the child approaches the age of six, both the mother and the child should be made acquainted with the importance of the first permanent molar and its care. There should be special watchfulness of the intercusping of the first molars. The occlusal surfaces should be immunized early in cases of considerable susceptibility and deep pits and fissures should be protected with temporary restorations before caries occurs. Care should be taken to guard the mesial surface of the first molar in its contact with the second temporary molar. Cleanings by the dentist should be frequent and examinations should be thorough. The home care should be watched and criticized when necessary, commended when well done. Proximal areas should be occasionally immunized.

Black copper cement should play a part in the treatment of dental caries. The molar teeth, both temporary and permanent, should be examined for pits and fissures at the earliest opportunity after they erupt. If there are undecayed pits or fissures, copper cement may be used, without excavating, until such time as a more lasting restoration may be made. It should be the general rule to open pits which are sufficiently deep to cause a fine explorer to stick. However, it will be safe to tide these over for a time, if it will help in the management of the child. In all such cases a definite recall of the child within three months should be arranged.

As the childhood period is past, attention is more definitely centered on the gingivæ. At this age, the fight has usually been

won so far as caries is concerned, and the principal anxiety will be to prevent disease of the investing tissues. Contacts and the occlusion should be constantly studied, and the cause of every slight irritation of the gingivæ corrected, if possible. Thereafter, the established routine by both parent and dentist, with gradually less attention to caries and more to the gingivæ and periodontal membranes, should be continued.

Falmer, James
 NAME *1532 S. Washington St.*
 ADDRESS *Chicago*
 NUMBER *4872* TEL. *Main 6217* NPIR
 BUS. TEL. *Main 3781* EXAM. NO. *1*
 DATE *12-2-34*
 AGE *14* NEXT EXAM. *June '35*

Watch 7 6/
 1/ Pq Crown deferred

OCCUSION DDP
 PATIENT CARE 123
 CRIES 123
 GINGIVAE 123

REFERRED BY *R. W. Kelsey*
 REPORT TO

RIGHT

DI TE WIN CS X D RA YS NM CA SE HSY DRY MOD ELS PHO TO

REP ORT INT ENT ME MO
 FIL ED INS TEL FOR VO

FIG. 602. First examination of James Falmer, patient 4872, on December 2, 1934, age 14. The occlusion is recorded as Class 2, Division 1, patient care fair, susceptibility to caries moderate, condition of gingivæ good. All of the permanent teeth are present except the third molars. Decays: occlusal upper right second bicuspid, mesial upper right first bicuspid, distal upper left lateral incisor, gingival third on buccal upper left second molar, mesial lower right second bicuspid. The buccal surface of the lower right first molar is to be immunized with silver nitrate (it is marked in blue). The proximal surfaces of the upper right first and second molars are too flat and the embrasures are to be widened with disks. There is an open contact, with inflammation of the septal gingiva, between the upper left second bicuspid and first molar, due to a proximal restoration which does not make contact. There are deposits of salivary calculus on the lingual surface of the lower incisors and cuspids. A previously made root filling is recorded for the upper right central incisor and the bone of the apical region appears to be normal. A porcelain jacket crown is to be made for this tooth. A full set of radiographs was made; the patient was instructed in the brushing of the lower incisors and the upper right molars. An estimate was made of the fee for the services to be rendered. This patient was referred by R. W. Kelsey. The next recall for periodic care is in "June, 1935" (in red). See chapter on oral diagnosis in Volume I, for explanation of markings on the chart.

The actual size of this card is 4x6 inches.

Such is the program that is being carried out by many practitioners today. In the following pages the effort will be made to systematize these methods in order that they be adopted as the routine of office procedure and service, especially by those who are entering upon the practice of dentistry.

THE EXAMINATION. Detailed directions for making and recording mouth examinations are given in the chapter on oral diagnosis

in Volume I. The examination record of James Falmer is shown in Figure 602. The record is given in full in the legend, and needs no especial comment except to call attention to the very simple markings on the chart as compared with the written description.

TREATMENT PLANNING. This subject is discussed in the chapter on oral diagnosis in Volume I. It need only be said here that treatment planning relates to the study of the conditions which affect the progress of dental caries, quite as much as to diseases and abnormalities presenting in other fields. Various methods of procedure must be weighed in treatment planning to determine what is best for the particular case and consideration should be given to the order in which operations should be performed to gain the most satisfactory results.

FINANCIAL ARRANGEMENT. This card, on the reverse side, has a place for the computation of an estimate of the cost of the service outlined, also for a memorandum of the manner in which the fees are to be paid. These entries are made or not, depending upon the circumstances in the particular case. This feature, while important in the management of a practice, has no place in the present discussion.

PROGRESS OF CASE. As each operation or other service is performed and entered on the permanent record card, it is checked on the examination chart, as indicated for the four restorations in the upper teeth in Figure 602. This may be done with colored ink or pencil if desired. On this plan, the card shows, on the occasion of each return of the patient, what operations have been performed and those yet to be done. The dentist thus has the opportunity to decide, before the patient enters the operating room, what operation will be performed. He should note the time allotted to the patient, or how much of the allotted time remains, if he has run over for the previous patient, and should endeavor to select an operation which may be completed on time.

The dentist should also consult the patient's permanent card, the last entry on which will be the operation performed at the previous appointment. This will refresh the dentist's memory of that service and place him in position to ask a question regarding it. The information may be of value to the dentist in noting the results of various types of service in causing pain or discomfort, and the inquiry should often be made as an expression of interest in the patient's welfare.

MEMORANDA FOR THE NEXT EXAMINATION. There is ample space in the center of the card for the notation of matters to be brought to the dentist's attention at the next examination. These may consist of a great variety of things, related to either service or fees. For example, in the center of the card in Figure 602, there is a memorandum to "watch" the gingival third areas on the buccal

surfaces of the upper right first and second molars. This indicates that there was some condition, probably a slight etching of those areas, which was called to the attention of the patient, with a warning regarding his care. As another example, the estimated service included a porcelain jacket crown on the upper right central incisor, and the patient decided to defer this for six months or more. A memorandum should remind the dentist of that, in order that he may raise the question of making the crown on the occasion of the next examination. There are many conditions which should be listed for future attention.

ARRANGEMENT FOR RECALL FOR PERIODIC CARE. The most fundamental single item, contributing to the success of a program of conservation, is the arrangement by which the dentist assumes the responsibility for sending the patient an appointment for reexamination and periodic care. The matter of definitely regulating the periods between examinations for each case makes it possible to care for each patient with a minimum amount of service and at the least expense. What is of much greater consequence—the plan provides for the best assurance against disease of the dental pulp and of the peridental structures, with their sequelæ.

It is clearly the dentist's duty, on the occasion when the operations for each new patient are completed, to explain this situation briefly and offer to put his name on a list for recall, whenever that seems desirable. In Figure 602, the time is set for "June, 1935." This card may then be placed in the June list in a file, having twelve guide cards—one each month in the year. If desired, the date may be entered in red. As the first of each month comes around, the cards for the patients to be recalled during that month are removed from the file and appointments are sent by mail or telephone, at such time during the month as may best suit the dentist's convenience in relation to the pressure or laxity of his appointments. During the recent years of business depression, patients who were on recall lists generally responded, and dentists who had previously inaugurated this system suffered less than did others from loss of patients. Also the teeth of these patients were not neglected.

SERVICE CHECK-UP. The last item in the patient's cycle is the check-up on previous service. On the recall of the patient, the dentist should state that his first duty is to examine his own previous operations, to determine if they are in good condition. This is an expression of interest in the service, and, when repeated with each examination of patients on the recall list, serves as a stimulating criticism by the dentist of his own operations. He will occasionally find a margin that is not perfectly smooth, a point where an opposing cusp strikes too hard, etc., etc. These corrections should be made at once.

The dentist also has before him the memorandum of items brought forward. In this case, Figure 602, he is reminded to ex-

amine the buccal surfaces of the upper right first and second molars, and also to raise the question of placing the porcelain jacket crown on the upper right central incisor.

This completes the cycle; the card has served its purpose. The patient is in the chair for general periodic care, which begins with a new examination. A new card is made out and a new patient cycle is begun.

Health, Nutrition and Hygiene

The general condition as to health, nutrition and hygiene appears to be definitely related to the variations in susceptibility and immunity to dental caries. The mechanism by which such a relation may exist has not been satisfactorily worked out and there is a lack of agreement among those who have studied this question. It was for this reason that Dr. Clara Davis, who has specialized in the feeding of young children during the past twenty-five years, was asked to write the chapter in Volume I on health, nutrition and hygiene. This article deals with this subject in a most comprehensive, yet simple, manner and raises the question whether the dentist or physician is justified in making diet recommendations without inquiry into the general health and hygiene of the child, particularly the hygiene of play, rest and sleep in relation to diet. It is pointed out that "*eating and digestion* must precede the supplying of proteins, carbohydrates, minerals, etc., to meet the body's needs, and eating and digestion impose their own prior requirements upon the selection of foods." One cannot read the chapter without gaining an appreciation of the fact that the dentist must be interested in the general health, nutrition and hygiene of the child, and that he is not justified in setting up a diet list for the limited purpose of controlling dental caries. The one exception to this statement might relate to the exclusion, or at least the material reduction, of free sugar.

Dr. Davis also reports a most unique feeding experiment with some fifteen children who were turned over to her by their mothers when from six to eleven months old and were returned at varying periods, from six months to four and a half years later. Ten remained on the experiment during practically the full period of the formation of the enamel of the permanent incisors and first molars. Each child sat at a separate table and ate whatever it desired, without limit as to quantity, from a large assortment of uncombined, unseasoned and unsophisticated foods, such as are commonly eaten by older children and adults. It was not unusual for a child to eat four or five bananas at a meal, or five or more servings of meat or potatoes. Exact weights of each item eaten in 32,000 meals were recorded and classified, and it was found that each child beautifully balanced its diet; and that all were healthy and vigorous. This experiment was made with no thought of influencing the occurrence of dental caries, yet a critical dental examination

at the close of the experiment revealed not the slightest trace of decay. Two boys of this group have since lived with Dr. Davis. They are, at the time of this writing, 9 and 9½ years old, and the teeth of both are entirely free from decay.

The chapter referred to is a statement of this problem which may be accepted by the dentist as a safe guide for inquiries and advice to his patients.

Studies in the field of diet and nutrition are not incompatible with the fact that dental caries is caused by acid producing micro-organisms, notwithstanding the contrary statements of some nutritionists, who seem to think the effect of diet on the occurrence of decay is entirely a matter of faulty structure of the enamel.

MOUTH HYGIENE

ILLUSTRATIONS: FIGURES 605-631

HYGIENE is defined as that branch of medical science which relates to the preservation and improvement of health, both in individuals and in communities. It has no special relation to particular diseases, as is the case with prophylaxis.

Mouth Hygiene should include all measures employed, mostly by each individual for himself, under the direction of the dentist, to keep the mouth in the healthiest possible condition. Every one should know what rules should be followed and what results may be expected. There is presented a great problem in education; in spreading the knowledge that many serious diseases which result from mouth conditions may be prevented; that the more common diseases of the mouth, such as the decay of the teeth and inflammations of the gingivæ and periodontal membrane, may be in part controlled by simple methods of cleaning at regular intervals.

Most important of all is the education of our people to an understanding of the real value of this care of their mouths to the end that the largest possible number will make this a part of their daily routine for the promotion of better health. This educational program is the dentist's responsibility to each patient under his care, and it is the profession's obligation to the mass of the people, particularly the children. Physicians, dentists, and nurses are the teachers who must, in their daily contact with our people, educate them in such matters. However, material aid has come and will continue to come from other sources.

The most noteworthy single effort to this end has found expression in the Forsyth Memorial in Boston, which was dedicated November 24, 1914. A fund of four million dollars was devoted to the erection and endowment of a splendid building for the purpose of caring for the mouths of the school children of poor families in Boston, and for the larger purpose of educating the general public to the value of clean and healthy mouths. The Forsyth Memorial is not to be considered a charitable institution, but an educational one—an institution which is not only proving the value of the proper care of the mouth by demonstrations and clinical records, but is also carrying on a far reaching program of public education.

In 1917, the late Mr. George Eastman established a Dental Dispensary for Children in Rochester, N. Y., and he later provided funds for the erection of buildings for this purpose in London, Brussels, Rome and Paris. Mr. and Mrs. Murray Gugenheim established a similar clinic in New York City in 1929, and a new building

was completed in 1931. Smaller dental clinics have been established in many cities throughout the world and, altogether, this movement has become of tremendous value in teaching the importance of mouth hygiene and the care of the teeth of young children.

Much information regarding mouth conditions has been gained during recent years from the examination of the mouths of our school children in many cities. Most of this work has been performed by dentists on their own initiative or under the direction of our various dental organizations. It is gradually becoming better systematized and its importance recognized by civic authorities. In a number of states, a dentist has been appointed as a member, or holds a staff position, on the State Board of Health, and dentists are employed as regular staff members of the various eleemosynary institutions, also a large number of cities have recognized the value of oral hygiene instruction and dental service in the public schools by making appropriations as a regular item in their annual budgets.

THE DENTAL HYGIENIST. A new movement was inaugurated by Dr. Alfred C. Fones in 1914, when a small group of trained women — dental hygienists — were given positions in the Bridgeport, Conn., public schools, as teachers of oral hygiene.* Their function was to interest younger children particularly as to the importance of conserving their teeth and to train them in mouth hygiene. In addition, these hygienists were permitted by law to clean and polish the teeth. This movement has grown until more than thirty states have passed laws which specify the training which young women may take to qualify for the licensing examinations for dental hygienist. The license also permits the hygienist to practice in a private office under the supervision of a dentist.

The dental hygienist movement was an expression of the recognized need for better care of the teeth of young children, and is to be considered an important forward step in preventive dentistry.

This movement has accomplished much more than the total result of the services of all of the dental hygienists; it has caused the dental profession to appreciate the practicability of the means employed to conserve the teeth, also to take greater interest in restorative measures, as applied to both the temporary and permanent teeth during childhood. In 1914, there was a marked difference in the viewpoint of the dental hygienist and the dentist; the hygienist's outlook was entirely along lines of prevention, the dentist's was primarily focused on restorative technic. The advent of the hygienist has caused the dentist to think and act more in terms of prevention.

In this discussion of mouth hygiene it should be understood that it is a field in which the hygienist is trained to cooperate with the dentist.

*Dental Cosmos, Vol. LXI, 1919, p. 607. Also see Mouth Hygiene, a Text-Book of Dental Hygienists, 1934.



FIG. 605—PANORAMIC VIEW OF THE DENTAL EXHIBIT

A Century of Progress Exposition in Chicago was the first of the great international expositions to invite the medical and dental professions to participate, and many millions of visitors were afforded the opportunity to gain reliable information in the field of health education, and particularly in regard to the prevention of disease. The Dental Exhibit was prepared by the Chicago Centennial Dental Congress, under the auspices of the American Dental Association and the Chicago Dental Society, and consisted of a "Portrayal of Problems of Dental Health and the Prevention of Dental Disease," with which was interwoven something of the "Development of the Profession and the History of Dental Practice." This exhibit was visited by more than eight million persons in the ten months that the Exposition was open during the years 1933 and 1934, and apparently attracted the attention of many who had not been reached by other methods of dental health education. A panoramic view of this dental exhibit is shown in Figure 605.

The work now being done in the instruction of our people regarding the maintenance of healthy mouth conditions is intended to bring them closer to the dentist in their knowledge of such things, and in this way assist in bringing about better cooperation between dentists and patients.

OBJECTIVE IN MOUTH HYGIENE. The objective of a program of mouth hygiene is to keep the mouth in such a state of health that disease is less likely to occur. Specifically, it is intended to increase the resistance of the gingivæ and assist in the prevention of decay of the teeth. This may be accomplished; (1) by stimulating circulation in the gingivæ and other supporting structures; (2) by the removal of accumulations of food debris and soft deposits, including calculus, which contribute to bacterial growth and cause inflammations of the gingivæ; (3) by the frequent removal from the surface of the enamel of colonies of acid-forming bacteria. It



A CENTURY OF PROGRESS EXPOSITION, CHICAGO, 1933 AND 1934.

should be clearly understood that the complete prevention of either decay or inflammations of the soft tissues is not to be expected as a result of whatever measures may be taken to promote mouth health, any more than the person who carries out the best possible regimen of general hygiene can be promised that he will be free from disease. There can be no question, however, of the value of both general hygiene and mouth hygiene in limiting the occurrence of disease.

Reference is made in Volume I to the occasional person whose mouth is in such a state of health that no artificial cleaning is necessary. These mouths represent perfection in structure; such persons generally have normal occlusion and masticate their food with much force; their mouths are cleared of all food debris within a short time after each meal, through the agency of the saliva. As a result of the force used in chewing, the circulation in the supporting structures is stimulated and the gums and gingivæ become hard and remain healthy. These mouths present the picture of perfect health, largely as a result of normal function.

There is much variation in the artificial cleansing necessary for different persons. The situation, so far as the individual is concerned, depends upon many of the factors presented in these volumes and an accurate opinion as to the degree of susceptibility may not be formed in early childhood. The only safe plan, therefore, is to set up a thoroughgoing program and apply it to all children, with the expectation that it will be modified in accordance with the developments in each case.

An analysis of this situation points to the fact that the preservation of the normal health of the gingivæ, and particularly of the thin, knife-like crests, is of greater importance than anything else in preventing decay. Pit and fissure decays may be best controlled without reliance on artificial cleaning, and the occurrence

of proximal and gingival third decays is largely due to the early blunting of the gingivæ during the childhood period, when susceptibility to caries is greatest.

The mouth hygiene program for the individual should be a cooperative one between the patient, who is responsible for the home care, and the dentist, who directs it. The dentist has the further responsibility of keeping the mouth in the best condition in order that the home care may be most effective.

The technical services of the dentist or dental hygienist in cleaning the teeth should be considered supplementary to the home care. Cleaning by the dentist should be necessary only where the home care is inadequate — as a check up on errors of technic or lack of interest and effort by the patient. The appointment with the dentist for periodic care should be used as a stimulant to the patient by calling attention to errors in technic. The attitude of the dentist, diplomatically expressed, should be that periodic cleaning by him should not be required if the patient's care is perfect. It should be the dentist's function to criticize the patient's efforts, favorably or otherwise, on such occasions.

The principal objectives may be attained by the following means:

The circulation within the gums and gingivæ may be stimulated and these soft tissues made more firm and resistant to both injury and infection, by vigorous brushing. The thinness of the crests of the gingivæ may be best maintained by movements of the brush in the direction from the gums over the margins of the gingivæ toward the occlusal or incisal margins of the axial surfaces of the teeth.

Removal of food particles and debris, also of recent (soft) deposits of calculus, may be accomplished by one or more of the following means: (a) rinsing the mouth with water, (b) brushing all areas that may be effectively reached with a brush, (c) the use of a rubber bulb syringe, (d) rubbing the surfaces with silk floss or rubber bands, (e) the use of tooth picks, (f) chewing coarse foods or gums.

These methods are ample to maintain the health of the soft tissues under ordinary conditions. They have proven effective in preventing dental caries in positions in which the vulnerable surface of the enamel could be thoroughly cleaned, while for less accessible areas, comparatively little has been accomplished. Separate consideration may be given to the three principal groups into which decays are divided according to the conditions of their occurrence.

Pit and fissure decays occur in surfaces which are normally cleaned in mastication and in which decay does not occur except

for the enamel defects which permit lodgements. In decays of this type, artificial cleaning is effective in relation to the opportunity which the form and size of the defect gives for the removal of the lodgements. Since many pits are too small to permit the entrance of a single tooth brush bristle, it would seem impractical to rely on artificial cleaning. Minor irregularities in occlusal surfaces may retain some soft food debris which is easily removed with a brush, but would usually be washed out by the saliva within a short time. The only satisfactory treatment of pits and fissures is to prepare cavities and make restorations, establishing the contours of normal, perfectly formed teeth. It is probably best to direct patients to brush these surfaces, but artificial cleaning should not be relied upon for the protection of pits and fissures against decay.

Gingival third decays in buccal and labial surfaces may, as a rule, be entirely prevented by artificial cleaning. These areas, except for some irregularity of position of the teeth or unusual conditions about the posterior teeth, are exposed to view and are easily cleaned with the brush. Their cleanliness and the prevention of decay by the patient is entirely a matter of understanding the situation and maintaining sufficient interest to carry out the dentist's instructions. Note should be made of the fact that the opportunity for uncleanness in these positions depends very largely on the blunting of the margin of the buccal and labial gingivæ.

Proximal surface decays present the real problem of preventing caries by artificial cleaning. The area of liability is that portion of the surface which is not cleaned in mastication and is not protected by the interproximal gingivæ. In the early childhood period this area of enamel is completely protected by the fullness of the gingivæ, which extend occlusally to the point of contact and to the line of food movement through the embrasures in mastication. The food slides along the surface of each septal gingiva from the contact point buccally and lingually through the embrasures; there is no unclean enamel on the proximal surface.

It is not until the crest of the gingiva recedes a little and thus exposes a slight area of enamel to the gingival of the contact that decay may begin. The problem is to select a means of cleansing the vulnerable area of enamel without causing further recession of the gingiva. The sweep of a brush through the embrasure from buccal to occlusal may be helpful in cleansing the enamel closer to the contact than would be done by food in mastication, but unless the area *directly to the gingival* of the contact is reached and cleaned, a proximal decay is not prevented—a beginning decay is not stopped. All known methods by which this area may be effectively cleaned present the danger of causing further recession of the gingivæ. These will be described later.

MOUTH HYGIENE TECHNIC.

The technic of cleansing the mouth will be first presented in its most simple form for the period of the temporary teeth, then for the transition period from the temporary to the permanent teeth and finally for the full compliment of the permanent teeth. A



FIG. 606.

FIG. 607.

FIG. 608.

standard program will be presented for each group, to be followed by consideration of the complications which arise, particularly in later life. This plan of presentation is chosen with the thought that each person should be trained in the standard program first

and, after that has been mastered, should receive from time to time such additional instruction as may be helpful.

A very large number of special devices, some simple, others very elaborate and complicated, have been designed for cleaning the mouth. Many are ingenious and effective, yet on the whole, and particularly if considered in terms of a large number of persons of all ages, it is believed that more will be accomplished with a very simple program, which will be easily understood and followed.

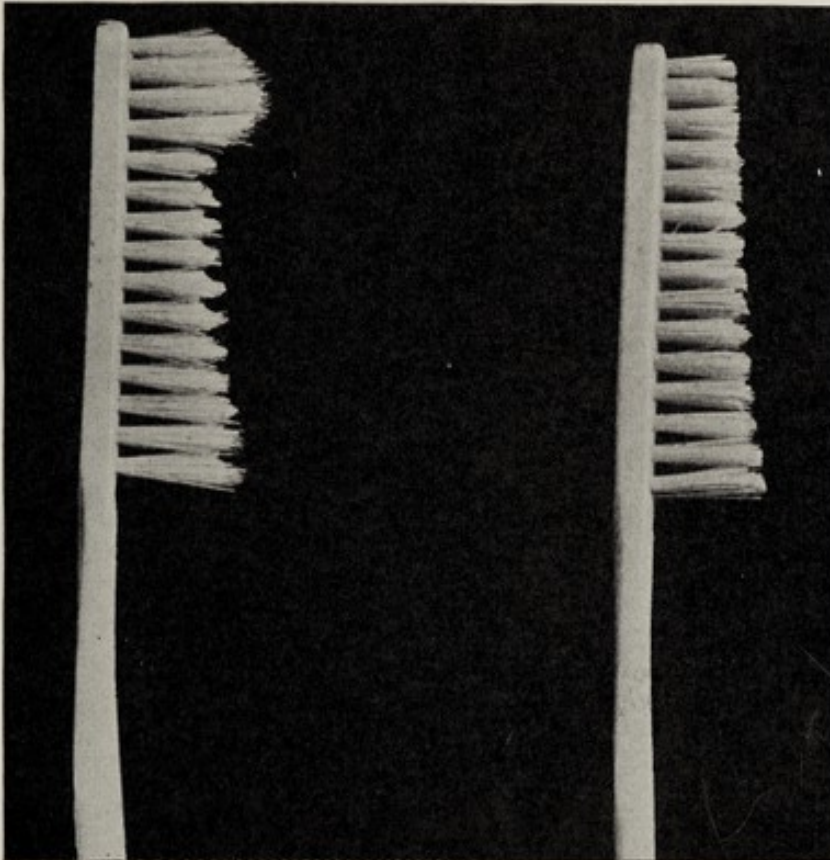


FIG. 609.

FIG. 610.

THE TOOTH BRUSH.

The brush is of more importance than all else in the cleaning of the mouth. The brush should be carefully selected, and the dentist should recommend to each patient the type of brush that he considers best. He should have at hand samples of the several brushes which he may wish to recommend for various purposes.

The brush should be held in the water for a moment before it is used. After using, it should be thoroughly rinsed with water and hung up to dry. The support for the brush should be such that the bristles will be free from contact with anything else.

A small brush is to be preferred. Brushes approximating in size those illustrated in Figures 606, 607 and 608 are recommended

as suitable for the child, the youth and the adult. The brush shown in Figure 607 is gradually becoming more popular for the adult. The bristles should not be too closely set; there should be nearly as much space between the rows of bristles, as is occupied by the bristles. A brush having the bristles rather deeply notched cross-wise is very desirable. See Figure 614. As to the stiffness, each person should select a brush which is as stiff as may be used vigorously on the gums without causing pain. Such brushes are usually marked "medium". A new brush is always somewhat stiffer than it will be after it has been used for a time. In selecting a new brush, one should always take this fact into consideration. While

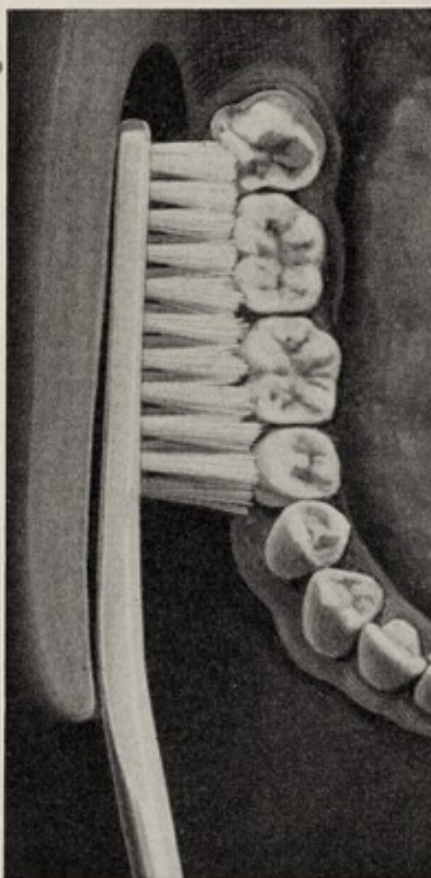


FIG. 611.

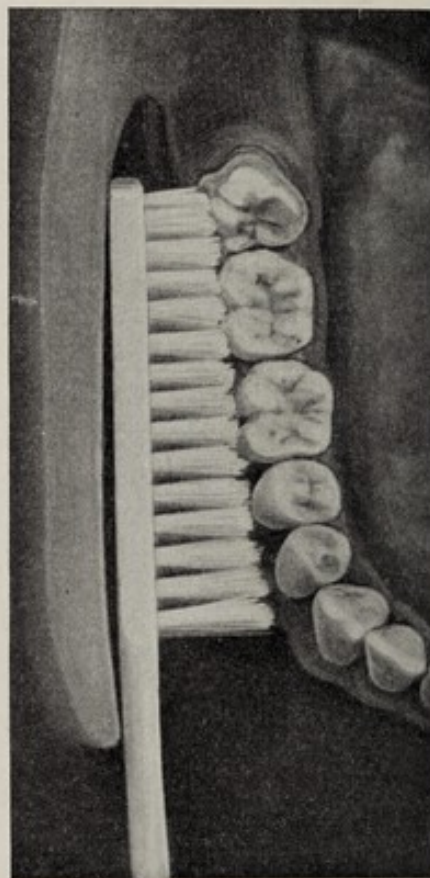


FIG. 612.

the brush is new the bristles may be softened by soaking them for a few minutes in warm water before using. Persons who use too stiff a brush are apt to avoid brushing the soft tissues, and thus fail to stimulate the circulation within the gingivæ.

Most tooth brushes on sale in the average drug store are too large to permit of sufficiently free movement in the mouth. Brushes shown in Figures 609, 610, 612 and 613 are too large. Figure 611 illustrates the largest brush, which could be recommended for an adult, in position for brushing the buccal surfaces of the lower teeth, the print being actual size. In Figure 612, the brush is too large for effective use in the mouth.

For many persons, special brushes should be selected to meet the peculiar conditions presenting in their mouths. In some mouths it is almost impossible to clean about the third molars, either upper or lower, unless the bristles near the end of the brush are very short. Those brushes with a tuft of very long bristles near the end are generally to be avoided, as they fold back against the handle, when the brush is carried far back in the mouth, and do little or no cleaning. See Figure 613. The end bristles

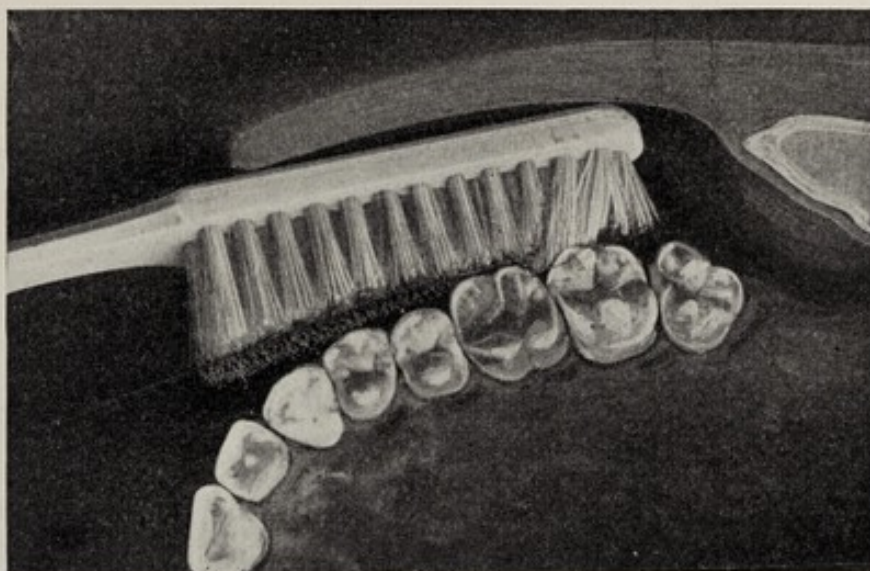


FIG. 613.

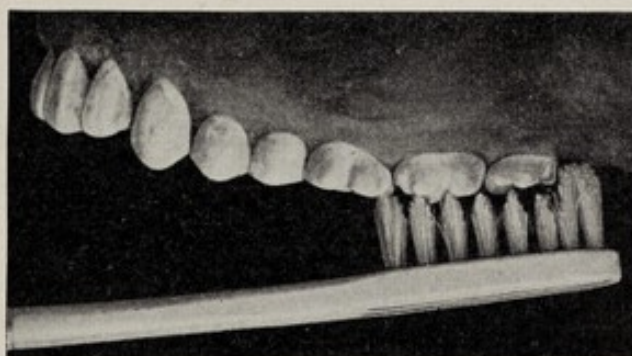


FIG. 614.

should be short enough so that there will be sufficient room between the teeth and the cheek for the brush to be moved freely. If there is any difference in the length of the bristles, those at the end of the brush should usually be the shortest. However, in some mouths there is insufficient room to the buccal of the upper third molars for a brush with the shortest possible bristles. In such cases, a brush with a small tuft of bristles at the end may be carried directly across the occlusal surface, with the tuft reaching over. The tuft may thus be moved along the buccal and also the distal surface. See Figure 614.

For some persons, whose lower front teeth are inclined lingually, a brush with a bend in the handle (the back side of the handle being convex) will make it possible to reach the lingual surfaces of these teeth to better advantage. See Figures 615 and 616, also 625.

The dentist should examine each mouth as to the available space for the brush in various positions, especially about the third molars and the lingual of the lower incisors. He should also note whether it is best to have the jaws apart or the teeth in occlusion while the buccal surfaces of the teeth are brushed.

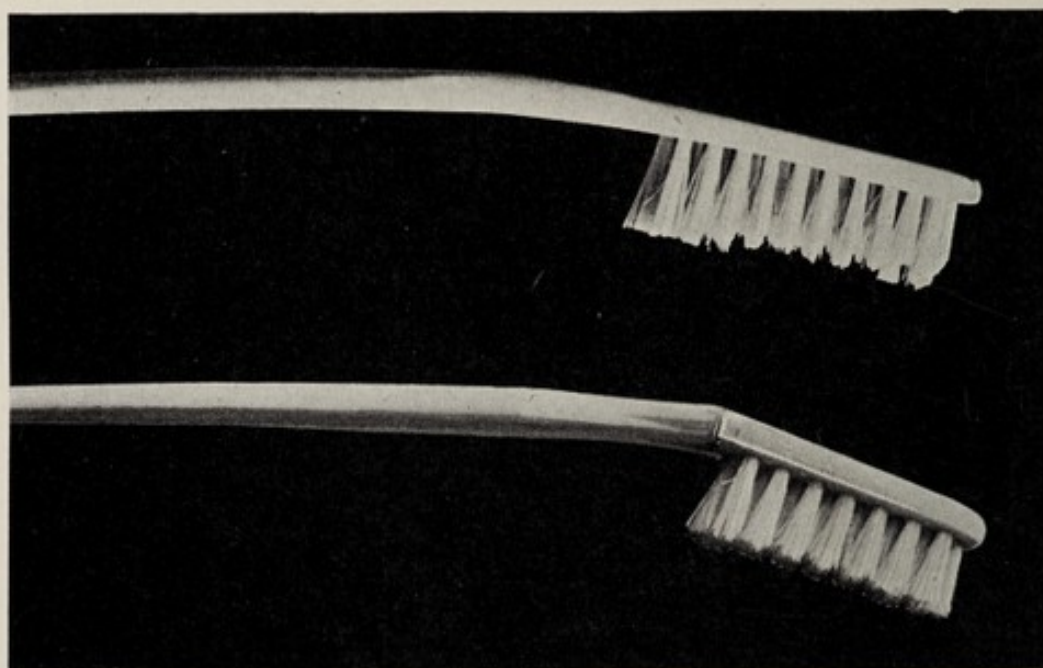


FIG. 615, above.

FIG. 616, below.

DIFFERENCE OF OPINION ON METHODS OF BRUSHING. There exists much difference of opinion as to the relative merits of various manipulations of the brush and of other procedures in cleansing the mouth. In the author's judgment, less depends upon the particular technic than the enthusiasm with which it is recommended and carried out. In preparing a motor driven tooth brushing exhibit for the Dental Exhibit at a Century of Progress Exposition in Chicago in 1933, a number of teachers and others who had had extensive experience in dental health education were consulted and the consensus of opinion was that the "up and down" movements of the brush would be best understood by the large majority of persons, and these movements were made in various positions in the mouth by six aluminum figures. See Figure 617.

The effectiveness of the home care of the mouths of the patients of any dentist will be a direct reflection of his own faith in such a

program and the manner in which he presents it to his patients. He should have samples of brushes of various types in his office for demonstration purposes and should be very exact in his instructions. He should preferably show each patient how to brush, or otherwise clean, his own (the patient's) mouth, or some special place in the mouth, while the patient observes with a sufficiently large hand mirror.

CARE OF THE TEMPORARY TEETH. The care of the temporary teeth should begin when the first tooth erupts. Previous to the



FIG. 617.

eruption of the teeth, the mouth of the baby needs no special care for cleanliness, except as may be directed by the pediatrician. During the period of the temporary teeth, it is unusual to have deposits of either kind of calculus, and therefore, as the rule, no measures need be employed to prevent these accumulations.

When the first temporary tooth erupts, the use of the tooth brush should begin. The brush should be of the smallest size obtainable; soft enough not to injure the gums, yet sufficiently stiff to be effective in cleaning. The child's mouth should be cared for

by the mother or nurse, and the brushing should be done after each meal. As the child comes under the dentist's care, about the age of three, it should be taught to do the brushing, under careful supervision, until it has acquired the necessary skill and has formed the habit of brushing the teeth as its first duty after each meal. Nothing is of greater importance to the future health of the mouth than for the child to form this habit of prompt and regular brushing of the teeth. The child that forms such a habit will come to appreciate the comfort of an habitually clean mouth and will not be likely to neglect the cleaning in after years.

The dentist should never overlook an opportunity to impress the importance of conserving the temporary teeth in order to avoid, as far as possible, the danger of disease and irregularities of the permanent teeth, which often interfere with the proper development of the face. Nothing is likely to be more effective in gaining and holding the interest of both parents and child in the care of the mouth than to direct their attention to dangers which beset the permanent teeth if the temporary teeth are neglected.

Most laymen are not particularly concerned about an extensive decay, or an exposed pulp, or an abscess of a temporary tooth, because, they reason, this tooth will be lost in a year or so, anyhow. If, however, these conditions are recognized as a menace to the permanent teeth, and particularly if the symmetry of the face is endangered, the case takes on a more serious aspect, and the active cooperation of all concerned is likely to be obtained.

In view of the fact that decay of the temporary teeth rarely occurs before the child is three years of age, it might seem to be inadvisable to recommend that the child's teeth be brushed three times each day, previous to the third year. On the contrary, it is quite important that the gingivæ about each temporary tooth be kept clean and healthy, also that the occurrence of decay in each mouth be delayed as long as possible.

If the dentist has the opportunity to make recommendations as to the care of the mouth of the very young child, he should suggest that the home care be not fully intrusted to the child previous to the third birthday, when an appointment should be made for him to see the child. All of the temporary teeth are in occlusion at that time and it is the dentist's duty to interest the child in the care of its own mouth and to instruct it in the proper brushing of its teeth. This should be a demonstration for both child and mother, intended to interest both, not only in the immediate, but the future care of the teeth. The dentist should select a suitable brush for the child and it is usually worth while to make the child a present of the brush on this occasion. See Figure 606.

TECHNIC OF BRUSHING THE TEMPORARY TEETH. The technic of brushing the temporary teeth should be very simple, with the expectation that it will be modified as the permanent teeth erupt.

A definite routine should be prescribed. It makes no especial difference where the brushing begins or ends, providing all areas which should be brushed are included in the routine.

The child should take a mouthful of water and should rinse its mouth thoroughly, forcing the water through the spaces between the teeth, with the teeth in occlusion and the lips closed.

After the brush has been held in running water for a moment, it should be placed on the gum to the buccal of the lower left molars and the movement should be upward over the buccal surfaces of the teeth with sufficient pressure to cause the bristles to sweep through the embrasures. The lingual surface of the molars should be brushed with a similar upward stroke. Each arch should be divided into three regions; the left molars, the anterior teeth and the right molars, and the same technic should be followed for each. Each molar region should be brushed on both the buccal and lingual surfaces. It seems unnecessary, however, to advise the brushing of the lingual surfaces of the incisors.

The occlusal surfaces of each pair of molars may then be brushed with a mesio-distal movement, although a linguo-buccal movement is recommended in cases in which the cheek may be retracted sufficiently to permit the handle of the brush to be held at right angles, or nearly so, to the line of the arch. This will add to the usefulness of the movement, as the bristles will sweep across the lingual and buccal embrasures.

It is well to recommend a certain number of movements of the brush—from five to ten—in each of the positions mentioned.

The child should again thoroughly rinse the mouth with water.

THE TRANSITION PERIOD. This period begins with the eruption of the first permanent molars and ends with the loss of the last of the temporary teeth. There is unusual difficulty in maintaining mouth cleanliness, and mastication is seriously interfered with, during the several years while the temporary molars are being replaced by the bicuspid. In a limited number of cases, the situation is further complicated by the presence of orthodontic appliances. It is also a time when it is often difficult to maintain the child's interest in any of the rules of hygiene.

The child should be made to understand that one of the great events in its life is the eruption of the first permanent molars. Every proper means should be employed to gain the child's interest and cooperation in the mouth hygiene program. The child should have a brush a trifle larger than that previously used, and a new program should be instigated. See Figure 607. This should consist of the addition of the positions and movements of the brush necessary to clean the first permanent molars. The brush should certainly sweep the embrasures between these teeth and the second temporary molars, as it moves occlusally on both the buccal and lingual sides. There is greater reason for brushing the occlusal

surfaces of the first molars during the first few years after they erupt than at any other time.

CARE OF THE PERMANENT TEETH. The technic should be similar to that for the transition period, with such modifications and additions as each case may require. The standard routine will be given in detail. It is recommended that two brushes be used alternately.

Emphasis should be placed on the thorough rinsing of the mouth, both before and after the brushing. With a quantity of water in the mouth, the teeth and lips should be closed and the water should be forced back and forth through the spaces between the teeth. When thoroughly done, this is one of the most effective means of cleansing that portion of the interproximal spaces which can not be reached with the brush.

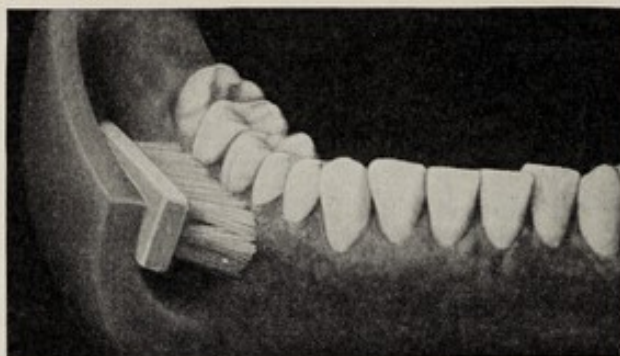


FIG. 618.

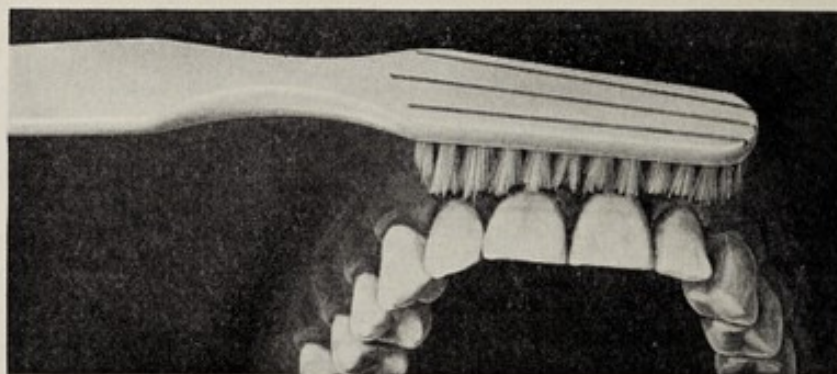


FIG. 619.

To establish a definite order or routine in brushing, it is suggested that the brush should be placed first on the gum far back on the lower left side, in the position of the second and first molars. See Figure 618 for the right side position. The movement of the brush should be upward over the margins of the gingivæ and the buccal surfaces of the teeth. In the latter part of the stroke, heavier pressure should be applied to cause those tufts of bristles, which are in contact with the interproximal gingivæ, to sweep through the embrasures, stimulating the gingivæ and cleaning the exposed surface of the enamel. Similar movements should be made

in a series of positions around the arch to include all of the lower teeth and every embrasure. The same technic should be followed for the upper teeth, the strokes being downward. See Figures 619, 620 and 621.

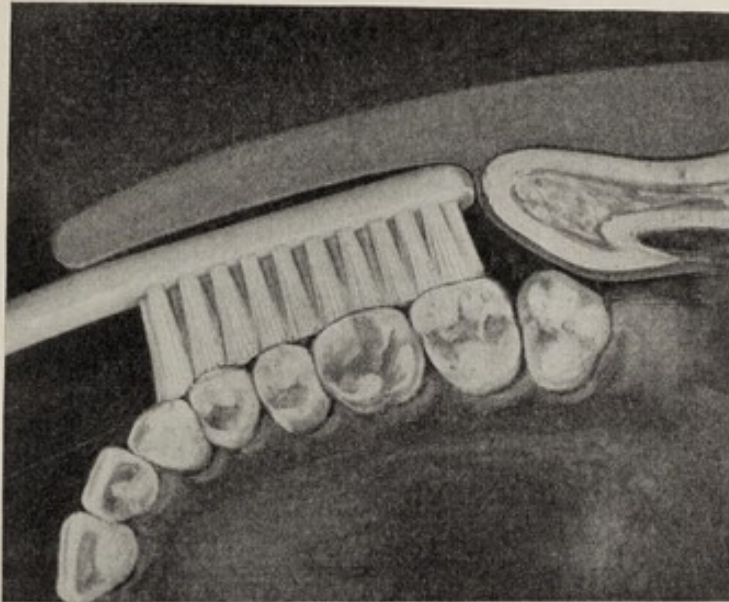


FIG. 620.

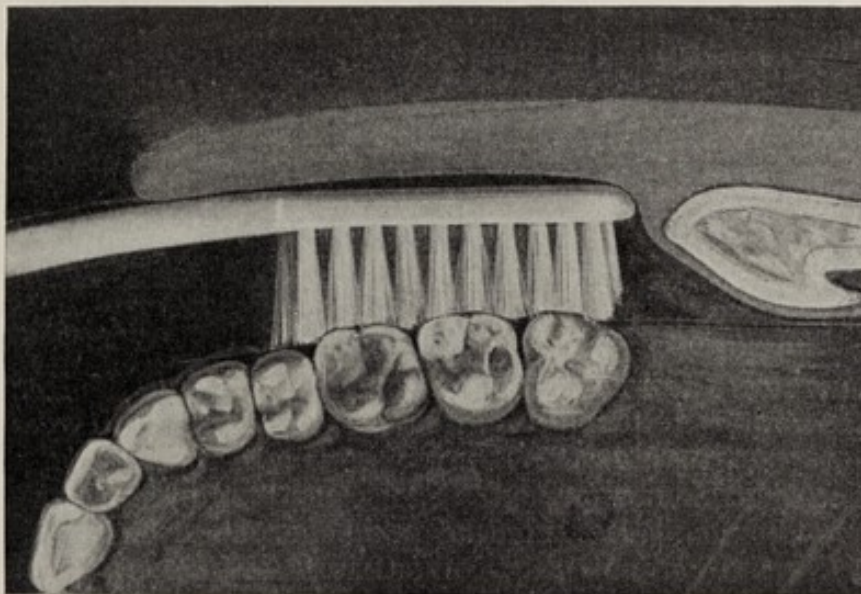


FIG. 621.

The motions for the lingual surfaces of the lower molars should be practically the same as those for the upper, but they are more difficult to make correctly. See Figures 622 and 623. The same may be said of the lingual surfaces of the upper molars. For both lowers and uppers the brush must be held somewhat obliquely to the line of the arch and most of the brushing done with the bristles toward the end of the brush.

The brushing of the lingual surfaces of the incisors, both lower and upper, is best done with an endwise motion of the brush. See Figures 624 and 625. The handle of the brush should project out of the mouth parallel to the length of these teeth. The brush, while held in this position, should be placed on the gum and the motion of the brush should be over the gum, gingivæ and teeth. The brush should then be lifted, replaced on the gum, and the motion over gum, gingivæ and teeth repeated several times. As

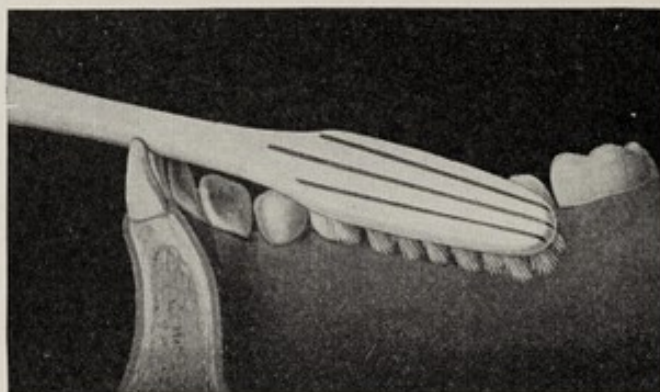


FIG. 622.

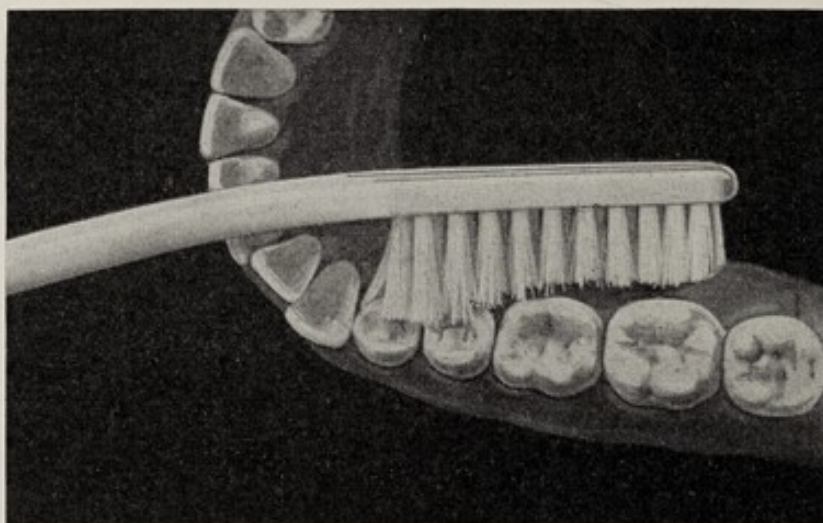


FIG. 623.

previously mentioned, this will tend to keep the crests of the gingivæ thin, and there is no position in the mouth where it is so important to keep the gingival margins thin as here, where the first deposits of salivary calculus usually occur. The thinnest possible gingival crest affords the least opportunity for the deposit of calculus.

When a patient is instructed in the brushing of the lingual surfaces of the lower incisors, he should be told to stand before a

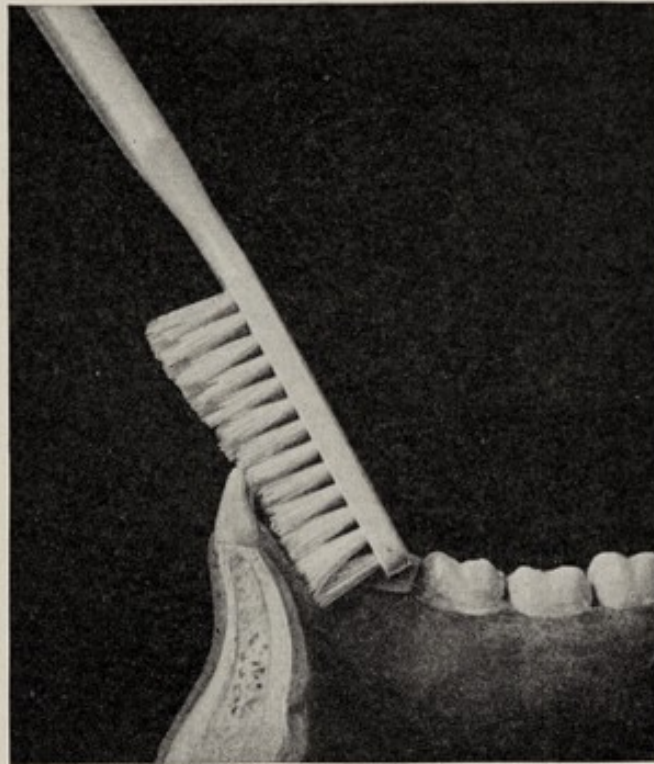


FIG. 624.

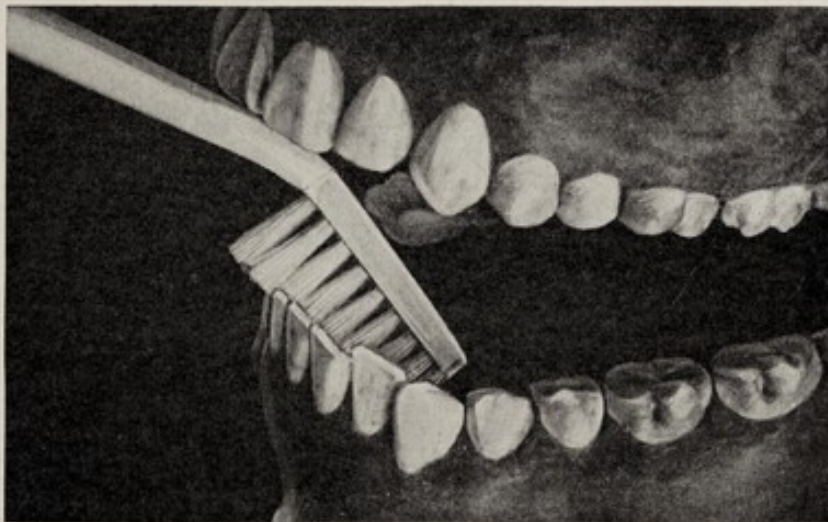


FIG. 625.

mirror and open the mouth wide, with the head tipped forward, so that he can see the gums to the lingual of the lower incisors. He should train himself in this movement before the mirror until he has mastered the technic.

When the third molars erupt, they should, if possible, receive the same attention as the other molars. In many mouths the upper

second and third molars can be more conveniently reached with the brush if the mouth is closed, because, with the mouth open, the ramus of the mandible is so close to the upper teeth as to leave insufficient space for the brush between the cheek and the teeth. In Figure 619 the mouth is open and the ramus prevents the brush from being carried back to the buccal of the third molar, while in Figure 620, with the mouth closed, there is ample space for the brush. It is also advantageous in some mouths if the jaws are closed in brushing the buccal surfaces of the lower second and third molars, as the tissues of the cheek are relaxed and may be pouched out with the brush.

In all cases in which the space to the buccal of the molar teeth is limited, the tufts of bristles near the end of the brush should, if necessary, be cut shorter than the others, in order that the brush may be manipulated with greater efficiency.

It will be difficult in many mouths to reach the gum overlying the upper third molars, or even the buccal surfaces of the crowns of these teeth, on account of the little space between them and the ramus of the lower jaw and the cheek, and a special brush will be necessary. See Figure 614.

If there are defects in occlusal surfaces, these should also be thoroughly brushed. As a rule these surfaces are so well cleaned in mastication that they require little brushing. If there are no defects, or if the pits and grooves have been made smooth by restorations, they should need no brushing.

Teeth which are not used normally in mastication, either on account of the loss of opposing teeth, or on account of a sensitive or tender tooth, should be very thoroughly brushed on all surfaces, as the cleaning of mastication must always be regarded as the principal factor in mouth cleanliness.

RECESSION OF BUCCAL, LABIAL AND LINGUAL GINGIVÆ. As the gingivæ recede on the buccal, labial and lingual sides of the teeth, the crests may become slightly blunted. This knife-like edge is more likely to be lost if brushing has been neglected for a time and deposits of salivary calculus have occurred. If, for any reason, the enamel next to the crests of the gingivæ is not well cleaned by the upward and downward movements described, the movements of the brush should be forward and backward, with about half of the width of the brush on the gingivæ and the other half on the enamel. The blunting, as a result of deposits, is generally most marked to the lingual of the lower incisors. In this position the brush should be held parallel to the long axis of the teeth and the teeth and gums should be cleaned with a lateral motion, back and forth from cuspid to cuspid.

The brushing in various positions, with a motion parallel to the labial, buccal and lingual margins of the gingivæ, should not

displace the upward and downward movements, but should be used in addition, in all cases in which the teeth are not well cleaned otherwise.

RECESSION OF CRESTS OF INTERPROXIMAL GINGIVÆ. A slight recession of the crests of the interproximal gingivæ, occurring between the ages of twelve and twenty-five, when the patient may be highly susceptible to caries, presents one of the most difficult problems in the control of caries, regardless of the fact that the patient may be cooperating splendidly. This recession is likely to occur in all four bicuspid-molar regions at the same time, or it may be confined to the gingivæ between the anterior teeth. In an occasional case, the interproximal gingivæ may recede sufficiently within two or three years to permit the beginning of proximal decays in all of the teeth. Both dentist and patient may be surprised to find from six to ten or more proximal decays at a single examination, although for several years previously only a few restorations had been required for pit decays. The dentist is also

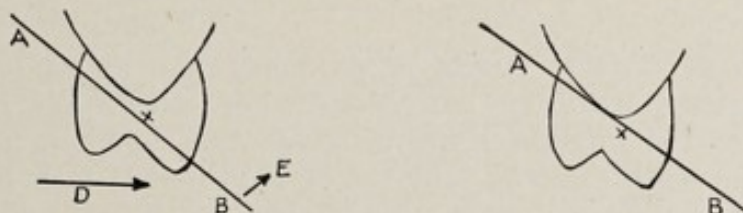


FIG. 626.

confronted with the prospect that many other similar decays will probably occur during the next two or three years. In the case illustrated in Figure 1137, there occurred twenty-four proximal decays within a period of two years.

It is a problem to thoroughly clean the enamel to the gingival of the contact without causing a further recession of the gingivæ. Silk floss appears to be the best method for this purpose. The loosely twisted floss is preferred to the tape, as the extra width of the tape presents the especial danger of injuring the soft tissues with its gingival edge. It should be held very close to the teeth and carried laterally through the contact, as illustrated in Figure 626. The ligature is held at A and B, and is moved in the direction of the arrow D, while B is moved very slightly in the direction E. The two illustrations show the positions at which the ligature is held before and after it passes the contact. In doing this the ends should be drawn a little, either to the mesial or distal, so that the silk will pass to one side or the other of the crest of the septal gingiva as it passes the contact, thus avoiding injury to this tissue. After it is in the space between the teeth, the two ends should be

drawn back and forth to rub the surface of one tooth, then it should be lifted over the crest of the gingiva and the surface of the other tooth rubbed in a similar way. It is quite a task to do this carefully and thoroughly in each of the thirty spaces between the teeth and few of those people whose teeth need such cleaning will do so regularly. It is, however, about the only effective method of cleaning these surfaces. Patients should be very carefully instructed in the manner of using the floss and should be impressed with the danger of injury to the soft tissues. It should be recommended that this be done once each day, preferably after the evening meal, or before retiring. One thorough cleaning with the floss each day is more effective than two hurried efforts.

The use of the rubber bulb syringe, described in succeeding paragraphs, is also desirable in these cases, to thoroughly cleanse the interproximal spaces after the floss has been used.

As mentioned under the preventive treatment of proximal decays, the dentist should apply ammoniated silver nitrate to all of the areas in question and the patient should be recalled every three months for inspection, until there is a definite change toward immunity.

CASES IN WHICH THERE IS CONSIDERABLE RECESSION OF THE INTERPROXIMAL GINGIVÆ. In cases where there has been much recession of the interproximal gingivæ, the cleansing of the surfaces of the teeth and the removal of food debris may be conveniently done in several ways—with the tooth-pick, silk floss or rubber bands, or with a rubber bulb syringe.

THE TOOTHPICK. The toothpick is designed to cleanse the interproximal space and the proximal surfaces of the teeth. It may be used by passing the thin flat end of the pick between the teeth and rubbing the surface, first of one tooth, then the other. A toothpick made of quill, or as thin a wooden pick as may be had, and made of a very close-fibered wood, having a smooth hard surface without splinters or splinters, will be the best to use. If a quill pick is used, the point should be cut off and the end rounded, to avoid pricking the gingivæ. For reasons previously stated, the use of the toothpick is indicated only in cases in which the gums have already receded sufficiently to give room for a toothpick to be passed between the teeth without pressure on the gum. Few persons have this much recession before middle age; it is for this reason that younger persons should not use a toothpick.

RUBBER BANDS AND SILK FLOSS. Rubber bands or waxed floss silk are generally preferable to toothpicks for cleaning the spaces between the teeth. The use of silk floss has been mentioned for the cleaning of the enamel to the gingival of the contact point in cases of slight recession of the gingivæ. Neither should be used, except in those spaces where there has been recession of the gin-

givaë, or in spaces in which food may be caught occasionally, even though the gingivæ are normal. Certain foods, such as chicken and other stringy meats, are much more likely than others to slip past good contacts, or to slip into the septal space from the buccal, labial or lingual. A silk floss or a rubber band is usually necessary to remove such lodgments. It would not be a good plan for every person to pass a rubber band or floss silk between the teeth after each meal, because of the danger of irritating the gingivæ and causing them to recede.

In using either the rubber band or floss silk, it should be held with the fingers close to the teeth on either side and then passed carefully through the contact without injury to the gingivæ.

All interproximal spaces which require the use of a toothpick, rubber band or silk floss to remove food debris, should be carefully examined to determine the condition of the contact. In the majority of cases, unless the attachment of the peridental membrane has been seriously injured, it should be possible to correct either the form of the contact or the tightness of it, so that food will not be caught. The methods of so doing are given elsewhere.

THE SYRINGE. There are two principal uses for the syringe in the mouth hygiene program; to maintain the health of the gingivæ by cleansing all of the subgingival spaces — the proximal subgingival spaces as well as those on the buccal, labial and lingual; and to remove food debris from interproximal spaces. The object of washing out all of the subgingival spaces, while the gingivæ are in normal or nearly normal condition, is to thoroughly cleanse them by removing whatever residue may remain from the serum, often containing the elements for the formation of deposits of serumal calculus, which is constantly discharged into these spaces from that portion of the gingivæ which overlies the enamel. There appears to be little residue in these spaces during childhood and early adult life, but as age advances, the content of this discharge is increasingly injurious, and the indication for washing the spaces is correspondingly increased.

For removing food debris from the interproximal spaces, the syringe is very efficient, and is especially indicated in those mouths in which there has been a recession of the septal gingivæ, while the contacts remain tight. In such cases the lodgments enter the spaces from the buccal or lingual and are not packed in, as is often the case when there is an open contact. This condition presents most frequently in the mouths of persons past middle age. The syringe is also of service in removing debris which has been forced past weak contacts, or crowded in where contacts are open.

The syringe should have as large a rubber bulb as can be conveniently held in the hand. The nozzle should be long enough so that the end will easily reach the third molars, and the opening in the end should be sufficiently large to give a good strong stream.

The bulb of the syringe shown in Figure 627 holds one and one-half ounces, the nozzle is three inches long, and the diameter of the opening in the end is 1.5 mm. Aside from the need of having a large opening, it is important that the end of the nozzle be so large that it would be impossible to get it under the free margin of the gingivæ. In addition to its effectiveness in cleaning, a very important advantage of the syringe is that there is no danger of injury to the gingivæ in its use. There is no other method of doing this cleaning which does not present considerable danger from frequent slight irritations. These have been pointed out in the consideration of the tooth brush, toothpick, silk floss and rubber band.

In using the syringe one should follow the same routine as with the brush, by beginning, for example, with the buccal surface

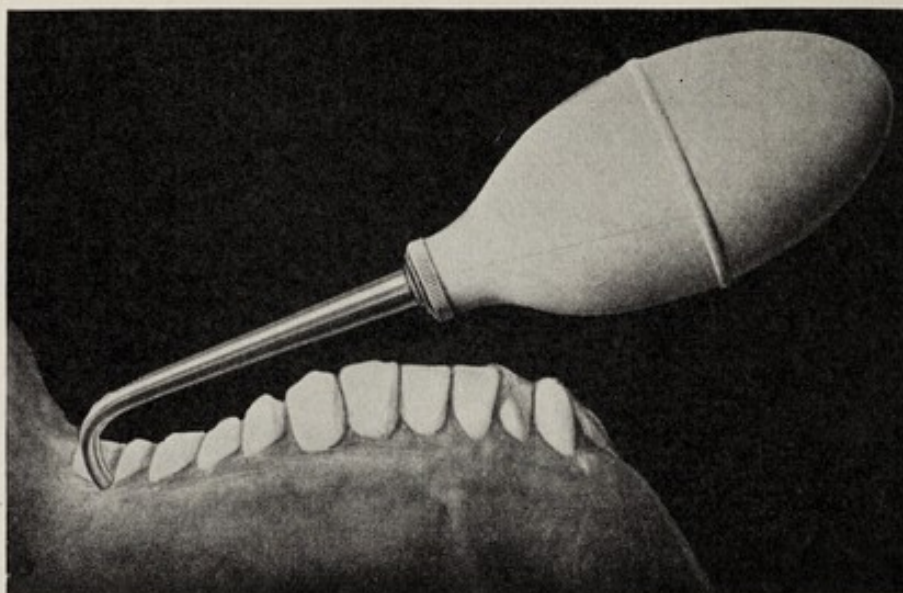


FIG. 627.

of the lower left third molar. The bulb should be pressed with full force, and the end of the nozzle should be drawn over the buccal surface of the tooth, halting slightly in the forward movement as the nozzle comes between the third and second molars, then over the second molar, halting again between the second and first molars, and continue this to the median line. With a little practice, one may gauge the movement so that this will use one syringe of water. With a second syringe, the nozzle should be placed on the buccal surface of the lower right third molar and drawn forward in a similar way. The buccal and labial surfaces of the upper teeth should be gone over in the same way; then the lingual surfaces of both the lower and upper teeth. This requires eight syringes of water. If one has two syringes, only about

one-half the time will be necessary, for there need be no waiting for the bulb to fill with water. One will fill while the other is being used.

The nozzle of the syringe should continuously touch the teeth, and be so inclined as to force the water toward the gingivæ. See Figure 627. One edge of the nozzle should be close to or barely in contact with the margin of the gingivæ, but in no case should the effort be made to place the end of the nozzle under the free margin of the gingivæ, on account of the danger of injury to this tissue.

In using the syringe in this way, all parts of the teeth and all of the subgingival spaces will be washed. The water will generally find its way to the deepest parts of the septal subgingival spaces as well. Most patients will soon come to feel the *lifting* of the gingivæ as the water enters the subgingival spaces. This use of the syringe gives a sense of cleanness and comfort not obtainable in any other way. It is well worth the effort expended for this purpose alone, and persons who once learn this use of the syringe will gladly continue with it indefinitely. But in addition to this, it is really the best aid to the brush as a cleaning agent.

METHOD OF BRUSHING INTERPROXIMAL SPACES SUGGESTED BY DR. WILLIAM J. CHARTERS.

In a paper* entitled "Ideal Tooth Brushing," Dr. Charters presented a method by which the tufts of bristles may be gently forced between the teeth in such manner that they will massage the surface of the interproximal gingivæ and also clean the enamel of the proximal surfaces to the gingival of the contact. The following paragraph, quoted from the paper, recites his technic:

"Place the brush at right angles to the long axis of the teeth, the point of the bristles in contact with the surfaces. Then gently force the bristles between the teeth, being careful not to pierce the gum, that is, do not allow the points of the bristles to rest on the gums. With the bristles between the teeth, exert as much pressure as possible, giving the brush several slight rotary or vibratory movements, causing the sides of the bristles to come in contact with the gum margin, producing an ideal massage. Be careful not to make this movement sufficiently extensive to remove the bristles from the spaces between the teeth. After making three or four small circles, remove and then replace. Make three or four applications in the same place, so that the points of the bristles will strike the labial, buccal and lingual surfaces, then slide them into the inter-proximal spaces. Move the distance of one embrasure and repeat the same process, holding the sides of the bristles firmly on the gum margin. The V-shape space between the teeth assists in crowding the sides of the bristles against the gingivæ. How-

*International Journal of Dental Research, Vol. IV, 1922, p. XI.

ever, when teeth are missing one must depend on his sense of touch to maintain the proper pressure with the sides of the bristles on the gum margin."

Two of the illustrations which accompanied the paper are reproduced in Figures 628 and 629. These illustrations show a larger number of bristles in and farther through the interproximal space than would be necessary to clean the enamel near the contact. They may be pressed into the interproximal space a lesser or greater distance, according to the condition of the interproximal soft tissue. This method is also recommended by Dr. Charters in recessions of the gingivæ and in the treatment of chronic pericementitis when considerable tissue has been destroyed.

The method is efficient in cleansing the proximal surfaces of the teeth. Each patient requires very careful instruction, particularly when this plan is used to prevent proximal decays, in order that the gingivæ may not be gradually forced to recede.



FIG. 628.



FIG. 629.

BRUSHING THE TONGUE. It is desirable that the surface of the tongue should be brushed. Nothing will give to the mouth a greater sense of cleanliness than a clean tongue. This applies more especially to adults than to children and since it is of great importance that the task assigned to children be simple, it seems advisable to reserve for the adult the recommendation that the tongue be brushed thoroughly on arising each morning as the last step in the brushing technic.

FINAL RINSING OF THE MOUTH. After brushing or using any other means of cleansing, the mouth should be quite thoroughly rinsed with several mouthfuls of water. It is well also, to rinse the mouth a number of times while doing the brushing. The technic has been described.

Until one has certainly formed the habit of brushing the teeth systematically in accordance with the plan mentioned, or any similar one which includes all positions which need to be brushed, he should stand before a mirror and watch every movement to see

that the brushing is thoroughly done. Even those persons who take the utmost care in the brushing of their teeth are liable to miss one or more places, and the dentist should, in his examinations, be constantly on the lookout for such neglected places and call the attention of patients to them. For children, the mirror should be hung very low on the wall.

WHEN CLEANING SHOULD BE DONE. The teeth should be cleaned after each meal. To this rule there should be no exceptions. It is the only safe rule for the large majority of persons to follow. If the technic is carefully carried out, a continuously healthy mouth, so far as deposits of salivary calculus and food debris are concerned, is assured. There is a special virtue in cleaning immediately after meals. To one who has formed that habit, the condition of the mouth annoys until the cleaning is done; it can not be forgotten.

It is not convenient for many persons, who are away from their homes during the day, to brush their teeth after the noon-day meal. In such cases, it should be suggested that the mouth be rinsed very thoroughly with water at the close of this meal. The teeth and lips should be closed and the water should be forced back and forth through all of the interproximal spaces.

TRAINING IN THE CLEANING OF THE MOUTH. Every person, in forming habits of cleaning the mouth, should be under the direct supervision of the dentist. It is very necessary that the idea of habit be recognized in anything that is to be repeated over and over again in the same way. Correct habits in every particular are essential in this cleaning. In the formation of the habit, every part of the mouth which needs it should be properly cleaned.

No other person than the dentist or dental hygienist should be regarded as fully competent to do this training, because no other person has the knowledge and skill in examination which renders him fit to determine whether or not the cleaning is in every way efficient. For this reason, patients who are not doing effective cleaning should be requested to bring their brushes to the dentist's office, in order that their technic and the suitableness of the brush may be criticized.

GUMS AS AN AID IN MOUTH HYGIENE. The chewing of various gums has often been recommended as an aid in cleaning the mouth. There can be no question but that the chewing of the ordinary chewing gum, for a few minutes after meals, is of value in removing particles of food which have lodged about the teeth. Anyone may make a test by eating one or two Brazil nuts, the meat of which is white, and then, after rinsing the mouth or brushing the teeth in the usual way, chew a piece of black licorice gum for a few minutes. If the gum is rolled thin on a glass slab, the particles of meat nuts, which have been removed from the teeth by the gum, may be observed.

Chewing gum has been used to some extent by physicians in promoting better cleanliness of the mouths of children who are ill, as indicated by the following reference in *American Medicine*, October, 1911, to an article by Dr. Le Grand Kerr, entitled "Chewing Gum as a Mouth Cleanser."

"Kerr finds that the use of chewing gum is very advisable in keeping the buccal cavity clean, particularly in diseases of children. The child naturally rebels against the cleansing process while it is ill, and therefore, if some more attractive and efficient way can be found to accomplish the same result, we ought to take advantage of it. The use of chewing-gum seems to offer the most relief. It is attractive to the child, and through its use at stated intervals the little patient is led to produce effectively two results that are most important in keeping the mouth and tongue clean—stimulation of the flow of saliva and the beneficial movement of the tongue, which is a most effective cleanser through its mechanical action alone. This method has been tried for months by the writer in cases of typhoid fever, scarlet fever, measles, and diphtheria, always with beneficial results."

The chewing of gum for a few minutes twice a day has also been recommended as a gymnastic—a chewing exercise for the muscles of mastication, and there is some evidence that it is effective in increasing the force of the bite of children. In an experiment conducted over a period of two years in an orphanage in Chicago, a group of children whose average bite on the first molars was 45 pounds at the beginning was advanced to 102 pounds at the end, a gain of 126 per cent. A control group in the same institution had an average bite of 87 pounds at the beginning of the experiment and 142 pounds at the close, a gain of 42 per cent. This evidence alone is not convincing, and the studies are being continued.

The above statements suggest the very practical advantage that may be gained in cases of children very susceptible to dental caries, if a rather tough gum were advocated, to be chewed for a period of five or ten minutes after meals. It should be a gum made for this particular purpose, and should require sufficient chewing force to give the muscles substantial exercise.

Persons of refinement very properly object to the chewing of gum in public and would not be inclined to encourage the habit. That is a question entirely apart from the benefit that might be derived, in the case of children very susceptible to caries, whose interest can not be stimulated to the point that they will effectively clean their teeth. A program which includes the chewing of a pleasant flavored gum for a few minutes after meals, should have sympathetic consideration, particularly during the period of great susceptibility, if it presents even a slight prospect of being helpful in conserving the teeth.

For persons who regularly eat their noon-day meal away from their homes, it should be advantageous to chew a piece of gum for five minutes, after they have rinsed their mouths with water, as suggested in a previous paragraph.

MOUTH-WASHES, PASTES AND POWDERS. No mention has been made of mouth-washes, tooth-pastes, tooth-powders, etc. It is believed that these are of very little or no value; that everything can be accomplished with plain water and a brush and nothing is gained by the use of medicine. If there is no disease of the tissues of the mouth, certainly no medicine is indicated. If the mouth is thoroughly cleaned the sense of comfort will not be bettered by the pleasant taste of a mouth-wash. There is no merit in the use of an antiseptic mouth-wash, as its effect is of but a few minutes duration. With the development of more complete knowledge of the etiology of dental caries, it should be realized that the acidity of the general saliva has nothing to do with decay and alkaline mouth-washes are not indicated to prevent decay. No solution taken into the mouth will have more than a very temporary effect and will be of no practical value.

Some children, and possibly a limited number of adults, may be induced to take better care of their mouths if a pleasant-tasting mouth-wash, or powder, or paste is prescribed. The idea has become so fixed in the minds of our people, as a result of advertising propaganda by manufacturers and the belief of many dentists that these preparations are beneficial, that it is not to be expected that the public, or the members of the profession, will quickly change their attitude, but in the light of present knowledge, there should be a gradual change to a more rational view. In the meantime, members of the profession should thoroughly familiarize themselves with these problems, and exercise judgment in presenting the facts to their patients. The most that can be said for the majority of such preparations is that they are probably harmless, although there can be little doubt but that some are injurious.

The following statement is quoted from the booklet of Accepted Dental Remedies, 1935, published by the Council on Dental Therapeutics of the American Dental Association, page 141.

"In view of the lack of evidence brought forward by the exponents of the indiscriminate and general use of 'mouth washes,' it may be stated categorically that the general use of 'mouth washes' can be considered to serve no more intrinsic purpose than as an aid in the mouth toilet in the removal of loose food and debris; and that the main action appears to be due to mechanical rinsing. It may be stated with equal emphasis on the same grounds that the average mouth of the normal person has not been shown to be in need of medicated 'mouth washes'; that is, 'mouth washes' that contain ingredients with active medicinal properties, such as astringents, protein precipitants, germicides of the phenol type and active chlorine."

CLEANING FIXED BRIDGES. Persons for whom fixed bridges have been placed are likely to find discomfort in the lodgment of food debris about such pieces, unless they have been made with due care to render the cleaning of them easy. The exposed parts of such pieces may be cleaned by the ordinary brush used in cleaning natural teeth, but that portion directed toward the mucous membrane can not be well cleaned in this way, and other means should be devised by the dentist for the particular case. No part of a fixed bridge should press on the mucous membrane; it should be supported wholly by its abutments. It should not come so close to the mucous membrane but that a piece of thin tape may be passed between the two and used to rub the part of the appliance that can not be reached by the brush. For this to be effective, the surface of the dummies toward the tissues should be convex from buccal to lingual rather than concave as many are made, especially in the portion of the surface toward the lingual. This rubbing by a tape, carrying no abrasive whatever, followed by the syringe, will complete the cleaning.

If the cleaning is regularly done after each meal, the bridge should be kept in excellent condition. If the cleaning is not regularly done, inflammations of the mucous membrane about the bridge and under it are very likely to occur. Furthermore the soft tissues about the teeth and roots, to which the bridge is attached, are liable to inflammation, which may result in the loss of both the teeth and the bridge.

Bridges require more care than any other of the artificial appliances placed in the mouth. Similar care must be exercised in the construction of the bridge; it should be made with the utmost precaution that every part be thoroughly cleanable and present sufficient space about the mucous membranes to give free access to the natural movements of the fluids of the mouth. Special provision must also be made for embrasures of proper width between the bridge dummies and the natural teeth which support the bridge, in order that there may be the normal cleansing of mastication.

CLEANING ARTIFICIAL DENTURES AND OTHER REMOVABLE APPLIANCES. Artificial dentures and removable appliances of all kinds, should receive more attention in the matter of cleanliness than the natural teeth. This is necessary to the full and comfortable use of such appliances.

The epithelium of the mouth, which is fitted for the friction it receives in chewing food, is continually giving off dead cells from its surface and renewing them by fresh growth. If a portion of this mucous membrane is constantly covered by a denture, which fits so well that food debris does not get under it, the dead cells will remain and within a day or so will cause the entire surface of the mucous membrane under the denture to be slightly or considerably whitened. If these dead cells are not brushed away,

they will soon decompose and render foul the whole surface of the denture in contact with the tissue. It often happens that more or less food debris will work in under some dentures, and this will decompose, causing inflammation of the mucous membrane. It is, therefore, a necessity to the comfort and full use of the denture that the cleaning of it and the mouth be done at regular intervals, the same as the cleaning of the natural teeth.

The denture should be placed under the hot-water faucet, if running water can be used, while the mouth and the natural teeth, if some remain in the mouth, are cleaned. The mucous membrane,

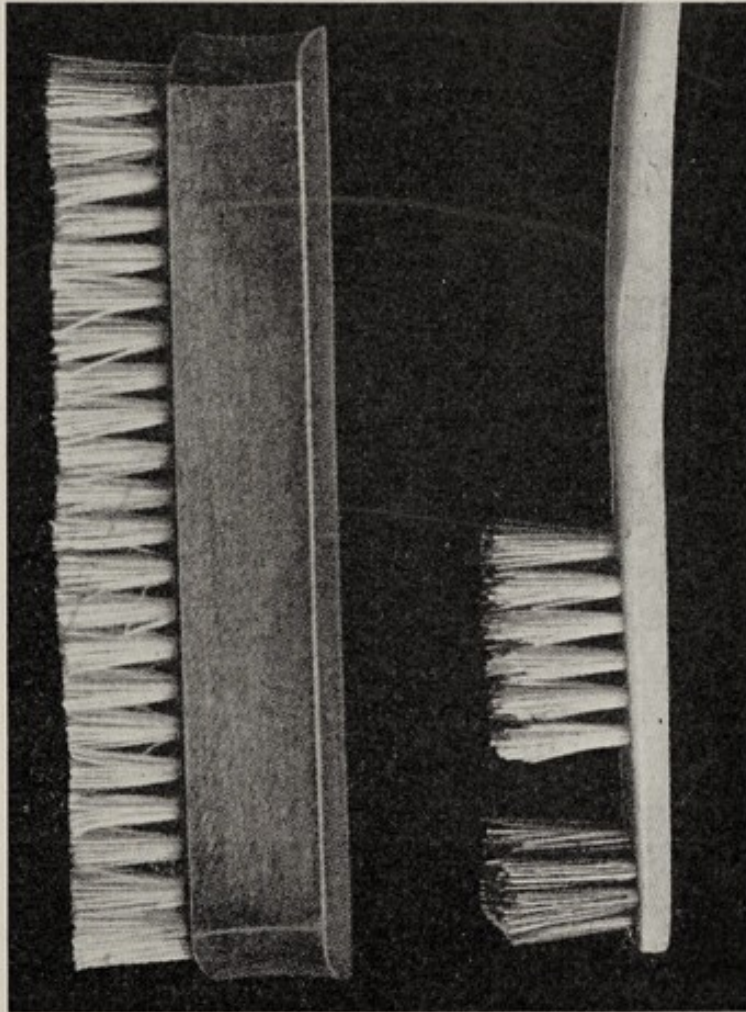


FIG. 630.

FIG. 631.

over which the denture fits, should receive a very thorough cleaning with a brush — one having bristles rather softer than those used for cleaning natural teeth. This will remove all deposits and dead epithelium which may have collected under the denture, and give to the tissues a sense of comfort.

The mucous, which gives the denture a slippery feeling when it is removed from the mouth, is washed away by the running water. Deposits of soft calculus may not be removed by running water, but can be easily removed by vigorous brushing. For this

purpose, a small hand brush, with the bristles thickly set, should be used. See Figure 630. Nothing besides the brush and water is needed for cleaning the denture, though there is no objection to using a little soap. The brushing should be continued until the denture is perfectly clean in every part. The movements of the brush should include those necessary to bring the bristles through the embrasures between the teeth on both the buccal and lingual sides. That part of the palatal surface which lies next to the tongue, as well as the surface which comes in contact with the mucous membrane, should be made thoroughly clean. That part which covers the residual alveolar ridge should be brushed with a special brush, designed for the purpose, and care should be taken to reach every part of this surface. See Figure 631.

If there is calculus coming into the mouth, more or less of it will be deposited somewhere on the denture, and if the cleaning is neglected, this deposit will become so hard that it can not be removed by the brush. Whereas when the deposit is fresh, having accumulated between meals or over night, as the longest period between cleaning, it will be so soft as to be easily removed by brushing. Therefore, if one neglects the cleaning, the denture will soon be in such condition that it can not be well cleaned with the brush. Persons will soon learn that the deposits of calculus occur in the same places time after time. These are especially the buccal surfaces of upper dentures about the molars and the lingual surfaces of lower dentures in the incisor region.

Cleaning by the Dentist or Dental Hygienist

AS PREVIOUSLY mentioned, the dentist or dental hygienist, should direct the home care of the mouth and should, at stated intervals, recall each patient for a critical examination, followed by the cleaning of the teeth.

As suggested in connection with the making of mouth examinations in Volume I, a record should be made of each condition for which the patient's care is criticized, in order that this may be used as a reference for a further check-up at a subsequent appointment. As time passes, such a plan not only serves to stimulate the patient to maintain the best home care, but also enhances the patient's appreciation of the dentist's service. The record should include all areas requiring special attention, particularly deposits of calculus, areas which are not properly cleaned by the patient, and the slightest noticeable recession of the interproximal gingival crests.

The extent of the actual cleaning operations to be performed by the dentist will vary with the age of the patient and the thoroughness of the home care.

It will be remembered that the program for ideal service is oftentimes far from perfection in its operation. Regardless of

the dentist's efforts, the reaction by the patient may be very slight. Some have contended that the dentist should refuse to clean the teeth of those persons who do not manifest sufficient interest to give reasonable cooperation. That might be justifiable in an occasional case, but it would seem worth while to consider each person as deserving of special study, because there are few people, among those who are inclined to go to a dentist, who will not sooner or later come to realize that their teeth deserve a little of their own time and care. They should be recalled more frequently, if possible, for cleaning, to give their teeth the best protection until such time as their cooperation may be obtained. Each dentist should develop his own argument in the particular case from a study of the patient. Successful practice depends largely on an analysis of patient reactions.

Special consideration will be given at this time to those services which the dentist may perform to prevent the occurrence of caries and maintain the tonicity of the gingivæ. The procedures in treatment of inflammation of the gingivæ and periodontal membrane are, for the most part, discussed in Volume IV.

The dentist should be constantly alert to the varying conditions which present and should use every possible means to enhance the effectiveness of the patient's care. As the several teeth erupt and come into their respective positions in the arch, he should note particularly the proximal contours and should often modify embrasure widths by the use of disks, in order that the natural cleaning in mastication, as well as the home care, will reduce the surface areas of liability. Methods of doing this are presented elsewhere, as are all other services which are helpful in preventing the beginning and progress of caries.

CLEANING THE TEMPORARY TEETH.

Previous to the time of the eruption of the first permanent molars, the cleaning of the temporary teeth is usually a rather simple procedure, particularly if there is reasonable cooperation in the home care. If the temporary teeth are in good condition, most children chew vigorously and the teeth and gums will be kept clean and in healthy condition. It can not be emphasized too strongly that the dental service program, by which the temporary teeth are kept in good order, is in reality the most important factor in maintaining the best hygiene of the mouth.

There may be some stain on the teeth, usually close to the margins of the gingivæ; it may vary in shade from green to brown or black. It may be easily removed with an orange wood stick in a porte polisher, or with a very small brush, a rubber disk or cup in the dental engine, and a little polishing powder. As a rule, children prefer the hand polisher to the dental engine, yet there is

a definite advantage in the use of the engine, occasionally at least, in performing a service which will certainly not be painful. The child is less likely to object to the use of the engine later on for cavity preparations. In many cases, it will be desirable to use both the hand instruments and the engine.

CLEANING THE PERMANENT TEETH.

In cleaning the teeth, as in all other preventive procedures, one should have constantly in mind the broader health relationship of this service. As has been mentioned, the enamel is the first line trench, which protects everything beyond, and prevents caries of dentin, pulp involvement and its sequelæ of alveolar abscess and systemic infection; just as the gingivæ constitutes the first defensive line against disease of the peridental membrane and systemic infection. The cleanliness of the mouth is the dentist's first battlefront in preserving the integrity of the enamel and the health of the gingivæ. This service, therefore, assumes a far reaching importance, which should elevate it to a plane that will justify the most critical study of, and careful attention to, the changing conditions in each mouth with advancing years, in order that it may be kept in the highest state of health and efficiency.

This presentation will be confined rather closely to the service designed to maintain mouth health, rather than to treat disease. It will, therefore, be directed mainly toward the prevention of decay, but will include mention of deposits of calculus attached to the enamel, the removal of which will usually permit the gingivæ to recover from the inflammation and injury caused by the deposit. The more extensive involvements of the supporting structures are considered in Volume IV, where the technic of removing deposits of calculus is given in detail.

The frequency with which a particular patient should be recalled for cleaning the teeth should depend upon many factors, but chiefly upon the degree of susceptibility, the cooperation in home care and the age. A standard of frequency in relation to age has been mentioned. Variation from this should depend upon the dentist's estimate of the susceptibility, which is of course in part a reflection of the home care.

TECHNIC OF CLEANING BY THE DENTIST.

ROUTINE. There should be a definite routine of procedure. If there are irritations of the gingivæ from any cause, these should preferably receive first attention. Each group of areas, into which beginning decays have been classified, should receive separate consideration—pits and fissures, proximal areas and gingival third areas.

THE GINGIVÆ. Lack of tone or definite irritation of the gingivæ during the childhood period is usually due to lack of clean-

liness of the surface of the enamel along the gingival margins; more frequently on the labial and buccal than on the lingual surfaces. The movements of the tongue usually keep the lingual surfaces clean throughout the childhood and early adult period.

The first slight deposits of salivary calculus may occur at almost any time after the tenth or twelfth year and will appear as a fine line along the margins of the gingivæ to the lingual of the anterior teeth and, generally at a later time, on the buccal surfaces of the upper molars. Deposits of serumal calculus on the enamel, beneath the unattached portion of the gingivæ, occur as a rule later than deposits of salivary calculus. Further consideration is given to deposits of both types in Volume IV.

For the maintenance of the health of the gingivæ it is necessary that the gingival portion of the enamel be thoroughly cleaned and polished. If deposits of salivary calculus are present, they should be removed first, as a matter of convenience in carrying out other procedures. The four scalers to the left in Figure 613 were designed for this purpose. Except for very unusual cases, deposits of salivary calculus are not covered by the gum tissue and are easily

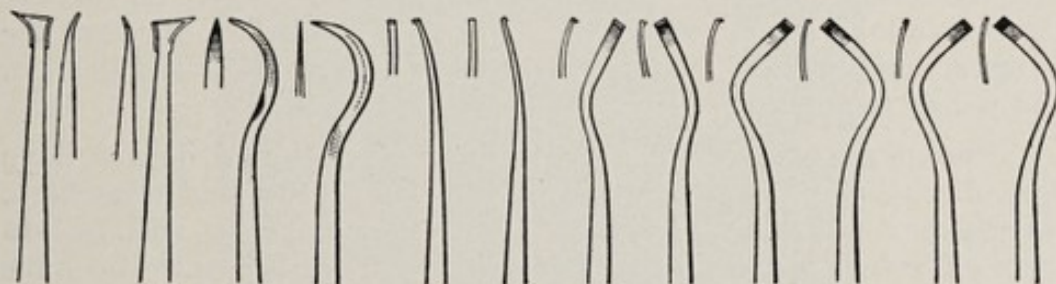


FIG. 635.

removed. The deposits about the lower incisors should be removed first; next, any other similar deposits on the lower teeth, and then the upper teeth, with especial attention of the buccal surfaces of the molars.

For all stains and deposits, one may begin with the buccal surface of the tooth farthest back on the lower left side, and then take in order the buccal and labial surfaces around the arch to the tooth farthest back on the right side. An orangewood point in the porte polisher, with a polishing powder, may be used to remove stains and accumulations, other than calculus. An appropriate pull scaler, see Figure 635, may be gently manipulated in the sub-gingival space to locate and remove deposits of serumal calculus. Similar deposits may be found on the enamel of proximal surfaces; either push or pull scalers may be used in removing these deposits, depending upon the access to the particular tooth surface.

The technic of manipulating scalers is given in detail in Volume IV.

APPLICATION TO DENTAL CARIES. The value of cleaning by the dentist in preventing dental caries is in direct relation to the sus-

ceptibility and to the home care. The need for cleanliness has already been stated.

PIT AND FISSURE DECAYS. The defects are such that micro-organisms may grow in them without being disturbed unless artificially removed. The acid formed in the deeper portions is directly applied to the enamel. The majority of these decays occur early, soon after the teeth erupt. It would seem reasonable to conclude that these decays would require the most aggressive efforts, both as to the detail and frequency of the cleaning, to be successful. It would require the earnest coöperation of the patient by proper daily care. And the effort must be continued from the earliest time in the childhood period of the permanent teeth to and, for most persons, beyond even middle age; for almost the lifetime.

It should, therefore, be the rule to prepare cavities and make restorations for all pits and fissures, whenever there is a sufficient pit or crevice to cause the finest exploring tine to penetrate far enough to resist easy withdrawal. The surface is thus rendered completely self cleansing in mastication, and should give no further concern so long as the restoration is in good condition. If there are irregularities in these surfaces, a brush wheel may be used to clean and polish them.

PROXIMAL DECAYS. The beginnings of proximal decays have been discussed in consideration of the home care, and elsewhere. However, it must be recognized that most patients will fail in their efforts to prevent decays of this class. In persons who have exhibited a high degree of susceptibility, as evidenced by the occurrence of pit decays within two years after the eruption of the first molars, it seems desirable that the most thoroughgoing program of immunization of proximal surfaces be inaugurated, as described under the technical treatment. Also, that this be combined with the use of silk floss by the patient as already discussed. Under this arrangement, the dentist will not only clean these areas of liability by rubbing them with the floss, but also further immunize them with silver nitrate by moistening the floss with the solution. If this treatment has not been inaugurated when the first proximal decay is discovered, the routine by the dentist and patient should be undertaken without delay.

GINGIVAL THIRD DECAYS. These occur in fewer mouths and later in life than other decays, most of them after the twentieth year. They occur in positions which are so easily reached by the tooth-brush in the hands of the patient that it would seem unnecessary for the dentist to undertake to treat them by cleaning operations. It has been satisfactorily demonstrated that the patient can prevent these decays by proper brushing, and there is much room for question as to the effectiveness of cleaning by the dentist alone. In other words, unless the dentist has the coöperation of the patient

by proper brushing, he will not succeed; and if these areas are properly brushed by the patient, his services are unnecessary.

Cases which present with beginning decays of very slight depth in these positions may be ground smooth and polished to facilitate the cleaning. Grinding should not be done unless there is an actual beginning of caries.

POLISHING. The hand polishers are usually to be preferred for the final polishing of the teeth, after they have been cleaned. Two forms of orangewood, one round and tapered to a point, the other wedge shaped, are used for this purpose. See Figure 636*. The orangewood points should be dipped into a fine polishing powder, to which a few drops of peroxide of hydrogen or water have been added. The labial and buccal surfaces of all of the teeth should be polished with the stick of wedge form, with rather heavy pressure, rubbing the enamel back and forth, while maintaining a thumb or finger rest, preferably on the teeth of the same jaw,

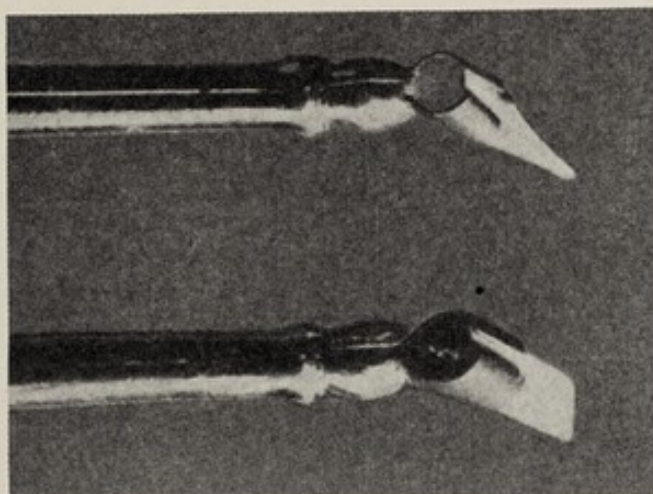


FIG. 636

in order that the movements may be under the best control. The bulk of this polishing should be devoted to the gingival third areas of liability to decay. In mouths in which the susceptibility is extreme, the gingival third areas on the lingual surfaces of the molars should also be polished.

The round orangewood point should be used for polishing the enamel of all proximal surfaces, with particular attention to the area of greatest liability to decay, immediately to the occlusal or incisal of the crest of the septal gingivæ. It is considered inadvisable to apply the point of the stick to the enamel immediately to the gingival of the contact point, except in cases in which the gingiva has already receded sufficiently to give room for it. The use of a silk floss, loaded with pumice, is to be preferred, because it

*From text book on Mouth Hygiene, by Alfred C. Fones.

presents less danger of injury to the soft tissues. In all manipulations with the wood points, care should be exercised not to injure the gingivæ, as one of the important considerations is to maintain the knife-like edge of the gingivæ in all positions.

Wood points, rubber disks, cups or brushes may be used in the dental engine for the polishing just described. These present a greater danger to the gingivæ from trauma, due to the speed with which the shaft revolves and the difficulty of access in some positions. They should be manipulated with great care, and the points, disks, cups or brushes should be so small that they may revolve within the crescent formed by the gingivæ on the buccal or labial surface of each tooth, otherwise the area of greatest liability to decay on these surfaces can not be thoroughly cleaned without injury to the gingivæ.

It should be understood that nothing is to be gained in the prevention of decay by polishing areas of enamel which are habitually immune. However, the luster of these surfaces may be increased in polishing them by either method.

Immunization of Beginning Decays with Silver Nitrate

SILVER nitrate has been used for many years for immunization of superficial areas of decay in positions in which the areas blackened by deposits of silver salts were not exposed to view. Until in recent years silver nitrate crystals were used and the silver was deposited by direct sunlight, or in some cases by reflected light. Its application to the permanent teeth was therefore limited very closely to occlusal surfaces of the molars and occasionally a gingival third area on a lower anterior tooth. It was also applied to proximal areas on the temporary teeth, particularly in cases in which the bulk of the decay had been removed with a disk and a smooth flat surface remained.

The preparation of ammoniated silver nitrate, announced by Dr. Percy R. Howe in 1917,* and advocated for the sterilization of infected root canals, has gradually come into use for the treatment of caries. The following statement is copied from "Accepted Dental Remedies", 1934, page 148, published by the Council on Dental Therapeutics of the American Dental Association: "The end product of the application of silver nitrate to carious areas is probably a mixture of silver proteينات and reduced silver, owing to the action of light and other reducing agents. In order to hasten the reduction of the silver salt, the use of the complex silver ammonium compounds as the nitrate or the oxide ($\text{Ag}(\text{NH}_3)_2^+$) was introduced. The solution as prepared contains approximately 30 per cent of readily reducible silver. Its most important use in dental practice is based on its ready diffusibility into the dentin. The finely divided silver which is laid down by this process in carious dentin retards the progress of dental decay. When judiciously used, it is said to arrest completely the course of caries."

James M. Prime reports† his clinical experience in the use of Howe's preparation over a period of years, but particularly during the period from 1930-1935, for disclosing and immunizing decays of enamel, also for the "sterilization and metalization" of carious dentin. The present consideration is of its use for the treatment of beginning decays of enamel. The use of this solution for the discovery of beginning decays is presented in the first volume of this work.

TECHNIC OF APPLICATION. Figure 641 is from a photograph of a temporary cuspid to which silver nitrate was applied soon after it

* Dental Cosmos, 1917, Vol. LIX, p. 481.

† Dental Cosmos, Vol. 77, 1935, p. 1046.

was extracted. It shows a definite area of caries in the enamel, although there was no cavity. Figure 642 is a mesio-distal section through a central incisor, showing a penetration of the silver into the carious dentin on the mesial surface, also a decay on the distal surface which had not completely penetrated the enamel.

Figures 643 and 644 illustrate two methods of applying the silver nitrate solution to the proximal surfaces of the upper central incisors with silk floss. In Figure 644, the floss has been tied tightly in the position ordinarily occupied by the saw in the Koerber saw frame. The interproximal space and the proximal surface of the teeth should first be cleaned. They should then be doused with equal parts of peroxide and water. A gauze roll should be placed under the upper lip and a blast of air blown on the teeth from both the labial and lingual directions to dry the surfaces thoroughly. The silk should then be carried past the contact point,

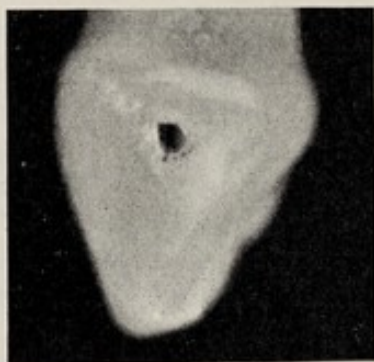


FIG. 641

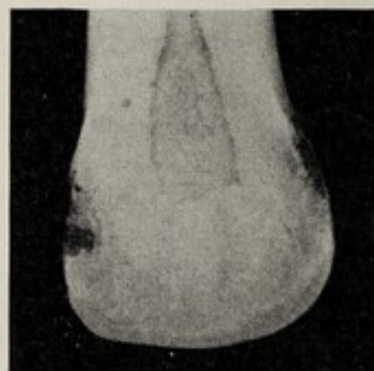


FIG. 642

when a drop of the solution should be picked up with a pair of cotton pliers and applied to the ligature over a space of from one-half to three-fourths of an inch. This portion should be drawn between the teeth and rubbed back and forth with some pressure over first one and then the other proximal surface, at the position a little to the gingival of the contact point. The ordinary waxed floss is used and care should be taken to hold the labial end straight out from the mouth to avoid the application of the solution to the labial surfaces of the teeth. A new piece of floss should be used for each space.

If bright sunlight is available the silver salts may be deposited by that means within a few minutes. Otherwise a very little eugenol may be applied with a bit of cotton rolled hard and to a point. The entire area to which the silver nitrate solution was applied will turn black almost immediately. However, it requires a little time for the metallic silver to be deposited and it should be allowed to stand for three or four minutes, while a similar treatment is applied to the teeth of the next interproximal space.

The entire area should be dried with pellets of cotton and the

air blast. Any remaining discoloration of the enamel may usually be rubbed off with a pellet of cotton, although it will occasionally be necessary to use a strip or a disk.

Figures 645 and 646 illustrate a method of removing any portion of stain that shows and is therefore objectionable. Figure 645 shows a method of securing slight temporary separation. A piece of rubber dam, about half an inch wide and three inches long may be twisted, then stretched and placed between the teeth in the position of the contact. Within two or three minutes there should be just enough separation to permit the finest strip to be carried past the contact. The strip should be narrow, so that the enamel which forms the contact will not be reduced. Figure 645 shows the piece of rubber dam in place between the teeth and Figure 646 illustrates the use of the strip in removing the deposit. The entire super-



FIG. 643

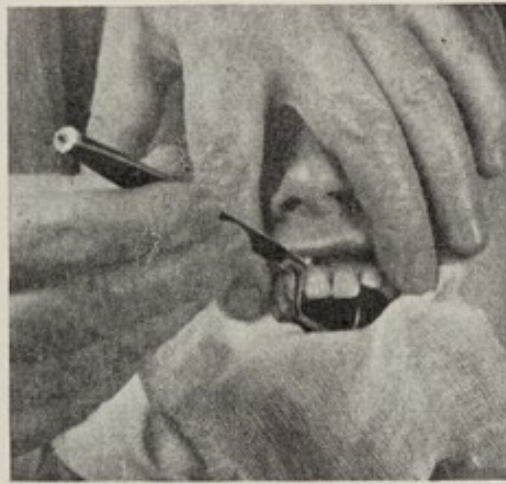


FIG. 644

ficial area of decay may be removed, if desired, and the surface polished.

The application of this solution to the proximal surfaces of the incisors may be made without the use of the rubber dam, as is recommended by Dr. Prime. However, time will usually be saved by using the rubber and the surfaces of the teeth may certainly be kept absolutely dry for as long a period as may be desired. If the six or eight anterior teeth are included in the rubber, the application of the solution may be made in one interproximal space after another until all have been treated and this may be followed with eugenol applied to all the areas. Thus much of the waiting time will be conserved.

For satisfactory application to the proximal surfaces of the bicusps and molars it is essential that the rubber be in place. It is absolutely necessary that the areas be dry, if the etched areas are to be impregnated. In addition, much time will be saved. The

same technic may be employed as for the incisors, except that the saw frame may not be used far back in the mouth.

The application of this treatment to the occlusal surfaces of both the temporary and the permanent molar teeth may usually be made without the rubber dam, although one should, if possible, take advantage of the placing of the dam for some other purpose to apply the silver nitrate. Otherwise gauze rolls and the saliva ejector may be used. After the occlusal surfaces are dried with the air blast a sharp explorer should be carried along the full length of each groove to locate depressions, either pits or fissures. Considerable pressure should be used to dislodge any foreign matter that may have been crowded in. The air blast should then be used again to be certain that each surface is clean and dry. The treatment should be applied, regardless of the finding of defects. The fissure shown in Volume I, Figure 154, is too small for a fine explorer to enter, while the larger pit in illustration 158 will just ad-



FIG. 645

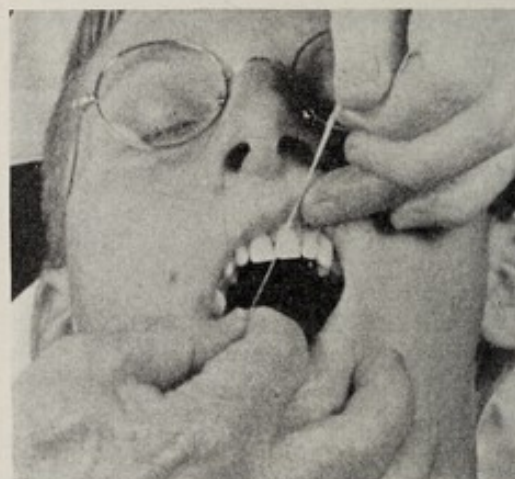


FIG. 646

mit such an explorer. Often the deeper portion of a smoothly rounded groove or pit is mostly composed of rather poorly calcified material, which may be etched a little from lack of artificial cleaning or lack of vigorous mastication. In any event no possible harm is done by the treatment, and it affords the earliest opportunity to detect the beginning of decay. If there is no etching, there will be no deposit of silver salts within the structure of the enamel. The application is made with a small, closely rolled pellet of cotton and considerable pressure should be used.

The proximal surfaces of the temporary molars are often difficult of access and difficult to keep dry during the period previous to the eruption of the first permanent molars. In some cases a rubber dam may be applied; in many it should not be attempted. However, the best effort should be made to maintain dryness. The solution may be applied with a wisp of cotton

wrapped on a smooth broach, or with a ligature as described. The space between the cuspid and first molar is less difficult than that between the molars.

It seems undesirable to consider the temporary anterior teeth, or the permanent lower incisors and cuspids, as the separation of these temporary teeth limits the occurrence of proximal decays and the permanent lower incisors seldom decay. However, in cases of extreme susceptibility, the permanent lower incisors should have this treatment.

Gingival third decays in both the temporary and permanent teeth should be prevented by proper brushing. Applications of silver nitrate should, as a rule, be made only in cases where whitened areas are discovered or a cavity has occurred. Then the treatment should be applied to all gingival third areas where the stain would not be noticeable, and the rubber dam should generally be placed to assure the dryness of the field.

EFFECTIVENESS OF SILVER NITRATE TREATMENT. Whenever, in using silver nitrate for the discovery of beginning decays, an area of enamel is blackened by the deposit of silver, that is an immunization treatment of caries. The silver will not be deposited in the enamel unless the surface of the enamel had been etched previously by the acid, excepting in cases in which the enamel was imperfectly formed.

The word *immunization* is used in preference to *prevention* in describing the treatment of caries with silver nitrate. Presumably it has no effect whatever on normal enamel and its application to normal enamel is of no value in preventing decay. Therefore, the object should be to treat the areas of liability at sufficiently frequent intervals to discover the earliest etchings of the surface of the enamel. The deposit of the silver in these etched areas seems to establish a degree of immunity. It is conceivable that the immediate area is immunized but that a new growth of organisms might occur on the immunized spot without damage to the structure of the tooth; also, that the colony might overgrow the immunized area and form acid which would etch the enamel beyond. Another application would immunize this area, and the process might continue until the entire area of liability should become immunized.

It seems desirable therefore to establish certain more or less arbitrary rules for the systematic use of silver nitrate as an aid in the control of caries, particularly for children, and this will be done in considering the treatment of several classes of cavities in both the temporary and permanent teeth.

It should be emphasized here that the use of silver nitrate as a disclosing and immunizing agent should be undertaken only with the understanding on the part of both the patient and the dentist that it requires considerable time and carefully directed effort to apply it effectively. It is of greatest importance that the tissue to which it is to be applied be absolutely dry, and this requirement

presents unusual difficulties in the mouths of young people. It should be looked upon by all parties concerned as a serious effort for the conservation of the teeth, which if successful, is of greater value than many carefully planned and perfectly executed restorations.

PENETRATION OF THE DENTIN. In many cases it will be found that decay has penetrated the enamel and has also involved the dentin, as illustrated in Figure 602. If the solution is properly applied under conditions of complete dryness, the silver will be deposited to the full depth of the carious dentin, and a bluish shadow will be observed through the enamel. In all such cases the tooth has been so extensively involved that a cavity must be prepared and a restoration made. Normal dentin will not be stained and the removal of all the carious dentin — all of the blackened dentin — will eliminate the shadow in the enamel. Incidentally, the undecayed dentin will be found to be less sensitive.

SILVER NITRATE STAINS. Silver nitrate will not stain enamel that has a normally hard glazed surface. It will very definitely penetrate and stain many areas of mottled enamel. It will stain many white spots in the enamel — spots which lack cement substance between the enamel rods. It will stain silicate cement restorations, also the margins of porcelain inlays and checks in the enamel. It should not therefore be applied recklessly, but its application should be limited as closely as possible to the immediate areas of liability. It will also stain the skin or finger nails, but not the mucous membrane. Stains of the skin may be removed with a saturated solution of potassium iodide. A disk will polish the stain from the nails.

ARGYRIA. The excessive use of silver nitrate internally results in the condition known as argyria, in which there occurs a deposit of minute particles of silver in the skin, which cause the skin to take on a peculiar metallic grayish discoloration, which remains permanently. There is no danger of such a sequella to the use of ammoniated silver nitrate as here recommended.

PREPARATION OF AMMONIACAL SILVER NITRATE. This solution is unstable and must be reasonably fresh to be efficacious. Therefore an arrangement should be made with a druggist to prepare a specified amount of the solution twice each month. It is inexpensive. It may be prepared by placing 3 grams of clean silver nitrate crystals in 1 cc. of distilled water. This should be heated, without boiling, and stirred with a glass rod until the crystals are dissolved. It should be allowed to cool to room temperature, when $2\frac{1}{2}$ cc. of 28% ammonia should be slowly added with stirring. This will throw down a black precipitate of silver, which is soluble in an excess of ammonia. A very little more ammonia may be slowly added, but the precipitate should not be wholly dissolved. The solution should then be filtered. It should be kept in an amber bottle with a glass stopper.

Treatment of Dental Caries by Restorations.

After decay has made a cavity in a tooth, the only treatment that has thus far been found effective in preventing its progress or in curing the decay has been the complete removal of all of the carious area and making a restoration with some substance that is durable. This treatment would seem to be violating the principles of physiology and pathology. The materials used for restorations cannot be placed in the soft tissues without causing more or less irritation; there will be a reaction against the presence of a foreign body, whether it be in the soft tissues or in bone. Any plug that may be placed in living bone will be loosened by absorption about it within a short time. In the teeth it is different. No irritation is produced in the dentin, except such as is caused by cutting the dentinal fibrils in the preparation of the cavity. This is manifested only in the production of pain. No absorption of the dentin occurs about the restoration. If the conditions as to the circulation, or the disposition to absorption or to inflammation that are manifested in bone were present in the teeth, it would be impossible to make artificial restorations; as a matter of fact, if such conditions existed, restorations would be unnecessary, as the tissue would have the power of self-repair. This emphasizes the fact that the structures of the teeth constitute a special class of tissue, the pathological conditions of which are different from those found in other parts of the body.

For artificial restorations to be successful, they must be very minutely performed. Cavities must be absolutely dry and clean when restorations are placed and the restorations must hermetically seal the cavities if recurrences of decay are to be prevented.

CURATIVE EFFECT OF RESTORATIONS.

Restorations are curative by shutting out everything from contact with cavity walls. They do not remove the tendency to caries. The curative effect of a restoration has beyond this a prophylactic effect that is important, and how far this will extend will depend directly upon the judgment and skill displayed in laying the outlines of the cavity and in shaping and finishing the restoration. If the outlines are so laid that a colony of micro-organisms may cover it and grow over its margins, it will not protect the area of liability; decay may begin again close beside the restoration. The enamel margin is the vulnerable line. The restoration itself, its own area, if it is made well and of material that

is durable in the mouth, is invulnerable. The shape given the surface of the restoration has much to do with the protection of its enamel margins and the health of adjacent tissues. Then, in order that a restoration may be protective, the margins of the cavity must include the vulnerable portions of this area.

Restorations are prophylactic in a very much broader sense. A restoration replaces a cavity which afforded opportunities for the collection of material for fermentation and the formation of other products of decomposition. If the contact point is properly made in proximal restorations, the tendency to lodgment in the interproximal space is removed. This affords a protection to the immediate parts and to the neighboring gum tissue. The restoration becomes prophylactic in a very much wider sense than the local curative effect, because it not only protects the immediate surface liable to decay, but the surrounding parts as well. It is also prophylactic in a still broader sense, in that it gives the natural use of the tooth; a tooth that was sensitive, which the patient avoided chewing upon, is brought again in full use. That full use extends to the health of the whole side of the mouth. Patients often, on account of one sensitive tooth, will avoid the use of that side of the mouth, chewing entirely upon the opposite side. In this way a single operation, by restoring full usage of the teeth, may serve to protect and guard the whole side of the mouth against future decay and against disease of the gums and peridental membranes. In this sense the prophylactic effect of the restoration is wide and important. It is also important in a broader sense again than this, for, by giving the full use of the apparatus of mastication, food is more perfectly masticated, is placed in a better condition for digestion, and the health of the individual is promoted.

What should be considered a permanent restoration? This question might be answered in various ways. Many restorations, made with what we ordinarily speak of as permanent materials, are not expected to last very long. Under some conditions, a restoration that protects the teeth for two or three years should be regarded as doing good service, particularly for children, where the conditions under which the operation is performed are very unfavorable. Other conditions, such as general nervousness, sensitiveness that cannot be well overcome, etc., contribute to the difficulties of making restorations, so that they can not be performed in the most thorough manner. A restoration that will protect and prevent depth of decay, even if it does not prevent the broadening of cavities, is sometimes justified for its value in conserving the pulp until such time when a second operation may be made under more favorable conditions. A restoration should practically last a lifetime if it is to be considered permanent. No dentist will be able to operate with that perfection that will make every restoration really permanent, but a large percentage of restorations should last a lifetime.

The conditions under which restorations are least likely to be permanent, even when well placed, are important. More restorations made for children will fail than for adults, because conditions are such that they are not likely to be as well made. In making restorations for the older persons, the conditions should be better, the patients will be under better self-control, and operations that will be really permanent should be very generally made. It is therefore, often a question of fine judgment when permanent restorations should be made for children.

SELECTION OF MATERIALS FOR RESTORATIONS.

The selection of the material that will make the best restoration in a particular case should generally depend upon the consideration of a number of things which may be listed, as follows:

Physical properties of the several available materials, which have already been discussed.

Personal equation of the operator in the manipulation of these materials.

Age and therefore the life expectancy of the patient.

Susceptibility to caries in relation to the age.

Tooth, type of cavity and its position in the tooth.

Opportunity to apply the rubber dam.

Condition of the peridental tissues.

Esthetics of the case.

Question of the fee.

Question of time required for the operation.

It is apparent at once that the problem is not a simple one. There is the further complication that there should be reasonable uniformity in the plan of selection for each person, particularly for young people. It is not a good plan to use both gold and amalgam in the same mouth, except in some orderly arrangement. It should not be a hit or miss affair. There should be a line drawn between the two; amalgam may be decided upon for all the molars, but not farther forward, or only where it will not be visible. A decision should be arrived at as early as possible as to the material to be used in various locations in the mouth, and this should be adhered to, unless there should be a real reason for deviation. This determination for small proximal decays in the anterior teeth is of greater importance than for any other class of cavities at the present time, because of the conflict of the more durable materials with esthetic requirements.

GOLD FOIL offers the opportunity, on the basis of its physical qualities, to make the most perfect restorations that can be made; it has everything to be desired in a restoration except the esthetic quality of good appearance. It requires more time to master the technic of manipulation, but once learned it is, for most operators, very satisfactory from the viewpoint of the perfect and lasting

restorations that can be quickly and easily made. Gold foil should be the material of preference for all fairly small restorations in cavities of easy and direct access, also for small mesio-occlusal restorations in bicuspid and for all proximal cavities in the anterior teeth which do not extend labially beyond the area of liability to surface spreading, and do not involve the incisal angle. The esthetic objection to the showing of gold in the anterior teeth contra-indicates its use, and a decision must be reached in each case, whether to use gold foil, or some other material. Gold foil will more certainly preserve the tooth throughout life than any other material.

Gold foil is particularly desirable for children past ten or twelve years of age, because it is likely to last longer than any other type of restoration and the life expectancy of children of that age is fifty-five or sixty years. It requires less time than a gold inlay for the type of cavity suggested, as it may be completed at the same sitting at which the cavity is prepared. It should be used more, rather than less, during periods of great susceptibility. For a given carious area, the prepared cavities for foil usually involve less tooth structure than cavities for inlays. Gold foil is contra-indicated when the peridental membranes are weak.

AMALGAM ranks next to gold foil as a material for restorations. Scientifically prepared amalgams, properly manipulated, are practically the equal of foil, except for the fact that it is not possible to take advantage of the elasticity of the dentin in condensing amalgam. The use of amalgam is limited to cavities in the bicuspid and molars, on account of its bad color. It should generally not be used for mesio-occlusal or buccal surface restorations in upper first bicuspid, and it is contra-indicated in the same positions in upper second bicuspid in the teeth of persons who show these teeth when smiling or laughing. Otherwise it is suitable for all classes of cavities in the bicuspid and molar teeth.

Amalgam requires practically the same cavity preparation as gold foil for pit and fissure and buccal gingival third restorations, and its use in proximo-occlusal restorations involves technical difficulties about equal to those for gold inlays. It is therefore in strong competition with both gold foil and the gold inlay in the posterior teeth, and it is probable that a larger number of restorations are made with amalgam than with all other permanent materials combined. It should be the material of choice for pit and fissure cavities in the temporary teeth, and in first permanent molars during the first few years after eruption, because of the short time required in placing the restorations. This type of restoration may be made for a smaller fee than either gold foil or a gold inlay. It is the writer's belief, without having made a sufficient actual count, that well made amalgam restorations last longer, on the average, than gold inlays. The manipulation of

amalgam is very easy for cavities with four surrounding walls; for all other cavities the missing wall or walls must be supplied with a matrix and sufficient separation must be secured for proximal restorations to provide a strong contact after the restoration is polished, thus adding to the technical difficulties. Amalgam restorations must be polished at a subsequent appointment.

GOLD INLAYS offer one principal advantage over gold foil and amalgam for proximal restorations; the most perfect contours can more certainly be made in practically every case, because of the opportunity to try the restoration in place and then modify both the contact and the general contour to make them the most perfect possible, before the inlay is cemented. This is especially advantageous in preserving the health of the interproximal tissues.

For this reason gold inlays should usually be selected in preference to amalgam or gold foil for all disto-occlusal and for large mesio-occlusal restorations in bicuspid and molars, except in cases in which the fee is a matter of important consideration. They are also to be preferred for large buccal cavities in molars, which extend under the gum margin, also for very large occlusal restorations. The requirements in cavity preparation for the gold inlay in proximal cavities in the anterior teeth, which necessitate considerably more cutting, should limit its use in these positions, except in cases of extensive decays, which may or may not involve the incisal angle, in the mouths of persons who show their teeth very little, or who prefer restorations of greater stability than can be made with other materials, regardless of the appearance.

Gold inlays may be made of any desired hardness, by choosing between the various alloys available. The weakness of the gold inlay is the cement used to seal the joint with the cavity walls, plus the additional hazard of the presence of moisture when inlays are cemented without applying the rubber dam. The principal technical difficulties are in the cavity preparation and the making of wax patterns. The casting process has been scientifically developed to the point where castings may be made which are uniformly as close to exact dimensional reproductions of the pattern as are practical for cementation.

PORCELAIN INLAYS. The unusual difficulties in the technic of making restorations of porcelain, which are complicated by the necessity of exactness of shade, also by the translucency and the modification of both shade and translucency by the cement with which the inlays are luted to place, greatly limit the use of this material. Porcelain inlays are definitely indicated in positions exposed to view — proximal and gingival third restorations in the upper anterior teeth, also in the bicuspid and molars as far back as these are visible in smiling and laughing, which varies much with individuals. Perfect contacts may be made and porcelain is

the only material available, other than gold, which is safe to use for proximal restorations in the incisors. The very gradual wasting of the cement along the margins eventually results in a slight discoloration which mars the otherwise fine appearance of these restorations.

A new technic for making porcelain inlays, which eliminates the necessity of a platinum matrix is presented elsewhere. Sufficient time has not elapsed to justify a statement at this time as to its reliability.

SILICATE CEMENT. The shade of the tooth may be more perfectly matched with silicate cement than with any other material, although, when used in proximal cavities in the anterior teeth, it places the health of the gingivae and the vitality of the pulp in jeopardy, and often fails to maintain its esthetic quality by washing out, or changing shade, or both. Until the silicate cements are improved to the point where a reasonable degree of permanence is assured, their use should be limited to restorations in cavities in positions in which the esthetic requirement is paramount.

THE PERSONAL EQUATION OF THE OPERATOR should in many cases modify the selection of the material to be used, notwithstanding the fact that the mastery of the several technics, except possibly that of porcelain in regard to shade, is within the reach of every ambitious and conscientious practitioner. There will always be operators who fail to meet the average in technical refinements in almost every operation, because of lack of comprehension of the pathological relationships, or lack of professional ideals which would compel them to give better service. However, there will always exist different degrees of ability in individuals in manipulation of the various materials, oftentimes because they master one technic in advance of others and more or less neglect the attainment of the finer items of technic in others. They are not well rounded in their training. Their use of materials is likely to be modified accordingly.

THE AGE OF THE PATIENT should be considered. The younger the person, the longer should the operations last. The most perfect operations with the most reliable materials should be made for young persons; the requirement for old people is the reverse. However, the greatest obstacles must be overcome in operating for young persons, and good judgment will determine the best time in point of age and physical and nervous reaction, when the most thorough operations should be undertaken. Many children should be carried through a period of years with the more simple operations, and the closest watchfulness to keep caries under control, until conditions are such that the dentist will have opportunity to make the best possible restorations.

THE CONDITION AS TO SUSCEPTIBILITY should generally direct the routine of procedure. Special attention should usually be given

to all conditions which might help to reduce susceptibility, such as the elimination of sensitive areas by placing temporary restorations of cement and urging the most thorough home care, vigorous mastication and attention to the diet. Inquiry should also be made regarding physical defects which might be related and to the general health. Later on the case will fall into line for more nearly regulation treatment. No greater mistake can be made than to place a considerable series of restorations, with much pain in the cavity preparations, during a period of extreme susceptibility, only to have them fail within a comparatively short time. It is a failure of judgment in management which is very unfair to the patient.

THE TOOTH AND TYPE OF CAVITY in relation to the selection of materials for restorations will be discussed in connection with the consideration of cavities of various classes.

OPPORTUNITY TO APPLY THE RUBBER DAM. More lasting restorations may be performed with each and every material if cavities are absolutely dry when they are placed. As a rule, this can only be assured when a dam is used. However, in many cases conditions are such that the rubber cannot be properly applied, or if it is, the clamps and other appliances interfere with the technical procedures of the restoration. The selection of materials must be modified accordingly. In the posterior teeth, where such difficulties most frequently present, it will often be best to use copper cement or base-plate gutta-percha in preference to any of the more permanent materials.

THE ESTHETICS as a guiding factor have already been discussed in considering the qualities and manipulations of the various materials. Further attention will be given to this subject in connection with the treatment of cavities by classes.

THE QUESTION OF THE FEE must often be a deciding factor in favor of the more extensive use of amalgam. It could hardly justify the use of cement, except with the understanding that cement is used to postpone permanent restorations for a few months. In the long run of years it is of importance, for persons of limited means, to adjust service as much as may be practicable in favor of lower fees.

THE QUESTION OF TIME is usually of importance in service for children, also for very nervous older persons and for persons who are in poor physical condition. Their courage and strength may be conserved by the selection of materials which require the minimum of time. This suggests the use of copper cement and amalgam in the back teeth and zinc phosphate or silicate cements in the front teeth until they may be replaced with materials of choice.

The selection of materials will receive further consideration in the discussion of the treatment of cavities by classes.

Painless Cavity Preparation

The dentist is confronted with many problems in which special consideration must be given to the symptom of pain. These include the severe paroxysms of tri-facial neuralgia; pain in other regions reflected by the fifth nerve, pain resulting from inflammations of the pulp and of the supporting structures of the teeth, etc., all of which are considered elsewhere. In addition, the dentist himself causes pain in carrying out the technical procedures in the treatment of dental caries and other pathological conditions of the hard tissues of the teeth. So much pain is caused as to be a considerable factor in the successful conduct of dental practice. If pain could be completely, or even very largely eliminated from the every day operations in cavity preparation, the conservation of teeth of a tremendously larger number of persons could be effectively accomplished. Many persons, who really are anxious to preserve their teeth, but dread the pain which the dentist inflicts, do not come to the dentist until discomfort requires. If pain could be avoided, they would be whole heartedly cooperative, their need for the dentists' services would be less and the conservation of their teeth greatly enhanced. In addition, the dentist could operate more rapidly and save much time. As the individual practitioner appreciates the effect that the diminution of pain may have on his own practice, he is likely to take more interest in this much neglected phase of dental service.

The treatment of sensitive dentin for the purpose of relieving or limiting pain in the excavation of cavities, has been prominently before the dental profession since the first discovery of anesthesia, and, perhaps, for many years before that time. Nothing would be gained by a recital of the many methods which have been enthusiastically promoted, and with each of which a limited number of practitioners have apparently achieved a considerable degree of success, although the majority have failed and, one after another, these methods have been discarded.

The thermal sensitiveness of the teeth must be considered in discussing pain caused in cavity preparation. It is a peculiar painful sensation caused by thermal shock. It is entirely different from sensitiveness of dentin. It is a true hyperemia, which is a normal reaction and, though painful for the moment, does no actual harm, unless too often repeated. If frequently repeated, it may result in injury to the thin walls of the blood vessels of the pulp and eventually cause its death.

Thermal sensitiveness may be caused by taking ice water or hot coffee into the mouth, by a disk which generates heat in polishing a restoration, by a bur which generates heat in the dentin because it is dull, or is revolved too fast, by the exposure to the air of a considerable extent of dentin in a large cavity, etc. Any restoration which arouses thermal sensitiveness as a result of

slight changes of temperature is especially dangerous to the vitality of the pulp because the shock is likely to be frequently repeated.

CAUSES OF PAIN IN CAVITY PREPARATION. As a rule, it may be said that progressive decays in teeth with vital pulps are sensitive to any form of mechanical interference. This sensitiveness varies greatly in different persons and in different carious cavities in the teeth of the same person. The great variation in sensitiveness of normal dentin is remarkable.

For all practical purposes in cavity preparation, it may be said that pain in cutting enamel may be due to either of two causes: (1) To heat generated by friction of a bur or stone, which is transmitted to the dentin along the dento-enamel junction. (2) To the vibration of the tooth by the slight roughness of a stone in grinding the enamel. The vibration of a stone will put an occasional patient on edge, upsetting the entire nervous system, within a few minutes. The pain caused by the bur may be eliminated by using a smaller and oftentimes a sharper bur, revolving less rapidly. The heat from the friction of the bur or stone may be prevented by the use of a stream of water constantly applied while cutting. Vibration may be prevented by using a fine, perfect stone, running at high speed with extremely light pressure.

In cutting the dentin in the preparation of cavities, pain may be caused in several ways. There are two types of painful sensations of the dentin to cutting instruments. One to actual cutting, as with a chisel; the other to a slight scraping of the chisel over the surface, without cutting. The latter is usually much more painful than the former. It arouses an extreme sensitiveness which seems to penetrate the entire nervous system. As a rule, a considerable cut, made with heavy pressure, using a sharp chisel, is the least painful of any cutting of the dentin. In cutting with a bur, pain is caused by the actual cutting, the same as with a chisel. If the bur is very sharp and is revolved slowly, it should cause no more pain than the chisel. If the bur is dull, or is revolved too rapidly it will generate heat which will cause thermal shock. The statement made relative to stones in grinding enamel, applies also to their use in cutting dentin.

Sensitiveness of dentin to cutting instruments is not materially different in teeth with carious cavities and teeth with normal dentin. The sensitiveness of dentin is greatest at the dento-enamel junction, where the fibrils are much branched. Broad and shallow areas of decay in buccal and labial gingival third areas are more sensitive than those of deeper penetration and less breadth. In all cavities the most sensitive areas are along the dento-enamel junction. Sensitiveness to cutting instruments indicates no especial danger to the pulp of the tooth, no matter how extreme it may be at the moment. This statement would not hold good for

a case in which the enamel is all removed in preparation for a porcelain crown, involving practically all of the most sensitive area of the dentin.

Sensation in dentin is transmitted through the dentinal fibrils. If these are cut off from any area, as by cutting out a section of the dentin part way between the pulp and the dento-enamel junction, sensation is immediately lost in the area of dentin containing the outer ends of the fibrils which were cut. Occasionally advantage may be taken of this in the preparation of cavities.

The fibrils which extend from an area of carious dentin to the pulp may be destroyed for a greater or lesser distance immediately beyond the decay, and that portion of the dentin may lose its sensitiveness. It may then be cut without causing pain.

From the above statements it will be observed that the pain caused in cavity preparation may be greatly reduced by using very sharp instruments with considerable pressure so that the cutting is accomplished with a few strokes, also by using none other than the sharpest of burs, revolved slowly. However, pain can not by this means be sufficiently reduced to make the operation acceptable to many patients as even reasonably painless.

PROCAIN INJECTIONS.

Cavities may be painlessly prepared after securing anesthesia by infiltrating the apical tissues or by nerve blocking with procain; infiltration being more generally used for the upper teeth and nerve blocking for the lower. However, only a comparatively few practitioners appear to be using this method as a routine procedure, presumably because the results in occasional cases are not satisfactory.

Dr. Hartman's Desensitizer.

On January 21, 1936, Dr. Leroy L. Hartman read a paper before a joint meeting of the First and Second District Dental Societies of the State of New York entitled "A New and Effective Means for Dentin Desensitization." The same paper was read before the Chicago Dental Society on January 27, 1936.* In this paper Dr. Hartman reviewed the writings of various investigators as to the method by which sensation travels to the pulp, also the many efforts which had been made to eliminate pain in cavity preparation. He then reported his own studies covering a period of about twenty years. The result is a solution which desensitizes dentin, apparently without any harmful results, and may be used effectively by a very simple technic. Dr. Hartman reported more than five hundred applications in cases in which the dentin was sensitive, with results very close to one hundred per cent satisfac-

*Bulletin, Chicago Dental Society, 1936, Vol. 16, Number 25, p. 4.

tory. At this writing more than two hundred cases have been carefully tabulated by members of the faculty of Northwestern University Dental School, with results similar to those obtained by Dr. Hartman, although the percentage of failures is higher.

Dr. Hartman began his more recent studies with the hypothesis "that the dentin must contain lipoids, which play an important part in the transmission of sensation in and through the dentin." This theory explained the fact that many remedies had been more or less successful in desensitizing dentin, as for example ether spray and chloroform, both of which are lipoid solvents. It also explained the sedative effect of the essential oils, which are soluble in lipoids.

Dr. Hartman therefore decided that it should be possible "to work out a topical application which would confine all of the action to the immediate vicinity of the application." He conceived the possibilities of a solution with a reversible action; one part of which would dissolve lipoids, while the other part would be soluble in lipoids. The lipoids might thus be subject to two opposing actions and if these could be properly balanced, the dentin would be desensitized for a considerable time. After many experiments, including clinical tests on sensitive teeth, a formula was developed which consisted of alcohol, ether and thymol. Alcohol and ether are lipoid solvents; thymol is soluble in lipoids, also in alcohol and ether, and may be crystalized out of the solution and remain on the surface of the dentin. Thymol is soluble in water in the proportion of about 1 to 1,000, and therefore not readily soluble in the saliva.

FORMULA. The formula, *by weight*, as eventually worked out, is as follows: thymol $1\frac{1}{4}$ parts, 95% alcohol 1 part, sulphuric ether (anesthetic) 2 parts. To maintain the proper balance of the solution, evaporation of the ether must be prevented. It should be kept in a brown glass bottle and stopped with a cork, which preferably has a tin lining. The solution should not be poured out into a dish but should be used by dipping a small pellet of cotton into the bottle, and immediately replacing the stopper.

APPLICATION. The solution is equally effective when applied to the temporary or to the permanent teeth. It must be applied directly to the dentin. It will not penetrate the enamel, and it may, therefore, be necessary to expose the dentin with a bur. The cavity should be dry, but should not be dehydrated. With a pair of pliers, a cotton pellet, of convenient size to be placed in the cavity, should be dipped into the solution, and then the excess of the solution should be removed, by pressing the pellet against the inside of the neck of the bottle. The cotton should be *only moistened* with the solution. It should be placed in the cavity without pressure, and should remain for one minute for children and one and one-half minutes for adults. Immediately after it is removed, a blast of warm air should be directed to the area of application. Again,

no attempt should be made to dehydrate the dentin. The warm air causes a layer of thymol to crystalize out of the solution and form a film on the surface of the dentin, while the action takes place within the dentinal tubules. The full depth of desensitization should be attained in about two minutes, although it is often possible to use a bur painlessly in less than one minute.

The solution is caustic, therefore the soft tissues of the mouth must be protected, preferably with a rubber dam. If any of the solution comes in contact with the tongue or soft tissues of the mouth, it will cause a burning sensation, which will last for several hours. Dr. Hartman suggests that a solution of sodium bicarbonate, used immediately as a mouth wash, will give relief in case of such an accident. In some cases, it may be safe to use cotton rolls, provided the gums are protected with a varnish or with vaseline. The rule should be that the rubber dam should be applied whenever it is possible to do so.

No other medicament should be applied to the dentin before this solution is used. For example, if phenol has been applied a short time before the application of the desensitizer, the latter will have no effect, and in cases in which phenol may have been used some days before, it will usually require several applications of the solution to desensitize the area.

If there is a slight opening through the enamel, some of the solution may reach the dentin, by applying it on the surface of the enamel. In the case of a gingival third decay, in which the enamel is etched, and there may be a central area of penetration, an application may be partially effective, so that an opening through the enamel and slightly into the dentin may be made with a bur, without pain, or with very little pain. Another application may then be made directly to the dentin.

In cases of pit cavities, the pit should be sufficiently enlarged with a bur to permit a small bit of cotton to be placed in it. The bur should definitely penetrate the full thickness of the enamel. The cotton should be in the form of a small roll, with one end projecting from the pit. This should be placed dry, and then a larger pellet should be moistened with the solution and held against the surface of the tooth over the pit. The small roll will serve as a wick to carry the solution to the dentin.

If the area of decay is small and lateral extensions are necessary to secure outline form, either along fissures or in preparing smooth surface cavities, a second application may be required, as the lateral penetration of the solution along the dento-enamel junction is variable. The solution may be applied directly to an area of carious dentin and anesthesia will generally be secured, although a second application may be necessary after the decayed dentin is removed.

If the cavity is large, or if the decay has spread considerably in the dentin so that the undermined enamel can be removed without pain, thus making a fairly large cavity, the best result may often be obtained by first placing within the cavity a piece of dry cotton which will about fill the cavity, and then holding another piece of cotton, moistened with the solution, in contact with the first piece. The larger the open cavity, the greater the indication for this method.

LENGTH OF PERIOD OF ANESTHESIA. If the tooth is kept dry, as with the rubber dam, it should remain insensitive for an hour or more. If the area becomes moist, the time will be reduced to possibly twenty minutes. Additional applications may be made at any time, if the tooth becomes sensitive before the operation is completed.

EFFECT UPON THE PULP. The action of this solution is strictly limited to the dentin. It has no effect on the pulp. All attempts to anesthetize pulps with solution have failed. One may cut entirely through the dentin without causing pain, but the pulp will be sensitive the moment it is touched.

A number of cases are reported by Dr. Hartman as having been under observation since the time when the solution was applied for the preparation of cavities, and the pulps have responded to monthly vitality tests for a period of six months. These tests are being continued. In a few cases in which teeth were to be extracted in order to make full dentures, patients consented to have the solution applied to one tooth, in which a considerable cut was made into the dentin. This tooth and another for a control, were extracted after varying periods of time, from a few hours to a week. They were then studied in serial sections and found to be normal.

OTHER USES OF THE DESENSITIZER. In setting inlays, if the dentin is sensitive, an application may be made as described above, and the cement used to set the inlay will not cause pain. Dr. Hartman reports that such teeth appear to be less sensitive afterward than in cases in which the desensitizer is not used. In such cases, the enamel walls of the cavity should be scraped with sharp instruments, to remove any residue of the solution, before the inlay is cemented to place.

In making preparations for crowns, it may be necessary to make several applications to the areas of exposed dentin, gradually advancing the desensitized field by applying the solution at the margin of the area from which the enamel has been removed. In fitting crown bands and taking impressions of teeth prepared for crowns, the dentin may be swabbed with a pellet of cotton slightly moistened with the solution. The solution may be applied to a porcelain jacket crown preparation previous to the setting of the crown to prevent the pain caused by the cement.

In the first report of studies made by members of the faculty of Northwestern University Dental School, 210 cases are tabulated. Before the application, the sensation of the dentin in each case was sufficient to be recorded as definitely painful to the use of a bur or a cutting instrument. The history in each case included the condition of the tooth — open cavity, necessity of enlarging opening through the enamel, previous restoration removed, etc., location of cavity, the number of applications made, the degree of relief from pain, etc. The rubber dam was in place in practically all cases. The results were as follows:

FIRST REPORT OF TESTS WITH HARTMAN'S SOLUTION.

210 CASES RECORDED BY FACULTY MEMBERS OF NORTHWESTERN UNIVERSITY DENTAL SCHOOL.

| <i>Number of Applications</i> | <i>Perfect Desensitization</i> | <i>Considerably Less Sensitive</i> | <i>Slightly Less Sensitive</i> | <i>No. Effect</i> |
|-------------------------------|--------------------------------|------------------------------------|--------------------------------|-------------------|
| 1 | 38 | 40 | 18 | 7 |
| 2 | 15 | 38 | 11 | 10 |
| 3 | 2 | 3 | 7 | 9 |
| 4 | 2 | 4 | 4 | 2 |
| Totals | 57 | 85 | 40 | 28 |

| <i>Number of Applications</i> | <i>Perfect Desensitization</i> | <i>Considerably Less Sensitive</i> | <i>Slightly Less Sensitive</i> | <i>No. Effect</i> |
|-------------------------------|--------------------------------|------------------------------------|--------------------------------|-------------------|
| 1 | 36.9% | 38.8% | 17.4% | 6.9% |
| 2 | 20.3 | 51.3 | 14.8 | 13.5 |
| 3 | 9.5 | 14.3 | 33.3 | 42.8 |
| 4 | 16.6 | 33.3 | 33.3 | 16.6 |
| Percentages | 27.1 | 40.5 | 19. | 13.3 |

These tables show that perfect desensitization was obtained in 27.1 per cent of cases, and that the tooth was considerably less sensitive in 40.5 per cent, making a total of 67.6 per cent in which the patient suffered no pain of consequence, and were therefore considered successful. In 19 per cent of cases, there was some reduction in sensation and in 13.3 per cent the result was negative.

These figures should not be considered as fairly representing the effectiveness of this solution, because of lack of understanding of all details of the technic, and particularly of the best methods of making the applications under the varying conditions presenting. The large majority of the failures were in cases in which previously made restorations were removed. In such cases it is desirable that at least a little of the dentin be freshly cut before making the application, and that generally was not done.

It will require considerable experience to determine the real value and the limitations of the use of this solution. At the present time, one seems to be fully justified in recording it as a splendid contribution which will be greatly appreciated by the public, and especially children. Its effective use should largely remove the fear of and tremendously increase the demand for dental service.

Pressure Anesthesia

The pulp may be anesthetized by pressure anesthesia, and thus eliminate the sensitiveness of all of the dentin of the tooth. The method used by the author for a number of years will be presented. There is nothing new in this method except certain minor steps in the technic. It has been used by a comparatively few practitioners for both the temporary and permanent teeth, and a much larger percentage of painless operations have been possible than by any previous plan. Carefully kept clinical records indicate that it is not harmful to the pulp. The indications for the use of this method are certainly greatly reduced by the recent announcement of Dr. Hartman's desensitizer.

THE SOLUTION. After considerable experimentation with a number of solutions, the following was suggested by Dr. Stanley W. Clark:

Formula for Pressure Anesthesia Solution.

| | |
|--------------------|-----|
| Cocain | 25% |
| Ether | 10% |
| Chlorophenol | 15% |
| Alcohol | 50% |

PLAN FOR ANESTHETIZING DENTAL PULP. The ideal anesthesia of a dental pulp may be easily attained in the case of a person 10 to 20 years old, by applying this solution to a perfectly normal tooth, in which no decay has occurred. An upper first bicuspid may be selected as an example. With a new 1 mm. inverted cone bur (No. 35) a hole may be cut through the enamel in the position of one of the occlusal pits without causing pain, if it is revolved slowly. The patient is instructed to report when the least sensation is felt, which indicates that the dentin has been reached. A new bur should then be used and the hole should be deepened just enough to be certain that the full diameter of the end of the bur is in the dentin. The patient should be told that this cut may hurt for a second and the momentary pain enables the patient to better appreciate the real value of the method during the excavation of the remainder of the cavity. This pain is a rather certain indication that the bur is in normal dentin; it also indicates the need of anesthesia in the particular case.

The bur is then withdrawn from contact with the dentin and the opening in the enamel is enlarged by making several cuts from within outward, changing it to the form of a section of a cone, with the larger end at the surface. A very small bit of cotton, rolled into a ball a little more than 1 mm. in diameter is moistened with the solution and placed in the bottom of the opening. A slightly larger piece of unvulcanized rubber is then placed in the opening and pressure, at first light and gradually heavy, is made with a round condenser, having a flat end 1.2 mm. in diameter. The solution is forced through the dentinal tubules into the

pulp and it is anesthetised. This may be accomplished in almost 100% of similar cases, and a cavity may be completely prepared without pain.

In actual practice, the effort is made to duplicate as closely as possible the conditions of this ideal case, and particularly to contrive to force the solution into normal dentinal tubules. That the solution may be easily forced through normal tubules into the pulp has been demonstrated by adding methylene blue to the solution and carrying out the technic described in freshly extracted teeth, which were afterward cut through in the line of the tubules to which it was applied. The tubules were found stained throughout their full length. In a number of cases, in which the application was made to lower bicuspid for the preparation of cavities, anesthesia of the lip occurred, which left no question regarding the penetration of the pulp.

Two principal plans are followed to reach normal dentinal tubules: (1) In all cases in which it is practicable to do so, a hole is drilled through normal enamel in a position that would necessarily be included in the prepared cavity, ignoring the carious area for the moment. For example, in case of caries of an occlusal pit, with an undecayed fissured groove leading away from the pit, the hole through the enamel is made at the extremity of the fissure farthest away from the pit. For a proximal decay in a bicuspid or molar, the hole is drilled at the position of an occlusal pit, which will later become a part of the step. (2) When a separate opening through the enamel is impractical, the cavity is opened and the decay removed by the technic to be described. A side cut of one or two millimeters is then made into sound dentin. The cut is similar to a starting point for a gold foil restoration, only slightly larger. For several of the cavity preparations illustrated, the plan of applying the solution to normal tubules will be shown, so further details need not be given here. Satisfactory anesthesia can not be obtained by forcing the solution into carious dentin, or into tubules which lead from the carious area to the pulp.

When good anesthesia is not secured, it may be because the instrument has pushed through the rubber and the solution has not been forced into the dentin. This is more likely to happen when the opening through the enamel is large. In every case the instrument used for making pressure should be as large as the opening will permit. The conditions must be such that the pressure is expended in forcing the solution through the tubules. Failure might be due to the fact that the hole exposed the ends of tubules that were affected by caries. In that case however, the cut into the dentin with the bur should not have been painful. It is also possible that the bur had not actually reached the dentin when the patient felt the pain, thus leaving a little enamel, which the solution would not penetrate. This would occur if sufficient heat were generated in cutting with the bur.

If secondary dentin of the hyaline type has formed on the walls of the pulp chamber, the solution could not be forced through, but a tooth in that condition should not be painful to cutting, without anesthesia. The most difficult cases are those in which cavities are very large, or the access is difficult and heavy pressure can not be applied to a very small area. If the opening is not more than three millimeters in diameter, but has good surrounding walls, sufficient pressure can be made. In some cases, only partial anesthesia will be obtained. The test should be made with the bur and the hole is thus made a little deeper. This gives better opportunity for success on the second effort. Occasionally several trials must be made before complete anesthesia is secured. In a few cases, for no explainable reason, there is no diminution of sensation.

Those cases, in which it is most difficult to anesthetize the pulp by pressure anesthesia, present the most favorable opportunity to use Dr. Hartman's desensitizer.

THERMAL SENSITIVENESS may be aroused repeatedly after a metallic restoration is placed in a tooth due to the fact that the metal is a good thermal conductor and is either too close to the pulp, or is in contact with a large area of dentin, as a mesio-distocclusal restoration. With each considerable change of temperature in the mouth, the pulp receives a shock. As a rule, in cases where reasonable judgment has been exercised in the operation, the sensitiveness will subside in a few days if the patient is careful about taking hot or cold drinks or food into the mouth, or protects the mouth from cold when out of doors in cold weather. The treatment for this condition is given under pulp treatment. It is the purpose here to tell how to avoid the pain of thermal sensitiveness in operative procedures. The answer is simple: Nothing should be done which will cause thermal shock. Desensitization or pulp anesthesia is for sensitiveness of dentin. One should avoid any procedure which would cause thermal shock, even though the pulp is anesthetised. It may do harm, even though there is no pain. Friction with disk, bur or stone generates heat. An air blast may be sufficiently cold or hot to cause thermal sensitiveness.

Thermal sensitiveness may be caused by a temporary restoration that does not seal the cavity or leaves a little dentin exposed. When metal restorations are used and there is any question as to thermal shock, the dentin should be treated with Dr. Hartman's solution and the deeper part of the cavity should be protected with cement. One of the principal objections to the use of anesthesia is that the operator will become less careful in preparing cavities. If so, he is likely to be reminded by a series of cases of thermal sensitiveness. Deep cutting and near approach to the recession lines of the pulpal horns should be avoided as a rule of practice.

Clinical Treatment of Dental Caries

THE pathology and clinical features of dental caries have been discussed, as have the principles involved in the preparation of cavities, the physical properties and manipulation of the materials for restorations and all accessory technics, as well as methods of prevention and control. In this chapter, these studies will be applied in the actual treatment of patients.

TREATMENT BY CLASSES OF CAVITIES AND FOR THREE GROUPS ACCORDING TO AGE. The treatment of dental caries will be presented for each of the five classes into which cavities of decay are grouped. This will also be divided into three age groups, to emphasize the differences in conditions and in treatment:

Period of the temporary teeth.

Childhood and early adult period of the permanent teeth.

Adult period.

It is not possible to draw a sharp line between the technical treatment for the periods devoted to the child and the adult, because there is much overlapping of these groups in both pathology and treatment. For the childhood and young adult period, there will be presented what might be termed the standard technic for cavities of each class, and stress will be placed on plans of management by which the dentist may take advantage of every opportunity to conserve the teeth. The consideration of neglected decays is, therefore, included in the adult period. This is done with the understanding that neglected decays are very common during the childhood period, also that the conditions as to susceptibility and treatment of the childhood period extend far into the adult period for many persons.

CLINICAL REPORTS. Cases will be arranged in the form of reports of clinical service for a limited number of individuals, from childhood through adult life, to whom names have been assigned for identification as they appear for operations listed under the several classes of cavities in the different age groups. This plan was adopted with the thought that it would give better understanding and appreciation of the variations in service for persons of different ages, and of the effect of service for the child on the mouth conditions and general health of the adult. It also makes possible the presentation of a more intimate dentist-patient relationship.

Practically every case presented is from the clinical experience of the author as recorded from day to day. Obviously it would not

be possible for one who has been in practice thirty-five years to report the continuous care of patients over periods of from sixty to seventy years. Therefore, the records of several persons of different ages have been combined under a single name to impress the continuity of dental service throughout life. In doing this, considerable liberty has necessarily been taken with the records to eliminate duplication in the presentation. Occasional operations for each patient will be reported in detail, others will be only mentioned to give completeness to the record. For a particular patient, operations will not always be recorded in the order in which they were performed, as those for the several patients are reported according to the classes into which cavities are divided. Comments are injected to call attention to variations in procedure.

In reporting operations in which improved technical procedures have been developed in recent years, the latest methods are given from the author's experience in similar cases. The objective in this plan of presenting the clinical treatment of dental caries is to impress upon the student and young practitioner that each technical performance is a real part of a program which, in the years to come, will have a health value for the patient.

The preventive measures employed by the dentist, including the cleaning of the teeth, will be presented in some detail. It is difficult to do much more than teach the principles of prevention in a dental college clinic. In the last analysis, the same patients should be cared for and observed over numbers of years and exact records must be kept, if one is to fully comprehend the possibilities of preventive practice.

THE ASSISTANT. In this presentation it will be understood that an assistant is serving with the dentist, but the assistant and her particular duties will be mentioned only when they are of special importance to the success of the particular procedure. This in no way reflects upon the value of her services in connection with almost everything the dentist does. However, when attention is called to the service of the assistant, it should suggest a situation in which one student in the dental school should serve as assistant to another. Such an exchange of courtesies between students will be found to be mutually beneficial in many ways.

The important service rendered by the Dental Hygienist is discussed in a preceding chapter. Her service will not be presented in the following pages, although, whenever the cleaning of the teeth, instruction in home care and the training of the child to an appreciation of the value of its teeth, are referred to as a service to be rendered by the dentist, it should be understood that this may be satisfactorily performed by the dental hygienist.

The ideal arrangement for a private dental office is to have a hygienist-assistant, with patient appointments so arranged that she

will, as far as practicable, perform her service as hygienist at hours when the dentist is engaged in operations in connection with which her services as assistant are of least importance.

APPLICATION OF PRINCIPLES. It is quite out of the question to cover every detail of the various operations. Something of a standard procedure is presented for a few cavities of each class. It is most important that the student know the principles of cavity preparation, and of the selection and manipulation of materials for restorations, in order that he may successfully meet the problems which arise almost every day in practice. The dentist should develop an inquisitive disposition and an ingenuity which will enable him to accomplish a desired result in ways not mentioned or demonstrated in this volume. For example, the effort is made to illustrate the use of the various excavators, yet there is hardly an instrument which may not be conveniently used on occasion for some other purpose. The margin trimmers were originally designed for the particular purpose of beveling the cavo-surface angle of the gingival wall in proximal cavities in the bicuspid and molars. It was soon discovered that they were equally desirable in cutting the bevel of the buccal and lingual walls of the proximal portions of these cavities, and it was later suggested that they might also be used to bevel the cavo-surface angle of the distal wall of mesio-occlusal cavities and the mesial wall of disto-occlusal cavities. More recently, a number of operators have used them as angle-formers—to make the line angles of proximo-occlusal cavities sharp and perfect. They are the most convenient instruments for finishing the mesial and in some cases distal enamel walls of gingival third cavities in the molar teeth; they may be used to advantage in trimming amalgam restorations to form, particularly the marginal ridge of proximo-occlusal restorations, before the matrix is removed. Such an understanding of the adaptability of instruments in varying situations makes for both exactness and speed in operating.

ORDERLY PROCEDURE. The highest degree of perfection with the saving of much time in operating should result from systematic planning and orderly procedure. A good operator may be distinguished from a poor one by the number of excavators on the operating tray when a cavity preparation is completed. After a brief study of a case, the good operator will form a mental picture of the entire procedure and can usually select in proper sequence all of the excavators required; *he uses few instruments*. The poorly trained operator does not proceed in an orderly way, will try this or that instrument to accomplish a certain step and must often change to a second or a third. He will very commonly fail to accomplish with each instrument all that might be done with it while it is in the hand and will pick it up again, possibly a third time; *he uses many instruments*.

Early in the author's practice a study was made of this question over a period of about six months. A plan was devised by which the assistant kept, for each amalgam and gold foil restoration, a memorandum of three items; (1) the number of minutes from the time the patient was seated in the chair until the cavity preparation was completed, (2) the number of minutes until the amalgam or the gold had been placed, (3) the number of minutes until the restoration was trimmed to form and polished, and the patient was dismissed. There was no effort to hurry, but attention was given to orderly procedure. For the preparation of each cavity, the excavators were selected in advance and placed on the tray in the order that they were to be used, and a mental note was made whenever it was necessary to select an additional instrument, or in case one that had been selected was not suitable. This developed better advance understanding of the requirements in each case, much improvement in the quality of the operations and a reduction in operating time of nearly twenty-five per cent. Thereafter, for the general run of cases, orderly procedure became a habit.

PATIENTS SELECTED FOR CLINICAL TREATMENT.

Six patients were selected, whose records would best exemplify a variety of conditions and personalities met with in practice:

Mary Brown, whose first examination was at four and a half years of age, has been an ideal patient in her willingness and desire to cooperate in every way, unusually faithful in keeping her appointments, conscientious in the care of her mouth and appreciative of the results achieved. She has been continuously susceptible to caries. There were thirteen decays in the temporary teeth and twenty-five restorations have been placed in the permanent teeth. She was married at twenty-four and went through a short period of rather extreme susceptibility immediately following her first pregnancy. Three third molars were removed, but she has lost no other tooth and all pulps are vital.

Thomas Johnson became a patient within a few days of his third birthday. He has been very nearly immune to caries from childhood, except for a few years beginning when he was about fifteen. A total of thirteen restorations have been made in his permanent teeth, and eight of these were for decays marked on his examination chart at the age of sixteen. He has been almost completely immune since he was twenty. He has enjoyed excellent health, his mouth has always been clean and his interest in his teeth has been constant. At the present time he has all thirty-two permanent teeth, in normal occlusion, and no pulps have been lost.

Frank Hines' first examination was at the age of five when sixteen decays were listed on his chart. This was a very bad case

of rather high susceptibility and neglect of the temporary teeth, which was changed to near immunity by gaining the interest of the boy in his teeth, and splendid cooperation from the mother in watching his diet. All of the temporary teeth were saved with vital pulps until they were shed and there have been but eleven cavities in his permanent teeth, with no teeth and no pulps lost.

William Fisher's story is very different. According to his father, he had no cavities in the temporary teeth, but he had lost one first permanent molar through neglect, previous to his first appointment with the author at the age of twelve. At that time there were occlusal cavities in the other three first molars; the decay in the lower right first molar being very large and deep. He had not been to a dentist since the lower left first molar was extracted. Up to the time he was thirty-eight, there had been but seven restorations placed in his permanent teeth, and because of his near immunity he had been extremely careless about keeping his recall appointments. He was then taken very sick with typhoid fever and his condition of immunity to caries was changed to one of extreme susceptibility. A little more than a year later, an examination revealed fourteen cavities, with two exposed pulps. He soon regained his immunity and continued with almost no further decay.

Miss Gertrude Wilson is an example of a very considerable percentage of persons who presumably desire to have their teeth properly cared for, but are unwilling to really place themselves in the care of a dentist and cooperate with him. She has been moderately susceptible all her life and she might have all of her teeth today if she had been willing to accept a recall program. Her record shows that she has gone to some dentist for examination about once every three or four years. As a matter of fact, she has generally made an appointment only when a pain in a tooth reminded her that it was urgent that she do so. Practically every decay has been neglected; the restorations are all large; she has lost three teeth other than third molars, also the pulps of five others. Her case is in direct contrast with that of Mary Brown.

John Stevens, with a high degree of immunity from childhood, is presented for the sole purpose of describing the treatment of a case of beginning abrasion, with the hope that greater interest may be aroused in the careful study and effective treatment of this condition. Only five restorations had been placed in his teeth up to the time when he was forty-five. Nine new restorations were placed to successfully retard the progress of the abrasion over a period of ten years.

THE ILLUSTRATIONS IN THIS VOLUME.

The illustrations in this volume include reproductions of many wash drawings made by G. V. Black. There are more than 300 new

illustrations, most of which are from line drawings made by the present author. In these the effort was made to show: (1) both the surface injury of the enamel and the penetration by caries of both the enamel and dentin; (2) the instrumentation and steps in the preparation of each type of cavity; and (3) the manipulation of the various materials in making and placing restorations. The attempt was made to draw each instrument in proper position and to exact scale, and those which are not shown in perspective may be measured with a millimeter scale to verify the formulae which are printed beneath. The magnification of each drawing is indicated; the large majority are $2\frac{1}{2}$ times the actual size. At the request of several teachers, the manufacturers' stock numbers, in addition to the formulae, are given for each instrument.

A comparison of the new set of 46 cutting instruments, with the set of 48 instruments illustrated in former editions of this work, will be found in Volume II, page 99.

Period of the Temporary Teeth

THE period of the temporary teeth begins with the eruption of the first tooth, when the baby is about six months old, and continues until the loss of the last tooth of the temporary set, usually about the eleventh or twelfth year. This period overlaps the childhood period of the permanent teeth, but the temporary teeth will receive separate consideration, except in cases in which the conditions and treatment are related to those of the permanent teeth.

Caries in the temporary teeth is not different from caries in the teeth of adults. So far as the tissues of the teeth are concerned, restorations may be made in the temporary teeth just the same as in the permanent teeth. The tissues of the temporary teeth are hard enough; they are strong enough. The differences in operating do not lie in the tissues of the teeth, but are due to childhood. Because the children are immature, their nervous systems, power of reasoning and of self-control are not yet developed, and the difficulties that belong to this period of life must be met.

THE CHILD is a bundle of impulses, each of which is ready to break into action without notice or restraint. Too frequently the dentist's first meeting with the child is when it has been wrought up by pain until its nerves are all on the alert, and it is ready to take fright at the least suggestion of further suffering.

Children are quick to discover a failure to perform a promised service, and if that failure has resulted in pain to them in the attempted operation, or if the suffering continues, the child-thought is that it has been injured or deceived. They are not much disposed to excuse an operator for difficulties which their own actions, or their resistance, have imposed. Their resentment is quick and sharp, and usually without reserve or concealment. On the other hand, they are just as quick to recognize a success. A child, who has been tortured by pain and has rebelled and fought against a painful operation for its relief, will, after finding the promised relief and comfort, have a warm smile of confidence for the person who conferred the benefit and will readily forget the pain inflicted. Such is the nature of the child. Children act from impulse rather than by processes of reasoning. Touch them right and they are easy to control; when touched wrong, oftentimes they may not be controlled. The important difference in performing operations for young children is in obtaining that control of the child nature which will give opportunity to do that which is best; or to continue ex-

pedients that will succeed temporarily until increasing age and greater self-control will give better opportunity.

The courage of a child should never be broken by any operation; the nervous system of a child should not be too severely tried; it is better to delay an operation, to temporize, particularly if the child is not in pain. It is true, that in some cases the operation must be performed; suffering must be relieved. If such an operation is over in a few minutes, the child usually will recover without difficulty. Tedious, prolonged operations break down a child's nervous system and destroy its courage. The child forgets a severe hurt quickly, but the nervous shock that comes from long continued operations or too frequent appointments, breaks the child down most.

It is of the utmost importance to succeed with whatever is undertaken, if the operator wishes to retain the control of the child. To fail of success, oftentimes results in the loss of the child's confidence. Therefore, the careful planning of operations for children is of special importance. If the confidence of the child is gained through a success, a lasting friendship is likely to be established.

The psychic influences of children are important. Some persons control children easily; children take to them, while they seem to shun others. Dentists, who are technically skillful, may not be able to operate successfully for children, because children do not like them for some reason. Others seem particularly fitted for the handling of children in their distress; they control children easily. There is something in the approach that gains the confidence of the child. This can be cultivated in a large degree. Generally those persons, who have a great love for children, control them well. But this is not the universal rule. The vagaries of the minds of children are very difficult to understand. Often they will give their confidence to a stranger, so far as painful operations are concerned, when they will not give it to persons whom they know well. One will often do well, on finding that he has failed in gaining the confidence of a child, to recommend it to someone else, or have someone else see it with him. Possibly he may gain the child's confidence in that way and retain it afterward. In this relation the dental hygienist, or the dental assistant, will sometimes be able to control the child for the dentist, when he fails.

IMPORTANCE OF CARE OF THE TEMPORARY TEETH. It should not be necessary to give further emphasis to the importance of the care of the temporary teeth. However, the technical procedures for the temporary teeth are given in the same detail as for the permanent teeth.

Many dentists have been too much inclined to neglect little children; to feel that operations for them are not of much conse-

quence. But children soon become adults, and their friendship tells in after-practice. One will often have to do that for children that will not seem to pay in dollars and cents; it may be necessary to spend time with them in which little or nothing is accomplished; time for which one will not feel like making a proper charge. Often the dentist should only temporize with a child at the first appointment; he should not try to do this or that operation which is necessary, but select something which may be successfully accomplished with little or no pain; not something to deceive, but something to gain the confidence of the child. One should never deceive a child; if it is necessary to cause pain, the child should be told in advance, but usually immediately before the hurt, and with a grasp on the child's jaw and everything in readiness, so that it will be quickly finished before the child has opportunity to object. Usually, with children, a deception is fatal to after-success. A dentist should not allow parents to deceive children in his office. Often the greatest difficulty in the management of children is the management of the parents. For the parent or the dentist to tell a child it will not hurt, when it is known that the service will be painful, is doing the child a wrong; it is lessening the child's confidence in humanity; and children ought to grow up with confidence in the integrity and honesty of those about them.

It is more difficult to care for children properly in a dental college clinic than in a private office, partly because the teeth of children who come to the clinic have been neglected, and the decays are likely to have penetrated so deeply as to have involved one or more pulps. As compared with private practice, a larger percentage have one or more teeth in such bad condition when they are brought in for attention, that it is necessary to inflict more severe pain in order to give them relief. Good cooperation from either the children who are brought to the clinic or their parents is not to be expected in more than a small minority of cases. The best plan by which to secure very young children, who are most likely to cooperate, is to inquire of older children who are of the more desirable type, if they have younger brothers or sisters at home. If the conditions are briefly explained to them, they will be much more likely to cooperate than would their parents. By this plan a great improvement in child patient personnel may be brought about within a few years. This applies to the dental practitioner as well as to the dental college clinic.

OCCURRENCE OF CARIES OF THE TEMPORARY TEETH. Caries of the temporary teeth occasionally occurs at two years of age. This is not the rule, but the rather rare exception. When it occurs so early, it is an indication of extreme susceptibility, and the teeth are likely to be destroyed quickly unless effective measures are employed. However, in the very large majority of cases, one or two very small pit decays, at the most, will be found in the teeth of

children three years old. For this reason, it is considered safe to establish the rule that the first examination of the teeth should be made near the third birthday.

There is wide variation in the time when pit decays occur, and this is in some measure an index of the susceptibility of the child, although it does not necessarily forecast a similar degree of susceptibility or immunity for the permanent teeth. In fact, there may be a change from extreme susceptibility of the temporary teeth to a very considerable degree of immunity by the time the permanent teeth erupt, or the reverse.

Decays are likely to progress rapidly in the temporary molars, and the pulps, which occupy a large part of the crowns, are quickly exposed, often without complaint of pain. For this reason, susceptible children should have appointments every three months.

The first decays in the incisors are likely to occur in the mesial surfaces of the upper centrals. The occurrence and extent of caries in the proximal surfaces of the incisors is limited by the gradual separation of these teeth, beginning usually about the third year.

RESTORATIONS. Metallic restorations should usually not be made for very young children, for the reason that it is generally out of the question to make proper cavity preparation. The temporary teeth are as painful as the permanent teeth, and sympathy for the child will prevent one from doing that which may seem to be desirable. Temporary measures must be employed until such time as more permanent operations may be made. As a rule, copper cement is preferred for pit cavities and for proximal cavities in the molars which occur very early. Amalgam should be substituted when conditions are such that thorough operations may be made. For proximal restorations in the incisors and cuspids, and for gingival thirds in all of the teeth, zinc phosphate or modified silicate cements are the best materials available. All cement restorations gradually wash out; they should be examined frequently and replaced when necessary.

It should be a part of the dentist's service to educate his patients and the public, as occasion presents, to the importance of early and frequent appointments for very young children. This should be suggested long in advance if the parents or the older children of a family are patients.

THE FIRST APPOINTMENT. The occasion of the first visit is an important one in the life of the child. It is a new experience and it should be a pleasant one; so pleasant, if possible, that the child will be willing, if it does not actually desire, to come again. Only rarely will a cavity be discovered at the age of three. As a rule, if decays are discovered, they preferably should not be cared for at the

first visit of the child. The first visit should be the occasion when the child and the dentist become acquainted. The teeth should be examined carefully and, although they may not need it, they should be cleaned with a brush or a rubber in the dental engine, and a pleasant tasting powder. If the operator is careful not to touch the gums, the child will likely enjoy its introduction to the engine, and that is quite important.

Prevention and Immunization; Temporary Teeth.

ILLUSTRATIONS: FIGURES 652-668.

THE first examination chart for the patient who has been given the name of Thomas Johnson, three years of age, is presented in Figure 652. As indicated on the chart, the occlusion was normal. No cavities were found, but there were rather shallow pits and fissures, which were not decayed, in the lower molars on both sides of the arch. They were marked for treatment with silver nitrate. It should depend upon the child and the circumstances whether or not such treatment should be undertaken on the occasion of the first visit or at a subsequent appointment. In this case it was done at the first visit.

Johnson, Thomas 1871 - *Andover St.*
 NAME NUMBER 986 RES. TEL. *North 731* NPIR ADDRESS *Chicago.* EXAM. NO. 1
 BUS. DATE 5-1-31
 TEL. DATE *July 31*
 BIRTH 4-3-38 NEXT EXAM
 AGE 3

RIGHT LEFT

OCCLUSION N
 REPORT TO PNR
 PATIENT CARD 123 DN M
 NP
 ND 123 M
 CAVITIES 123
 GINGIVAE

DI TE WIR GLS X - D RA YS NM CA SE HOT DRY MOC ELS PHO TO REP ORT IND ENT ME MO FIL ED INS TR FOR WD PR EV SER VICE ES TI- MA TE D MN

FIG. 652. The examination card here illustrated is a 4x6 inch card, which is reduced to about two-thirds its actual size. It is fully described in the chapter on oral diagnosis in Volume 1. This chart is printed in green ink on the regular card, in order that entries in black may be more readily distinguished.

The record on the above card for Thomas Johnson is as follows: He was patient No. 986; this was his first examination, at three years of age; occlusion normal, cleanliness good, immunity high, gingivae fine; occlusal pits, not decayed, in all four lower molars (these are recorded in blue on the card, indicating that the areas are to be immunized); the mother was instructed in the care of the boy's mouth.

PITS AND FISSURES.

APPLICATION OF AMMONIATED SILVER NITRATE. The technic of applying silver nitrate is very simple. With everything in readiness, air was first blown on the teeth so that the child might understand what was to happen. Gauze rolls were held on either side of the teeth, and they were dried with cotton pellets and the air blast. The silver solution was applied with a very small, closely rolled piece of cotton, with which the occlusal surfaces were rubbed hard. The area was then moistened with a very little eugenol, applied with another piece of cotton. The areas immediately turned black. They were kept dry for about two minutes to give sufficient opportunity for the silver to be deposited. The areas were then rubbed with a fresh piece of cotton to remove the excess of black stain from the surface. Generally part will remain, but it will wear off in a day or so, unless it has actually penetrated the enamel, in which case it will remain black and serve as an immunizing agent. The procedure should be explained to the mother in advance, in order that she will understand that there may be some discoloration of the teeth for several days, or permanently.

ARRANGEMENT FOR PERIODIC RECALLS. The importance of watching the temporary teeth was mentioned to the mother, and arrangements were made for the next appointment. It was sug-

Brown Mary 416 Mayfair Ave.
 NAME NUMBER 1372 RES. TEL. Main 217 NPIR ADDRESS Chicago. EXAM. NO. 1
 DATE 1-5-39
 DATE OF BIRTH 7-12-34 AGE 4½
 DATE Apr. 39
 NEXT EXAM

RIGHT LEFT

OCCLUSION N PNR
 REPORT TO Mother referred by Mrs. Jas. Shields
 PATIENT CASE 123 DN ND 123
 M M CINGIVAE

BI TE WIN GS X - D RA YS NM CA SE NOT CRT MOD ELS PRE TO

PR EV SER VICE ES TI-MA TE SEP OCT NOV DECEMBER JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DECEMBER

FIG. 653. Examination of Mary Brown: Patient No. 1372, first examination at 4½ years: occlusion normal, cleanliness medium, caries susceptibility moderate, condition of gingivae good. Decays: mesial of both upper incisors, occlusal of both lower second molars. The proximal surfaces of all of the molars, including the distal surfaces of the second molars, are marked as being too flat and the embrasures should be widened. Instructions to the mother regarding the care of the child's teeth. See chapter on oral diagnosis in Volume I for explanation of chart.

gested that a memorandum would be made to call the mother three months hence when the time arrived for the next examination, and this was acceptable. The home care of the teeth was discussed and a proper brush was recommended. It is recorded that this child was called in at three month intervals, and silver nitrate was applied to the occlusal surfaces of the lower molars several times during the next eighteen months, when three small amalgam restorations were made.

PROXIMAL SURFACES OF MOLARS.

The second patient, who is named Mary Brown, required more attention. Her first visit was at four and a half years. Very small pits were found in both of the lower second molars, just large enough for an exploring tine to stick a little. There were mesial



FIG. 654A.



FIG. 654B.

surface decays in both of the upper central incisors, also the proximal surfaces of all of the molars were very nearly flat, including the distal surfaces of the lower second molars. See examination chart, Figure 653. It was decided to widen the molar embrasures slightly with disks as the first procedure.

WIDENING THE EMBRASURES: SILVER NITRATE. At the second appointment a knife edge carborundum disk, $\frac{1}{2}$ inch in diameter, was used to widen the lingual embrasure between the upper molars sufficiently to make room for disks, which were then used to trim the mesio-lingual and disto-lingual angles of these teeth. This cutting consisted principally in so trimming the surfaces which formed the lingual embrasure as to widen the occlusal portion of the embrasure and increase its width almost to the point of contact, without touching the enamel which formed the contact. These surfaces were polished with fine grit disks. The upper left molars and cuspid are shown before and after disking, in Figures 654 A and B.

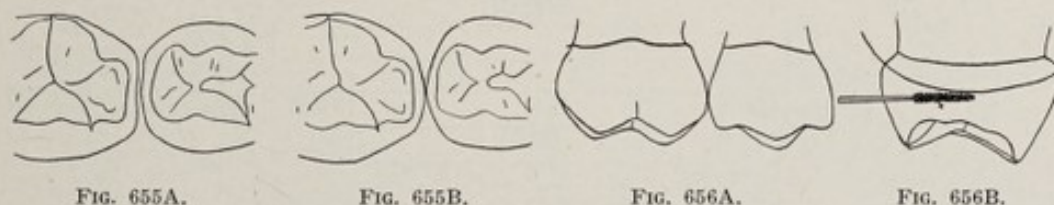
At a subsequent appointment, having gained slight separation between the lower molars with a loop of an orthodontic wire about the contact points for forty-eight hours, the trimming was all done

with disks, leaving a well rounded contact. The lower molars are shown slightly separated in Figure 655 A, and after they were trimmed in Figure 655 B. It will be noted that the points of contact were not cut away. Each cut surface was polished with fine disks. Silver nitrate was also applied to these surfaces with cotton wrapped on a stiff broach, as illustrated for the upper right second molar in Figures 656 A and B.

The treatment of the cavity in the distal surface of the upper first molar and the pit cavities in the lower molars will be recorded later, in discussing the restorative treatment of the temporary teeth.

PROXIMAL DECAY CUT AWAY; SILVER NITRATE. The third patient, designated as Frank Hines, presented for the first time when five years of age. See examination card, Figure 657.

The lower right molars were recorded as being in slight disto-occlusion, while the relation of the molars on the left side was



normal. The teeth had apparently received little attention and the susceptibility to caries was marked. There were slight decays in the central and distal pits in the upper left second molar, gingival third decays in the upper left central and lateral incisors and the upper right first and second molars, also proximal decays in the distal of the upper left central incisor and mesial of the lateral. There were three other small pit decays and five small proximal decays in the lower molars. The incisor decays will be described under the restorative treatment.

Here was a case in which it was necessary to secure the best possible cooperation of both the boy and his mother if the temporary teeth were to be saved during the years immediately following the eruption of the first permanent molars. It was quite apparent that no real pressure had been brought upon the boy to brush his teeth, and his attention was repeatedly called to the necessity of thorough brushing. He finally took over this task on his own responsibility and did it exceptionally well. The mother was impressed with the necessity for a better balanced diet, with less of sweets, both for desserts and between meals. By the time the

cient space for the cuspid. Therefore, in trimming these surfaces, the effort should be made to remove the affected enamel with the least possible loss in the space occupied by these teeth.

In this case a thin, fine grit carborundum stone was used and the cutting was in the lingual embrasure, widening the embrasure, while sloping the cut from occlusal to gingival. The surface of the enamel was cut away to, and a very little beyond, the point of contact, in such form that a new contact was soon formed a little to the buccal. The cut surface did not extend below the margin of the gum. It did include all of the decayed enamel and exposed the carious dentin, without removing it. More was cut away from the occlusal surface than elsewhere, and the inclination of each cut surface was such that it met the surface of the tooth at the line of the gum margin. No shoulder was left in that position, as it would be likely to decay. The cut surface, which is illustrated in Figure 658 A, was polished with fine sand-paper disks. Silver nitrate was then applied to the carious dentin, as shown in Figure 658 B.

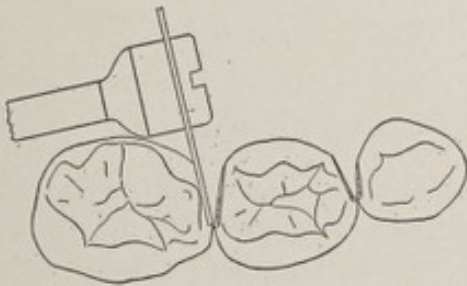


FIG. 658A.



FIG. 658B.

MODIFICATION OF CONTOUR OF DISTAL SURFACE OF SECOND TEMPORARY MOLAR. The distal surfaces of Mary Brown's lower second molars were unusually flat in the bucco-lingual direction, as recorded on her chart in Figure 653. When she was about five years old, disks were used to make these surfaces sufficiently convex to assure wide embrasures between them and the first permanent molars, soon to erupt. This consisted principally in cutting away a little of the marginal ridge toward the buccal and lingual angles of the surface, at an inclination which involved not more than half the depth of the distal surface at the disto-buccal and disto-lingual angles, thus avoiding injury to the gingivae. This was done as a means of reducing the danger of decay of the mesial surface of the first permanent molars. These teeth are normally in contact for four or five years during the period of generally great susceptibility and every opportunity should be seized to avert decay of the first molars, most important of all teeth.

Whenever this modification of the distal surface of the temporary molars is not made before the first permanent molars erupt, and it is discovered after they erupt that the embrasures are too narrow, the distal surface of the temporary molar, regardless of the presence or absence of decay, should be cut away as shown in Figures 659 A and B. This shows the grinding all from the lingual, which will usually be sufficient. However, the buccal embrasure should also be widened if the surfaces of the teeth are too close for the best cleaning in mastication, as already illustrated for the lower molars in Figures 655 A and B. In all cases of this kind, the cut surface should be polished with the finest grit disks. Care should be taken not to cut or injure the surface of the first permanent molar.



FIG. 659A.



FIG. 659B.

PROXIMAL SURFACES OF INCISORS AND CUSPIDS.

SILVER NITRATE. When Thomas Johnson was examined at four and a half years of age, there were slight decays in the mesial surfaces of the upper central incisors, which were in contact, also a small cavity in the distal surface of the upper left first molar. The lateral incisors and cuspids had moved sufficiently to open the contacts on both sides of the lateral incisors. Silver nitrate was applied to the mesial surfaces of the central incisors. A small roll of gauze was placed under the lip and after the teeth were dried, the solution was applied to each proximal surface with cotton wrapped on a stiff broach, as shown in Figure 661 A. This was followed by eugenol, and the decayed areas were impregnated with silver. Most of the affected enamel of both teeth was then removed with fine strips as shown in Figures 661 B, and 661 C. These teeth required no further treatment.

TRIMMING FOR SLIGHT DECAYS; SILVER NITRATE. On Mary Brown's examination card, Figure 653, mesial decays were marked for both upper central incisors. These teeth had not moved apart. A fine grit carborundum stone was carried between them, cutting away a little of both proximal surfaces and leaving a definite space between the teeth. With a thinner stone the lingual embrasures were considerably opened and the decayed enamel was entirely cut away. There remained a little decay of the dentin, which was

treated with silver nitrate. The lingual inclination of the surfaces was such that the black areas did not show. This operation is illustrated in Figures 662 A, B, C and D.

GINGIVAL THIRD AREAS IN LABIAL AND BUCCAL SURFACES.

TREATMENT BY DISKING AND WITH SILVER NITRATE. When Mary Brown returned for her periodic examination at the age of six, there was a small cavity in the distal surface of the upper left first molar, also four beginning gingival third decays in the upper right and lower left molars. The gingival areas were sufficiently etched to be white when thoroughly dried and an exploring tine would glide over the etched surfaces, except that of the upper



FIG. 661A.



FIG. 661B.

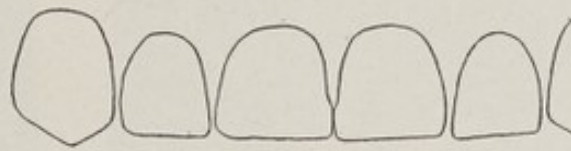


FIG. 661C.

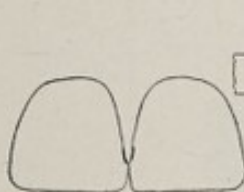


FIG. 662A.

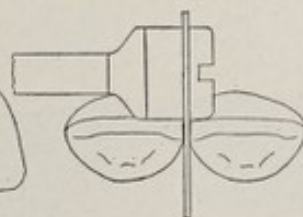


FIG. 662B.

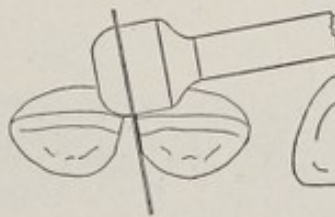


FIG. 662C.



FIG. 662D.

right first molar, which was slightly rough and chalky. It was evident, however, that the depth of penetration of the enamel was slight. This chalky enamel was removed with a 10-6-12 spoon, using rather heavy pressure, and the surface was smoothed and polished with disks. The depression was so slight as to be hardly noticeable. Silver nitrate was then applied to all four of the gingival areas. See Figures 664 A. and B.

MALOCCLUSION OF TEMPORARY TEETH.

When the general practitioner accepts responsibility for the care of the mouth of a child, he also assumes an obligation as diagnostician and advisor in all conditions within the mouth or related to it which have a bearing on the future health of the child. This includes a definite responsibility in relation to conditions of malocclusion of the temporary teeth. His first duty in this connection is to make a record on the examination card of the occlusion —

whether it is normal, or the conditions as to irregularity. If there is an irregularity, he should make inquiry as to the possible cause, such as sleeping posture, thumb sucking, and other habits, and give advice as to their correction. He should oftentimes refer a child to a nose and throat specialist for examination as to obstructions to normal breathing. He should then take such steps as may be proper either to improve the conditions so far as the temporary teeth are concerned, or to assure, if possible, the correct relations of the permanent teeth. If there is a definite malocclusion of the temporary teeth, an orthodontist should be consulted, preferably before the eruption of the first permanent molars.



FIG. 664A.



FIG. 664B.

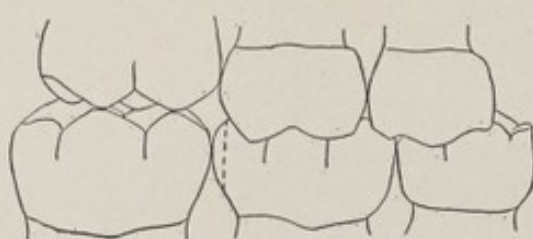


FIG. 665A.

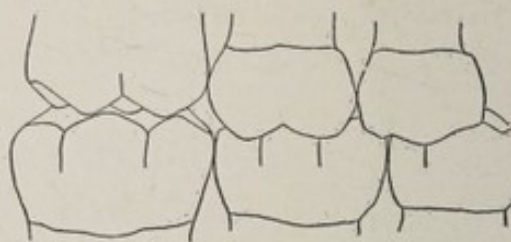


FIG. 665B.

PREVENTION OF IRREGULARITIES. There is occasional opportunity for the general practitioner to prevent irregularities of the permanent teeth by attention to the temporary teeth previous to, or at the time of, the eruption of the first permanent molars. If the lower temporary molars are in disto-occlusion, their distal surfaces should be modified, if possible, in such manner as to guide the first permanent molars into proper mesio-distal relation. For example, as recorded on Frank Hines card, Figure 657, the lower right temporary molar was in slight disto-occlusion, and the lower first permanent molar would necessarily come into disto-occlusion with the upper. To prevent this, the distal surface of the second temporary molar was ground off sufficiently, as indicated by the broken line in Figure 665 A, to permit the lower molar to move forward while the upper first molar was held in its position by the upper temporary molar. The cusps of the upper first permanent molar thus made their first contact with the distal inclined planes of the lower and the two teeth gradually moved into normal mesio-distal relation. See Figure 665 B.

The same result may be attained in such a case by placing a gold shell crown on the upper second temporary molar, with a distal prominence to guide the permanent molar into proper relation with the lower molar as these teeth erupt.

THUMB SUCKING. A device which has proven very satisfactory in a fair percentage of cases in correcting the habit of thumb sucking consists of a flattened gold palatal bar attached to two shell crowns, which are cemented over the first temporary molars on either side of the arch. The bar does not lie against the roof of the mouth, but stands away to leave about an eighth of an inch of space. This prevents the child from pressing the thumb against the roof of the mouth and it will usually discontinue the effort after a few weeks. This device is illustrated in Figure 666.

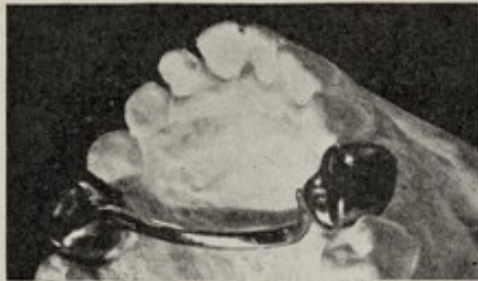


FIG. 666.

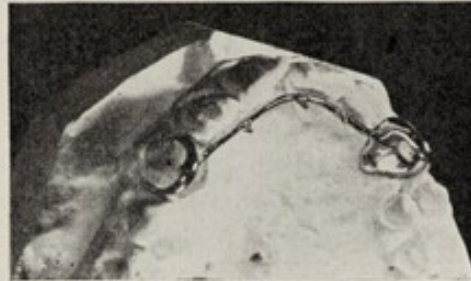


FIG. 667.

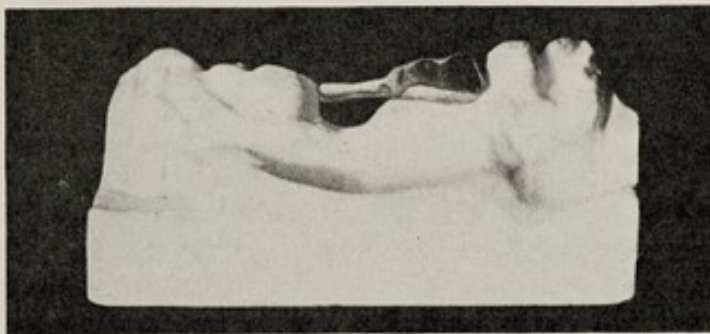


FIG. 668.

LIP BITING may be corrected in many cases by cementing a small bar, with five or six dull pointed prongs, on the lingual side of the upper incisors, as illustrated in Figure 667. These prongs are not sharp enough to hurt either the tongue or lip unless pressed hard against it, as in sucking or biting the lip. Then it is painful and the child is compelled to discontinue the habit as long as the appliance remains.

In placing either of these appliances, better results are usually obtained if the child is not told of their purpose.

SPACE RETAINERS. If a second temporary molar should be lost in advance of its scheduled time, a space retainer should be made

to prevent the first permanent molar from moving mesially and thus disturb the occlusal relations. A very convenient form of retainer is that shown in Figure 668. The bar extending from the shell crown on the first temporary molar has a somewhat enlarged and rounded end which makes contact with the first permanent molar. The occluso-gingival diameter of this bar is greater than the bucco-lingual diameter. If a first temporary molar is lost, a similar appliance may be attached to the second molar.

The temporary cuspid is less often lost on account of extensive decay than the molars, but orthodontists report that a cuspid is occasionally extracted because the permanent incisors are crowded. When this is done, it usually creates a much worse irregularity by allowing the lateral incisor and first bicuspid to partially close the cuspid space and thus cause the permanent cuspid to erupt to the labial of the line of the arch. When such a case is discovered, or in a case in which the temporary cuspid must be extracted early, a space retainer should be used. This may be made of bands attached to the lateral incisor and first bicuspid, with a bar attached to one band which may slide in a tube attached to the other and permit the teeth to move apart, but prevent them from moving closer to each other. As a rule there is no need for a retainer when an incisor is lost, as these teeth are being moved apart by the growth of the bone. In some cases, however, when one or more incisors are lost early, a bridge is desirable to assist in phonation.

RESTORATIONS; TEMPORARY TEETH

Class 1. Pit and Fissure Decays

ILLUSTRATIONS: FIGURES 670-698.

IN THE first examination for Mary Brown, see Figure 653, occlusal pit cavities were noted in both lower second molars. The treatment of the lower right molar is illustrated in Figures 670 to 681.

PIT CAVITY, LOWER SECOND MOLAR; COPPER CEMENT.

This was a very small pit, which the point of the exploring tine would enter very slightly and stick a little. See Figures 670 and 671. The patient was but four and a half years old and in view of the fact that the decay apparently did not fully penetrate the enamel, it was thought best to avoid the possibility of causing pain. A 6 tenths mm. inverted cone bur was used to open the pit. The bur was first held at a slight angle, as shown in Figure 672, so that the angles of the blades would engage the enamel first. After a little start had been made, the shaft of the bur was held more nearly in the line of the long axis of the tooth and, since there was no appreciable amount of caries, the cutting was continued with

the intention of penetrating almost the full thickness of the enamel, stopping just short of the dentin. The opening in the enamel was enlarged a little and the cavity was as shown in Figure 673. The restoration was made with black copper cement.

Attention is called to the statement in a previous chapter regarding the mixing of this cement: that everything must be in readiness when the mix is started, so that the cement can be placed immediately when it is of the right consistency. The set is so fast that a difference of a few seconds means a good or a poor restoration with copper cement. It sets much faster in warm weather. If it is just right, the cement sets very hard and wears slowly, maintaining a smooth, shiny surface. These restorations should be checked at each recall of the patient and replaced when they have washed out appreciably.

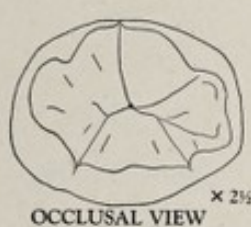


FIG. 670.



FIG. 671.

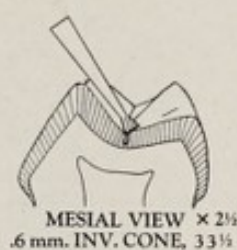


FIG. 672.



FIG. 673.

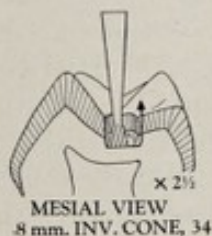


FIG. 674.

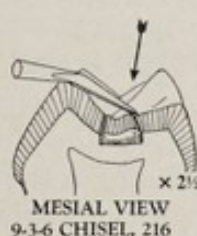


FIG. 675.

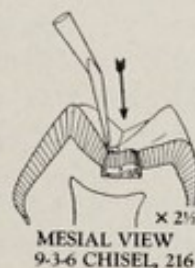


FIG. 676.



FIG. 677.

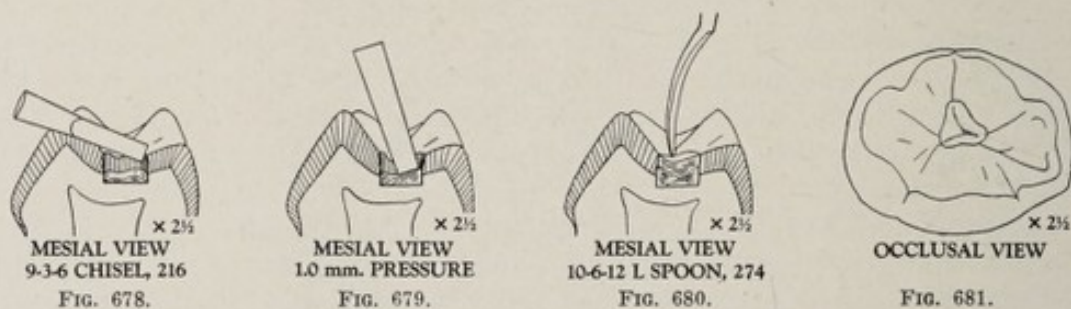
NOTE:—For each of the illustrations in this volume, which show the technical procedures in cavity preparation and the placing of restorations, the direction from which the surface or section of the tooth is viewed is indicated. If an instrument is shown, its name and formula are listed; also the manufacturer's stock number. The magnification of each drawing, as compared with the tooth, is also given. In all cases in which the instruments are not drawn in perspective, the measurements with a millimeter scale will be found to correspond with the drawings, most of which are $2\frac{1}{2}$ times the actual size. The blade of the chisel 3 mm. long in Figure 676 should measure $7\frac{1}{2}$ mm.; the 8 tenths mm. bur in Figure 674 should measure 2 mm. in diameter, and the blade of the spoon in Figure 686 should measure $2\frac{1}{2}$ mm. in width.

PIT CAVITY, LOWER SECOND MOLAR; AMALGAM.

OUTLINE AND RETENTION FORM. A year later, an amalgam restoration was made in the cavity referred to above. An inverted cone bur was used to remove the remaining copper cement. It was then carried slightly into the dentin, after telling the patient that it might hurt a little. She said it "didn't hurt much". Slight lateral

cuts were made along the buccal groove and to extend the cavity slightly to the mesial and distal, when the painful part was finished. Figure 674. Hartman's desensitizer might have been employed, but the painful cutting was so quickly over with, that the child did not mind. Figure 675 shows the cavity form as made with the bur. A 9-3-6 chisel was then used to break down undermined enamel rods, using it with lateral pressure on the far side of the cavity, as shown in Figure 675, and with a push motion on the near side, Figure 676. This completed the outline form. It also completed the resistance and retention form. The very slight decay had been removed before the copper cement was placed the year previously.

FINISH OF THE ENAMEL WALL. For this cavity, the child being only five, the restoration was made without the rubber dam. The measured amalgam and mercury were placed in the mortar, then



the mouth was packed with gauze, one small roll to the buccal and one under the tongue, extending backward on the right side. A small paper saliva ejector was used. The assistant began triturating the alloy and mercury while the gauze rolls were placed in the mouth. The cavity was dried with cotton and air. The same 9-3-6 chisel was then used to finish the enamel wall; first with a push motion in the direction parallel with the margin of the cavity, as in Figure 677, and a scraping motion wherever this was more convenient. See Figure 678. The direction of the rods was such that no bevel of the cavo-surface angle was required.

TOILET OF THE CAVITY. The cavity was cleared of loose debris with the air blast, then wiped with a small bit of hard rolled cotton.

AMALGAM RESTORATION. The amalgam was placed in the cavity in two small pieces, the first of which about half filled the cavity. Pressure was applied with the condenser to force the amalgam into the angles surrounding the pulpal wall. See Figure 679. The second piece was then placed, which more than filled the cavity and heavy pressure was exerted on the entire mass. This was done with direct pressure and without burnishing. After about three minutes, during which time the gauze rolls were replaced, the amalgam was trimmed to form with a 10-6-12 spoon. See Figure 680. The edge of the blade was carried along the margins, while

resting on the surface of the enamel, so that too much amalgam would not be cut away. The occlusal contour was also trimmed to form. Figure 681 shows the outline of the restoration.

DISMISSAL OF PATIENT. The patient was dismissed, and the amalgam was polished at a subsequent sitting. Before leaving, the child asked "When shall I come again," in a manner which indicated her willingness to return. This young lady seemed to be a little proud of the fact that she had suffered a little without complaint. Why should she object to coming again? She left with a "Thank you, doctor." This was an auspicious start on a dentist-patient relationship which has continued for more than thirty years.



FIG. 683.

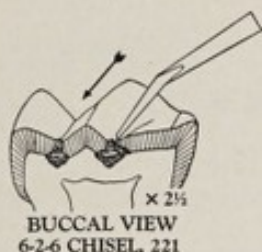


FIG. 684.

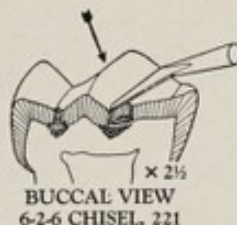


FIG. 685.

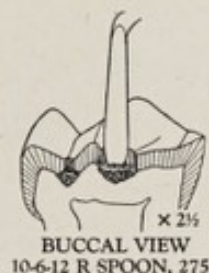


FIG. 686.

TWO SMALL PIT CAVITIES, UPPER SECOND MOLAR; AMALGAM.

Patient Thomas Johnson went along until his sixth year without a new cavity being discovered. He had missed the preceding recall for periodic care and six months had elapsed since the last examination. Both lower first permanent molars were partially erupted, and there were slight defects in the enamel forming the central fossae of both teeth, the care of which will be reported later. Two pit cavities were found in the occlusal surface of the upper left second temporary molar, also one in the upper right first molar and two in the upper right second molar. The amalgam restorations in the upper left second molar will be described. The occlusal view of this tooth is shown in Figure 683.

OUTLINE FORM. Some of the enamel rods had fallen away in the pit in the central fossa, so that a bur was not required. A 6-2-6 chisel was used with a push motion, also to reach across the cavity with lateral pressure to chip off in small pieces the enamel which had been undermined by caries, as indicated in Figures 684 and 685. There had occurred very little decay of the dentin and a 10-6-12 spoon was used to remove it. The spoon was placed at the lingual side of the cavity and, with fairly heavy pressure, a sweep was made from lingual to buccal, keeping the sharp edge of the blade against the undecayed dentin. Most of the decay was removed with a single cut. See Figure 686. Two additional cuts were made

to remove the remainder. This cutting caused a very little pain when the sharp blade necessarily cut into the sound dentin in removing the last of the carious dentin. This simple preparation, with two instruments, would have been sufficient for a restoration with copper cement, which might have been made had there been reason for postponing the placing of a more permanent restoration. See Figure 687.

The cavity in the distal pit was prepared at the same time. A 6 tenths mm. inverted cone bur was used to make the opening through the enamel and the loose ends of rods were removed with the same 6-2-6 chisel as was used for the other cavity, followed by the spoon to remove the decay. This cavity might also have received a copper cement restoration at this time. See Figure 688.



FIG. 687.



FIG. 688.



FIG. 689.

The further preparation of these cavities called for the use of a bur and the cutting would likely be painful. An application of Hartman's solution was made in each cavity and the preparation was continued without causing pain.

RETENTION FORM. The pulpal walls of both cavities were made flat, with sharp line angles, by using a new 1 mm. inverted cone bur, which was revolved slowly while held parallel to the long axis of the tooth and carried around each cavity. This cutting was interrupted several times for a few seconds to avoid thermal shock. See Figure 689.

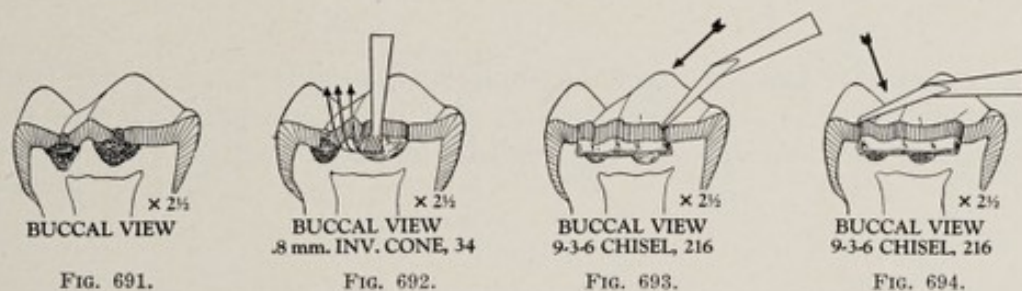
AMALGAM RESTORATIONS. The cavities were finished by trimming the enamel walls, and amalgam restorations were placed as described for the previous case.

TWO LARGE PIT CAVITIES, UPPER SECOND MOLAR; AMALGAM.

Frank Hines had pit decays in the corresponding tooth. See examination card, Figure 657. The same series of drawings will be continued to show the difference in the technic. The decay was more extensive, particularly in its involvement of the dentin. Also, the distal groove was fissured through the oblique ridge and the other grooves were slightly fissured. There was considerably less sound dentin between the decayed area and the pulp in this

tooth, see Figure 691, as compared with the previous case, illustrated in Figure 684.

OUTLINE FORM. After the overhanging enamel had been chipped away about the decay in the central fossa, as described for the previous case, an 8 tenths mm. inverted cone bur was employed to open the fissure along the distal groove and join the two cavities. It required three short cuts to break through to the distal pit, as shown in Figure 692. The overhanging enamel along the fissure and about the decay in the distal pit was then broken down and an application of the desensitizing solution was made. All of the carious dentin was next removed from both cavities with a



spoon to be certain that the pulp was not exposed. See Figures 693 and 694.

RETENTION FORM. The decay was so deep that it would have endangered the pulp to have cut the pulpal wall to the level of the deepest penetration. It was therefore prepared by cutting a shelf in the dentin, less than a millimeter deep, as shown in Figure 695. The deeper part of each area, from which the decay was removed, was filled with cement.

APPLICATION OF RUBBER DAM. The field of operation may always be more certainly kept dry if the rubber is applied. With young children it becomes largely a question of the unusual difficulties involved and the possible punishment that may be inflicted. It is often practicable, in making occlusal restorations, to place a clamp on the tooth, and, having punched but one hole in the rubber, slip it over the clamp. This can be done in a few seconds. If the mouth is to be packed with gauze, it should be done before the enamel wall is finished, and the amalgam should be mixed by the assistant while the dentist is finishing the enamel wall.

FINISH OF THE ENAMEL WALL. Figure 695 and 696 show two positions of the 12-6-6 chisel in cutting the enamel wall in the direction parallel to the margin of the cavity. In Figure 695 the instrument is used with a push motion in trimming the lingual wall; in Figure 696 with a scraping motion along the distal wall.

Figure 697 is a mesial view of the posterior two-thirds of this cavity as seen in a bucco-lingual split section. This gives a good

understanding of the excellent retention form in cavities prepared with pulpal walls in the horizontal plane and the surrounding walls at right angles to the pulpal wall.

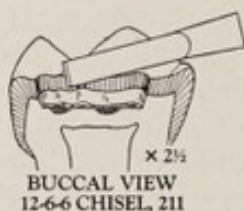


FIG. 695.



FIG. 696.

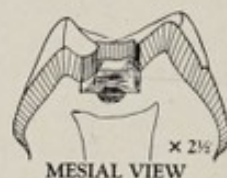


FIG. 697.

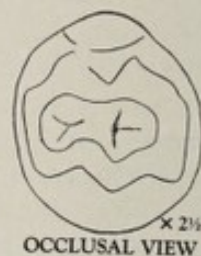


FIG. 698.

AMALGAM RESTORATION. Although this cavity was larger than the previous one, the technic for placing the amalgam was the same. An occlusal view of the restoration is shown in Figure 698.

Class 2. Proximal Decays in Molars

ILLUSTRATIONS: FIGURES 703-743.

DISTAL CAVITY, UPPER MOLAR; COPPER CEMENT.

ON Thomas Johnson's examination chart, at the age of four and a half years, there was marked a small cavity in the distal surface of the upper left first molar. A distal view of this cavity is shown in Figure 703; a mesio-distal sectional view in Figure 704. It will be noted that this decay began, as do most proximal decays in the temporary molars, rather close to the occlusal surface and it required but little lateral spreading occlusally in the dentin to undermine the enamel of the marginal ridge. It will also be observed that the pulp chamber is very large.

OUTLINE AND RETENTION FORM. When a proximal decay occurs in the tooth of a child so young, the least possible cutting should be done that will include the removal of all of the decay. In preparing the cavity in question, the enamel of the marginal ridge was broken down with a 6-2-12 chisel, held at first in the position shown in Figure 704. The direction was gradually changed by moving the handle of the instrument mesially and closer to the plane of the occlusal surfaces of the teeth. It was possible, in view of the undermining of the marginal ridge, to remove the enamel as far mesially as is shown in Figure 705. However, this cutting was less wide bucco-lingually than the width of the surface involvement of the enamel in Figure 703. It was therefore necessary to cut the cavity a little wider bucco-lingually and also remove the

occlusal enamel as far mesially as the deepest penetration of caries in the dentin. An 8 tenths mm. inverted cone bur was placed in the cavity and, after warning the child that it would hurt, the bur was pressed mesially, cutting only the width of the diameter of the bur in the dentin. There was no objection of consequence by the patient on account of the pain and additional cuts were made to enlarge the cavity slightly in the mesial, buccal and lingual directions — incidentally removing all of the carious dentin, as illustrated in Figure 707. The enamel walls were made smooth with hatchets 9-3-12, right and left, used with a push motion for the

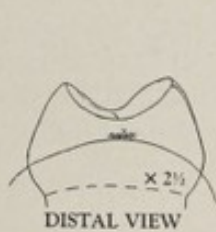


FIG. 703.

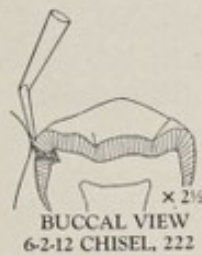


FIG. 704.



FIG. 705.

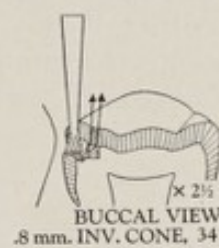


FIG. 706.



FIG. 707.

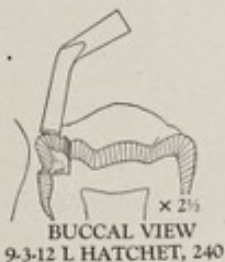


FIG. 708.

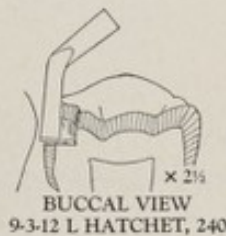


FIG. 709.



FIG. 710.

buccal and lingual walls, as illustrated in Figure 708, and with a scraping motion along the gingival wall, as in Figure 709. The mesial wall was trimmed with the 9-3-6 chisel.

COPPER CEMENT. In view of the age of the child, copper cement was placed without further preparation of the cavity. This was trimmed smooth at all margins. The finished restoration is shown in Figure 710.

On two occasions during the next fifteen months, it was necessary to add more copper cement, due to the fact that the restoration had partially washed out. Most of the previously placed cement was cut away with a bur in order to have good retention for the replacement. At a convenient time, an amalgam restoration was made, after better retention form had been obtained.

DISTAL CAVITY, UPPER FIRST MOLAR; AMALGAM.

When Mary Brown was six years old, an amalgam restoration was made for the decay in the distal surface of the upper left first molar. This decay had made greater progress in the dentin than in the case reported for Thomas Johnson, and the cavity preparation will be reported in greater detail.

OUTLINE AND RETENTION FORM; ANESTHESIA. Figure 711 is a distal view of the upper right first molar, and Figure 712 is a mesio-distal section illustrating the extent of the decay in the dentin. As will be noted by the surface involvement of the enamel, the decay in both enamel and dentin is more extensive in the bucco-lingual direction. Instead of cutting away the enamel of the marginal ridge, as in the previous case, an opening was made through the enamel of the distal pit of the occlusal surface with an 8 tenths mm. inverted cone bur, starting with the bur in the posi-



FIG. 711.

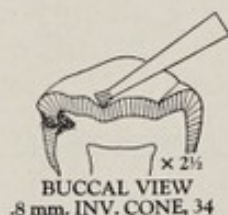


FIG. 712.



FIG. 713.

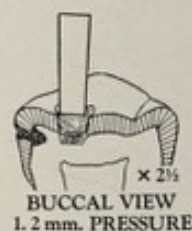


FIG. 714.

tion shown in Figure 712. The bur was pressed through into the dentin and the opening through the enamel was enlarged to about 1.5 mm. diameter at the surface. See Figure 713. This gave an ideal situation for pressure anesthesia, as it was possible to use sufficient pressure on the unvulcanized rubber in the confined space to force the solution through normal dentinal tubules. See Figure 714. The bur was then used to cut distally to the decayed area. This was done with a series of cuts, as indicated in Figure 715, regardless of the fact that the tooth was so well anesthetized that it would not have caused pain if one continuous cut had been made with the bur. *There is no doubt but that many pulps die from thermal shock resulting from heat caused by the bur, when the pulp is anesthetized and the patient feels no pain.* Therefore, the same care should be exercised in cutting with the bur, whether the pulp is anesthetized or not.

The pulpal wall was squared out with a 1 mm. inverted cone bur, as illustrated in Figure 716. The bur was then used to undermine the distal enamel wall and break out a little of the enamel at the gingivo-buccal and gingivo-lingual angles, to give the best form to the cavity and at the same time remove the most vulnerable enamel. The outline form and retention form were completed with

the 9-3-12 right and left hatchets. In Figure 717 the left instrument is illustrated in two positions, one trimming the lingual wall of the occlusal portion of the cavity, the other the lingual wall of the proximal portion. In Figure 718 the right instrument is being used to make the pulpal wall smooth; the movement of the blade being from lingual to buccal.

Attention is called to the fact that the pulpal and gingival walls of this cavity are in the same horizontal plane. Or it might convey a better idea of the actual condition, if it is stated that the pulpal wall was carried through to the distal without deeper cutting. This was permissible for the reason that the decay began so near to the occlusal, due to the position of the contact point, that there was no object in cutting the gingival margin deeper, as it would be fully covered by the gum margin.

WIDENING AN EMBRASURE. The occlusal view, Figure 719, shows the buccal embrasure slightly narrower than the lingual. It

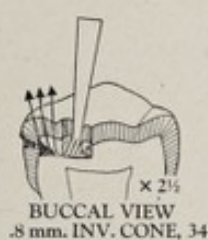


FIG. 715.

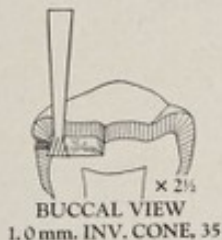


FIG. 716.

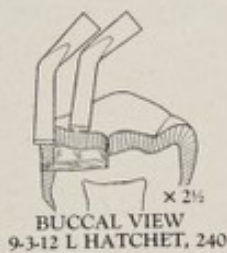


FIG. 717.



FIG. 718.

would have been in better form if the cavity had been cut farther to the buccal. Instead, the same result was accomplished by disk-ing off the buccal portion of the distal surface to the position of the broken line. This may be done in any position on the temporary molars where an embrasure is too narrow, so long as it does not too greatly reduce the thickness of the enamel.

APPLICATION OF RUBBER DAM. Two holes were punched in the rubber dam and a number 18 clamp was placed on the second molar. The chair was tipped back; the operator stood behind the chair and used the fourth grasp. One hole was slipped over both the clamp and the second molar, the other over the first molar. A ligature was carried through the contact between the first molar and the cuspid to turn the edge of the rubber under. It was not forced under the gum margin, but was left in position to be used a little later. The field was thoroughly dried.

FINISH OF ENAMEL WALL. The pair of 9-3-12 right and left hatchets were used to finish the walls of the distal portion of the cavity; the left instrument of the pair for the lingual wall, cutting from occlusal to gingival, also to smooth the lingual half of the

gingival wall, cutting from buccal to lingual. See Figures 720 and 721. The right instrument was similarly used for the buccal wall and the buccal half of the gingival wall. The buccal and lingual enamel walls were inclined slightly outward and the cavo-surface angle was beveled. The gingival wall was safe, prepared in the horizontal plane, as the enamel rods of the temporary teeth are inclined occlusally in all positions in the axial surfaces. The 9-3-6 chisel was used to smooth the enamel walls of the occlusal portion of the cavity, which required no bevel. See Figure 722.

IMMUNIZATION OF PROXIMAL SURFACE OF THE ADJOINING TOOTH. Whenever a proximal cavity is prepared, advantage should be taken of the opportunity to apply silver nitrate to the easily accessible proximal surface of the adjoining tooth, if there is the slightest appearance of a whitened area when the enamel is dry. In this case there was a white spot of about the same shape as the area in the distal surface of the first molar, but the surface of the enamel was smooth. Silver nitrate was applied and the spot became black and remained so, indicating the deposit of silver.

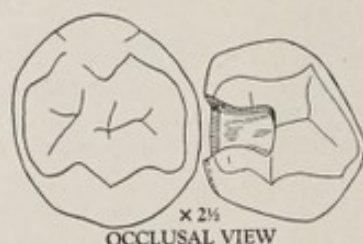


FIG. 719.

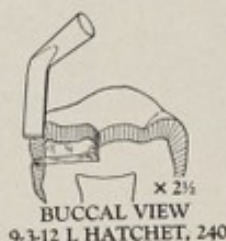


FIG. 720.



FIG. 721.



FIG. 722.

APPLICATION OF MATRIX. A thin piece of stainless steel matrix material was cut about 4 mm. wide and about 18 mm. long. The end edges were bent at a slight angle and the corners were turned up as illustrated in Figure 454. It was placed around the distal, buccal and lingual surfaces of the first molar, as shown in Figure 723, with the turned corners to the gingival. The ligature, which was left between the first molar and the cuspid, was again passed through the same space and one end drawn through far enough to make a small loop. This loop was slipped over the matrix and was gently pushed down near to the gingival edge of the matrix and drawn tight. Two more loops were placed around the matrix and the ligature was tied on the buccal side with a surgeon's knot. The matrix was thus held firmly against all distal margins of the cavity. See Figures 723 and 724.

AMALGAM RESTORATION. It was not thought necessary to separate the temporary teeth in making this proximal restoration, as the second molar would move forward and promptly close a space

so slight as that resulting from the use of a thin matrix. The trituration of the amalgam was started by the assistant as soon as it was apparent that the ligature would draw the matrix into the proper position. The amalgam was placed in three pieces, the first against the mesial and pulpal walls, the second against the pulpal wall and the matrix, and the third filled the cavity overfull. Heavy direct pressure was made over the occlusal surface, including all margins. Special attention was paid to the pressure of the amalgam against the matrix in order to secure a good contact with the mesial surface of the second molar. The plan of placing and condensing the amalgam is illustrated in Figure 725.

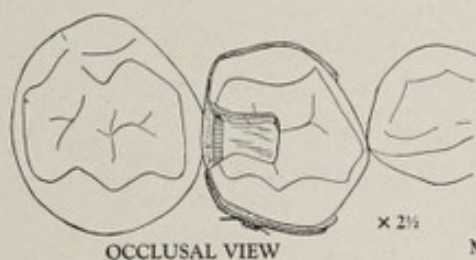


FIG. 723.

MATRIX

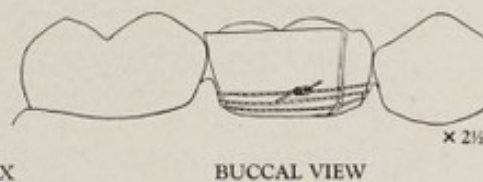


FIG. 724.



FIG. 725.

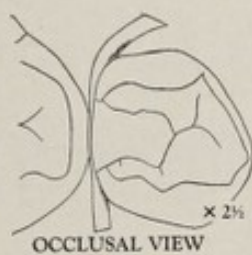


FIG. 726.



FIG. 727.

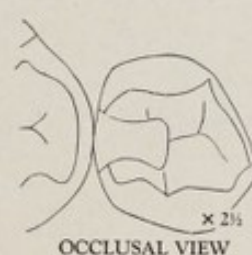


FIG. 728.

CONTOURING THE RESTORATION AND REMOVAL OF THE MATRIX. After the amalgam had set fairly hard, the ligature was removed and the matrix was bent away from the buccal and lingual surfaces of the tooth. The buccal end was cut short with the pair of small heavy curved scissors. Figure 726. A margin trimmer 15(95)-9-12 was then used to trim the amalgam next to the matrix in the form of the marginal ridge of the occlusal surface. The occlusal surface was carved to approximate form before the matrix was removed, in order that the amalgam might be harder and therefore less likely to be disturbed in drawing the short end of the matrix past the contact point. A spoon was used, as already described, to carve the occlusal surface to form and trim the margins smooth. The long end of the matrix was then grasped with a pair of flat nosed pliers and the short end was slowly drawn through the contact to the lingual. The slight excess of amalgam at the gingival, buccal and lingual margins of the proximal portion of the restora-

tion was trimmed off with the gold finishing knives, as illustrated in Figures 433, 434 and 435, finishing gold foil restorations. The patient was then requested to close the teeth very gently to discover any high spots on the occlusal surface, which might require further trimming and proper corrections were made.

The distal and occlusal views of the restoration are shown in Figures 727 and 728.

Johnson, Thomas 1871- *Andover St.*
 NAME NUMBER 986 RES. TEL. *North 731* NPIR ADDRESS *Chicago.* EXAM. NO. 15
 BUS. TEL. DATE 12-3-36
 DATE OF BIRTH NEXT EXAM
 AGE 8 1/2

RIGHT LEFT

OCCLUSION N PNR
 REPORT TO 123 DN M ND 123
 PATIENT CARE NP M CINGIVAE

DATE WIN GS X YS RA YS CA SE NOT ONLY POC ELS PNC TO

REP ORT PWT ENT ME MO
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FIG. 733. Examination of Thomas Johnson: Patient No. 986, fifteenth examination, age 8½ years; occlusion normal, cleanliness good, susceptibility medium, gingivae fine. Chart shows all temporary incisors replaced by permanent teeth and all four first permanent molars in place. Decays: occlusal pits in both temporary upper first molars, also occlusal pit and distal surface of temporary lower left second molar. The mesial surface of the lower right first permanent molar was marked in blue on the chart to indicate a slight beginning decay to be immunized. The previous operations were checked and a full set of radiographs was made. See chapter in Volume I on oral diagnosis for explanation of chart.

DISTAL CAVITY, LOWER SECOND MOLAR; AMALGAM, GOLD INLAY.

When Thomas Johnson came in for periodic care, at the age of eight and a half years, he had missed the two previous recalls; the first because of illness, the second because he was away from the city with his mother. See Figure 733. There were two cavities in the lower right second temporary molar, one in the central pit and one in the distal surface, which had undermined the enamel of the occlusal surface, and much of this occlusal enamel had broken away. The cavity was filled with debris. The occlusal view is presented in Figure 734, the distal view of the second molar in Figure 735.

The immediate concern was for the mesial surface of the first permanent molar. The undermined enamel of the cavity in the second temporary molar was broken down with chisels and most of the decay was removed with a spoon, so that a good view of the first molar might be had. It appeared to be in perfect condition. However, when the preparation of the cavity in the temporary molar had been completed and the rubber dam was applied, a white spot appeared on the mesial surface of the permanent molar as soon as it was thoroughly dry. Silver nitrate was therefore applied. After waiting two or three minutes, the surface was polished with fine disks and nearly all of the blackened area was removed, indicating that the depth of the etching had been very slight. Practically all of the etched enamel was removed with the disks.

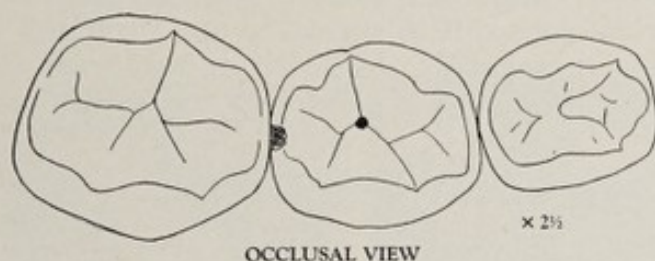


Fig. 734.



Fig. 735.

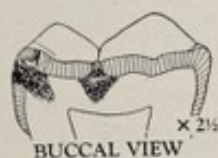


Fig. 736.

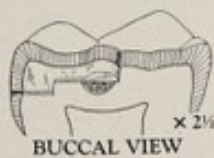


Fig. 737.

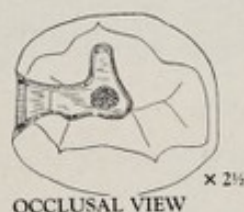


Fig. 738.

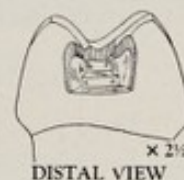


Fig. 739.

CAVITY PREPARATION. There were only minor differences in the technic of preparing the disto-occlusal cavity in the second temporary molar as compared with the similar cavity in the first temporary molar just described. Therefore the preparation will not be given in detail.

Figure 736 is a mesio-distal section showing the penetration of both decays, which were extensive in the dentin, having undermined much of the enamel and penetrated far toward the pulp. It will be noted in Figure 737 that the pulpal wall was not cut to the full depth of the carious dentin in the central area. The deeper portion of the cavity was filled with zinc phosphate cement. It was necessary, in this case, to cut the gingival wall deeper than the pulpal wall, also deeper than the surface decay of the enamel, due to the undermining of the enamel in the gingival direction by lateral decay in the dentin. The occlusal outline of the finished cavity is shown in Figure 738 and the distal view in Figure 739.

SEPARATION. In view of the fact that an amalgam restoration was to be made, it was desirable to secure a little separation in advance, in order that the contact might be properly restored without the use of a separator. The cavity was therefore filled very slightly overfull with pink base-plate gutta-percha and the boy was directed to chew on this during an interval of two weeks. On his return the teeth had been separated sufficiently to allow for the thickness of a matrix and for polishing; the gutta-percha had also been forced against the gingiva, compressing it a little between the teeth.

Gutta-percha should not be allowed to remain in such a cavity very long without inspection, as there is danger of injury to the gingiva. Most children chew vigorously, often exerting more than one hundred pounds on the temporary molars, and the repeated pressure on the gutta-percha causes it to spread in any direction in which it is not confined—to separate the teeth or compress the gum, or both. The gingiva will quickly regain its normal contour

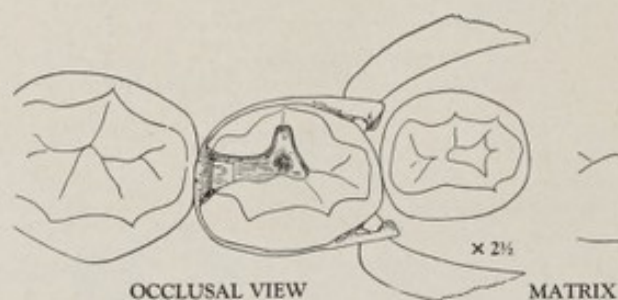


FIG. 740.



FIG. 741.

after a slight compression, but may never fully recover, if forced down to the cemental line or beyond. None other than pure base-plate gutta-percha should be used, because a softer material, such as temporary stopping, will be forced into the interproximal space without separating the teeth.

THE IVORY MATRIX. In this case the matrix holder designed by Dr. H. W. Ivory, illustrated in Figure 461, was used. Several different sizes of prepared matrices are available, and each has several holes punched in either end, near the edge that is to be at the gingival. The matrix was bent to the approximate contour of the tooth and the jaws of the holder were placed in two of the holes, one near either end of the matrix. It was then slipped over the tooth to test its length. It was too large and one of the jaws was changed to the next hole, in order to make the loop of such length that the jaws would bind on the opposite angles of the tooth—the mesio-buccal and mesio-lingual angles in this case. Then while the matrix was held in position with one hand, the adjusting screw was turned with the other and the matrix was drawn tightly about the tooth. See Figures 740 and 741.

AMALGAM RESTORATION. In making the restoration, heavy pressure was maintained on the occlusal surface of the amalgam and against the matrix to force it hard against the mesial surface of the first permanent molar at the position of the contact point. After the amalgam had set, the holder was detached and the matrix was removed as described for the previous restoration. The patient was given another appointment within forty-eight hours, in order that a wide, fine grit strip might be passed between the teeth to polish the distal surface of the amalgam before the teeth had settled back to the positions they occupied previous to the use of the gutta-percha for separation.

RESTORATION WITH GOLD INLAY. The ideal restoration in this case would have been a gold inlay, in order to give the mesial surface of the first permanent molar the best possible protection. It



FIG. 742A.

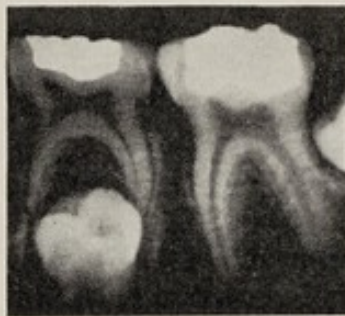


FIG. 742B.

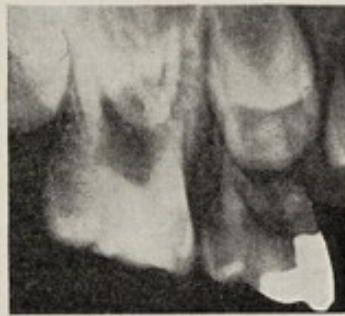


FIG. 742C.

is the only position in the temporary teeth in which a gold inlay should occasionally be used. The use of a gold inlay in the temporary molar is not indicated in cases in which a restoration is also required in the mesial surface of the first permanent molar, but is desirable if the first molar is not decayed. When the decay of the second temporary molar occurs very early, as in this case, it may be difficult to secure a proper contact with amalgam, and a good contact is of the utmost importance to prevent decay of the first molar. A gold inlay was not made in this case and the technic will not be given. Its use is mentioned to impress the importance of making the best possible contact and proximal surface form for distal restorations in the second temporary molars.

RADIOGRAPHS OF RESTORATIONS.

Radiographs of temporary teeth in which restorations have been made are shown in Figures 742 A, B and C and 743 A, B and C. These are presented for the purpose of emphasizing what has been said regarding the size of the pulp chambers in the temporary teeth. The first permanent molars are shown in five of the illustrations, thus affording opportunity for comparison, not only of the sizes of the pulp chambers, but also of the thickness of the enamel

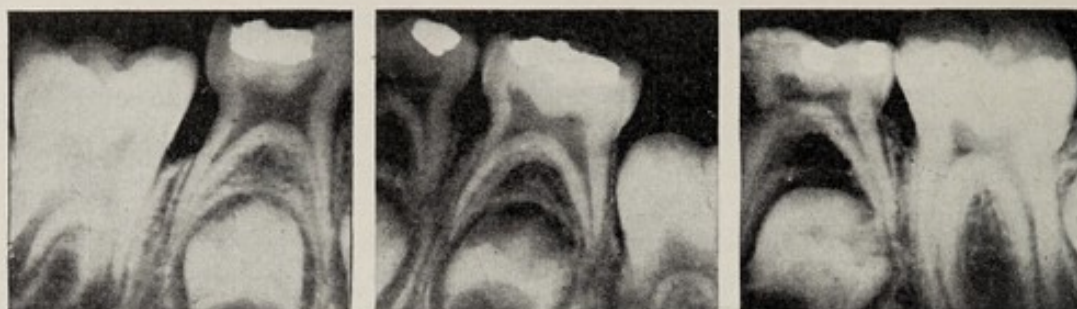


FIG. 743A.

FIG. 743B.

FIG. 743C.

and dentin. These illustrations are a little more than $1\frac{1}{2}$ times actual size, so the distance from the surface to the pulp chamber is correspondingly less in the teeth. In comparing the sizes of the pulp chambers in these temporary molars with those of the first permanent molars, it should be remembered that the pulp chambers of the permanent molars are much larger than they will be a few years later.

Classes 3 and 4. Proximal Decays in Incisors and Cuspids.

ILLUSTRATIONS: FIGURES 745-754.

ON Frank Hines' first examination card, see Figure 657, proximal decays were marked in the distal surface of the upper left central incisor and the mesial of the lateral. These had penetrated to such depth that restorations were required. He was then not quite five years of age.

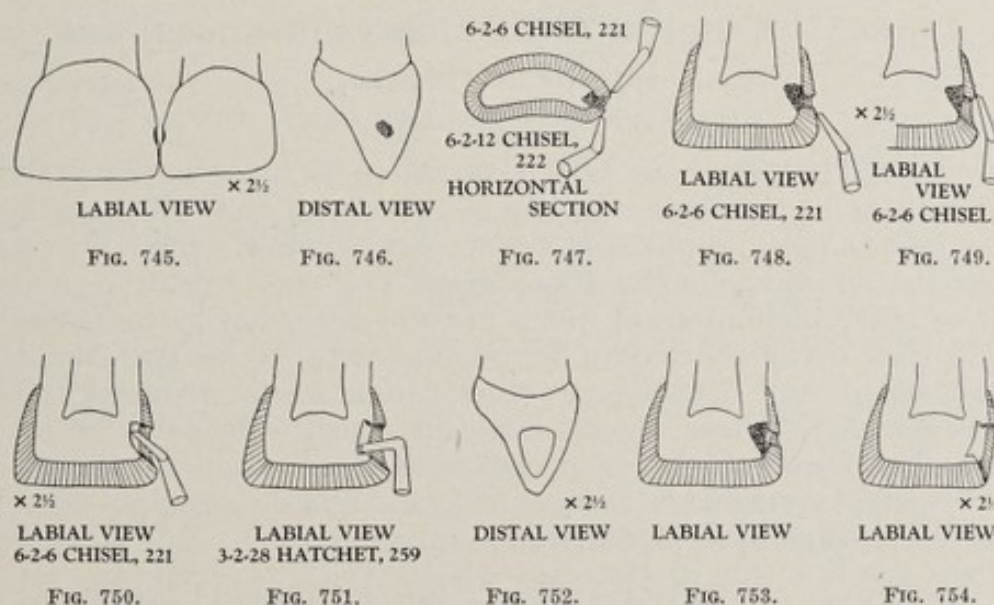
PROXIMAL DECAYS, UPPER INCISORS; CEMENT.

The labial view of these teeth is shown in Figure 745 and a distal view of the central incisor in Figure 746. The penetration of the decay is illustrated in both the horizontal section, Figure 747, and the mesio-distal section, Figure 748. There was no thought of extension for prevention in preparing these cavities, although the teeth had moved apart very little, if any. It is not very unusual for the temporary central incisors to remain in contact until the fifth or sixth year, but the lateral incisors generally move away from the centrals before the fifth year. It was only necessary to remove the decay, secure retention form and place a restoration. The treatment of the decay in the central incisor will be illustrated and described.

OUTLINE FORM. The undermined enamel was chipped away with chisel 6-2-6 from the labial and chisel 6-2-12 from the lingual, Figure 747. Chisel 6-2-6 was used for the incisal and gingival walls, with a push motion for the incisal and with lateral pressure

for the gingival. In both positions the approach was from the labio-incisal direction. See Figures 748 and 749. The same instrument was afterwards held in a position to the labial almost at right angles to the long axis of the tooth to prepare the gingival wall.

RETENTION FORM AND REMOVAL OF CARIES. The removal of the carious dentin and the shaping of the retention were accomplished, for the most part, with the 6-2-6 chisel and the 3-2-28 hatchet, the approach being in part from the labial and in part from the lingual. The chisel was first used to remove the bulk of the decay and square out the axio-labial and axio-lingual line angles, the movement of the blade being mostly from incisal to gingival. Figure 750. Then, by turning the instrument with the handle more nearly at right angles to the labial surface, the axio-gingival line angle was made definite. The hatchet 3-2-28 was then placed in the cavity with the handle almost parallel to the long axis of the tooth and the blade was carried around the incisal angle, making a definite undercut. See Figure 751.



FINISH OF THE ENAMEL WALL. The enamel walls were made smooth with the two chisels mentioned. The gingival wall was prepared in the horizontal plane, with no bevel of the cavo-surface angle, due to the fact that the rods are all inclined incisally.

RESTORATION WITH CEMENT. One of the modified silicate cements was used for this restoration. A zinc phosphate cement would be preferred by some operators. The directions for mixing and placing these cements have already been given. No effort was made to restore the contact, as the teeth were moving apart. The restoration is illustrated in Figure 752.

PROXIMAL CAVITY, INVOLVING INCISAL ANGLE; CEMENT.

CAVITY PREPARATION. A glance at the decay in the dentin in Figure 748, as compared with Figure 753, shows how little additional lateral spreading of decay incisally is required to undermine the enamel of the incisal angle. This necessitates the extension of the outline form as shown in Figure 754, also slight modification of the retention form. In some cases this would include undercuts along the incisal portions of the axio-labial and axio-lingual line angles. The incisal margin of the enamel should be slightly rounded, as illustrated in Figure 754, to give better protection to the margin of the cement.

RESTORATION. In placing the restoration in such a cavity, no attempt should be made to restore the incisal angle, as the cement would soon be broken off or worn away. The entire restoration should be only very slightly convex from the margin of the lingual wall, to the margin of the labial wall. The difference in the outline of the two restorations is illustrated in Figures 751 and 754.

Class 5. Gingival Third Decays in Buccal and Labial Surfaces.

ILLUSTRATIONS: FIGURES 758-766.

IN PRACTICES where fair cooperation is obtained in regular brushing of the teeth, cavities in the buccal and labial surfaces have been almost eliminated from consideration; they are seen infrequently. Occasionally these areas are very sensitive, and it will be best not to attempt much in the way of cavity preparation at the time. The decay may be removed with one or two cuts of a sharp spoon, and a temporary restoration made with zinc phosphate cement. A few months later the sensitiveness will be much less and the cavities may be prepared in better form. If the decay has penetrated through the enamel, Hartman's solution may be used, being careful to protect the gingivae.

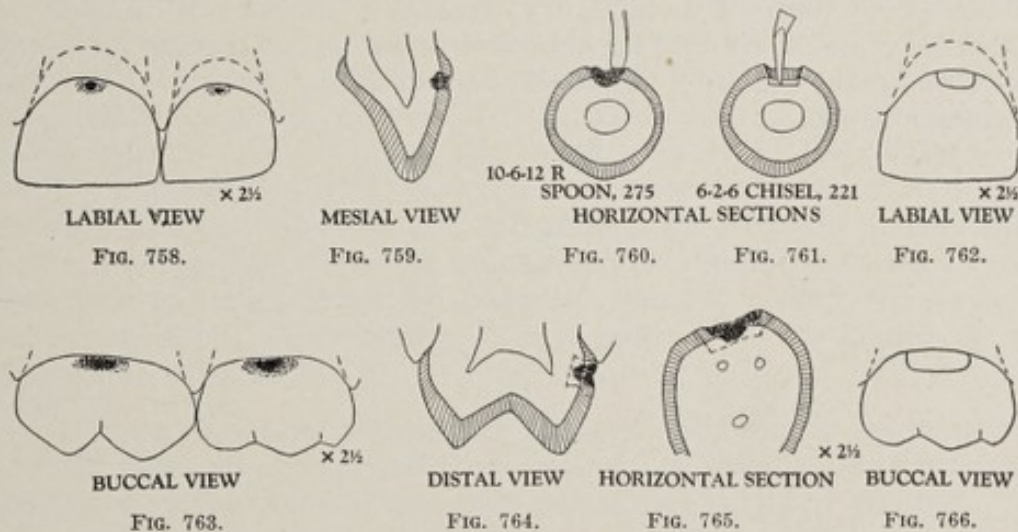
GINGIVAL THIRD CAVITIES, UPPER INCISORS; CEMENT.

Patient Frank Hines had four gingival third decays marked on his card, see Figure 657. They were in the upper left central incisor, the upper left lateral and in both upper right molars. The restorations in the central incisor and the first molar will be reported. Figure 758 is a labial view of the upper left central and lateral incisors; Figure 759 is a labio-lingual section and Figure 760 is a horizontal section of the central incisor, each showing the extent of the decayed areas in the enamel and dentin.

OUTLINE FORM. In this case a spoon was the first instrument used. Figure 760. It was placed at the distal margin of the surface decay in the enamel and was carried mesially to include the deepest part of the decay in the dentin. Practically all of the decay

was removed by this one cut. It is often surprising how little pain is caused by such a cut with heavy pressure, when the tooth is quite sensitive to a light touch with an instrument. As a general rule, extension for prevention is not practiced in preparing cavities of this class in the temporary incisor teeth. They are lost so soon that it is hardly necessary. It seems best, therefore, in most cases, to make the smallest possible preparations, and endeavor to gain the interest of the child in brushing the teeth, on the assurance that it can prevent further decay in all gingival third positions.

RETENTION FORM. Two cuts were made with a sharp chisel, with firm pressure; one along the axio-gingival line angle, one along the axio-incisal. See Figure 761. In both cases these line angles were slightly undercut. This gave sufficient retention and the mesial and distal walls were left with an outward inclination. It



is preferable to have the retentive form between the gingival and incisal walls, rather than at the mesial and distal extremities of the cavity, for the reason that, if new decay occurs, it will usually be to the mesial or distal of the restoration, and will not weaken its retention.

CEMENT RESTORATION. A restoration was made with a modified silicate cement. In some cases it might be safer, so far as dryness is concerned, to use a zinc phosphate cement, which sets quicker. It is not so very important, when the tooth will be shed in about a year. The restoration is shown in Figure 762.

GINGIVAL THIRD CAVITIES, UPPER MOLARS; AMALGAM.

The cavities in the molars present practically the same problem, except that these teeth normally last four or five years longer. Therefore, in making restorations in the molars, the cavities should be prepared with more definite retention form, and oftentimes

with some extension — far enough, at least to be certain that every particle of enamel that has been etched on the surface is removed.

A buccal view of the molars is presented in Figure 763, a bucco-lingual sectional view of the first molar in Figure 764, and a horizontal section in Figure 765, showing the extent of the decay. The outlines of the prepared cavity are indicated by broken lines. The gingival enamel wall was prepared in the horizontal plane; the occlusal enamel wall was inclined considerably to the occlusal, due to the inclination of the enamel rods. The outline of the restoration is shown in Figure 766.

If the child is very susceptible, restorations in the molars should usually be with amalgam, with the rubber dam in position. They should be made with the utmost care and well polished. Second choice would be copper cement, particularly for the second molars, and possibly a modified silicate cement for the first molars. If the cavity can not be kept dry, amalgam should not be used. If the child is one who may be expected to return at regular intervals, black copper cement, replaced occasionally, is often the best material to use.

Childhood and Early Adult Period

THIS period extends from the sixth to the twenty-fifth year. It is the period during which the future health of the natural denture is usually determined — whether it is to be conserved throughout life, or eventually lost and replaced by artificial substitutes. It is also the period during which chronic mouth infections as a menace to the health must be, in large measure, prevented. It is, therefore, the most critical period for each person from the dental viewpoint.

CHILDHOOD PERIOD OF THE PERMANENT TEETH. The difficulties which confront the dentist during this period are centered around the fact that it includes the childhood period of the permanent teeth, which for each tooth, comprises the time from its eruption until the growth of the root has been completed. This includes the time from the sixth to the sixteenth year, if the third molars are excluded from consideration, or until about the twenty-fifth year, including those teeth. The twenty-fifth year has been chosen as the most logical dividing line between this and the adult period for the reason that, in the average individual, it marks a rather definite trend toward immunity to caries and thereafter the dentist is likely to be more concerned about the relation of restorations to the health of the supporting structures.

During the childhood period there will constantly be some permanent teeth in the mouth that can not be treated as temporary teeth, nor as the teeth of an adult would ordinarily be treated. The roots of the permanent teeth are not completed until several years after the teeth have taken their places in the arch. During this period of growth they are liable to rapidly progressive caries; the pulps are much larger than in adult life and are therefore especially liable to become exposed by caries or in the preparation of cavities. In the event of exposure, removal of the pulp and the making of a root filling in the tooth affected may not be undertaken previous to the particular time of the completion of the growth of the root and the narrowing of its apical foramen to a very small opening. Therefore, in such cases, exposure of the pulp by caries means the loss of the tooth, no matter how important it may be to the future of the child. The period, therefore, includes the consideration of the growth of the roots of the permanent teeth, as well as the treatment of caries during the period of greatest susceptibility for many persons. The growth of the roots and the gradual reduction in the sizes of pulp chambers and of root canals are discussed in the chapter on development in Volume I.

Caries of the permanent teeth presents considerable differ-

ences when occurring in different localities in the mouth or upon different surfaces of the teeth, and at different ages of patients that call for differences in the management of cases. Occasionally all classes of cavities will be found in the same mouth and require treatment at the same time. This is comparatively rare, but when it occurs in a young person the case is a very grave one. The rule is that in very susceptible persons, particular classes of cavities make their beginnings at about a certain time after each of the several teeth has taken its place in the arch. This certain time will be early or late with different patients, according to the intensity of the susceptibility and favorable or unfavorable local conditions. If the first molar is found with occlusal decay at eight years, two years after it takes its place, the second molar is apt to be decayed in the occlusal surface at fourteen, or two years after it presents in the arch. The same rule follows in pit cavities in other teeth. If, however, the first molar is not decayed until twelve, other pit cavities will also be late occurring, and not so many will occur. Occlusal decays do not occur if there are no pits, but they do not necessarily occur if there are pits. The number and the time of their occurrence will be controlled mostly by the susceptibility to caries in the individual.

Cavities of the other classes occur at a later date as the rule. Therefore, when cases are closely followed with respect to individual teeth, one class must be dealt with first, then another and then a third, as the patient grows older.

The first molars and the incisors are particularly liable to caries during the childhood period. The first molars suffer much the oftenest. The fact that these teeth take their places very quietly to the distal of the temporary molars without the dropping away of any of the temporary teeth to announce their coming serves to conceal their eruption. Parents generally do not know of the presence of these teeth, or do not realize that they are permanent teeth. They are, therefore, more frequently neglected than any other teeth.

FIRST PERMANENT MOLARS. The lower first molars are usually the first of the permanent teeth to be attacked by caries. The decay is almost always in the central pit of the occlusal surface, but occasionally in the buccal pit also. Cavities in a similar position in the upper first molars begin soon afterward. This is so common and the effects of this early beginning of decay in these teeth are so grave, that it requires special consideration. These teeth are the first of the permanent teeth erupted and are usually through the gums by the middle of the sixth year of the child's life. In this, however, there are wide variations which have been noted. They are often deeply decayed by the eighth year and generally require restorations before that time in families in which there is considerable susceptibility to caries. There are no other

teeth that are so often lost from inattention at the proper time as these. There are no other teeth easier to protect by proper attention correctly timed. The early loss of the first molars is from occlusal decays in about ninety-five per cent of cases, and these are the easiest cavities to manage when taken in time.

The first molars are the most important of all of the teeth. They are the largest, strongest and most effective in mastication. For several reasons, which have been mentioned, their loss causes more derangement of the masticatory apparatus and of facial expression than any other, not even excepting the incisors, for the incisors have not so prominent a function in the general development. If the incisors are lost early or late, the loss may be replaced artificially, and mastication is not seriously deranged. However, when the first molars are lost, the damage is practically irreparable. The occlusion of the remaining teeth is usually deranged by the falling backward of the bicuspid and the movement forward of the remaining molars, unless a space retainer is employed. See Figure 668. The occlusion is likely to be imperfect at best; in many cases it will be very defective, for often the second and third molars assume such an inclination to the mesial that the occlusal surfaces do not meet fairly together, but strike only upon the distal cusps, rendering mastication imperfect. The second molar is likely to come into the best position in the arch when the first molar is extracted at about the ninth or tenth year. This fact should favor the removal of many very badly decayed first molars, particularly those with the pulp involved, rather than make a futile effort to save them. If one only is lost, the incisor teeth are generally crowded to that side in the filling of the lost space, moving away from the median line and seriously deranging the expression of the mouth. When two are lost on the same side, the teeth occupying the front of the mouth will generally move to that side. For these reasons, the effort should be made to guide the second molars into their proper positions, and retain the first molar space until such time as a proper artificial substitute may be made.

CHILD TO ADULT. This period is also the transition period from childhood through adolescence to the adult, during which the physical, mental and psychic changes and reactions are sometimes very rapid and may present vagaries of action and thought which must be met by the dentist in order to maintain the best patient cooperation. A boy in high-school who always has been "Bill" suddenly changes to "William" and when he returns from his first year at college he is "Mr." and "Sally" may change to "Miss Somebody" in one holiday season. The physical development and changes are as rapid as the mental. A boy, who may have been more or less of a baby, very fractious and difficult to manage, who could see no reason why dentists were permitted to exist, returns in six months for periodic care a serious minded young fellow who

seems to have suddenly appreciated the fact that the dentist is doing a worth while service in which he should cooperate. On the other hand a girl, who has always "taken her medicine" without complaint, decides to manage her own affairs and gives the dentist little time or consideration. The two examples, so far as boy or girl are concerned, are reversible without prejudice to either. For the dentist these changes should present an interesting phase of his practice in its challenge to him to understand each patient and meet each new situation in such manner that he may carry these youths through to maturity while maintaining high standards of service. The most exasperating child may become the dentist's most enthusiastic supporter as an adult.

TECHNICAL TREATMENT DURING THIS PERIOD. Attention is again called to the fact that the technical treatment for this period, as here presented, will be devoted largely to a program of management by which patients are cared for under the most favorable conditions, to emphasize the possibilities of tooth conservation. Neglected decays, which are frequent during childhood, will, for the most part, be included in the adult period.

Class 1. Pit and Fissure Decays.

ILLUSTRATIONS: FIGURES 772-869.

CAVITIES of the first class, in the large majority of persons met in practice, are first to appear. These include pit and fissure cavities in the molars, bicuspid, upper lateral incisors, and more rarely in the upper central incisors also. In a large proportion of persons, the first of these are in the molar teeth, and in many persons these are the only cavities of this class, the incisors often being free from pits and fissures, and decay not occurring in the pits of the bicuspid. Under equal conditions of susceptibility and local conditions among the different teeth, decay in pits and fissures would occur within about a certain time after the teeth take their places in the arch. In highly susceptible persons this will be within from one to three years, and at a later time as the susceptibility is less. Therefore, while this class is first to appear in the individual teeth, the cavities are scattered over a considerable period of time, and, as both the susceptibility and local conditions vary greatly in different persons, cavities of this class occur at various ages. It is only through the careful observation of records of many persons that general rules are made out.

The local conditions relate almost entirely to the form and depth of pits and fissures. Well-closed pits rarely decay. In very susceptible persons decay begins early in deep pits and in fissures. In immune persons, decay may not occur at all in these.

The pit cavities are the simplest of all cavities to treat, and, when taken in time, rarely present any considerable difficulty. It should be remembered, however, that in occlusal surfaces, the whole surface of the restoration is fully exposed to thermal changes by hot and cold drinks and foods. They are, therefore, in more danger from thermal sensitiveness in proportion to their area than other restorations. In proximal cavities, much of the area of the restoration is shielded by the proximating tooth. In buccal cavities the restorations are not so directly exposed to thermal changes. Therefore, where dealing with very deep cavities especial care should be had to shield the pulp from thermal changes.

Pit cavities in the occlusal surfaces of the bicuspid are much less frequent than in the molars, and when there has been reasonable watchfulness, they may be restored when small. They are therefore easy of management. They frequently occur at from four-

teen to sixteen. These should be treated early to prevent the burrowing of decay from undermining the marginal ridge, which would also involve a portion of the enamel of the proximal surface. By this extension the simple pit cavity is converted into the more complicated occluso-proximal cavity, which increases the difficulty of treatment. For this reason one should be watchful of the pits in bicuspid during the childhood period and care for them upon the first appearance of decay. This watchfulness is especially necessary in these teeth for the reason that the pits are generally small and the beginnings of decay very much hidden until considerable burrowing has occurred. Careful examination of the proximal surfaces of these teeth for decay should always be made before making restorations in the pits, to see whether or not they may need treatment. The proximal surfaces decay much more frequently than the pits, and in the treatment of these, the pit restorations previously made must always be removed in cutting occlusal anchorages.

When examining for pit and fissure cavities in children of families highly susceptible to caries, the least showing of the beginning of caries should not be allowed to pass without immediate treatment. The dentist should never lose sight of the fact that in young persons the pulps of the teeth are much larger and their horns are much longer than in the teeth of mature persons. For this reason the pulp becomes endangered by a decay of much less depth. Sometimes they will even reach the pulp of the tooth before making any noticeable showing upon the surface. The carious material is white, the surface of the enamel is complete except the pit or fissure. It may show through the enamel as a grayish area, or the decay may not be detected except by the fine-pointed explorer. All such decays demand immediate attention.

A dentist reported a case in which, in examining the teeth of a girl about eighteen years old, he was trying the pits as usual with the exploring tine, when, to his surprise, the entire enamel cap of a bicuspid came away with the instrument. He found the whole of the dentin of the crown a softened mass. The appearance of the tooth had given no suspicion of the actual condition.

REMOVAL OF ALL CARIOUS DENTIN. It should be the rule that every particle of softened material should be removed and, if the pulp is exposed in so doing, it should be dealt with according to the conditions found. Some practitioners have been inclined to leave some softened dentin in deep occlusal cavities and make a restoration over it, claiming that when securely covered in, especially if saturated with an antiseptic, no more decay will occur. This procedure is very tempting in handling deep occlusal cavities. So far as the continuance of the decay is concerned the statement may be correct, but the carious mass contains acid elaborated during the carious process, which especially endangers the vitality

of the pulp. This is the principal reason why many pulps die under such restorations.

In many cases in which there is a question whether the pulp is involved or not, all of the decay may be removed without exposing the pulp and its continued vitality be thus assured, providing it is sufficiently protected against thermal shock. However, the actual condition as to exposure may not be determined until the very last of the softened dentin is removed, and one who is inclined to leave some carious dentin for fear of exposing the pulp will inadvertently cause the death of pulps which were at the time protected by a sufficient layer of sound dentin. In the large majority of cases in which any carious dentin remains in the tooth, even though it has not actually reached the pulp at the time when the cavity is prepared, the pulp will eventually die. Therefore, the vitality of the largest number of pulps will be conserved by the complete removal of all carious dentin when the cavity is prepared, as the only pulps which will likely be lost by following this rule are those which would die if they were not removed. It is far better to remove the vital pulp and treat the canals under the most favorable conditions, because in cases in which some decay is left, the pulps may die very gradually and without causing the patient the slightest discomfort. The periapical tissues may be involved and partially destroyed and the discovery of the condition may be only by radiographic examination.

POSSIBLE EXCEPTION DURING THE CHILDHOOD PERIOD. The only justifiable exception to the above rule is in cases presenting during the childhood period, when the root development of the particular tooth is incomplete. The slight irritation of the pulp by the acid is less likely to cause its death, so long as there is a large apical opening, which permits the free circulation of blood through many vessels, with no danger of strangulation of the vessels of the pulp. Also in such cases, there is the possibility that the pulp may remain vital indefinitely if it is exposed in removing the last particle of decay and is treated by capping.

When the decay is very extensive and it seems certain that the pulp will be widely exposed if all of the carious dentin is removed, it will usually be best to leave the deeper portion of the decayed mass, with the hope that the pulp may remain vital until the root is completed. When the decay is less extensive, and there is the possibility that the pulp may not be exposed by the removal of all of the decay, the effort should be made to remove every particle, proceeding very carefully, and if there should be a slight exposure in so doing, it should be capped. In all such cases, only a temporary restoration should be made, followed by vitality tests and radiographic examinations of the root development at frequent intervals.

Prevention and Immunization; Pit and Fissure Decays.

APPLICATION OF AMMONIATED SILVER NITRATE. When Thomas Johnson reported for periodic care at the age of six, both lower first molars were partially erupted and the general outline of the uppers could be seen in the contour of the gum. Neither the child nor the mother was aware of this. There had been considerable pain in connection with the eruption of the temporary molars, which the mother remembered, but the child had long ago forgotten, and, although the mother knew that the first permanent molars would erupt "back of the temporary molars" she was rather expecting some complaint from the child to call the event to her attention.

The importance of these teeth was again discussed, also the several principal contributing elements in their care. The lower molars were inspected very carefully with a sharp explorer along the length of each developmental line to find possible imperfections in the grooves. There was a shallow defect in the enamel of the central fossa of the right tooth, and as is generally the case, the same condition was found on the left side. However, neither tooth had a defect sufficiently deep to hold the point of the explorer. Therefore, silver nitrate was applied to the occlusal surfaces of both teeth to better fortify them against decay.

Neither tooth was sufficiently erupted to permit the placing of a rubber dam clamp; therefore a saliva ejector, gauze rolls and the air syringe were used to secure dryness, the air being warm. The packing consisted of three gauze rolls; one covered the orifice of Stenson's duct, one was placed to the buccal and one to the lingual of the lower teeth on the side on which the treatment was to be made. Additional rolls were conveniently at hand for replacement. The maintenance of absolute dryness is essential to secure penetration of the silver.

A small, very closely rolled piece of cotton was held in a pair of strong beaked pliers and, when moistened with the solution, the occlusal surface of the tooth was rubbed thoroughly several times. The air blast was used at intervals to maintain dryness, and the eugenol was similarly rubbed over the surface. This left the entire occlusal surface quite black. Dry cotton was then used to rub off as much of the discoloration as possible. That which remained at the time had for the most part disappeared within a comparatively few days.

This treatment was repeated in this case, as in others, as a general routine, within the next six months. In view of the high incidence of pit and fissure decays, this should be the rule for all molar teeth—first, second and third molars—soon after their eruption. In whatever measure it will immunize these areas, that much will be gained in the effort to conserve these important teeth.

One should not, however, rely on silver nitrate in cases in which there are pits of sufficient depth to hold an explorer.

Restorations; Pit and Fissure Decays.

SMALL PIT CAVITY, UPPER FIRST MOLAR; COPPER CEMENT.

At the age of twelve, Mary Brown's upper right first molar had a very small pit decay in the central fossa of the occlusal surface. An explorer could be passed through the opening into the dentin. Also it was noted that the mesial surfaces of the upper central incisors were very flat incisio-gingivally. See Figure 772.

It was necessary to decide whether a permanent restoration should be made in the first molar at once, or postponed for a year or more. An amalgam restoration might be made immediately without causing much more pain than in preparing cavities for copper cement. If gold foil was to be used, it would be advantageous to postpone the operation for a year or more, when the restoration might be placed under the most favorable conditions. It was decided to make a temporary restoration with black copper cement, to be followed later with gold foil. This decision was influenced by the

Brown, Mary 416 *Mayfair Ave*
 NAME NUMBER 1372 RES. TEL. *Main 217* NPIR ADDRESS *Chicago* EXAM. NO. 19
 BUS. TEL. DATE 4-3-37
 AGE 12 NEXT EXAM. Oct. 37

RIGHT LEFT

OCCLUSION N
 123
 PATIENT CARE

CARIES 123
 123
 GINGIVAE

REFERRED BY
 REPORT TO

REP. ORT. INF. ENT. ME. MO.
 FIL. ED. INS. T'R. FOR. W'D.

FIG. 772.

FIG. 772. Nineteenth examination of Mary Brown: Patient No. 1372, age 12 years. All permanent teeth were present except the third molars, occlusion normal, susceptibility moderate, gingivae in good condition, patient care good; previous service checked; mesial surfaces of upper central incisors marked as too flat, with too long a contact incisio-gingivally; decay in central fossa of upper right first molar, mesial surface upper left first molar, occlusal of lower left first bicuspid and buccal pit in lower right first molar. The previous operations were checked. See chapter on oral diagnosis in Volume I for explanation of chart.

fact that this girl had been quite faithful in keeping her appointments for periodic care, and the susceptibility to caries was rather high, which suggested the probability of more pit decays.

One is justified in using copper cement in this way for patients on whom he may count to keep their recall appointments, but should not do so for those who may not be definitely relied upon in this respect. For this reason, copper cement should be employed much less frequently in dental college clinics than in private practice.

This is a very effective method of treatment for pits in second molars which are very slow in erupting and particularly when the form of the crown is such that a rubber dam clamp is inclined to slip off. The gingivae will often be so full for several years after pit cavities are discovered, that a clamp may not be placed without causing pain. If the child may be relied upon to return at suffi-



FIG. 733.

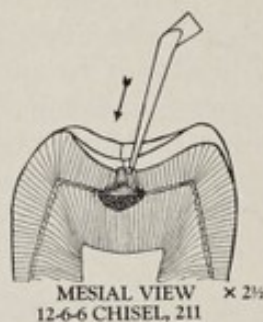


FIG. 774.

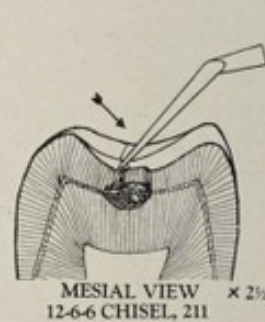


FIG. 775.

NOTE:—For each of the illustrations in this volume, which show the technical procedures in cavity preparation and the placing of restorations, the direction from which the surface or section of the tooth is viewed is indicated. If an instrument is shown, its name and formula are listed, also the manufacturer's stock number. The magnification of each drawing, as compared with the tooth, is also given. In all cases in which the instruments are not drawn in perspective, the measurements with a millimeter scale will be found to correspond with the drawings, most of which are $2\frac{1}{2}$ times the actual size. The blade of the chisel 2 mm. long should measure 5 mm. in Figure 806; the 1 mm. bur in Figure 782 should measure $2\frac{1}{2}$ mm., and the 12 width chisel in Figure 785 should measure 3 mm.

ciently regular intervals for replacement of the portion of the cement which may have washed out, it enables the operator to choose the most favorable time for permanent operations.

CAVITY PREPARATION. An 8 tenths mm. round bur was used to enlarge the opening through the enamel, as illustrated in Figure 773. The enamel that had been undermined by caries was split off with the 12-6-6 chisel. With the chair tipped well back and the patient's mouth wide open, there was good access for this instrument with direct pressure, for all except the lingual wall, as shown in Figure 774. The same instrument was used for the lingual wall by reaching across the cavity from the buccal direction, breaking the enamel away with lateral pressure. See Figure 775. The carious dentin was removed with the pair of 10-6-12 spoons. The right instrument of the pair was placed against the buccal wall of the

cavity and, with rather heavy pressure, most of the carious material was removed at one cut. See Figure 776. One or two additional cuts with each instrument were necessary to remove every particle of the affected dentin, as illustrated in Figure 777.

PLACING THE RESTORATION. The black copper cement sets so rapidly that everything must be in readiness before the mix is started. It is a great advantage to have an assistant mix the cement in order that the dentist may devote his entire time to the patient. The mouth was packed with gauze, and a saliva ejector was placed in the mouth, partly to be certain that the mouth would not be closed. The prepared cavity was then dried while the cement was being mixed. The cement was placed in the cavity when the mix was rather thin, to have opportunity to press it well into the cavity before it should become too hard. As the cement assumed a waxy consistency, heavy pressure was made on it with a beaver tail burnisher. The excess was removed with the burnisher and within a few seconds the restoration was trimmed to form with large spoons.

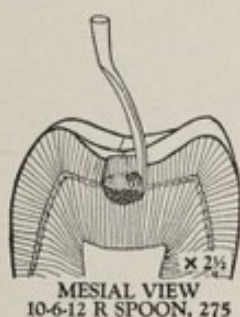


FIG. 776.

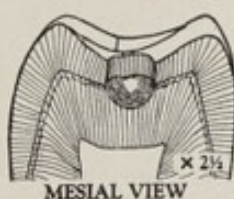


FIG. 777.

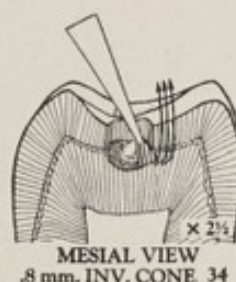


FIG. 778.

SMALL PIT CAVITY, UPPER FIRST MOLAR; GOLD FOIL.

When Mary Brown was fourteen years of age, a gold foil restoration was made in the occlusal pit cavity in the upper right first molar, in which the placing of copper cement has been described. That portion of the cement which gradually washed out had been replaced twice. In each case, a part of the remainder of the cement, but not all, was removed with a bur, to gain better anchorage for the portion to be added.

OUTLINE FORM. The copper cement was removed with a 1 mm. inverted cone bur, which was withdrawn several times with lateral pressure to enlarge the opening through the enamel. After the last of the cement was removed, the enamel was undermined about 1 mm. along the buccal groove, as illustrated in Figure 778. Very slight extensions were then made along the mesial and distal grooves to points where smooth margins could be made. This cutting was painful.

The 12-6-6 chisel was again used to break down the enamel around the margins of the cavity and thus complete the outline form. The instrument is shown chipping off the enamel in the mesio-buccal portion of the cavity with a push motion in Figure 779, and in a cross-mouth position to break away the enamel of the disto-buccal portion with lateral pressure in Figure 780. The handle of the instrument was in about the position of the upper right cuspid. The use of the chisel in this way, with lateral pressure, is very effective in splitting off undermined enamel, if the cutting edge is sharp. Figure 781 illustrates the completed outline form.

APPLICATION OF THE RUBBER DAM. Although this patient's teeth had been very recently cleaned, the gingival areas were swabbed with a cotton pellet saturated with hydrogen peroxide to be certain there were no deposits of gummy material which might be forced under the gingivae. The contacts between the teeth were tested with a ligature. Three holes were punched in the rubber in



FIG. 779.



FIG. 780.



FIG. 781.

the positions of the three upper holes in Figure 554. The cuspid was not sufficiently erupted to be included. In the illustration referred to, the holes are punched for lower right molars and bicuspid. If this rubber is turned half way around, the holes will be in the proper position for the upper left teeth. After the rubber had been washed, the area around the holes was lubricated with cocoa-butter. A number 18 clamp was placed on the first molar (the second molar had not erupted), and the fourth grasp was used to place the rubber over it. It was also slipped over the bicuspid, and a ligature was used to carry it through the molar-bicuspid contact. The ligature was then withdrawn.

ANESTHESIA. This was not a favorable case for pressure anesthesia, although the form of the cavity was excellent for applying heavy pressure—about 3 mm. wide and sufficiently deep. Partial anesthesia may be obtained, particularly when some normal dentin may be exposed by a slight extension of the cavity, but good results are not to be expected from efforts to force the solution through dentinal tubules which lead away from an area that has been

affected by caries. Hartman's desensitizing solution was therefore used. It was possible, after the first application, to enlarge the opening somewhat before the patient felt any pain. A second application was made, and the remainder of the preparation was painless.

RETENTION FORM. The 1 mm. inverted cone bur was again used to secure retention form. It was pressed into the dentin less than the depth of the head of the bur and then moved slowly around the cavity clockwise, with the engine revolving at low speed. See Figure 782. Two or three momentary stops were made to avoid heat, which might seriously affect the pulp, even though there was no pain. See Figure 783.

In preparing retention form in occlusal cavities, it should be remembered that a pulpal wall which is very shallow in the position of a pit, will be of greater depth in the dentin as the walls are extended to include portions of the cusps. Therefore, the depth of cutting in opening a pit or extending a groove should not be more than half the length of the head of the bur into the dentin — about $\frac{1}{2}$ mm. If the remainder of the pulpal wall is prepared at

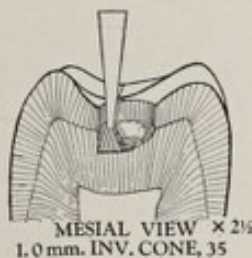


FIG. 782.



FIG. 783.

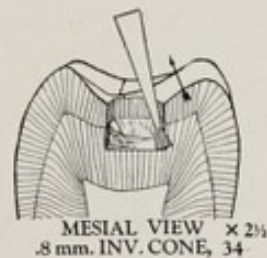


FIG. 784.

the same level, the surrounding dentin wall will be deeper as more and more of the inclined planes of the several cusps are included in the cavity.

STARTING POINTS. Two starting points were made with an 8 tenths mm. inverted cone bur, as shown in Figure 784. The head of the bur was placed against the pulpal wall and pressed laterally in the dentin for possibly half of its width, then withdrawn occlusally, cutting gradually less and less from the dentin as it was withdrawn.

CONVENIENCE FORM. This cavity was so small that special cutting for convenience in condensing and adapting the gold was not necessary. However, if the cavity had been larger, the mesial and buccal walls would have been inclined outward slightly, in order that most of the gold could be condensed with mallet force. The direction of the condensing force is in the line of the shaft of the condenser point; angles or bends in the shank do not change the direction of the force. To get proper adaptation, the direction

should be at an angle of 6 or more centigrades to the plane of the wall. Therefore, in a case in which the shaft of the condenser must be held very closely parallel to the mesial wall and can not be held at approximately a 6-centigrade angle, it is not possible to secure good adaptation; the foil must necessarily be condensed with hand pressure. However, if the wall were prepared with a mesial inclination of 6 centigrades, gold could be adapted with mallet force.

It is often desirable to incline the mesial and buccal walls of occlusal cavities in lower molars as a matter of convenience form when restorations are to be made of gold foil.

FINISH OF THE ENAMEL WALL. The cavity was wiped dry with closely rolled cotton pellets, and the enamel wall was finished with straight chisel 12. There was good access to use this instrument with a push motion in a direction parallel to the line of the cavity margin all around this cavity, as shown in Figure 785. However, it was used with a scraping motion along the lingual wall, as shown in Figure 786. The bevel of the cavo-surface angle could have been made with the same chisel, but the direction of the rods was such that a bevel was not required.

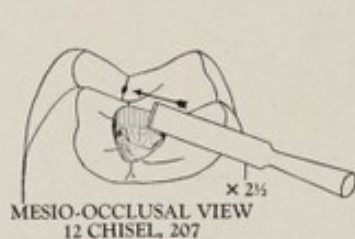


FIG. 785.

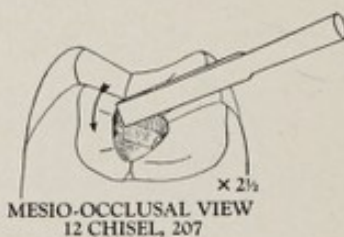


FIG. 786.



FIG. 787.

The enamel rods close about a pit are all inclined toward the pit, therefore, in finishing the enamel walls of small pit cavities it is not necessary to bevel the cavo-surface angle. If the surrounding walls are parallel, or at right angles to the pulpal wall, there will be no short ends of rods exposed at the margins and the preparation will be safe. As occlusal cavities are larger, the direction of the rods gradually changes until they are at right angles to the surface and then they are inclined outward more and more as the cusps are approached. Therefore, the cavo-surface angle of large occlusal cavities generally requires a slight bevel.

TOILET OF THE CAVITY. Warm air was used to blow the enamel dust from the cavity, and the walls were thoroughly wiped with a cotton pellet. This completed the preparation of the cavity, as shown in Figure 787.

RESTORATION WITH GOLD FOIL. For a child of fourteen, gold foil was considered the best restoration in this cavity; amalgam would have been the second choice. The cavity was too small to consider a gold inlay. The remainder of the occlusal surface of this tooth

was well formed and there was every reason to expect that a gold foil restoration would last during the patient's life time, barring the possible necessity of removing it to prepare a step for a mesio-occlusal restoration later on. If this girl had been very susceptible to caries, an amalgam restoration would have been placed, because of the greater probability that it might have to be removed.

STARTING THE RESTORATION. The gold condenser 5-10-3 was placed in the starting points to be certain they were in good form to accommodate it. See Figure 788. Gold was then built into the starting point in the disto-linguo-pulpal angle, using the holding instrument in the left hand to maintain pressure on the gold until it was anchored. A pellet of gold was partially compressed into a small mass immediately covering the starting point, and was then condensed into the anchorage by hand pressure. There was sufficient gold to avoid the possibility that the condenser point might be pressed through it, instead of condensing it. Several additional pellets were condensed into the starting point and against the im-

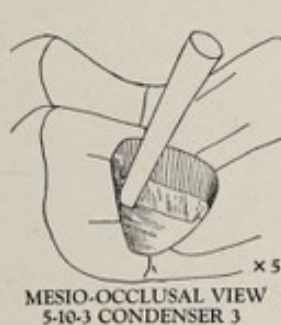


FIG. 788.

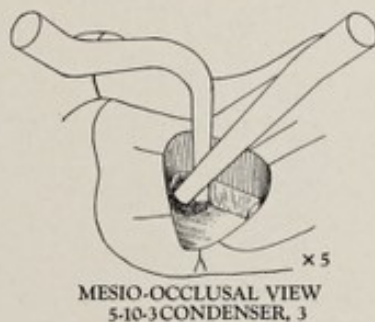


FIG. 789.

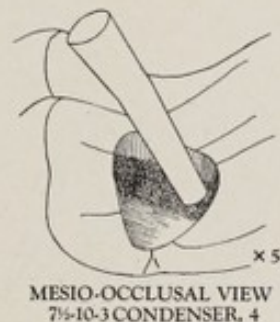


FIG. 790.

mediately adjacent walls. As more gold was added, it was built equally over the distal, lingual and pulpal walls, the surface of the condensed gold being kept flat.

PLACING THE GOLD; MALLETING. It was the assistant's duty to pass the gold from the annealing tray to the cavity with the special gold carrying instrument, see Figure 391, held in the right hand, and to place each pellet in contact with the previously condensed gold in exactly the desired position to properly build the restoration. She had learned to select the most suitable sizes of pellets to use in various positions for each class of restoration. The condensing force was also supplied by the assistant, the mallet being held in her left hand. With the operator standing on the right side of the chair and the assistant on the left, her left arm and hand, as used in malleting, offered the least obstruction to the proper lighting of the field of operation. The blows of the mallet were of the bounding type, the head of the mallet being drawn back immediately after it struck the instrument. The bounding blow is the opposite to a

following blow. Most operators prefer a double blow, a tap tap, which must be so timed by the assistant, as to be struck immediately following slight hand condensing pressure by the operator. This pressure by the operator's hand should be sufficient to put the peridental membrane on tension to receive the blow from the mallet. This method of condensing gold is much less tiresome for the patient than any other. The automatic mallet duplicates this technic in part. The hand pressure necessary to release the spring is sufficient to put the peridental membrane on tension, but the blow that follows is without rebound; it is a "dead" blow which jars the tooth more than the rebounding blow of the hand mallet.

The condenser was held at a right angle with the surface of the condensed mass. If the cavity had been a perfect box form, with all three walls — distal, lingual and buccal — meeting, each with the others, at right angles, the direction of the condenser would have been at a $121\frac{1}{2}$ centigrade angle to each wall, which is a very desirable angle for proper adaptation. See Figure 789.



FIG. 791.



FIG. 792.

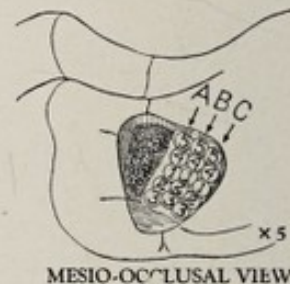


FIG. 793.

When the gold had been built occlusally along the disto-lingual line angle as far as the dento-enamel junction, additional gold was added to build along the disto-pulpal line angle toward the other starting or anchorage point, and a $7\frac{1}{2}$ -10-3 condenser was used. The direction of the condensing force was gradually changed from that shown in Figure 789 to that in Figure 790, as the disto-bucco-pulpal point angle was approached. The holding instrument was not laid aside until gold was anchored in the second special retention point, for which it was necessary to change back, for the moment, to the 5-10-3 condenser.

STEPPING THE CONDENSER POINT. It will be noticed in Figure 790 that the gold built along the disto-pulpal line angle covers about equal portions of the surfaces of the distal and pulp walls. This gives the best opportunity for adaptation to those walls, and this should be accomplished by a definite plan of stepping the condenser point on each new piece of gold. Figure 791 is a mesio-distal section of this tooth, which shows also a section through the mass of

gold already condensed. The parallel lines indicate the series of planes representing the progressive building of the restoration.

As each new pellet of gold was added, the first blow was struck at as nearly the center of *the mass of previously condensed gold* as was practicable, and was stepped toward one of the walls. In Figure 791 the stepping was in 1, 2, 3 order toward the pulpal wall; it was next stepped in positions 4 and 5, Figure 792, toward the distal wall. In Figure 793, if the stepping illustrated in Figures 791 and 792 should be the first row of blows struck on the new piece in the position A, and similar blows should follow in positions B and C, the stepping would in reality be from the center of the mass of previously condensed gold toward all three walls — pulpal, distal and buccal. At the same time one would be using the wedging principle in condensing the gold against the buccal wall. The stepping of the condenser and the wedging principle, by which full advantage may be taken of the elasticity of the dentin, are presented in the chapter on the manipulation of materials for restorations.

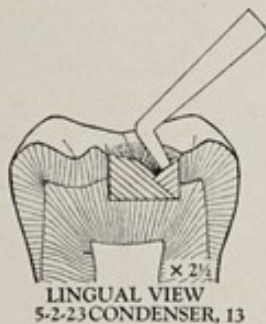


FIG. 794.



FIG. 795.



FIG. 796.

CONDENSING WITH HAND PRESSURE. The building was continued as described, until as much gold had been added as was practicable while maintaining a direction which would give good adaptation with the 7 1/2-10-3 condenser point. The approach was varied, being in the main from the mesial as described, then from the buccal and also in a partly cross-mouth position from the lingual. There remained a small area in the mesio-buccal portion, to which proper access could not be had with mallet force. It was therefore necessary to use the 5-2-23 hand pressure condenser, illustrated in Figure 794. It will be noted that, with this instrument, the desired direction of force could be applied to the mesial wall, or to the buccal wall. It requires considerable training of the muscles of the fingers in the manipulation of instruments to enable one to place much gold by hand pressure, without fatigue of the muscles concerned. It also requires more time. Therefore, all cavities should be so prepared in the matter of convenience form as to reduce the hand pressure condensation to the minimum. This

cavity was so small as to require very little. This completed the placing of the restoration, which was slightly overfull along all margins.

The small round condenser, 5-10-3, with which the restoration had been started, was then stepped over the entire surface to be certain that the gold was evenly condensed. Two soft spots were found, and when they had been fully condensed with the small instrument, there were depressions sufficient to require the placing of another small pellet of gold in each. The final condensation and adaptation of gold at the margins was accomplished with the 10x5-3-3 parallelogram condenser. It was held in the position shown in Figure 795, and moved around the cavity, except in the mesio-buccal region, which had been fully condensed with hand pressure. The effect of blows on the parallelogram instrument is to drive the gold more securely against the margins, without danger of injury to the enamel, which in this case had been prepared with almost a right angle margin all around.

FINISHING THE RESTORATION. A fine carborundum stone about 3 mm. in diameter was used for the first trimming of the surface. This was rotated so that the movement of the edge of the stone was

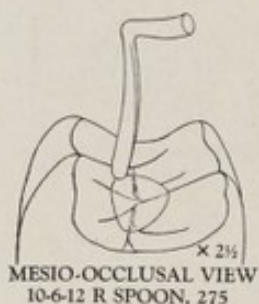


Fig. 797.



Fig. 798.

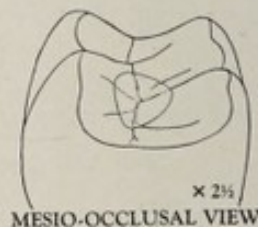


Fig. 799.

in all positions off the margin of the gold toward the enamel. It was followed by a 3 mm. finishing bur which will cut the surface of the gold as would a fine sharp file, leaving it almost polished. It was first used to reproduce the grooves and contour the surface, then to trim the margins, being held with the blades rotating in the direction of the length of the margin. In this latter position, there is no danger of trimming away too much gold, as the contact of the blade with enamel, which it will not cut, prevents it from cutting the gold below the plane of the surface of the enamel. The position of the finishing bur in this cutting is shown in Figure 796.

Where the margin crosses a groove, the finishing bur may not cut away all of the overlap of gold, as it will not fit into such a narrow depression. A 10-6-12 spoon was used to trim away any remaining excess of gold and make the marginal contour the same as that

of the enamel. See Figure 797. A series of disks, each finer than the previous one, were used to give the restoration its final polish. See Figure 798. Since a better polish results if the disks are rotated rapidly, they were lubricated with cocoa-butter to reduce the heat without appreciable effect on the polishing, but the disk was not kept in contact with the gold for more than a few seconds at a time. On and off, on and off, should be the rule in polishing metal restorations with disks. The finished restoration is shown in Figure 799.

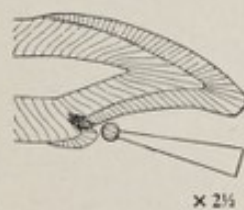
PREPARATION FOR AMALGAM. If this cavity had been prepared for an amalgam restoration, the only difference would have been the omission of the starting points for anchoring the first pieces of gold.

PIT CAVITY, LINGUAL SURFACE, UPPER LATERAL INCISOR; GOLD FOIL.

A small pit cavity in the lingual surface of the upper right lateral incisor is listed on Frank Hines' examination card at the age of eleven. A view of the lingual surface of this tooth is given in Figure 801, and a labio-lingual section in Figure 802. This

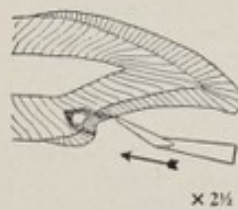


FIG. 801.



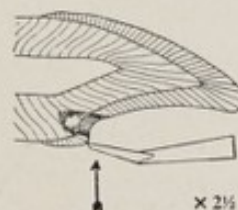
DISTAL VIEW
.8 mm. ROUND, 2

FIG. 802.



DISTAL VIEW
6-2-6 CHISEL, 221

FIG. 803.



DISTAL VIEW
6-2-6 CHISEL, 221

FIG. 804.

and the other sectional drawings also illustrate the position of this tooth in relation to the principal direction of approach in operating, with the chair and patient's head tipped well back.

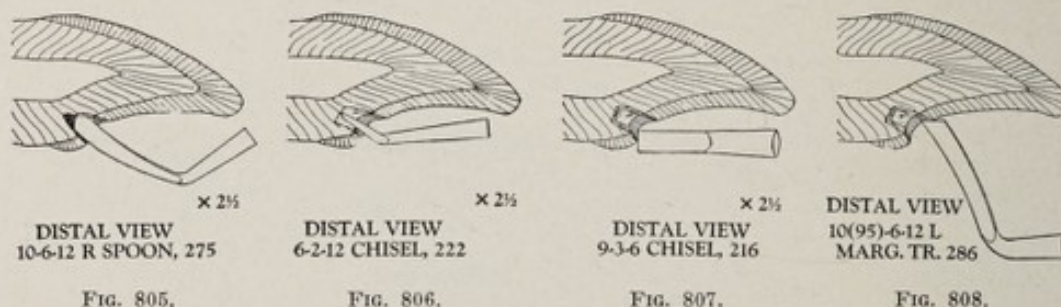
One should never fail to look for pits in the lingual surfaces of the upper lateral incisors when examining mouths of young persons; because of the danger of early involvement of the pulp, since the pulp chamber is unusually large in relation with the size of the tooth. At that time an opening was made through the enamel with a round bur, the decay was removed with a spoon and a cement restoration was made, in order that the placing of a metal restoration might be delayed until the pulp should be better protected by the building of more dentin. The permanent restoration was placed when the boy was thirteen years old, replacements being made occasionally of the cement that had washed out.

The cavity preparation will be reported as though the decay was discovered at the age of thirteen.

OUTLINE FORM. The opening through the enamel was very small and an 8 tenths mm. round bur was used to enlarge it. This is the one place in the mouth where no other bur than a round bur should be used, on account of the danger of exposing the pulp. The bur was held in the position shown in Figure 802, and care was exercised to avoid the possibility of pressing the bur too far in the direction of the pulp. The cut was made as shown in Figure 803. The surrounding enamel was broken down with a 6-2-6 chisel. See Figures 803 and 804.

It will depend upon the access in each case whether a straight hand-piece or the contra-angle hand-piece should be used when enlarging the opening through the enamel. If the tooth is inclined lingually, or the patient can not open the mouth very wide, it may be more convenient to use the contra-angle; otherwise the straight hand-piece may generally be used. In any event the cutting with the bur should be only in the enamel.

APPLICATION OF RUBBER DAM. The rubber was applied as soon as the outline form was obtained, in order to maintain dryness of the cavity and give a better view. As in the mouths of most young



persons, with full gingivae, it was difficult to keep the edge of the rubber turned under the gingiva on the lingual side and a ligature was therefore passed through the contact on either side of the lateral incisor, with the loop on the lingual side, which was drawn closely against the lingual surface of the tooth, about midway of the length of the crown. The ends on the labial side were held in a direction so that the two strands were barely to the gingival of the contact, free of pressure on the gingivae. A beaver tail burnisher was then used to push the lingual loop to the gingival, while slight traction was made from the labial, and the edge of the rubber was turned to the gingival. Two small pieces of sticky wax were then attached to the enamel in the positions of the mesial and distal lingual marginal ridges, which held the rubber in place. The ends of the ligature were left loose on the labial side. The gingiva was not injured, and the procedure was not painful. The positions of attachment of the sticky wax are indicated by the broken lines on the marginal ridges in Figure 812.

REMOVAL OF CARIOUS DENTIN. The remaining carious dentin was removed with the 10-6-12 spoons, one or two cuts being made with each, as illustrated in Figure 805.

RETENTION FORM was obtained with the 6-2-12 chisel, squaring out the angles of junction of the axial wall with the surrounding walls, as shown in Figure 806. The cavity was so small that starting points were not prepared. The axio-mesial and axio-distal line angles were made very sharp, to give opportunity for anchorage between the mesial and distal walls, which were only about 2 mm. apart.

FINISH OF ENAMEL WALL. There is considerable variation in the direction of the enamel rods about these pits, particularly those of the incisal wall, and the directions were determined by splitting off the enamel in securing outline form. The enamel wall was finished with a 9-3-6 chisel for the mesial, distal and gingival walls, and the 10 (95)-6-12 margin trimmers for the incisal, as illustrated in Figures 807 and 808.

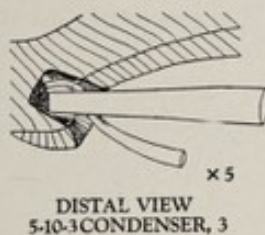


FIG. 809.

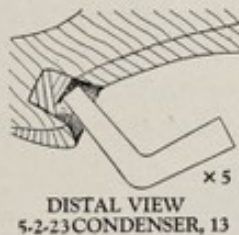


FIG. 810.

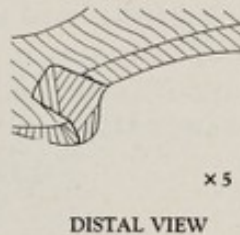


FIG. 811.



FIG. 812.

GOLD FOIL RESTORATION. The first piece of gold was placed along the gingivo-axial line angle and the first condensation was into the gingivo-axio-distal point angle with condenser 5-10-3, while a small curved holding instrument kept the remainder of the pellet in position. Then, while holding the condenser in place with a little pressure, the holding instrument was moved to a position next to the end of the condenser. It was held there to prevent movement of the gold while the condenser was moved to the gingivo-axio-mesial point angle, also until sufficient gold was condensed there to definitely anchor the small mass of gold between the two point angles. More gold was added, building about equally over the gingival and axial walls, as illustrated in Figure 809. This illustration is a 5 diameter enlargement, while the preceding illustrations are $2\frac{1}{2}$ diameters. Additional gold was condensed on the same plan, until the axial wall was entirely covered. The 5-2-23 hand pressure instrument was then used to condense the gold against the incisal wall. See Figure 810. The building was continued until the contour of the lingual ridge was restored. See Figure 811. Figure 812 is a lingual view of the tooth and the restoration.

LARGE PIT CAVITY, LOWER FIRST MOLAR; AMALGAM.

An appointment was made for William Fisher for his first examination when 12 years of age. See Figure 815. His chart shows occlusal decays in both upper first molars, the treatment of one of which will be reported later, also one fairly large open pit cavity in the occlusal of the lower right first molar. The lower left first molar had been extracted on account of an abscess, which had resulted from exposure of the pulp by caries before the roots were completely formed.

It was apparent that the cavity in the lower right first molar was a neglected case; sufficient time had elapsed not only for extensive lateral decay in the dentin, but also for backward decay of the enamel, which had so weakened its structure that the rods of the central portion had been broken off by the force of the bite in chewing. However, he said he had had no pain. This at least suggested the possibility that the pulp might not be exposed.

This was a typical case of a neglected decay and it represented the situation which prevails in the mouths of a large percentage of persons who undoubtedly desire to have their teeth cared for properly, but who have not been made to understand the absolute necessity of periodic examinations. So extensive a decay should not and

Fisher, William 3228 Lake Ave.
 NAME ADDRESS
 NUMBER 2627 RES. South 482 NPIR
 BUS. TEL. CHICAGO. 1
 TEL. EXAM. NO. 3-2-32
 DATE Sept. 32
 NEXT EXAM
 AGE 12

RIGHT LEFT

OCCLUSION N PNR
 Referred by Mr. James Williams
 123 DN ND 123
 PATIENT CARE M M CINGRAE
 NP

DATE WORKS X-RAYS CASE HIST. ORT. MOD. ELS. PNR TO

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REP. ORT. EVS. ENT. ME. MO. FIL. ED. INS. TEL. FOR. WD.

FIG. 815. First examination for William Fisher: Patient No. 2627, age 12 years; occlusion normal, all temporary teeth missing except the two upper cuspids, lower left first permanent molar removed by previous operator; all other permanent teeth present except third molars; patient care very poor, susceptibility moderate, gingivae slightly inflamed. Decays: occlusal pits in both upper first molars, large occlusal cavity in lower right first molar; full set of radiographs made. See chapter on oral diagnosis in Volume I for explanation of chart.

generally does not occur in the mouth of a patient who is on a regular recall schedule. If this boy's teeth had been examined a year previously, this cavity could hardly have been overlooked. A number of restorations had been placed in his teeth and the lower left first molar had been extracted. Apparently, he was not very susceptible to caries, but it was evident that he had not been examined with any degree of regularity. He was not greatly interested when the plan was proposed, although his father accepted the plan and promised that the boy would come when the notice should be received. However, it will be seen that he continued to be somewhat indifferent and his appointments were often postponed or missed entirely.

OUTLINE FORM. The preparation of this cavity was undertaken on the presumption that the pulp would not be exposed. The occlusal view of the cavity is shown in Figure 816. The extent of the decay in the dentin and the backward decay of the enamel are well illustrated in Figure 817. It would appear that the pulp was

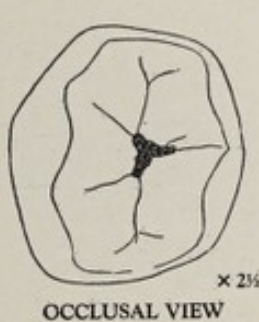


FIG. 816.

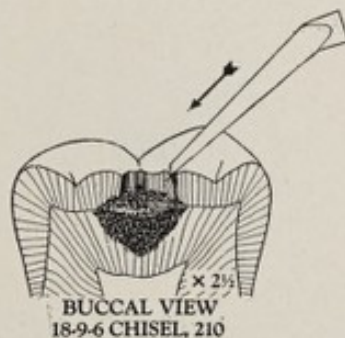


FIG. 817.

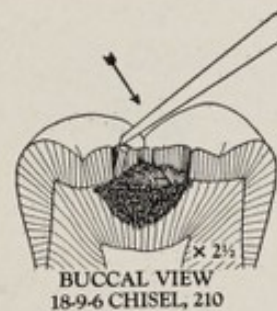


FIG. 818.

not involved, although the decay was sufficiently close to jeopardize the future health of the pulp, and to call for special consideration for its protection.

As a rule, practically all of the undermined enamel can be broken away with hand instruments and this was accomplished with a single instrument, chisel 18-9-6. This is illustrated in four drawings. In Figures 817 and 818 the approach was from the mesial, and the enamel to the mesial and distal of the opening was broken away by splitting it off rather than by cutting. In Figures 819 and 820 the buccal and lingual walls were broken down from the buccal approach. In the first use of this instrument the operator was in the right side in front position; for the buccal approach a shift was made to the right side behind. If the undermined enamel had been too strong to be easily broken down with the chisel, an inverted cone bur would have been placed in the cavity and drawn outward through the enamel several times, cutting a slot. The remainder could then have been broken down with the chisel.

In cavities of this type, in which the enamel has been considerably undermined, it may be split off more expeditiously and without discomfort to the patient by placing the chisel in the same position in which it would be used with a push motion, and then have the assistant strike it with a quick, rebounding blow. The mallet should not follow the chisel, as it might drive it into the carious dentin and cause pain. If one is careful in placing the chisel, and does not attempt to split away too much at one time, the enamel will break off very readily. This plan should be used where it is quite evident that there is considerable undermining of the enamel and should be discontinued when the limit of the undermined area is approached. It would be painful if such a blow were struck on enamel supported by sound dentin.

The outline form required extensions to include the fissures. However, it was decided to first remove the carious dentin to determine whether the pulp might be exposed.

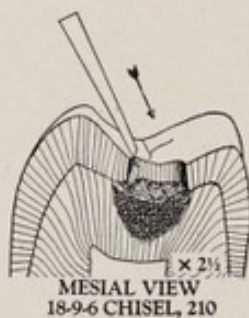


FIG. 819.

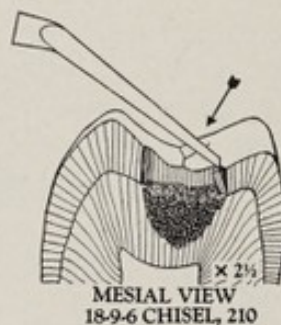


FIG. 820.

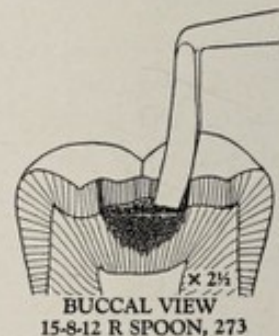


FIG. 821.

APPLICATION OF THE RUBBER DAM. The rubber dam was applied at this time to insure a better view and in order that pulp treatment might be instituted immediately after the removal of the carious dentin, if that should be necessary. It was certain that a non-conductor of zinc phosphate cement would be required, and the cavity should be kept dry for that, even though other treatment might not be indicated.

DESENSITIZER. This is the type of case in which pressure anesthesia is not indicated. An application of Hartman's desensitizing solution was made directly to the carious dentin, and most of the decay was removed without discomfort to the patient, although the latter part of this cutting was painful. A second application was made and the extensions along the grooves and other cutting in the preparation of the cavity was not painful.

If Hartman's solution were not available, it would have been recommended that the decay be carefully removed and, if the tooth were found to be very sensitive, a sedative should have been sealed in place for several days before placing cement in the deeper portion of the cavity.

REMOVAL OF CARIOUS DENTIN. In every case, all of the undermined enamel should be removed before any attempt is made to remove the decayed dentin. Figure 821 is a central mesio-distal section of the tooth, viewed from the buccal. It shows the extent of the carious dentin, which was removed with the 15-8-12 spoons. The right instrument of the pair was placed on the lingual side of the decayed area and a fairly deep cut was made with a sweep across to the buccal, not attempting to remove all of the carious mass. A similar cut was made from mesial to distal. Thereafter the remainder of the decayed dentin was removed a little at a time, reserving until the last those portions where there was greatest likelihood of exposing the pulp. By this careful procedure, it is often possible, without causing pain, to detect a near exposure where the dentin is so thin that the color of the pulp is transmitted through as a pink area. The pulp may then be capped, or anesthesia may be employed for its exposure and removal.

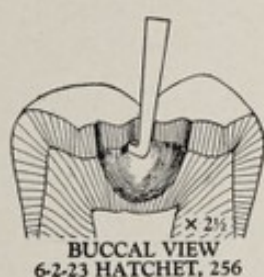


FIG. 822.

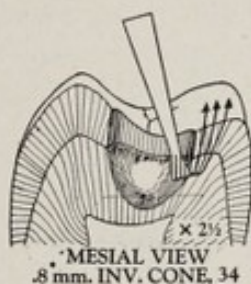


FIG. 823.

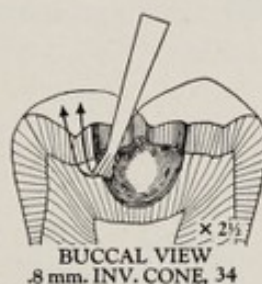


FIG. 824.

In this case, all of the carious dentin was removed without exposure, and apparently without too close approach to the pulp.

In view of the possibility that every particle of undermined enamel might not have been removed in preparing the outline form, a 6-2-23 bibeveled hatchet was used to make a test. See Figure 822. The end of the blade was placed against the dentin near the dentoenamel junction and moved laterally with sufficient pressure to discover and remove several particles of carious dentin which remained. The enamel overlying these positions was then cut away.

CONTINUATION OF OUTLINE FORM. All of the grooves were fissured for some distance from the cavity and particularly the lingual groove, which is very often imperfectly formed. The outline was extended with an 8 tenths mm. inverted cone bur to include all of these grooves. This is illustrated for the lingual fissure in Figure 823, for the distal extension in Figure 824 and the mesial in Figure 825. For the latter, the contra-angle hand piece was used.

The depression in the dentin was filled with zinc cement. In doing this, a piece of stiff paper was cut to permit it to be placed in the cavity and rest on the surrounding dentin. Sufficient cement to fill the depression from which the carious dentin was

removed, was then placed on the paper, which was laid in the cavity with the cement side down. Pressure was made on the paper with an amalgam condenser. After the cement had partially hardened, the paper was removed and the excess of cement was trimmed away with chisel 18-9-6. The cement also served as a non-conductor of thermal changes in the metallic restoration and prevented subsequent shock to the pulp. Care should be taken not to entrap air in placing the cement.

Slight extensions were made along the lines of the buccal and the disto-buccal grooves, as shown in Figure 826. The enamel was also slightly undermined in the positions indicated by the broken lines near the margins of the cavity in this illustration, to provide for better contours for the outline of the prepared cavity. The 18-9-6 and also the 18-9-94 chisels were used to trim the enamel walls to final form, observing the direction of the enamel rods in various positions. The use of the 18-9-94 chisel, with the reverse bevel, is shown in breaking down the lingual enamel wall in Figure 827.

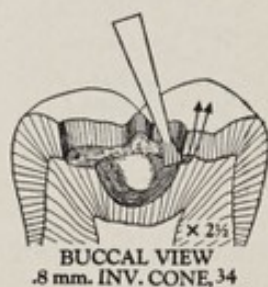


FIG. 825.



FIG. 826.

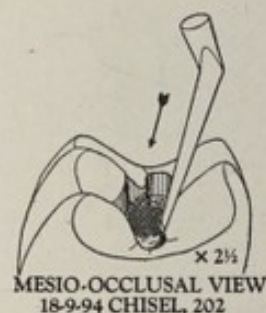


FIG. 827.

The completed outline form is illustrated in Figure 828. Particular attention is called to the extension of the cavity along the lingual groove. This groove was slightly fissured beyond the crest of the lingual marginal ridge for several millimeters on the lingual surface. However, the outline of the cavity was not extended beyond the crest of the marginal ridge. There was a sharp depression in the groove on the lingual surface, but it was smooth. A similar fissure on the occlusal surface should always be opened, because food debris would pack into it. On the lingual surface, or on any axial surface, the movement of food in mastication keeps such a fissure clean. If there should be a definite pit in such a fissure, it should be opened and a restoration should be made.

RETENTION AND RESISTANCE FORM. It would obviously greatly increase the danger to the pulp, either by actual exposure or from thermal shock following the placing of a metal restoration, if the

pulpal wall should have been cut to the depth of the deepest penetration of the decay. All requirements of both retention and resistance form could be satisfied with less depth, therefore a 1 mm. fissure bur was employed to cut a shelf around the area from which the carious dentin had been removed. This shelf was on the average about 1 mm. in depth from the line of the dento-enamel junction. In most positions the bur, in the contra-angle hand-piece, was held parallel with the long axis of the tooth. See Figure 829. As the mesial, distal and lingual extensions of the cavity were approached, the bur was held at such an angle that the cavity wall would be inclined outward, thus leaving more dentin to support the enamel of the marginal ridges. Only a single cut was made around the cavity with the fissure bur. The remainder of the pulpal wall which formed the shelf was cut with an 18-9-6 chisel to the same level as the cut made with the bur.

One needs to have the internal anatomy of each tooth in mind when retention form is prepared in cases in which the decay in the dentin is deep or has spread much laterally. Resistance and retention form call for a box-like cavity with sufficient depth to guar-



FIG. 828.

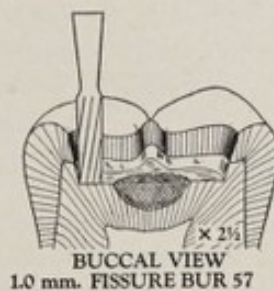


FIG. 829.

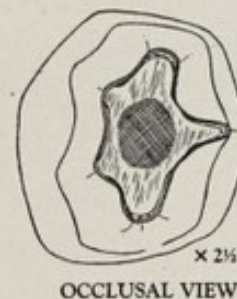


FIG. 830.

antee the stability of the restoration, while the vitality of the pulp is best conserved if the operator avoids near approach to it or to the horns of the pulp. It is not possible to know to what degree the recessional lines of the horns are calcified, and the only safe plan is to keep away from those lines. The grooves in the occlusal surface lie between the recessional lines, therefore a cavity may be extended along the line of a groove to secure better retention, with the least danger of too close approach to the recessional lines. Except in cases of abrasion, the depth of cutting for retention should seldom be more than 1 mm. in the dentin, regardless of the fact that caries may have penetrated much deeper, as in this case. Neither is it necessary that the shelf extend entirely around the carious area in the dentin; in some cases a shelf on two sides would be sufficient.

FINISH OF ENAMEL WALL. In cavities of this size there may be much variation in the direction of the enamel rods, therefore, in securing outline form much care was taken to chip off pieces of enamel in every position in the various walls. Especial attention was paid to the extension of the lingual wall to the lingual marginal ridge, where the direction of the rods is very uncertain. The margin was so trimmed and beveled as to include a little of the lingual surface beyond the crest of the ridge. In most positions, the enamel walls of this cavity were inclined outward in the direction of the rods. The enamel wall was finished with the 18 width straight and binangle chisels by first making the walls smooth and then beveling the cavo-surface angle very slightly.

An occlusal view of the completed cavity for an amalgam restoration is shown in Figure 830. There are slight undercuts in the dentin in the positions of the buccal and disto-buccal grooves, also in the lingual wall directly opposite these two positions.



FIG. 831.



FIG. 832.

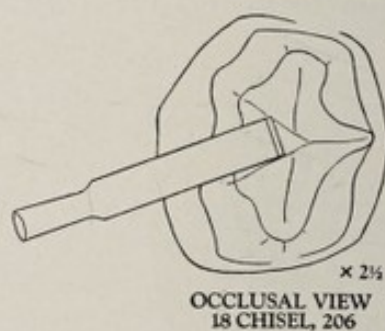


FIG. 833.

RESTORATION WITH AMALGAM. The alloy and mercury should be weighed in advance and the mixing should be according to the directions in the chapter on the manipulation of materials. Six pieces of amalgam were used. First, three small pieces were condensed into the narrow extension along the lingual groove and into the undercuts of the buccal and disto-buccal grooves. A larger piece was then condensed in the distal portion of the cavity, a similar piece in the mesial portion, and finally a piece in the center which overfilled the cavity. Heavy pressure was made on this with the 35x15-7-12 condenser, which was also stepped about the margins with direct pressure. See Figures 831 and 832.

TRIMMING THE AMALGAM. The major excess of the amalgam was removed with a beaver tail burnisher, the motions of the blade being in the direction over the margins toward the enamel, leaving a slight excess along all margins. After the amalgam was partially set the 18 straight and 18-9-6 chisels were used to trim away the excess and reproduce the inclined planes of the occlusal surface, as



FIG. 834.



FIG. 835.



FIG. 836.

shown in Figure 833. The margins were trimmed with the 15-8-12 spoons, holding a part of the edge of the blade in contact with the enamel, as illustrated in Figure 834. The various grooves of the occlusal surface were reproduced with the same instruments. See Figure 835. The restoration was polished with fine disks at a subsequent appointment. Figure 836.

LARGE PIT CAVITY, LOWER FIRST MOLAR; GOLD INLAY.

For the larger pit cavities in molar teeth the choice of materials for restorations usually is between amalgam and the gold inlay. However, in a limited number of cases, porcelain inlays may be preferred. The large occlusal cavity selected for the amalgam restoration for William Fisher, will be used to illustrate the preparation and restoration with a gold inlay.

CAVITY PREPARATION. The only difference in the cavity preparation for either a porcelain or a gold inlay is in the inclination of the cavity walls to permit the withdrawal of an impression or wax pattern. There can be no undercuts as were made for amalgam. The inclination of the bevel of the cavo-surface angle should be the same for the gold inlay as for amalgam, but for porcelain, the marginal angle should be as nearly a right angle as it is practicable to prepare it.

One should be able to look into a cavity prepared for an inlay and see every part of all walls from one point of view. One's line of vision should be the same as the line along which a wax pattern of the cavity is to be withdrawn and it is often necessary to view the reflected cavity in a mouth mirror. If all of every wall can not be seen, there must be either an undercut or a projection.

Figure 837 shows the preparation of this cavity for a gold inlay. This should be compared with Figure 830, the amalgam preparation, in which there are four undercuts. All walls of the amalgam cavity are practically parallel, except at the extreme mesial, distal and lingual extensions, which were inclined outward to give greater dentinal support to the enamel of the marginal

ridges. Figure 838 is a mesio-distal section of the tooth viewed from the buccal. Figure 839 is a bucco-lingual section cut in the plane of the lingual groove, viewed from the mesial. The extension of the lingual groove, which was fissured, to the very crest of the marginal ridge is shown, also the continuation of the fissure on the lingual surface, which was not included in the cavity.

MAKING THE WAX PATTERN. A piece of wax was warmed by rotating it over a flame and molded into the form shown in Figure 472B. The smaller end was again heated slightly to make it softer than the larger end, all of the piece being quite plastic. It was then



FIG. 837.



FIG. 838.

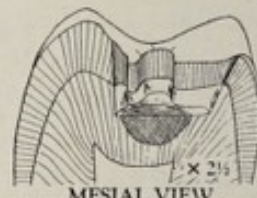


FIG. 839.

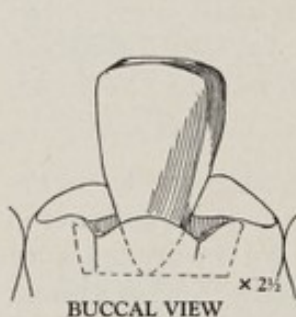


FIG. 840.

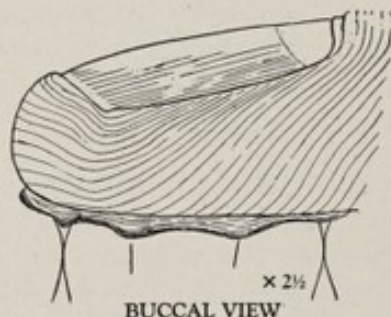


FIG. 841.

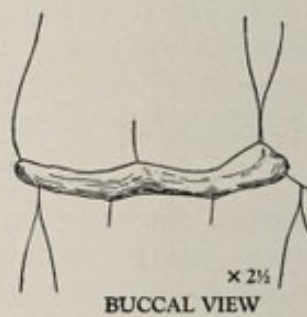


FIG. 842A.

placed in the cavity as shown in Figure 840 and pressed into the cavity and over the occlusal surface of the tooth, with a finger. Figure 841. The patient was immediately requested to bite through the wax until the mouth was entirely closed, thus making an impression of the upper teeth in the wax as a guide for carving: See Figures 842A and 842B. The bulk of the excess wax was trimmed away with a warm carving instrument, and the carver shown in Figure 473D was used to trim the wax to form, while keeping some portion of the edge of the blade resting on the enamel to prevent cutting too deeply into the wax, as illustrated in Figure 843. The final trimming was done with the curved edge carver. See Figure 844. The surface was then burnished with the burnisher shown in Figure 473F, which has a rounded end.

The pattern was chilled with room temperature water and an exploring tine was pressed slowly into the wax at about the center. It was lifted out of the cavity, and mounted on the sprue former, which was in turn set into the sprue base. See Figures 845, 846 and 847.

If it requires more than very gentle force to remove the wax pattern from the cavity, the cavity side of the wax should be examined with a magnifying glass to find any projections which might correspond to slight undercuts in the cavity walls. In such cases, unless the wax is chilled until it is fairly hard, it is possible



FIG. 842B.



FIG. 843.



FIG. 844.



FIG. 845.



FIG. 846.

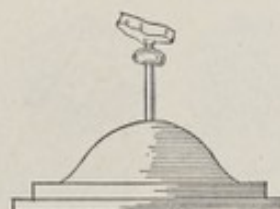


FIG. 847.

to remove it by exerting a little force, the slight projections of the wax being compressed for the moment, but promptly resume the form corresponding to the undercut of the cavity wall. If any are found, the wax should be trimmed and then replaced in the cavity to be certain there was no distortion in removing it.

RESTORATIONS IN A VARIETY OF PIT CAVITIES.

A number of illustrations are presented which may be helpful in the preparation of cavities of this class and in the selection of the materials to be used in making restorations. Practically all pits are in positions where the restorations do not show. Buccal pits in upper first molars may be seen occasionally, but, otherwise, the appearance of these restorations is of little concern from the esthetic point of view.

OCCLUSAL PIT CAVITIES. Gold foil should, as a rule, be used for all small pit cavities of convenient access, such as the pits and fissures occurring in the buccal surfaces of the molars and in the occlusal surfaces of the bicuspid, as well as the small and medium size cavities in the occlusal surfaces of the molars.

Each bicuspid, upper and lower, has two fossae, which may be separated by a transverse ridge or they may be connected by a groove. There may be a decay in one or both pits. The greatest variation in form is found in the lower second bicuspid.

When there is a definite ridge, two separate restorations will usually be made, as illustrated in the upper left first bicuspid for Thomas Johnson, Figures 848 and 849, or the lower left second bicuspid for Frank Hines, Figures 850 and 851.

On the other hand, when a groove connects two pits and this groove is partly or entirely fissured, a single restoration is in order,



FIG. 848.



FIG. 849.



FIG. 850.



FIG. 851.



FIG. 852.



FIG. 853.



FIG. 854.



FIG. 855.



FIG. 856.



FIG. 857.

as illustrated in Figures 852 and 853, an upper right first bicuspid, also 854 and 855, a lower right second bicuspid for Mary Brown, and in the lower right second bicuspid for Thomas Johnson, in Figures 856 and 857.

Any of these restorations might be made with amalgam, but they are too small to suggest the use of gold inlays. When occlusal decays in the bicuspid are neglected, the proximal surfaces are likely to be involved, as illustrated in Figures 201 to 206 in Volume I. For this reason, large occlusal restorations should seldom be required in the bicuspid.

Restorations such as that in the occlusal surface of the upper left first molar for William Fisher, illustrated in Figures 858 and 859, should preferably be made with gold foil. However, if the patient's finances are limited, or if the degree of susceptibility is high, particularly in a young person, amalgam should be used.

CONSIDER SUSCEPTIBILITY IN SELECTING MATERIAL FOR OCCLUSAL RESTORATIONS. It is important to make the best possible estimate of the susceptibility of a child in deciding whether to use gold or amalgam for occlusal restorations, because they must generally be removed if and when proximal decays occur in the same teeth. A proximal decay occurring in a bicuspid after an occlusal restoration has been made, will practically always necessitate the removal of the occlusal restoration in order that a proximo-occlusal cavity may be prepared. Likewise a mesial decay in any of the upper molars will require the removal of a previously placed restoration in the central fossa, and a distal decay will call for the removal of a restoration in the distal fossa or the disto-lingual groove. In the lower molars, all or a part of an occlusal restoration would be removed in preparing a step for a proximal restoration. It might be a reflection on the dentist's judgment if he should be compelled, for the reason mentioned, to remove a number of gold foil restorations



FIG. 858.



FIG. 859.



FIG. 860.



FIG. 861.



FIG. 862.



FIG. 863.



FIG. 864.

in occlusal surfaces within two or three years after they were placed. This situation may be best met, particularly in cases in which occlusal decays occur in the first molars within two or three years after these teeth erupt, to carry them along with black copper cement for a few years, until a better estimate may be made as to the degree of susceptibility. If the child can not be kept under observation, amalgam should be preferred to copper cement, and should be placed at the earliest time that a rubber dam may be applied.

EARLY AND LATE TREATMENT OF OCCLUSAL DECAYS WHEN GROOVES ARE FISSURED. Figures 860 and 861 illustrate an occlusal restoration in the upper left first molar for Thomas Johnson. All of the grooves were fissured, and it was necessary to extend them to the marginal ridges of the occlusal surface. It was made with

gold foil, although amalgam or a gold inlay might very appropriately have been selected, depending upon full consideration of all related conditions. A very large restoration, see Figures 862, 863 and 864, was made for William Fisher in the upper right first molar. This was a case in which there had been extensive undermining of the enamel by lateral decay of the dentin from both the central and distal pits. A gold inlay was used, although amalgam is equally indicated for these very large restorations in the occlusal surfaces of molar teeth.

A comparison of the restorations illustrated in Figures 861 and 864 is of special interest. In both cases there were decays in both the central and distal pits, and all of the grooves were fissured. The decays were discovered early in Thomas Johnson's tooth, Figure 861, before the fissures were decayed, while in the case of William Fisher, the decay had penetrated the enamel of all fissures and had also extended laterally in the dentin. The difference in the size of the two restorations represents the difference in the average run of cases for patients who cooperate on a recall plan

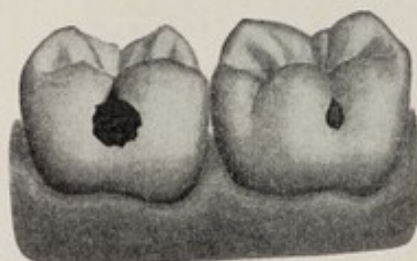


FIG. 865.

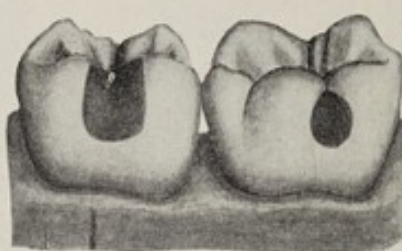


FIG. 866.



FIG. 867.

and those who do not. The two restorations also indicate the relative danger to the pulp from thermal shock. A little further delay on Mr. Fisher's part and the pulp would have been exposed.

The preparation of the cavo-surface angles in these two cases was different. In Figure 861, a bevel was required at the extremity of each extension along a fissure, where the cavity approached the marginal ridge, or extended beyond the ridge, as in the disto-lingual groove. The directions of the rods vary so much in these positions that it should be the rule to prepare the margin with a slight bevel. The other margins of this cavity required no bevel because the rods were all inclined toward the fissures. In Figure 864, the margins of all walls were beveled, for the reason that the decay in the dentine had everywhere undermined enamel to the point where the rods were inclined outward.

BUCCAL PITS IN MOLARS. Figure 865 shows buccal pits in the lower right first and second molars, for which restorations were placed for Mary Brown. Gold foil was used for the first molar. It will be noted that the cavity was extended slightly toward the

occlusal, because the buccal groove was fissured. The cavity in the second molar was larger and there was another cavity in the occlusal pit, while the buccal groove was deeply fissured from one to the other. It was necessary to join the two and the restoration was made with a gold inlay, although amalgam might have been used. See Figures 866 and 867.

A somewhat similar condition presented in the upper left molars of John Stephens. See Figures 868 and 869. There was considerable lateral decay of the dentin in both teeth. The restoration in the first molar is very nearly round in its marginal outline. In preparing the retention form, all of the point angles were undercut with a bur, making the outline of the axial wall almost square, and the axial wall was prepared in a single plane parallel to the long axis of the tooth. A round cavity with a concave base is the most difficult form in which to make a restoration with gold foil. It requires very little additional cutting to change such a cavity to box-form, in which the first pieces of foil are easily anchored. The second molar had an occlusal, as well as a buccal pit decay, and the buccal groove was fissured. Amalgam was used for the restoration.

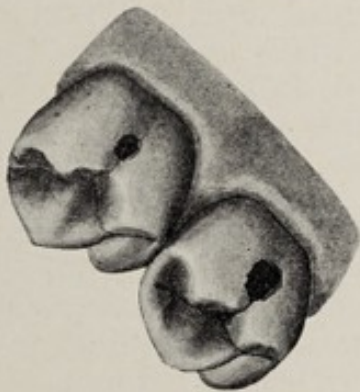


FIG. 868.

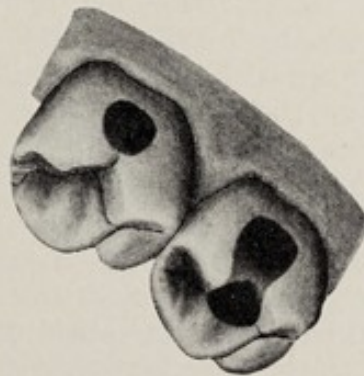


FIG. 869.

USE OF STRAIGHT OR CONTRA-ANGLE HAND-PIECE. The straight hand-piece may generally be used for all pit cavities in the upper bicuspid and the pits in the central fossa of the molars; in some cases, it may be used for the distal fossa of the first molar and less often for the second or third molar. Pits in the buccal surface of both the upper and lower first molars may be conveniently reached with the straight hand-piece, and less often those in the second molars, depending upon the extent to which the cheek may be retracted. The straight hand-piece may be used for pits in the occlusal surfaces of the lower bicuspid and first molars in many cases, provided the teeth are not inclined to the lingual. The shaft of the hand-piece may be held nearly parallel to the long axis of the tooth, with the approach slightly from the buccal, the cheek being retracted.

The contra-angle hand-piece should be used in all positions in which there is not good access for the straight hand-piece. The contra-angle will often be most conveniently used for distal pits in the occlusal surface and buccal pits in the upper second and third molars, also for occlusal cavities and also buccal pits in the lower second and third molars. It should be used less frequently for the occlusal surfaces of the lower bicuspid.

APPROACH FOR HAND EXCAVATORS. The access for hand excavators calls for similar differences in the angles of the blades, although these instruments may generally be used from the mesial, buccal or lingual directions, the latter being a cross-mouth position. The chisels with blades at the angle 6 may be very generally used, although the angle 12 will often be more convenient in cavities in which the bur is used in the contra-angle hand-piece. The hatchets of angle 12 should often be used for the occlusal surfaces of the lower molars. The chisels of angle 23 may be used instead of the bur in the contra-angle hand-piece for squaring out the pulpal or the axial wall, particularly in buccal and occlusal cavities in lower second and third molars.

Class 2. Proximal Decays in Bicuspid and Molars.

ILLUSTRATIONS: FIGURES 871-954.

DECAYS in the proximal surfaces of the teeth, and particularly those in the bicuspid and molars, are the most destructive of all involvements of the teeth by caries and occupy a large share of the time which the dentist devotes to restorative treatment.

In the order of occurrence, these cavities follow or occur later than those in pits and fissures, but are usually earlier than those occurring in buccal and labial surfaces. It must be understood, however, that this expresses the general rule found by making averages from many recorded cases and to which there are many exceptions. Between the time and the frequency of the appearance of proximal cavities in the incisors and in the bicuspid and molars, there is the utmost variation in different individuals. In some, the incisors will escape entirely or with but one or two cavities, while the posterior teeth will have many; and in others, the situation will be reversed. In considering individual proximal surfaces, the first molars are in contact from the time of their eruption, at first with the temporary second molars and later with the second bicuspid, and their broad flat mesial surfaces are therefore a year or more in advance of all other proximal surfaces of the permanent teeth in their contact relationships. The mesial surfaces of the central incisors are the next proximal surfaces to be in contact. Records indicate that the mesial surfaces of the first molars are more often decayed than other proximal surfaces of the posterior teeth, and the mesial surfaces of the upper central incisors more frequently than other proximal surfaces of the anterior teeth. In any of the teeth, except the first bicuspid, the mesial surfaces are more often decayed than the distal, apparently because they are less rounded in contour. In considering these, it must be remembered that there are two areas of liability—one mesial and one distal on each tooth—while in the first and fifth classes there is but one, except as buccal pits in some of the molars furnish a second. Therefore, if the liability were equal, the proximal cavities would be double the number of either the first or fifth classes.

AREAS OF LIABILITY. The forms of the areas of liability are different in the molars and bicuspid from those in the incisors

and cuspids, because of the differences in the contour of proximal surfaces of these teeth, but the essential characters of the areas are the same in all, so that they are really much alike. The conditions which give opportunity for these decays are to the gingival of the contact point.

In a strict account of the examination of ten thousand persons who applied for treatment in the clinic in Northwestern University Dental School, only nine persons were found in whose teeth superficial spreading of decay of the enamel had passed across the angles of the teeth from one surface to another, or had extended from two surfaces and met across the angles. All of these were cases of unusual severity of caries that had been neglected until all effort to chew food had been practically abandoned by the patients. This marks the angles of the teeth, or an approach to them, as the line of safety along which to lay cavity margins in the preparation of cavities in proximal or buccal surfaces.

The best management of these cavities requires that the operator make a study of each individual proximal surface involved, determine the boundaries of its area of liability to decay, and that in the preparation of the cavity, the whole of the area of liability be included within the cavity outline. Also, the preservation of the health of the septum of gum which normally fills the interproximal space to the contact point is one of the important factors in treatment. It follows, that in the preparation of these cavities, they must, in order to be curative and preventive, be cut so far into the embrasures, both to the buccal and to the lingual, that the excursions of food in the act of mastication will sweep their marginal lines and keep them constantly cleaned, and the gingival margin must be so laid that it will be covered by the gum septum. Then, if the form of the proximal surface, and especially of the contact point, is so made that it will protect this gum septum, and is sufficiently prominent to preserve the full mesio-distal breadth of the tooth, the permanence of the restoration made with technical skill is assured.

DEPTH OF CAVITIES. Every cavity should be as shallow as the removal of all decay will allow wherever this will give safe anchorage in dentin. This should be taken as the expression of a principle in all treatment of caries by restorations. Large restorations extending far out toward buccal or labial angles, should be made only when demanded by undermining of the enamel by lateral decay in the dentin.

IN VERY SUSCEPTIBLE PERSONS, proximal decays are very likely to destroy the teeth quickly. In such cases, they are more

liable to attack the teeth in the order of their eruption, and are often discovered within two to four years after the teeth have taken their places in the arch. These are the most difficult cavities to treat successfully. The child must be dealt with; the teeth become abnormally sensitive, the self-control and endurance of the patient are low, and, yet, this is just the case in which the technical procedures in treatment need to be carried out with the greatest degree of minuteness to be successful.

A mesial cavity occurs occasionally in the first permanent molar while it is in contact with the second temporary molar and it requires treatment very early. This is the only proximal cavity in the molars that begins at a very tender age. The second molar is not erupted until twelve, and rarely has a cavity before fourteen or fifteen. And it is only at this age that distal cavities in first molars begin to occur. Cavities may be found in the proximal surfaces of the bicuspid almost as rapidly as they take their places. When this occurs, the teeth decay with great rapidity and the most painstaking operating in respect to minute details and the full inclusion of areas of liability will be required to protect them until the coming of immunity relieves them of danger. Cases occur in which temporary restorations must be resorted to, to bridge over periods of extreme sensitiveness, but the time of their use should be confined to the shortest possible limit. At this age, the failure of effective use of the teeth in chewing food quickly brings with it sensitiveness of the peridental membranes, and it is of the utmost importance to have the patient using the teeth vigorously to restore the tone of the supporting structures and promote the greatest cleanliness. Often temporary restorations, made with this special end in view, together with the arousing of the proper effort on the part of the patient in mastication and hygiene, will accomplish the desired end within a few months. The case may then be regarded as under control and the necessary restorations leisurely and effectively made. Sufficient time should be given between sittings — a week or more — to allow the hyperesthesia aroused by the one operation to pass away before beginning the next. In this way the operations may progress with a continuous improvement of the conditions. Definite plans of management with these ends in view are of the utmost importance in extreme cases of hyperesthesia with notable impairment of mastication.

HYPERESTHESIA of dentin does not limit the use of the teeth except when food is forced into a cavity in such a way as to affect the dentin directly. Cases of extreme hyperesthesia of the dentin will be met with in many cavities in persons who have no impairment of mastication. A solid restoration corrects the difficulty as soon as the patient realizes that the use of the tooth will not hurt. This, of course, relates to cases in which the sensitiveness has occurred so recently that there has been no impairment of

the tone of the peridental membranes, which often occurs when the occlusal wall of a proximal cavity has broken away, exposing the cavity to direct food pressure. The difficulty is only in the preparation of the cavity. But the question of thermal sensitiveness and the danger of hyperemia of the pulp will require consideration. In a large proportion of the cases of hypersensitive dentin there will be no especial thermal sensitiveness. This question generally relates to individual teeth and does not materially affect the treatment of other cavities. If there are many cavities that have rendered chewing painful and ineffective, and the habit of avoiding foods requiring effort in mastication has been long continued, they may prove exceedingly difficult to treat. The whole mouth is often in a condition of hyperesthesia.

If there are pulp exposures that are preventing the patient from chewing food, these must be eliminated by the appropriate treatment as a first procedure whenever practicable. Bad contacts or open cavities, which allow food to so impinge upon the gums as to continually cause pain, should be treated with temporary restorations in such a way as to substantially remove the difficulty without delaying until permanent operations can be placed. The recovery of the health of the gum septums and peridental membranes from sensitiveness caused by irritation and lack of use, should always be especially looked to in the making of temporary restorations, and these must be so made as to promote this. Often gutta-percha is forced upon the gum septum in such a way as to cause its absorption and do permanent injury. This should, by all means, be guarded against with jealous care. When this has occurred, every effort should be made by artificial cleaning and the mild stimulation of the interproximal gum tissue to induce a regrowth that will fill the space. This will often be successful, but often it will fail.

PROPHYLACTIC VALUE OF FORM IN PROXIMAL RESTORATIONS. The form given to restorations in proximal surfaces of the teeth is of the utmost importance in the prevention of recurrence of decay, and in the prevention of the occurrence of disease of the gums and peridental membranes. The points to be attained are: (1) The preservation of the full mesio-distal breadth of the tooth crown; (2) correct form of proximal surface; (3) correct form of interproximal contact; (4) the health of the gum septum. The general rule will be that the original form of the teeth should be reproduced in the restoration, but it often happens that the original form is not the best form, and in such cases, when practicable, the form should be improved. The most essential features are that the contact point be well rounded so that it will touch the approximating tooth only at a small rounded point, and that this be sufficiently

prominent to restore the original tooth form and therefore restore the full normal breadth of the interproximal space. If amalgam is used, this requires that the teeth be separated sufficiently to allow the finish to be made without in any degree narrowing the mesio-distal breadth. Indeed, it is better to widen this just a little. Measurements show that when the average person has arrived at the age of forty years, he has lost, by wear of the proximal contacts of his teeth, one centimeter in length of the arch measured around the labial and buccal surfaces of the teeth from the mesial cusp of the right third molar to the mesial cusp of the left third molar. Some of this loss should be regained with every proximal restoration that is required. When the forms of the teeth have been good, their restoration reinstates the normal conditions, and cleanliness and health are readily maintained.

If, on the other hand, the mesio-distal breadth is not restored, the two teeth will soon be crowded together, narrowing the interproximal space, and the crowding upon the gum septum will cause its partial absorption. It will be shortened and will fail to fill the narrowed interproximal space, affording opportunity for lodgments in a position difficult to clean. The embrasures are also narrowed by reason of the teeth falling together, which prevents the excursions of food through them in mastication, and increases the area of liability, or carries its borders farther toward the angles of the teeth, so as to place the margins of the restoration in greater danger of recurrence of decay.

When the proximal contact is not sufficiently prominent to restore the mesio-distal breadth of the tooth, it is necessarily flattened and broadened, and is in that degree less well adapted to maintain the cleanliness of the space. If it is flattened to any considerable degree, it will not only fail to be self-cleaning, but will grasp and hold stringy particles of food. These will be forced upon the gum septum, causing pain in mastication, which will be a grave annoyance. Absorption of the gum septum will occur, forming a pocket that will hold debris, which will decompose and cause recurrence of decay at the gingival margin of the restoration, or it will cause disease of the peridental membrane, with final loss of the tooth. It will also endanger the neighboring teeth.

In bicuspid and molars, the form of the occlusal surface, in its relation to the interproximal space and the embrasures, is occasionally of great importance to cleanliness. Irregularities of the teeth often prevent this form of cleaning being effectively done. Also the forms of teeth may be such in particular instances that it is not well done. In many cases where a more effective cleaning of an interproximal space by the process of mastication seems desirable, the form of the part of the occlusal surface

replaced by the restoration may be so modified that, in the crushing of food, a greater amount of it will be directed into the embrasure and effect a more thorough cleaning of the marginal lines of a restoration. This may usually be done by diskling away some portion of the marginal ridge and so sloping the surface toward the embrasure that, when the food is crushed upon it, it will tend to slide into and through the embrasure.

A change in the form of the proximal surface may often be made that will improve the cleaning of the parts, especially in broad proximal cavities in the molars and bicuspid. The distal surface of the first molar, particularly when the disto-lingual cusp is large and protrudes to the distal so that the lingual embrasure is much narrowed, will not have its disto-lingual angle well cleaned by the excursions of food, and on this account decay is especially liable to occur along the gingival portion of the lingual margin after the restoration is made, if the original form is preserved or reproduced. In this case it is much better to carry the cutting somewhat beyond the disto-lingual angle of the tooth, and, in finishing the restoration, reduce the distal protrusion of this cusp and widen the embrasure; or it may be sufficient to reduce the thickness of the enamel of the disto-lingual cusp with a disk in connection with the preparation of the cavity. If, at the same time, the distal marginal ridge is left low, or the occlusal surface sloped a little toward the embrasure, so as to direct the food into it, the cleaning of the lingual margin of the restoration will be so improved as to prevent this tendency to recurrence of decay at this point.

In the bicuspid. there are great differences among different individuals in the mesio-distal breadth of the lingual cusps as compared with the buccal. When the lingual cusps are broad in this direction, the lingual embrasures are very narrow, so that the cleaning of the lingual marginal lines of restorations will be very imperfect; these embrasures should be broadened by diskling the lingual cusps wherever practicable, or by separating the teeth sufficiently to build out a prominent contact point, and so finish the occlusal surface as to direct the excursions of food into and through these embrasures so that they will be continually cleaned in mastication. In making these form changes, every care must be taken to slightly increase the mesio-distal breadth of the tooth at the contact point. The observant operator will find many places other than those cited in which to apply the principles which the particular cases given illustrate. Whenever cases of great intensity of susceptibility to decay demand treatment, every means at our command of increasing or facilitating the natural cleaning of the marginal lines of our restorations should be studied for the individual case.

Prevention and Immunization; Proximal Decays in Bicuspids and Molars.

WIDENING EMBRASURES. In testing the contacts while examining the mouth of Frank Hines, at the age of fifteen, it was noted that the embrasures between the upper molars were unusually narrow. Particularly the mesial surfaces of the second molars were exceptionally flat. In order to increase the scouring effect of food in mastication and thus reduce the bucco-lingual width of the area of liability to caries on these proximal surfaces, the embrasures were widened.

A Ferrier separator was applied to gain sufficient room for the disks, in order that the surfaces might be well polished. Coarse disks, $\frac{5}{8}$ inch in diameter, were first used to trim the enamel near the buccal and lingual angles of these surfaces. Disks of this size will not reach the enamel which forms the contact if the shaft is held on the buccal or lingual side of the teeth, as it should be. The disk was held in such position that the embrasure would be widened, not only in the direction from the contact point to the buccal and lingual angles of the tooth, but also from gingival to occlusal. The thickness of the enamel was reduced most near the occlusal and gradually less to the level of the margin of the gingivae. There was no shoulder where the cutting left off, but instead a continuously smooth contour. The disks were placed in the contra-angled hand piece for trimming the mesial surface of the second molar. Finer disks were then used to trim the surfaces closer to the contact and to make the portion previously trimmed smoother. These disks were manipulated cautiously to avoid touching the enamel forming the contact. Finally disks, without grit, were used to give the surface a good polish.

IMMUNIZATION WITH SILVER NITRATE. Although the period of immunity which results from the impregnation of the enamel with silver has not been determined, its routine application to apparently undecayed proximal surfaces, in mouths of susceptible persons, seems to be justified, particularly for the reason that decays in proximal surfaces are less well under control than others. However, this treatment should not be undertaken unless it is to be done with ample time at the operator's command and with strict attention to every detail. The rubber dam should be applied, as the teeth must be absolutely dry for a period of several minutes. Warm air should be blown on the surfaces at intervals to hasten the drying. The silver nitrate solution should be rubbed into the surface with a ligature, or with cotton on a large stiff broach. All treatments and examinations of cases should be recorded to determine the most practicable time intervals between treatments.

The following general plan is suggested for practitioners who

are inclined to study the efficacy of these treatments for proximal surfaces:

1. Application to mesial surface of first permanent molars about two years after they erupt, seizing especially the opportunity to treat this surface at the time when, perhaps, there may be a distal cavity in the second temporary molar, also at the time between the loss of the second temporary molar and the eruption of the bicuspid.

2. Take advantage, on the occasion of the preparation of each proximo-occlusal cavity in any tooth, of the opportunity to treat the completely exposed surface of the neighboring tooth.

3. As a routine, treat all proximal surfaces for susceptible persons once a year from about the tenth year until a considerable degree of immunity is apparent. In carrying out such a plan, it is suggested that this be divided into two periods six months apart. For example, the lower teeth may be treated in March of each year, the upper teeth in September. This arrangement makes it practical to examine the mouth, clean the teeth and apply the silver nitrate at one appointment for periodic care.

MAINTENANCE OF GOOD CONTACTS. One of the most effective means of preventing caries in the proximal surfaces of the bicuspid and molars is the maintenance of proper contacts. In connection with each restoration for a proximal decay, the several contacts in the bicuspid-molar region should be considered as a group. If the restoration should be for a decay in the mesial surface of the first molar, for example, and the contact between the bicuspid should not be sufficiently tight to offer considerable resistance to the passing of a ligature, the mesio-distal width of the first molar should be sufficiently increased in placing the restoration to move the second bicuspid mesially and thus tighten its contact with the first bicuspid. By the same operation the contact pressure between the first and second molars would also be slightly increased.

In view of the fact that there is a continuous slight wearing of the enamel which forms the contacts, it is a good rule of practice to very slightly increase the mesio-distal width of each tooth as restorations are made. In placing inlays, this may be accomplished by building a sufficiently prominent contact to require a little force to press the inlay to place. If it is allowed to remain in the cavity for three or four minutes, it will cause enough movement of the teeth so that less pressure will be required in setting it with cement. A separator must, as a rule, be employed for restorations with amalgam or gold foil.

In all cases in which the contact pressures are increased, the bite should be tested immediately after the restoration is placed and adjustments should be made, if necessary, to avoid the possibility of disturbing the teeth of the opposite arch.

Restorations; Proximal Decays in Bicuspid and Molars

In examining Thomas Johnson at the age of sixteen, several proximal decays were discovered, including one in the mesial of the upper right first molar, which will be reported here, and one in the mesial surface of the upper right central incisor, which will be reported later. As the final record will show, this patient was generally very nearly immune to decay, and the cavities marked on this chart, Figure 871, indicate his period of greatest susceptibility.

MESIAL DECAY, UPPER FIRST MOLAR; AMALGAM

A view of the mesial surface of the upper right first molar is shown in Figure 872. The enamel rods had fallen away in the central portion of the area. The cavity was discovered with an explorer, which passed through the enamel into the dentin and caused some pain. The progress of the decay in the dentin is shown in the mesio-distal section. Figure 873. A horizontal section would show a much wider spread of caries of the dentin, corresponding to the form of the surface involvement of the enamel. The lateral decay in the dentin had not undermined the enamel of the marginal ridge.

Johnson, Thomas 1871- *Andover St.*
 NAME NUMBER 986 RES. TEL. North 731 NPIR ADDRESS Chicago 22
 BUS. TEL. DATE 4-12-37 EXAM. NO.
 TEL. DATE Oct. 37 NEXT EXAM
 AGE 16

RIGHT LEFT

OCCLUSION N
 PATIENT CARE 123
 REFERRED BY
 REPORT TO

CARIES 123
 GINGIVAE 123

DATE WIN GS X = D RA TO NM CA SE HOT UNY MOD ELS INC TO

DD RV SERVICE ES TI- MA TE

RED OST INF ENT ME MO
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FIG. 871. Twenty-second examination of Thomas Johnson: Patient No. 986, age 16; occlusion normal, patient care fair, susceptibility moderate, gingivae in good condition. Decays: mesial surface upper right first molar, mesial upper right central incisor, mesial and distal upper left second bicuspid, mesial lower right first bicuspid and distal of cuspid, mesial lower left first molar. A weak contact is marked between the upper right first and second bicuspids. It was tightened, with the use of a Ferrier separator, when the mesio-occlusal restoration was placed in the first molar. The patient was criticised for his failure to properly brush the lingual surfaces of the lower incisors. Previous operations were checked and a full set of radiographs was made. See chapter on oral diagnosis in Volume I for explanation of chart.

ANESTHESIA. In view of the fact that the preparation of the step for retention form would require much cutting in the dentin of the occlusal surface, which would be painful unless anesthesia could be obtained, the initial operation was to make an opening through the enamel in the central fossa with an 8 tenths mm. inverted cone bur, rotating slowly. When the dentin was reached, it was painful. The opening through the enamel was enlarged with a 1 mm. inverted cone bur, without pressing the bur into the dentin. Several cuts were made by first placing the bur at the depth of the dento-enamel junction and then cutting laterally as it was withdrawn. This made an opening through the enamel about 1.5 mm. in diameter, slightly larger at the surface, in the best form for pressure anesthesia.



FIG. 872.



FIG. 873.



FIG. 874.

NOTE:—For each of the illustrations in this volume, which show the technical procedures in cavity preparation and the placing of restorations, the direction from which the surface or section of the tooth is viewed is indicated. If an instrument is shown, its name and formula are listed, also the manufacturer's stock number. The magnification of the drawing, as compared with the tooth, is also given. In all cases in which the instruments are not drawn in perspective, the measurements with a millimeter scale will be found to correspond with the drawings, most of which are $2\frac{1}{2}$ times the actual size. The blade of the hatchet 6 mm. long in Figure 876 should measure 15 mm.; the 1 mm. bur in Figure 875 should measure $2\frac{1}{2}$ mm., and the 18 width hatchet in Figure 879 A should measure $4\frac{1}{2}$ mm.

A new 1 mm. bur was then placed in the opening to make a cut in the dentin, possibly half the depth of the head of the bur. See Figure 874. It was painful but required only a few seconds. Pressure anesthesia was then used successfully.

DESENSITIZER. Hartman's solution might be preferred for this case. The rubber dam should be in place and a very small bit of cotton should be rolled between the thumb and finger and placed in the opening through the occlusal surface, with one end in contact with the dentin and the other end protruding slightly from the opening. This cotton should be dry. A larger pellet of the cotton should then be moistened with the solution and held in contact with the occlusal surface. The small roll will serve as a wick to draw the solution into contact with the dentin and desensitize it.

OUTLINE FORM. A series of cuts were then made with the same 1 mm. bur along the mesial groove through the marginal ridge to expose the decayed area, as illustrated in Figure 875. The

outline of the step was prepared by alternate cutting with the bur to undermine the enamel and chipping away this enamel with the chisels 18 and 18-9-6, as has been described for occlusal cavities. This cutting along the line of the mesial groove was not more than a half millimeter into the dentin. The remainder of the step was then cut at the same level, which gave greater depth of dentin wall, due to the increasing height of the inclinations of the cusps, at a little distance from the groove. This cutting included an extension along the buccal groove to give the step a dovetail form for good retention.

The enamel of the marginal ridge was broken down as a part of the procedure of preparing the occlusal step. The undermined enamel of the mesial surface, to the buccal and lingual of the cavity proper, was split off with the pair of 12-6-12 enamel hatchets. See Figure 876. These instruments were also used with a lateral motion to break away as much as possible of the enamel to the

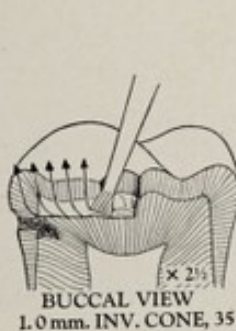


FIG. 875.

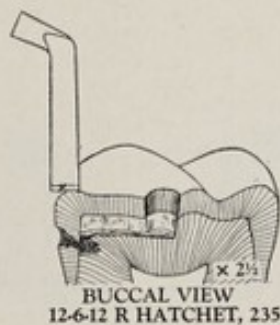


FIG. 876.

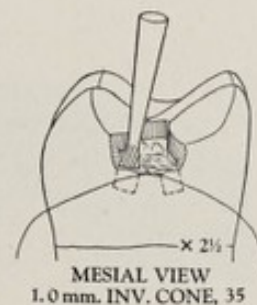


FIG. 877.

gingival. However, this cutting did not place the margins in self-cleansing areas and further extensions were necessary. The inverted cone bur was placed in the decayed dentin and cuts were made, one to the gingivo-buccal, another to the gingivo-lingual, as shown in Figure 877. In each case the actual cutting was in the dentin to undermine a little of the enamel, which was then broken away with the bur without cutting it. On this plan the danger of injuring the proximating tooth with the bur was reduced to the minimum. From each of these points the bur was drawn occlusally along the dento-enamel junction so that the buccal and lingual walls might be made parallel. The 12-6-94 chisel was then used through the embrasures, to chip off the enamel of the buccal and lingual walls that had been undermined with the bur, and particularly to square out the angle of junction of the buccal and lingual walls with the gingival wall. See Figure 878. The buccal, lingual and gingival enamel walls were then trimmed to form with the pair of hatchets 18-9-12. See Figures 879A and 879B. The buccal and lingual enamel walls of the mesial portion of the cavity were

inclined outward, in the plane of the direction of the rods. This completed the outline form.

There is considerable variation in the outward inclination of the enamel rods in the proximal surfaces in bicuspid and molars, in the positions to which the buccal and lingual walls of cavities are placed. Figure 880A is a cross section of a bicuspid at a level a little to the occlusal of the gingival wall of a mesio-occlusal cavity. The buccal and lingual walls in the dentin should be prepared in parallel planes for gold foil or amalgam restorations; these walls in the enamel should be in the direction of the rods for all cavities, with a bevel of the cavo-surface angle. Figure 880B is a section through a restoration in this cavity.

EXTENSIONS OF CAVITY WALLS. The enamel may be split off much more readily with the approach from the buccal or lingual than by cutting from occlusal to gingival with hatchets. When the extensions of the enamel walls in the proximal portion of cavities

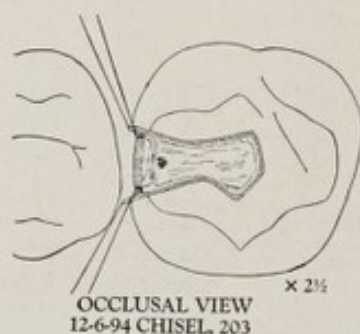


FIG. 878.

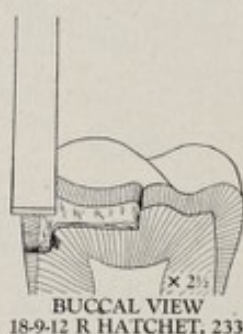


FIG. 879A.

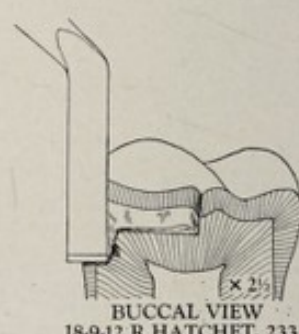


FIG. 879B.

of this type are prepared with hatchets, working from the occlusal, it is often difficult to make the bucco-gingival and linguo-gingival angles sharp. In such cases, if access may be had to use a chisel or hatchet from the buccal or lingual direction, the enamel in question may be chipped away very easily.

The extent of the cutting to the buccal and lingual must be determined in each case by the conditions presenting, which include the form of the marginal ridges, the position of the contact, the flatness or convexity of the proximal surfaces, the practicability of widening the embrasures by disking and the opportunity of gaining a little space with the separator. Generally, the position of the contact and the contour of the marginal ridges are largely under the operator's control. If conditions are such that food will be forced through the embrasures to the buccal and lingual of the contact in normal fashion, the cavity extensions should be to lines where there will be at least 1 mm. width of embrasure when the restoration is completed. There should be sufficient embrasure

space to permit the blade of a chisel or hatchet 12 tenths mm. wide to be placed in the embrasure, with the width of the blade in the mesio-distal direction and the length of the blade parallel to the cavity margin, and almost as far into the embrasure from buccal or lingual as the margin of the cavity. These tests should be made as each cavity is prepared until one may measure the width of the spaces accurately with the eye.

The position of the gingival wall in relation to the crest of the interproximal gum septum should be carefully noted. While the requirement is that the gingival margin shall be fully protected by the gum, in preparing a cavity in the tooth of a person so young, one should anticipate some further recession with advancing years, by extending farther gingivally. To make such an extension of the gingival wall, the inverted cone bur should be placed with its end against the gingival wall, and inclined sufficiently for its edge, or circumference, to engage in the dentin, along the dento-enamel junction, and make one cut from the center of the gingival wall to the bucco-gingival angle and another to the linguo-gingival



FIG. 880A.



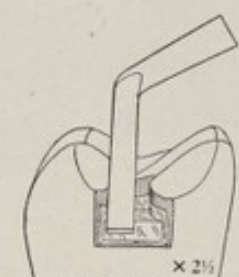
FIG. 880B.

angle. The bur should follow the dento-enamel junction very closely, to avoid unnecessary depth of cutting in the dentin. The gingival enamel which has been undermined may be further weakened by carrying the bur back and forth with pressure against the enamel from the dentin side. It is best not to endeavor to entirely remove this enamel with the bur, due to the danger of injuring the proximating tooth when the enamel breaks away. If the outer portion of the enamel is left, it is easily removed with hand instruments. At the gingival, the space between the margin of the cavity and the proximating tooth should be at least sufficient for a blade 6 tenths mm. wide, held with the width of the blade in the mesio-distal direction, to be passed from buccal to lingual between the teeth. It may be necessary to cut the gingival wall deeper or to separate the teeth to secure this width of space.

RESISTANCE AND RETENTION FORM. The 12-6-12 hatchets were again used to cut the buccal and lingual dentin walls in parallel planes, the approach being from the mesial. The axial wall was cut at right angles to the gingival wall with the approach from the

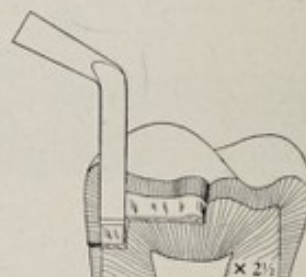
buccal. The same instruments were used with a scraping motion to make the gingival wall smooth in the horizontal plane. In so preparing these walls, the angles of the blades were held in positions to make all of the line angles sharp and give this portion of the cavity a true box form. See Figures 881 and 882.

Line angles can always be made definitely sharp if the instrument is in such position that the angle of the blade moves along the length of the line angle. For example, if an 18-9-12 left hatchet is held with the cutting edge of the blade against the buccal wall of a mesial cavity in an upper right first molar, the far angle of the blade may be made to follow the axio-buccal line angle and cut it to a sharp angle. However, when the cutting edge of this blade reaches the gingival wall it is difficult to cut the bucco-lingual line angle sharp, because it would require sufficient pressure to square out the entire line angle at once. This line angle may be squared out very easily by placing the cutting edge of the blade in the bucco-lingual direction, the approach being from the buccal, and carrying the near angle of the blade along the bucco-lingual line angle in the mesio-distal direction.



MESIAL VIEW
12-6-12 L HATCHET, 234

FIG. 881.



BUCCAL VIEW
12-6-12 R HATCHET, 235

FIG. 882.

All of these line angles may be definitely squared out, or slightly undercut when desired, with the margin trimmers. The curves of these blades and the angles of the cutting edges in relation to the length of the blades, permit the instruments to be so placed that the acute angles of one or another of these blades may be used for each line angle of either a mesio-occlusal or a disto-occlusal cavity in any upper or lower bicuspid or molar tooth. It is often desirable to slightly undercut the buccal and lingual walls along the lines of the axio-buccal and axio-lingual line angles in the preparation of proximo-occlusal cavities for amalgam.

The carious dentin had been entirely removed in preparing the outline and retention form.

Attention is called to the fact that the buccal and lingual dentin walls are parallel in the proximal portion of the cavity, while the

corresponding enamel walls are inclined outward, in the direction of the rods.

APPLICATION OF THE RUBBER DAM. A No. 18 clamp was selected, and the hole in the rubber for the second molar was slipped over the bow of the clamp, which was then placed on the tooth. The second molar hole was again stretched and was guided to a position between the jaws of the clamp and the gingivae as it contracted. If one is operating without an assistant, this is often the easiest method of applying a clamp and the dam over a molar tooth. The rubber was applied over four teeth, the two molars and the bicuspids, using the fourth grasp, with the chair tipped back and the operator in the left side behind position.

FINISH OF THE ENAMEL WALL. The pair of 15(80)-8-12 margin trimmers and the chisel 18-9-6 were used to finish the enamel wall. The margin trimmers were each used in three positions, the right instrument (1) to smooth and bevel the cavo-surface angle of the proximal portion of the buccal wall, cutting from occlusal to

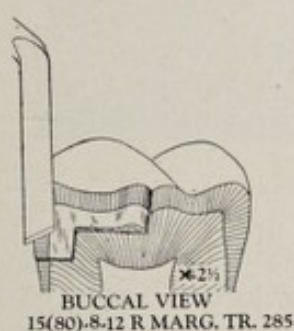


FIG. 883A.

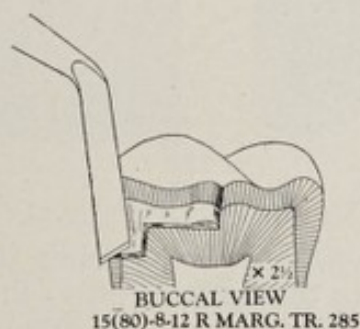


FIG. 883B.

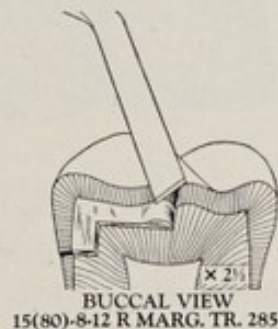


FIG. 883C.

gingival, (2) to finish the buccal half of the gingival wall, the motion being from lingual to buccal, and (3) to bevel the cavo-surface angle of the buccal portion of the distal wall, also cutting from lingual to buccal. See Figures 883A, 883B, 883C. By changing the direction of approach the last cutting was continued for a part of the buccal wall of the step portion of the cavity. In beveling the cavo-surface angle of the buccal wall of the proximal portion of the cavity and of the buccal portion of the gingival wall, the instrument was moved from buccal to gingival, also from gingival to buccal, around the angle to make a continuous bevel of the cavo-surface angles of the two walls in the form of a curve. The bucco-lingual line angle was sharp in both the dentin and enamel, except for the bevel of the cavo-surface angle. The left margin trimmer was used in similar manner for the opposite or lingual wall. The remaining portions of the enamel walls of the step were finished with the 18-9-6 chisel.

APPLICATION OF MATRIX AND SEPARATOR. A matrix was cut on a slight curve, as illustrated in Figure 455. When it is necessary to use a separator to gain a little space to allow for the thickness of the matrix and the polishing of the amalgam, a matrix of this type, cut from a very thin piece of metal, is preferred to any other. It is easily and quickly placed and is held securely in position by a ligature and the separator jaws. The matrix, with the ligature in place, is shown in the occlusal and buccal views, Figures 884 and 885.

The separator was then applied, the bows being propped with base-plate gutta-percha, in order that the jaws would not impinge on the gums, as the adjusting screws were tightened, and would also hold the matrix tight against the gingival margin of the cavity. Modeling compound may be used instead of gutta-percha, but temporary stopping is not sufficiently hard to be satisfactory for this purpose.

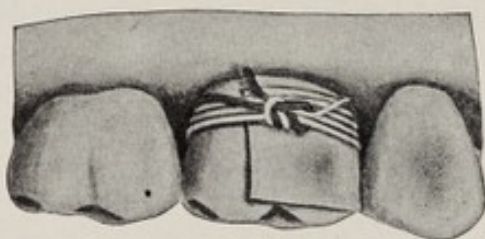


FIG. 884.



FIG. 885.

PLACING THE AMALGAM. In condensing the amalgam, particular attention was paid to the adaptation to the gingival wall. An ordinary pen was used as a convenient means of conveying the pieces of amalgam to the cavity. The point was reversed in the holder, the point being inserted in the slot, leaving the rounded end projecting. A small piece of amalgam was placed on the concave side of the pen, which was held by the assistant with the edge slightly overlapping the edge of the matrix. The amalgam was pushed into the proximal portion of the cavity with a beaver-tail burnisher, and the 15x35-7-10 condenser was used to press it to place and adapt it to the walls of the cavity. Several additional pieces were condensed in the same way. This instrument, used from the mesial approach, and the 35x15-7-10 from the buccal, were especially designed for the purpose of condensing amalgam in this position. Both instruments were also used for condensing the amalgam in the occlusal portion of the cavity, each being held in a position at a right angle to that in which it was held for the proximal portion.

CONTOURING THE RESTORATION AND REMOVAL OF THE MATRIX. As soon as the amalgam had set fairly hard a 15 (80)-8-12 margin trimmer was used to trim the amalgam next to the matrix to the

form of the slope of the marginal ridge. This trimming reduced the danger of breaking away a portion of the amalgam in removing the matrix. The occlusal surface was then carved to form with large chisels and spoons as previously described. The separator was removed, also the ligature which held the matrix. The lingual end of the matrix was cut as short as possible with a pair of small, heavy bladed, curved scissors. The matrix might then have been removed by drawing it to the buccal with a pair of flat nosed pliers. In this case, considerable force had been used to gain the little separation that was required and it was thought best to replace the separator to avoid the possibility of injury to the amalgam in removing the matrix. The buccal end of the matrix was also cut short and the separator was applied as shown in Figure 886, with the ends of the matrix free between the jaws. The teeth were moved apart sufficiently to allow the easy removal of the matrix.

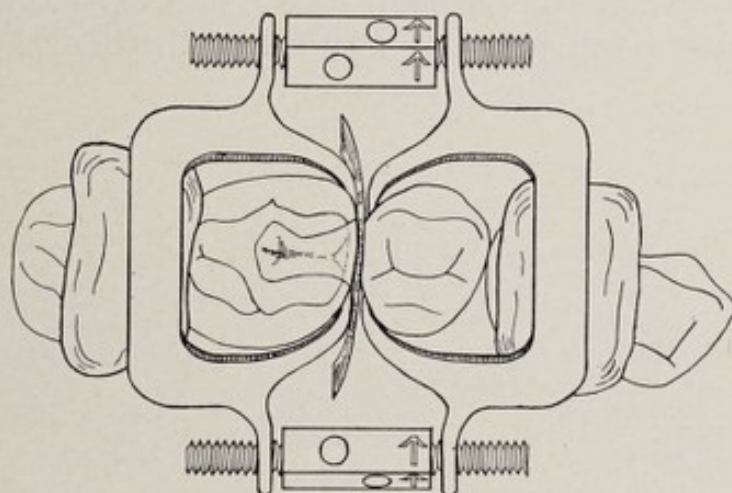


FIG. 886.

The finishing knives were used to trim any slight excess of amalgam along the margins of the proximal portion of the restoration.

The occlusal outline of the restoration is shown in Figure 887, the mesio-distal sectional view in Figure 888. The occlusal view shows the convexity of the proximal surface, the point of contact and the buccal and lingual margins in relation to the width of the embrasures. In the sectional view, the contour of the proximal surface is illustrated. The convexity at the contact changes to a concavity to the gingival of the contact to give more space for the gum septum, and then becomes flattened to meet the enamel at the gingival margin.

At a subsequent appointment, the restoration was polished. The separator was again applied for a moment in order that a fine strip might be used in finishing the contact.

MESIAL DECAY, UPPER FIRST MOLAR; GOLD INLAY. A mesio-occlusal gold inlay was placed in the upper right first molar for John Stephens at the age of eighteen. The detail of the cavity preparation will be omitted, except as it differed from the cavity just described. The decay had undermined the mesial marginal ridge, as shown in Figure 890, and the undermined enamel was therefore broken away with a 12 straight chisel, holding the blade parallel to the mesial surface at first, then turning the blade at a slight angle, first toward the buccal and then toward the lingual, to make the occlusal opening the shape of a letter V.

DESENSITIZER. This extension of the cavity to the occlusal made it possible to apply Hartman's desensitizer. With the rubber dam on, the application was made to the carious dentin which had been exposed. The inverted cone bur was then used to make a cut along the mesial groove to the central fossa, instead of beginning in the central fossa and cutting mesially, as in the preceding case. A second application was necessary before the central fossa was reached.

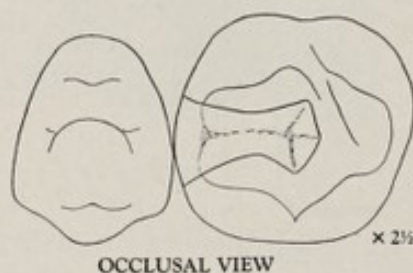


FIG. 887.

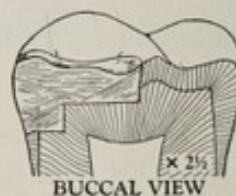


FIG. 888.

Special attention was paid to the inclination of the cavity walls, to be certain that a wax pattern could be withdrawn without distortion. In the preparation of mesio-occlusal cavities, the axial and distal walls are likely to be slightly undercut, because of the mesial approach, particularly if a bur is used in the straight hand-piece to square out the pulpal and gingival walls. The enamel walls were given the same very slight bevel of the cavo-surface angle as for amalgam in the proximal portion of the cavity. No bevel was required for the occlusal portion in either cavity as the position of the margin in relation to the slopes of the cusps was such that no short ends of rods would be exposed, even though the walls were all at right angles to the pulpal wall.

THE WAX PATTERN. The technic of making the wax pattern has been described. In this case a copper band was used, as illustrated in Figures 891A, 891B. It was a fairly close fit at the gingival margin, when the opposite side of the band was in contact with the

disto-buccal and disto-lingual angles of the tooth. However, the fit was not so close but that a thin edge of the wax might be forced beyond the margin of the cavity. The wax was softened and placed in the band with an excess to the mesial side, so that this portion of the wax would be in advance of the edge of the band. The band was then pressed to place while pressure was, at the same time, made with the finger on the wax. The wax was thus forced against the gingival wall, with a little excess over the margin. It was chilled with room temperature water and the band and wax were removed together. The band was cut through on the distal side and removed. The wax was then replaced in the cavity and trimmed to form. After the bulk of the excess wax had been removed from the occlusal surface with a warm spatula, the remaining wax was carved to form with the same instrument and in the same manner as illustrated in Figure 843 and 844 for a pattern for an occlusal surface restoration. The proximal portion was trimmed with the thin blade wax carver, illustrated in Figure 475c. The buccal, lingual and gingival margins were trimmed even with the surface of the enamel. The marginal ridge was also



FIG. 890.

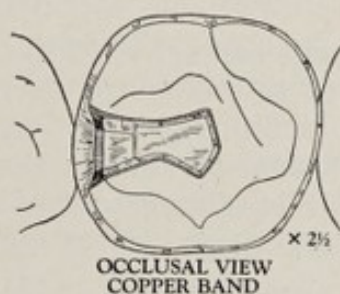


FIG. 891A.

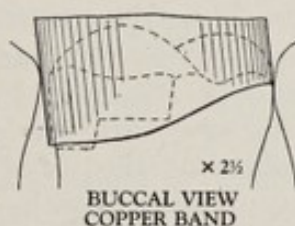


FIG. 891B.

properly contoured. The copper band had prevented contact of the wax with the proximal tooth.

After the wax was again chilled, it was removed with an exploring tine, which was carefully inserted into the wax at a point slightly to the occlusal of the contact, where there was the greatest bulk of wax and therefore the least danger of distortion.

The wax pattern of such a cavity may be made without using the copper band, by so forming the wax that a soft point may be placed in contact with the gingival wall and pressure applied immediately upon the entire mass with a finger of one hand, while the thumb and first finger of the other hand are held to the buccal and lingual of the embrasures, to limit the spreading of the wax into the embrasures. The occlusal surface should be trimmed as previously described, but considerably more carving is required for the proximal portion, because the wax will occupy a part of the interproximal space. The wax about the contact point should be

left until the last, in order that it may assist in holding the pattern securely in the cavity while the surface is carved to form. A silk ligature should be carried past the contact, holding it hard against the surface of the proximating tooth, to make a space that will accommodate a fine strip, without removing an appreciable amount of the wax. The entire proximal surface of the wax should then be made smooth with a fine, wide strip drawn gently back and forth, with the ends so held that the strip will be in contact with the entire proximal surface of the wax and will contour it to the approximate form desired for the inlay.

FINISHING THE INLAY. Previous to the return of the patient, the region where the sprue former was attached was ground smooth and the cavity side of the casting was examined with a magnifying glass to discover any irregularities which might prevent it from being properly seated in the cavity. These were cut away. Occasionally a slight undercut in a cavity wall will be reproduced in the wax and duplicated in the casting, or there may be a minute globule of gold corresponding to a bubble in the investment. There were slight marginal overlaps which were trimmed close to the marginal outline. All surface irregularities of the casting were ground smooth.

The casting did not make contact with the distal surface of the bicuspid, when it was fitted to the cavity, as the copper band was between the wax and the contact point of the bicuspid. When a band is not used it is recommended that the wax, which would otherwise form the contact, be trimmed away, as one may be more certain of the fit of the casting if it does not make contact with the proximal tooth.

The margins were tested with fine exploring tines and each margin was trimmed to properly meet the contour of the tooth. The occlusion was tested by asking the patient to close and move the teeth laterally with pressure, while a piece of carbon paper was held between the teeth. Several minor adjustments were made. Then, with the casting in the cavity, the proximal surface was examined in its relation to the contour of the distal surface of the bicuspid and scratches were made on the surface of the inlay to indicate the proper position for the contact. A piece of gold solder was then added and adjustments were made by grinding to develop the best form of proximal surface and contact point. The contact region was so contoured as to be of even convexity in all directions, with the contact so tight that the patient was conscious of the slight pressure against the bicuspid; this allowed for the removal of a little of the surface in the final polishing. The normal concavity between the convexity of the contact area and the gingival margin was reproduced to give ample space for the gum septum. The contact was then tested, as illustrated in Figure 337, to be certain that it was not too broad in either the bucco-lingual or

occluso-gingival direction. The inlay was then polished and immersed in alcohol in a small dish on the operating tray before it was cemented.

CEMENTATION. The life of many very perfectly made inlays is cut short by lack of care to secure perfect dryness in cementation. Whether the rubber dam should be placed or not will depend on the immediate situation in the particular case. Attention is called to the statement in the chapter on materials that no dental cement is hydraulic. It has been claimed that certain cements require a little moisture to set properly and many dentists have been led into a false sense of security which has made them careless about the dryness of the field when cementing inlays. The presence of moisture contributes to the failure of a gold inlay, as it does to the failure of restorations of gold foil and amalgam. There is hardly an operation in the routine procedure of the dental office in which it is so important to have a trained assistant, who will mix the cement while the operator looks after the dryness of the field.

In this case a rubber dam was not used. The flow of saliva in this patient's mouth was not excessive and the cavity — in the mesial surface of an upper first molar — was kept dry by the use of a gauze roll, the saliva ejector, pellets of cotton rolled closely, and warm air. Then, while the assistant mixed the cement, the enamel walls were scraped lightly with sharp chisels and hatchets, to be certain they were free from deposits from the saliva. None of the enamel was removed. The walls were then thoroughly rubbed with cotton pellets. When the cement was ready, the operator took a portion on a spatula of the best form for the case, and applied the cement to the cavity walls while the assistant covered the cavity side of the inlay with cement. The inlay was placed in the cavity and held under considerable pressure for two or three minutes, while the initial set of the cement was progressing. The patient was then requested to close on a piece of unvulcanized rubber and maintain steady pressure for several minutes.

The cement was allowed to set until it was sufficiently hard that the excess could be broken away in two or three large pieces. An exploring tine was carried through the space to the gingival of the contact to remove particles of cement that remained, and a ligature was passed through the contact to be certain that the immediate area was free of cement.

The margins, except the gingival, were given a final polish with fine disks. A narrow, fine grit strip was passed through the space to the gingival of the contact to polish the gingival margin.

MESIAL DECAY, UPPER BICUSPID; GOLD FOIL

When Frank Hines returned for his semi-annual appointment for periodic care at the age of seventeen, four proximal cavities were discovered. See examination card, Figure 892. These included the distal of the lower right first bicuspid, the mesial of the upper left first bicuspid, the mesial of the lower right second molar and the distal of the lower right first molar. The preparation of a mesio-occlusal cavity in the upper left first bicuspid and the technic of placing a gold foil restoration will be presented here.

Prepared cavities in the mesial surface of the first bicuspids present unusually favorable conditions for gold foil restorations. They are exceptionally easy of access and can often be prepared with less showing of gold than for a gold inlay, as the proximal portion may be slightly narrower at the occlusal than at the gingival, instead of wider, as is necessary for an inlay. The entire restoration can be completed at one appointment and requires less time. This statement applies to all four first bicuspids and to the second bicuspids in cases in which the decays are not too broad bucco-lingually, as often occurs in these teeth when the proximal surfaces are rather flat.

Hines, Frank *1672 - Welling St.*

| | | | | | | | |
|-------------|------|------|----------|------|---------|----------|-----------|
| NAME | RES. | TEL. | main 814 | NPIR | ADDRESS | Chicago. | 15 |
| NUMBER 1932 | TEL. | | | | | | EXAM. NO. |
| BUS. | | | | | | | DATE |
| TEL. | | | | | | | 5-4-32 |
| | | | | | | | Nov. 32 |
| | | | | | | | NEXT EXAM |

AGE 17

RIGHT

OCCLUSION N

PATIENT CARE 123

REFERRED BY

REPORT TO

CARIES 123

GINGIVAE 123

T U L W J

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CA SE

HST CRT MOD ELS PNO TO

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ES TI-

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FIL ED INS YR FOR WD

FIG. 892. Fifteenth examination for Frank Hines: Patient No. 1932, age 17; occlusion normal, patient care poor, susceptibility moderate, gingivae inflamed on account of lack of care; previous service checked. Decays: mesial upper left first bicuspid, mesial lower right second molar, distal lower right first molar, distal lower right first bicuspid. The gingiva was inflamed between the lower right first and second molars, due to the broad flat contact between these teeth. This was corrected in placing the restorations. See Figures 922 and 924. The patient's attention was called to the lack of proper cleanliness of his mouth, particularly the buccal surfaces of the bicuspids and molars. A full set of radiographs was made. See chapter on oral diagnosis in Volume I for explanation of chart.

In this case, the surface involvement of the enamel was narrow bucco-lingually, as are many cavities in the mesial surface of the first bicuspid. This is due to the shape of the cuspid, which permits the natural cleaning in mastication to scour more of the surface than is the case on other proximal surfaces of the bicuspid. The decay in the dentin, as seen in a mesio-distal section, had not undermined the marginal ridge. See Figures 893 and 894.

CAVITY PREPARATION. The preparation of the cavity was made along the same general lines as the mesio-occlusal cavity in the first molar for Thomas Johnson. Certain differences will be noted. In breaking away the enamel of the mesial surface to the buccal and lingual, hatchets 9-3-6 were used, the right instrument in the lingual embrasure, the left in the buccal. Figure 895. The gingival portion of the cavity was extended to the buccal and lingual to include the full area of liability, but the occlusal width was made

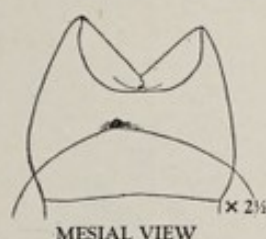


FIG. 893.



FIG. 894.

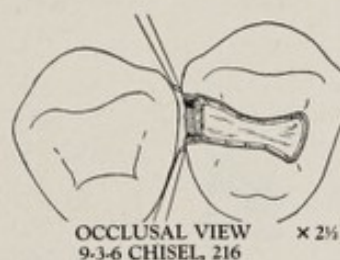


FIG. 895.

very slightly less as illustrated in Figure 896, thus reducing the showing of gold in the position in which it is most conspicuous — at the buccal extremity of the mesial marginal ridge. The 10(95)-6-12 margin trimmers were used to make all line angles sharp, this being a very definite requirement in the preparation of cavities for gold foil restorations.

The occlusal step was prepared a little less wide than for a gold inlay and with parallel buccal and lingual walls. Four starting points were made, two in the disto-pulpo-buccal and disto-pulpo-lingual point angles, and two in the axio-gingivo-buccal and axio-gingivo-lingual point angles.

Before the enamel walls were finished, a rubber dam was placed from the first molar to the lateral incisor, with a clamp on the first molar. A Ferrier separator was also placed and very slight separation was gained before beginning the condensation of the gold.

CONDENSING THE GOLD FOIL; THE STEP PORTION. The first pieces of gold were condensed in the starting point in the disto-pulpo-lingual angle, and the building was continued in the step portion

of the cavity on the same plan as has been described for the occlusal restoration for Mary Brown. See Figures 788 to 798. As in that case, the assistant passed the pellets of gold from the annealing tray to the cavity with a foil carrier, held in the right hand, and supplied the condensing force with a mallet held in the left hand. From the starting point the gold was built along the disto-pulpal line angle and it was definitely anchored to the disto-pulpo-buccal point angle. A change was then made to the 10x5-3-3 parallelogram condenser, which was so held that a flat side of the nib might be placed against the buccal wall when the gold was condensed there, and similarly against the lingual wall when condensing there. This instrument was used in building gold in the step portion until the pulpal wall was fully covered.

THE PROXIMAL PORTION. Gold was next condensed into the starting point in the axio-gingivo-lingual point angle and built along the axio-gingival line angle to the axio-gingivo-buccal point

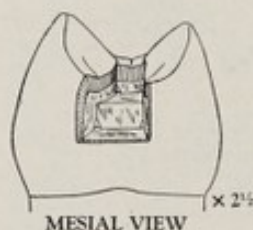


FIG. 896.

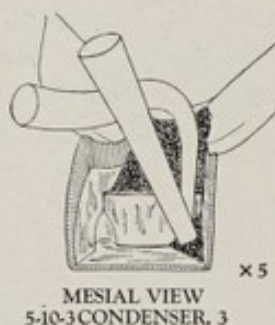


FIG. 897.



FIG. 898.

angle, thus duplicating exactly the starting and building along the disto-pulpal line angle in the step portion of the cavity. See Figures 897 and 898. In continuing this building the 6x12-6-10 parallelogram condenser was used until the margin of the gingival wall was approached. The flat sides of this instrument are helpful in securing good adaptation against the axial and gingival walls. Figure 899. A change was then made to the 12x6-6-10 parallelogram condenser, as illustrated in Figure 900, in order to maintain the proper direction of force against the gingival wall, and to be able to place the flat sides of the nib against the buccal and lingual walls.

Attention is again called to the fact that the direction of the force is in the line of the shaft of the instrument and not in the direction of that portion of the shank which is at an angle to the shaft. A straight condenser could generally be used with the right direction of force against the gingival wall in the position of the axio-gingival line angle, but as the building progresses toward the

margin of the gingival wall, the distal surface of the proximating tooth will cause the instrument to be held more nearly at a right angle to the gingival wall. Adaptation can not be secured when the direction of the force is perpendicular or nearly so, to the wall, as explained in the chapter on the manipulation of materials. A binangle condenser is therefore necessary to give the right direction of force for proper adaptation as the building approaches the margin of the gingival wall. The nib of this instrument is held perpendicular to the gingival wall, but the handle and therefore the direction of force is at an angle of 12 centigrades to that wall.

When the margin of the gingival wall had been covered, several pieces of gold were so placed that a part of each would project into the interproximal space and remain, while additional gold was welded to the previously condensed gold. See Figure 901. This excess of gold at the gingival margin was subsequently condensed with a foot condenser. The plane of the surface of the gold in the proximal portion of the cavity was then gradually changed to

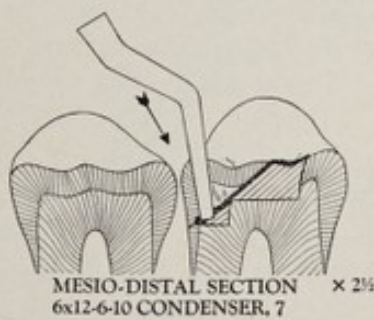


FIG. 899.

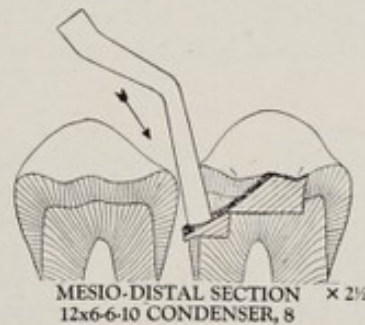


FIG. 900.

approach the horizontal as more gold was condensed. When it was built to the level of the pulpal wall, the two sections of the restoration were joined. Figure 902.

In some cases it would be more convenient to condense the gold in the proximal portion first. The placing of the gold in the step portion might follow the plan described, starting in the distal portion of the step, or the proximal portion might be built to the level of the pulpal wall and then continued distally along the linguo-pulpal line angle, the access being from the buccal, then along the distal wall to the disto-buccal angle and finally in the mesial direction.

THE WEDGING PRINCIPLE. In condensing the gold between parallel walls, as was done for the bulk of this restoration, it was practicable to take advantage of the elasticity of the dentin by using the wedging principle. This required no additional blows, but the following of an orderly plan. This plan is fully described

in the chapter on the use of the various materials for restorations. See Figures 412 to 417. For this particular restoration, with the approach from the mesial, the wedging principle was applied in the stepping of the two parallelogram condensers, previously mentioned. With either instrument one flat side could be placed against the buccal wall when making the final condensation there, the other against the lingual wall in condensing there, to wedge the gold between that previously condensed and the wall. Heavier blows of the mallet were struck along these walls, as each piece was condensed, thus taking full advantage of the elasticity of the dentin.

THE CONTACT. As the building of gold in the proximal portion of the cavity approached the contact point, the separator screws were turned to gain a little additional separation. The gold was then condensed against the distal surface of the cuspid in the area immediately about the contact point with heavier blows of the mallet, in order that this part of the restoration would be as hard as it was possible to make it, to resist the friction of movement in contact with the proximating tooth. More gold was added until the occlusal surface was built to form and slightly overlapping the margins.

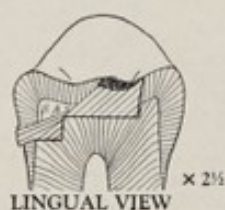


FIG. 901.



FIG. 902.

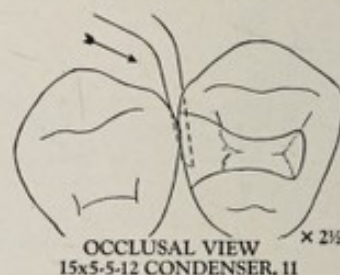


FIG. 903.

AFTER CONDENSATION. Finally, the foot condenser 15x5-5-12 was used for after condensation along the margin of the gingival wall. The excess of gold which had been left along that margin was condensed with blows at right angles to the long axis of the tooth, placing the toe of the condenser into the interproximal space, first from the buccal side, then from the lingual. See Figure 903. The instrument was so held that only the toe, and not the entire foot, was used to condense the gold. The quadrangle condensers, shown in Figure 398, were designed to avoid the bows of the separator and reach into the interproximal space for this special purpose. However, the new Ferrier separators permit so much greater freedom of access, that the regular foot condenser may be generally used.

FINISHING. The finishing of proximo-occlusal gold foil restorations has been sufficiently described in the chapter on the manipulation of materials for restorations. However, attention is here

called to the fact that the separator screws should be turned sufficiently to create a very slight space between the gold and the proximating tooth, which will guide the blade of the saw in the first trimming of the contact. If the attempt is made to cut through with the saw without the extra separation, it will require more force, and the saw will be more likely to cut into the gold and prevent the making of a perfect contour. One side of the saw blade should be constantly flat against the proximating tooth in making this cut, and this is easily done if the above directions are followed.

MESIAL DECAY, UPPER BISCUPID; PORCELAIN INLAY.

The cavity for which the gold foil restoration was made, would require very slight modification for a porcelain inlay. The starting points would be omitted and the surrounding walls would all be inclined outward, also the axial wall would be in a plane parallel with the distal wall, both being inclined distally.

An impression of the prepared cavity would be taken in modeling compound and the porcelain inlay might be made by either of the methods which are described and illustrated in the chapter on the manipulation of materials for restorations. See Figures 483 to 487, inclusive.

MESIAL DECAY, UPPER BICUSPID; NON-COHESIVE AND COHESIVE GOLD FOIL.

Restorations in proximo-occlusal cavities, and particularly mesio-occlusal cavities in the bicuspid and the first molar, may be conveniently made with gold, using the combination of non-cohesive and cohesive foil. The combination consists of placing a large flat cylinder or mat of non-cohesive foil on the gingival wall and building cohesive gold over it. This method offers the advantage of greater certainty of securing perfect adaptation to the gingival wall. The leaves of the non-cohesive gold will not cohere even under heavy pressure, and will therefore adjust themselves to irregularities of the surface as the cohesive foil is condensed over the non-cohesive. It also permits of effective after-condensation between the condensed cohesive foil and the gingival wall.

In Mary Brown's examination when seventeen years of age, proximal cavities were discovered in the mesial surface of the upper left second bicuspid, in the distal surface of the upper right central and lateral incisors, and in the mesial surface of the lower right first molar. Occlusal pit cavities were also found in two upper and two lower bicuspid. See Examination card, Figure 908. The combination of non-cohesive and cohesive foil was used for the restoration in the mesio-occlusal cavity in the upper left bicuspid. The extent of the surface decay is shown in the mesial view, Figure 911.

PREPARATION OF THE CAVITY. The cavity preparation was similar to that for the mesio-occlusal cavity in the first bicuspid for which a gold foil restoration was made for Frank Hines. The only difference was in the preparation of the starting points in the axio-gingivo-buccal and axio-gingivo-lingual point angles. These were definitely recessed into the axio-buccal and axio-lingual line angles and were extended occlusally nearly to the level of the pulpal wall.

PLACING THE RESTORATION; THE NON-COHESIVE FOIL. The gingival wall was covered with a mat of non-cohesive gold. The flat cylinder or mat was made by first folding a sheet of foil into a ribbon a little wider than the width of the gingival wall in the mesio-distal direction, and then rolling this ribbon upon a flat steel instrument of suitable width. The width of the instrument was such that the flat cylinder, made by rolling the ribbon around it, was a little longer than the bucco-lingual breadth of the gingival wall. When the cylinder was placed flat upon the gingival wall with one side of the ribbon against the axial wall, the other side protruded slightly over the gingival cavo-surface angle of the cavity. The breadth of the cylinder was slightly greater than the

Brown Miss Mary 416. Mayfair Ave.

| | | | |
|-------------|---------------|----------|-----------|
| NAME | RES. | ADDRESS | EXAM. NO. |
| NUMBER 1372 | TEL. Main 217 | Chicago. | 26 |
| BUS. | | | |
| TEL. | | | |

AGE 17 DATE 9-2-32

Mar. 13

NEXT EXAM

RIGHT

LEFT

OCCLUSION

N

123

PATIENT CARE

REFERRED BY

REPORT TO

CARIES

123

123

GINGIVAE

DS. EV.

SER. VICE

ES. TI.

MA. TE

RED. ORT.

PH. ENT.

ME. MO.

FIL. ED.

PH. TR.

PUR. WD.

FIG. 908. Twenty-sixth examination for Miss Mary Brown; Patient No. 1372, age 17; occlusion normal, patient care good, susceptibility moderate, gingivae in good condition; previous service checked. Decays: occlusal upper right first bicuspid, distal of upper right lateral and central incisors, occlusal upper left first bicuspid, mesial upper left second bicuspid, mesial lower right first molar, two occlusal pits in lower right second bicuspid, occlusal lower left second bicuspid. Gingiva was inflamed between lower right first molar and second bicuspid due to food wedging between the teeth. This was corrected in making a mesio-occlusal restoration in the first molar. A full set of radiographs was made. See chapter on oral diagnosis Volume I for explanation of chart.

bucco-lingual width of the cavity and a little pressure with an amalgam condenser was required to make it lie flat against the gingival wall. Such a mat was first laid loosely in the cavity, as illustrated in Figure 912, and then pressed against the gingival wall as shown in Figure 913. There was no attempt to condense the gold in pressing the mat to place. The starting points had been extended far enough occlusally to give ample opportunity to condense cohesive foil into them, over the non-cohesive foil.

THE COHESIVE FOIL. The condensation of the cohesive foil was begun in the axio-gingivo-lingual point angle, over the non-cohesive foil, and some of the non-cohesive foil was crowded into the starting point in advance of the cohesive. The cohesive foil was built along the axio-gingival line angle to the axio-gingivo-buccal angle, condensing the non-cohesive under it, thus locking a part of the mat of non-cohesive gold under the cohesive foil. See Figure 914. As the building over the gingival wall continued, the non-cohesive foil was condensed under the cohesive and continually crowded

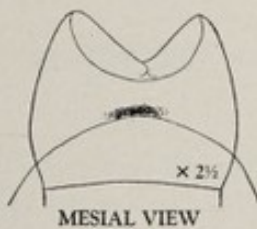


FIG. 911.



FIG. 912.

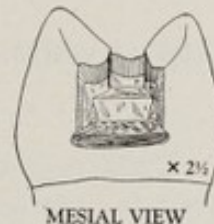


FIG. 913.

toward the axial wall. The holding instrument was used for a longer time than for an all cohesive foil restoration; until a considerable mass of cohesive foil had been wedged between the buccal and lingual walls. See Figure 915, in which the edge of the mat of non-cohesive gold may be seen between the cohesive foil and the gingival wall. Thereafter the technic was the same as for a restoration made entirely of cohesive foil. In this case, the condensation of gold in the step portion of the cavity was the same as for the gold foil restoration previously described, except that it was placed after gold had been condensed in the proximal portion of the cavity up to the level of the pulpal wall.

AFTER-CONDENSATION. When the restoration was otherwise completed, a foot condenser was used for after-condensation of the exposed non-cohesive gold along the gingival margin, the object being to wedge that portion of the gold more closely between the gingival wall and the cohesive foil, thus making the adaptation perfect along the gingival margin.



Fig. 914.

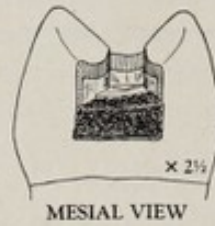


Fig. 915.

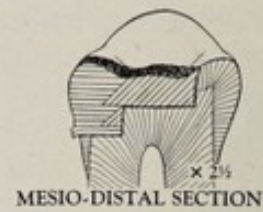


Fig. 916.

The plan of placing the gold is illustrated in Figure 916, in which the first two layers next to the gingival wall represent the non-cohesive foil. This was followed by cohesive foil built about equally over the axial and gingival walls, until the axial wall was completely covered. The proximal portion was then built up to the level of the pulpal wall, when a new beginning was made in the distal portion of the step, and was extended mesially to cover the gold that had been placed in the proximal portion of the cavity.

RESTORATIONS WITH GOLD FOIL IN OTHER PROXIMAL SURFACES OF BICUSPIDS AND MOLARS.

Two restorations with gold foil in mesio-occlusal cavities in upper bicuspid have been described. The technic is generally the same for proximal restorations in other positions in the bicuspid and molars, yet it seems desirable to refer to certain minor differences.

MESIO-OCCLUSAL CAVITIES IN LOWER BICUSPIDS. The prepared cavities and the restorations in the lower bicuspid are in all essentials the same as for the uppers, except that the lower teeth are slightly smaller in their bucco-lingual diameter, about one millimeter on the average, and the prepared cavities are correspondingly narrower.

One case may be briefly described of a mesio-occlusal restoration in a lower right first bicuspid for Mary Brown. Such a restoration may occasionally be made in any bicuspid, upper or lower, but is more frequently indicated in the lower first bicuspid, which usually has a prominent transverse ridge. An occlusal view of the tooth is shown in Figure 917. In this case, the occlusal step was not extended to the distal pit. The cavity was so small that the need for a step involving so much of the occlusal surface was not imperative. It was, therefore, prepared with a slight dovetail, made by cutting to the buccal and lingual from the mesial pit, as illustrated by the occlusal view of the restoration in Figure 918.

MESIO-OCCLUSAL CAVITIES IN MOLARS. The technic of placing restorations with gold foil in mesio-occlusal cavities in molars is the same as for bicuspid, and this method should be preferred in many cases in which the cavities are of moderate size. The bucco-lingual width of decays in the mesial surface of first molars depends in large measure upon the contour of the distal surface of the second bicuspid. When the surface of the second bicuspid is of average convexity, the prepared cavity in the first molar should be of the same dimensions as a mesio-occlusal cavity in a bicuspid, except that the step portion will be a little larger. The access for placing a restoration is the same and there are no special difficulties to be encountered. Non-cohesive foil may be used for the gingival wall in the same manner as described for the bicuspid.

Mesio-occlusal cavities in second molars, upper and lower, are generally prepared a little wider in the proximal portion than in first molars, to meet the requirements of extension for prevention. The access for placing foil is practically the same, although the placing of a separator and the trimming and polishing of the proximal surface of the restoration, particularly at the gingival,



FIG. 917.

FIG. 918.

is more difficult, and for this reason gold inlays should generally be used in preference to gold foil, in order that the proximal contour and the contact may more certainly be made in the best form.

DISTO-OCCLUSAL CAVITIES IN BICUSPIDS AND MOLARS. In distal cavities in the bicuspid and molars, it is more difficult to obtain the best angle of force for the condensation and adaptation of gold, and for this reason, certain modifications of procedure are necessary. There is no difference whatever in the principles involved. The angle of force inclined from distal to mesial can not be obtained with direct-action instruments. Often an angle from the disto-buccal can be used, especially if the buccal wall is so cut away in the preparation as to facilitate the use of this line of force. In this case, in the beginning, a thick mass of gold should be built in the axio-linguo-gingival angle and gradually extended out to the cavo-surface angle of the cavity along the linguo-gingival angle, extending it at the same time along the axio-lingual and axio-gingival angles, forming at first a triangular mass in the point angle. The building should be continued, keeping the plane of the

surface of gold sloping occluso-lingually from lingual to buccal, gradually covering the gingival and lingual walls and their cavo-surface angles, until the bucco-lingual angle is reached. The gold should then be wedged into the bucco-lingual angle, between the gold already built and the buccal wall, by hand pressure or the back-action condenser.

In the upper molars this can generally be done with direct-acting instruments by special care in obtaining the correct angle. It must be distinctly remembered, however, that no attempt should be made to condense against any wall using mallet force that is in the least inclined away from the surface of the wall, against which the gold is being condensed. A contra-angle instrument, which permits the condensing point to come readily against the wall, may properly be used by hand pressure, directed laterally to the line of its shaft; but not with mallet force when its direction inclines even a little away from the plane of the cavity wall. Therefore, when in any case a direction that is at least fully parallel with the wall can not be had, the building must be done by hand pressure. When gold has been condensed into the bucco-axio-lingual anchorage point by either plan, the lines of force will not be especially difficult to obtain for the remainder of the restoration.

In distal cavities in lower bicusps, and occasionally in lower molars, in which access may be had with a direct-acting instrument to condense gold in the linguo-axio-lingual point angle, but access may not be had with a direct-acting instrument in the bucco-axio-lingual point angle, a slight modification of the usual cavity preparation may be made in some cases to simplify the procedure of placing the gold. The lingual end of the axio-pulpal line angle may be cut and so rounded that the linguo-axial line angle will curve to the mesial, and the linguo-pulpal line angle will curve to the gingival, the two joining to make one continuous curved line angle from the linguo-axio-lingual point angle to the linguo-pulpo-mesial point angle. The first pieces of gold should then be condensed in a starting point in the linguo-axio-lingual angle, and the building should continue along the linguo-axial line angle in the occlusal direction and then follow the curve of this angle into the step portion of the cavity, along the linguo-pulpal line angle in the mesial direction to an anchorage point at the linguo-pulpo-mesial angle. By this plan the gold may be securely anchored between the two points entirely with direct mallet force, and this will be easily and quickly accomplished. The subsequent building should be across the gingival wall from lingual to buccal, and it will be easier to condense foil into the bucco-axio-lingual point angle on account of the fact that the mass of gold is securely anchored.

MESIAL DECAY, LOWER SECOND MOLAR; AMALGAM.

In the examination of Frank Hines' mouth, Figure 892, cavities were found in the mesial surface of the lower right second molar and distal of the first molar. It frequently happens that caries will attack the proximating surfaces of two teeth at the same time, as the conditions as to contact, width of embrasures and position of the gum septum are the same for both. This is the reason, in cases in which there is a cavity in but one of the proximating teeth, for applying silver nitrate to the surface of the adjoining tooth when, fortunately, it has apparently escaped or has been only slightly etched. In a considerable percentage of cases caries will have injured the enamel of the adjoining tooth by dissolving a little of the cementing substance from between the rods, and this area will be stained black and immunized by the deposit of silver.

In this case, however, there were cavities in both teeth. The extent of the decay in both is shown in the mesio-distal section, Figure 919. The depth of the embrasures between these teeth was



FIG. 919.

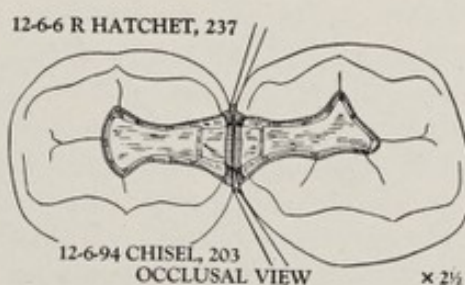


FIG. 920.

less than average, due in part to the fact that the surfaces were not of normal convexity, and also for the reason that the decays had permitted them to move closer together.

CAVITY PREPARATION. Certain details of the preparation were different from those already presented. The outline form of the cavity in the distal surface of the first molar was obtained as the first procedure to secure better access for operating on the second molar. The initial opening was made in the central fossa of the first molar and a slot was cut along the line of the distal groove and through the marginal ridge to expose the decayed area. The bur was then placed in the cavity in the mesial surface of the second molar and a slot was cut occlusally through the marginal ridge, then along the mesial groove to the central fossa. The enamel was broken down on both sides of these cuts in both of the teeth with right and left hatchets 18-9-12. This cutting included the more extensively undermined enamel of the proximal surfaces

of both teeth, to the buccal and lingual of the decayed areas. The outline form of the cavity in the first molar was next obtained. This gave an excellent view and very good access to the mesial surface of the second molar.

BUCCAL AND LINGUAL EXTENSIONS. Further extension to the buccal in the mesial surface of the second molar was made with chisel 12-6-94, the approach being through the buccal embrasure, and the lingual wall was extended with hatchet 12-6-6, right, in the lingual embrasure, as illustrated in Figure 920. These two new blades are very convenient for this particular cutting. The reverse bevel binangle chisel gives exactly the right approach from the buccal, while the angle of the blade of the hatchet permits the handle to be a little above the occlusal surfaces of the teeth on the left side of the arch, while the blade is placed in the embrasure between the lower right first and second molars, at right angles to the long axis of the tooth. The latter instrument may be held in a position directly across the mouth, with the handle

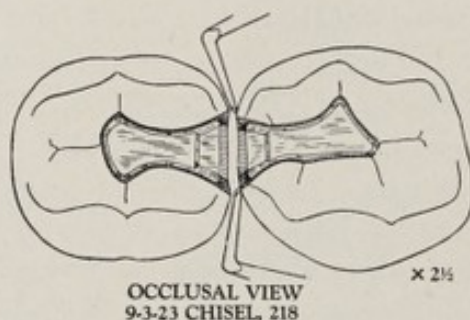


FIG. 921.

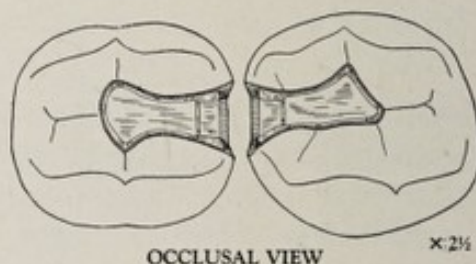


FIG. 922.

above the left first molar. Similar extensions in the distal surface of the first molar, to the buccal and lingual, were made with chisel 9-3-23. See Figure 921. These buccal and lingual extensions can usually be made with the pair of hatchets 18-6-12, from the occlusal. However, the approach through the embrasures will often enable one to split off the enamel with less effort, and to remove very easily the little portions of the enamel at the gingivo-buccal and gingivo-lingual marginal angles, which are sometimes difficult with hatchets cutting from occlusal to gingival.

RETENTION FORM. The resistance and retention form in both cavities was prepared with a 1 mm. fissure bur in the contra-angle hand-piece. The bur was held at right angles to the long axis of the teeth, and was first moved clockwise around each occlusal step with the end of the bur against the pulpal wall. This bur had blades on the end and the sides, and the line of junction of the surrounding walls with the pulpal wall was squared, while the

surrounding dentin walls were trimmed smooth and at right angles to the pulpal wall. The gingival dentin wall, and the lines of junction with the axial, buccal and lingual dentin walls were similarly trimmed with the same bur. In all of this cutting, very little dentin was removed; the cutting consisted principally of squaring out the line angles about the pulpal and gingival walls.

SLOW SEPARATION. The mesio-distal width of the interproximal space had been reduced by the forward movement of the second molar, which was permitted by the loss of the enamel of the contact in both teeth, and it was thought best to secure some separation before placing either of the restorations. After the outline and retention forms had been obtained in the preparation of these cavities, which had included the removal of all carious dentin, a Ferrier separator was placed, and a prop of base-plate gutta-percha was arranged under the mesial bow. The distal bow extended a little beyond the distal surface of the second molar so that a similar prop could not be placed on the occlusal of that tooth. Therefore, when the mouth was packed with gauze rolls and everything was in readiness, the assistant held the handle of an instrument of proper size for the purpose, with one side resting diagonally across the disto-lingual angle of the second molar, and the other side under the bow of the separator, so that it could not move gingivally when the screws were tightened. The teeth were moved about half a millimeter and pink base-plate gutta-percha was warmed only enough to make it sufficiently plastic and was then packed solidly into both cavities. It was trimmed to the approximate form of the occlusal surfaces, but was purposely left a very little too full. The separator remained in place for about three minutes, to allow the gutta-percha to become hard, in order that it would hold the space gained. The patient was instructed to chew on the gutta-percha and thus increase the separation of the teeth. He was dismissed for four weeks. On removing the gutta-percha when he returned, there was a full millimeter of space between the gingival margins of the two cavities, as shown in Figure 922.

PLACING OF RUBBER DAM. The only other details of the case to be reported are the placing of the rubber dam and the matrix for the mesio-occlusal amalgam restoration in the second molar. The third molar had not erupted, and one of the special clamps, illustrated in Figure 584, was placed on the second molar. Holes were punched in the rubber for the two bicuspid and two molars as shown in Figure 554, and the rubber was placed over the clamp, using the fifth grasp. This is generally the easiest procedure of all in placing the rubber. The operator need not look into the mouth. The chair was low and upright, the operator stood on the right side in front, felt the clamp with the first fingers, which were on either side of the hole, and the rubber was stretched over the

clamp. It immediately slid to place, due to the inclined sides of the bow, which are without angles.

After the rubber had been placed over the other teeth, and the holder was fastened about the patient's head; a special loop knot, illustrated in Figure 580, was tied in the center of an 18-inch ligature, which was placed about the second molar with the knot at the disto-lingual angle of the tooth, and tied with a surgeon's knot on the buccal side of the tooth. The clamp was then removed. The object of placing the loop knot at the disto-lingual angle of the tooth was to prevent the rubber from slipping off when the clamp was removed to allow for the placing of a matrix.

FINISH OF ENAMEL WALL. The finish of the enamel walls was the same as has been described; the buccal and lingual enamel walls of the proximal portion of the cavity were made smooth, with an outward inclination parallel to the direction of the rods, with the right and left hatchets 18-9-12, and the cavo-surface angle was beveled with margin trimmers 15(80)-8-12.

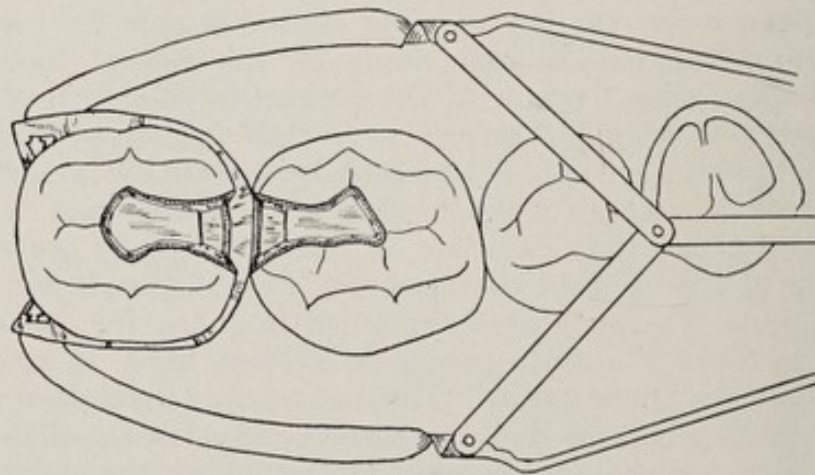


FIG. 923.

THE IVORY MATRIX. A band for the Ivory matrix was selected and adjusted to the tooth by placing the jaws of the holder in the holes at either end of the metal strip, so that the jaws would bind on the disto-buccal and disto-lingual angles of the tooth when the adjusting screw was tightened. See Figure 923.

AMALGAM RESTORATION. The amalgam was then placed, following the technic already described. At the next appointment, this restoration was polished and another amalgam restoration was placed in the disto-occlusal cavity in the first molar. See Figure 924. In placing the restoration in the first molar, a thin steel matrix was cut to proper size and tied in place with a ligature wrapped three or four times around the tooth, as previously

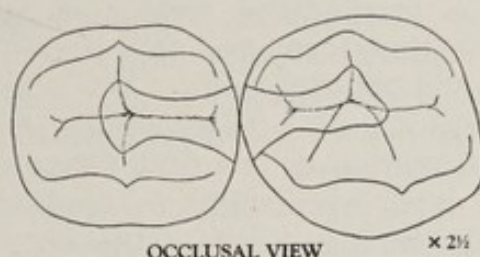


FIG. 924.

described and illustrated in Figures 884, 885 and 886. The separator was again placed while the assistant was mixing the amalgam and the distal bow of the separator was again stabilized with an instrument held between the occlusal surface of the second molar and the bow. Comparison of Figure 924 with 920 will show the improvement in proximal contours gained by the slight separation of the teeth.

MESIAL DECAY, LOWER FIRST MOLAR; AMALGAM.

When Frank Hines was eleven years old there was a cavity in the distal surface of the lower right second temporary molar, with the marginal ridge broken away. The tooth was quite loose and was extracted at once. There was a small cavity in the mesial surface of the first permanent molar, located a little farther from the occlusal surface than the usual position, due apparently to the depth of the cavity in the temporary molar. Contrary to the general rule it seemed probable that a simple mesial cavity might be prepared, without cutting through the marginal ridge. Figure 925 is an illustration of the mesial surface of the first molar. There was a whitened area about two and a half millimeters wide buccolingually and possibly one and a half millimeters occluso-gingivally, with a decayed area penetrating the dentin near the center.

CAVITY PREPARATION. An inverted cone bur was placed in the cavity and cuts were made to the buccal and lingual, slightly beyond the etched enamel. Another cut was made to place the outline below the margin of the gingiva, and a third to include the etched enamel to the occlusal. A 12 straight chisel was then used to split off the undermined rods of all four walls of the cavity, noting especially the direction of the rods of the occlusal wall, which are generally so much inclined to the occlusal as to make the margin of a restoration unsafe. Due to the fact that the area of decay was farther to the gingival than usual, the occlusal enamel wall had about the same outward inclination as the gingival wall and was considered satisfactory for either an amalgam or a gold restoration.

Retention form was made by squaring out with an inverted cone bur, the axio-lingual, axio-buccal and axio-lingual line angles. The axio-occlusal line angle was slightly undercut, with the 3-1-28

bibeveled hatchet. A mesio-distal section of this tooth, Figure 926A, shows the retention form and the direction of the enamel rods of the gingival and occlusal walls.

A rubber dam was placed, with a number 18 clamp on the first molar; it was also slipped over the first temporary molar, which was slightly loose. With everything in readiness, the assistant began triturating the amalgam while the operator finished the enamel walls. The occlusal wall was finished with the sides of the blade of the straight chisel 12, which had been sharpened for the purpose. The buccal, gingival and lingual walls were finished with the 9-3-12 right and left hatchets. The outline of the cavity, which does not include the point of contact, is shown in Figure 926B.

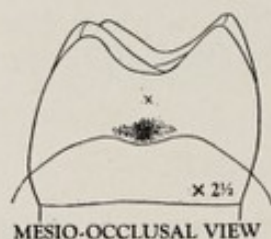


FIG. 925.



FIG. 926A.

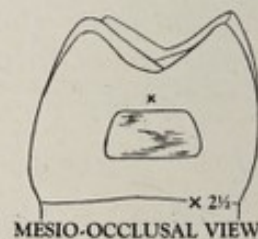


FIG. 926B.

PLACING THE AMALGAM. The assistant placed a small piece of amalgam on the rubber dam to the mesial of the tooth with a pair of pliers and it was first pushed, then pressed into the cavity with a flat faced condenser, illustrated in Figure 491D. This was followed by two other pieces, which were condensed with heavy pressure in the direction of the axial wall. The instrument was stepped along the surface with direct pressure in each position, but without a lateral or burnishing movement. The restoration was polished at the next appointment.

RESTORATIONS IN A VARIETY OF PROXIMAL CAVITIES IN BICUSPIDS AND MOLARS.

The variation in procedure due to position of teeth in the mouth and the different degrees of exposure of the parts to view and to approach, relate mostly to the second and third molars and the lower bicuspid. The upper first bicuspid are usually so well exposed that both the mesial and distal cavities are easily reached and, except for the fact that smaller cutting instruments are necessary, the instruments and instrumentation is the same as for the first molars. As a rule, distal cavities in the upper first molar and mesial cavities in second molars may be reached with a bur in the

straight hand-piece; the contra-angle may be required for the distal of the second molar and the mesial of the third molar.

In the lower bicuspid and molars, particularly when inclined lingually, the contra-angle hand-piece is often required. When preparing disto-occlusal cavities in lower bicuspid which are much inclined to the lingual, it is desirable to include the first and second molars in the rubber dam, in order to provide ample room for the use of the mouth mirror. Should the second molar be missing and the third molar present, one of the special clamps, illustrated in Figure 584, should be used on the third molar and the rubber should be placed over it.

The embrasures usually extend deeper between the bicuspid than the molars, and the bucco-lingual width of proximal cavities is usually less. The depth of the embrasures between the second bicuspid and first molar varies considerably, depending largely upon the contour of the distal surface of the bicuspid, which is



FIG. 927.



FIG. 928.



FIG. 929.

often less convex than other proximal surfaces of the bicuspid. As a matter of complying with the rules of extension for prevention, the bucco-lingual width of restorations in the approximating surfaces of any two teeth should be the same, because it is the width of the embrasure at the position of the margins which gives opportunity for the scouring by food in mastication.

The form of the occlusal step will depend upon the conformation of the surface of the particular tooth. It is usually desirable to follow each groove for at least a short distance, not only to place the margin where a smooth finish may be made with the restoration, but also to obtain a dovetail form, or its equivalent. Many variations in the forms of the occlusal step are illustrated in this chapter and in the chapter on the treatment of bicuspid and molars during the adult period.

A number of cases will be briefly described to suggest variations in methods of procedure and in the selection of materials for restorations. The only proximo-occlusal restorations in the bicuspid and molars which call for esthetic consideration are those placed in the treatment of neglected decays in the mesial surfaces of the upper bicuspid and less often the first molar. In these

cases the decay in the dentin has undermined the enamel of the mesio-buccal angle. When decays are discovered early, the buccal margins of the restorations usually do not show.

MESIAL CAVITY, UPPER BICUSPID; GOLD INLAY. A typical proximo-occlusal cavity is illustrated in Figures 927 and 928, which show the occlusal and mesial views of the preparation for a gold inlay in the upper left second bicuspid for Frank Hines. Attention is called to the slight distal inclination of the axial and distal walls, both of which should always be visible from the direct occlusal view; also, in the view from the mesial the outward inclinations of



FIG. 930.



FIG. 931.

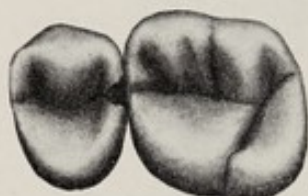


FIG. 932.



FIG. 933.

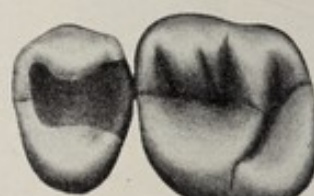


FIG. 934.

the buccal and lingual walls are from gingival to occlusal. Figure 927 also illustrates the typical dovetail of the step portion of cavities in bicuspids. This form of step not only provides excellent retention form, but also is least likely to jeopardize the vitality of the pulp, the horns of which extend in directions toward the buccal and lingual cusps. The restoration is shown in Figure 929.

WIDE EMBRASURES, NARROW RESTORATION. The gold inlay placed for Frank Hines in treatment of a distal decay in the upper right second bicuspid calls attention to the occasional opportunity to prepare a proximal cavity very narrow in the bucco-lingual direction. As shown in Figure 930, the contact between the first molar and second bicuspid is farther to the buccal than normal, due to the slight irregularity of the position of the bicuspid. The embrasures are much wider than usual, and the areas of liability to decay on the proximal surfaces of both teeth are correspondingly narrow bucco-lingually, as is the restoration, shown in Figure 931.

SEPARATION TO WIDEN THE EMBRASURES. Another situation with which the dentist is often confronted is illustrated in Figures 932, 933 and 934, in which a gold inlay was placed in the treatment

of a decay in the distal surface of an upper left second bicuspid for John Stephens, when he was sixteen. The contact between the second bicuspid and first molar was very broad bucco-lingually and it was necessary to gain separation and widen the embrasure, as a matter of protection to the mesial surface of the first molar. This was a rather unusual case in that the decay had occurred in the bicuspid without involvement of the first molar. A separator was placed at the time the cavity was prepared and while the pattern was made for the inlay. However, the separation of the teeth was not sufficient to open the embrasures to the desired width, and base-plate gutta-percha was therefore packed into the cavity and allowed to harden before the separator was removed. The appointment for placing the inlay was set for two weeks ahead, in order to permit the tissues to become adjusted to the slight movement of the teeth. On his return the inlay was first fitted to the cavity, the occlusal surface was ground in adjustment of the occlusion and all margins were polished. The separator was then placed and the screws were turned to gain the desired width of the embrasures at the positions of the buccal and lingual margins. Gold solder was then added to the inlay to make a tight contact and correct proximal contour. After final polishing the restoration was cemented to place before the separator was removed. See Figure 933.



FIG. 935.



FIG. 936.



FIG. 937.

Figure 934 illustrates a common error in the preparation of such a cavity. This is not cut sufficiently to the buccal. The difference is apparent in comparing the two illustrations. There is only the slightest difference in the amount of tooth structure cut away in Figure 933, but it places the margin where it will certainly be kept clean.

MESIO-DISTO-OCCLUSAL GOLD INLAY. The preparation of a cavity for a mesio-disto-occlusal restoration with a gold inlay is illustrated in Figures 935, 936 and 937. There were mesial and distal decays in the upper left second bicuspid and a mesio-disto-occlusal cavity was prepared. Special attention is called to the inclinations of the walls of this cavity, to permit a wax pattern to be withdrawn without distortion. From the direct occlusal view, all of every wall of this cavity is visible, including the axial walls of both the mesial and distal portions. The inclination of the two axial walls is also illustrated in the central mesio-distal section, Figure 936. As viewed

from either the mesial or distal, the inclinations of the buccal and lingual walls would be seen as in Figure 937. The wax pattern was prepared by pressing the soft wax into a thin copper band, of proper size to be slipped over the tooth with the least bit of space to spare. This band, with a little wax projecting at either end, was pressed over the tooth and forced gingivally until the edge of the band was in about the position of the gingival margins of the cavity. At the same time pressure was maintained on the wax at the "occlusal end" of the band. After a minute or two, the wax was chilled and the band and the wax were removed together. The excess of wax at the ends of the band was trimmed away and the band was cut with a fine carborundum stone and removed. The wax was then replaced in the cavity and trimmed to proper form. The final step in the preparation of the pattern was to trim both contacts free of the proximating teeth with a fine sand-paper strip.

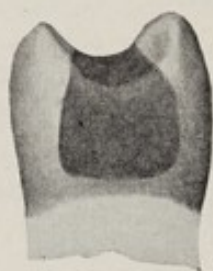


FIG. 938.

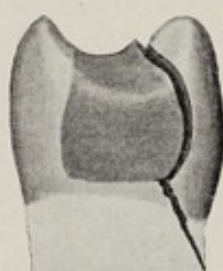


FIG. 939.



FIG. 940.



FIG. 941.

After the inlay had been fitted, the distal contact was added and adjusted to make a proper contact with the first molar. Then the mesial contact was very slightly over built, in order to tighten the contact between the first bicuspid and the cuspid which was not quite as tight as it should have been. The restoration was cemented to place and the margins were polished.

MESIO-DISTO-OCCLUSAL RESTORATION IN BICUSPID WITH PULP REMOVED. Whenever a mesio-distal-occlusal restoration is required for a bicuspid from which the pulp has been removed, the cavity should be so prepared that the cusps of the tooth will be protected from direct contact with the teeth of the opposite arch, to avoid the danger of fracture. In such cases, very little dentin remains to support the cusps and they are liable to break as the result of striking on some hard substance in food that is being chewed. Very frequently, the break includes a small piece of the root. Figure 938 shows a restoration in the form that would ordinarily be made when the tooth has a vital pulp. If such a restoration is made for a tooth from which the pulp has been removed there is great danger that a cusp will be broken off, as shown in Figure 939. The preparation and restoration should be made as illustrated in Figures 940-941.

THE FORM OF THE STEP FOR PROXIMO-OCCLUSAL RESTORATIONS IN BISCUPIDS. Mention has been made of the necessity of removing occlusal restorations in bicuspid, when a proximal decay occurs after such restorations are placed. A more serious problem frequently confronts the operator when a proximal decay occurs in one surface of a bicuspid after a proximo-occlusal restoration has been made in treatment of a decay in the opposite surface. Unless there is some unusual condition as to contact or proximal surface form in a particular interproximal space, both surfaces of any bicuspid are about equally liable to become involved, and the cavity for the first proximo-occlusal restoration should be so prepared as to anticipate the possible decay of the other surface.



FIG. 942.

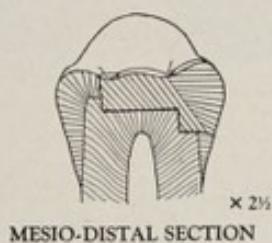


FIG. 943.



FIG. 944.



FIG. 945.



FIG. 946.

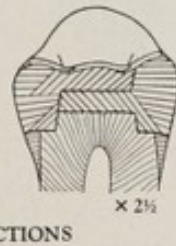


FIG. 947.

The method of doing this will depend somewhat on the age of the patient and the form of the tooth. For young persons, particularly if the teeth are large and the cusps not exceptionally long, the step portion of the cavity should be prepared a little wider, but no deeper than would be necessary to provide ample retention. The buccal or lingual half of a considerable part of the step portion of such a restoration may be cut away, if necessary, in preparing a step to retain a restoration in the opposite surface.

The plan of doing this is illustrated in Figures 942, 943 and 944. The first of these drawings shows the occlusal view and the second a mesio-distal sectional view of the step for the first restoration, and the third the occlusal view after the second restoration has been placed.

For older persons, the pulps of whose teeth have receded considerably, the step may be prepared rather narrow but with more

depth than necessary, in order that the occlusal half may be cut away to give sufficient retention form for the second restoration. Figure 945 illustrates a narrow step viewed from the occlusal; Figure 946 shows the depth of this step as compared with Figure 943. The step of the second restoration overlaps the deeper portion of the step of the first restoration, as shown in Figure 947.

In some cases the step of the first restoration may be prepared both slightly deeper and wider than would be required, yet neither sufficiently wide nor deep to permit of either of the suggested plans. It may then be possible to overlap the first restoration with the second by cutting away a part of the step of the first restoration on a slanting plane from lingual to buccal.

If provision is not made in advance for the step to anchor the second restoration, it will usually be necessary to remove the restoration previously placed and make a mesio-disto-occlusal restoration.



FIG. 948.



FIG. 949.



FIG. 950.

FORM OF STEP IN LOWER FIRST MOLAR. The peculiar conformation of the occlusal surface of the lower first molar, due to the fact that it has five cusps, often requires that the occlusal step include much of that surface in order to secure margins which will permit of a smooth finish. For example, the mesio-occlusal gold inlay placed for Miss Brown, in treatment of a decay in a lower right first molar, is illustrated in Figures 948, 949 and 950. The grooves of this surface were so deeply fissured that the cavity outline was necessarily extended to include all of them, and the lingual groove was especially deep. Should a distal decay occur subsequently to the placing of this restoration, it would be practical to cut away whatever might be necessary of the step portion in order to secure retention in preparing the new cavity, without otherwise disturbing the mesio-occlusal restoration.

TYPICAL UPPER MOLAR PREPARATION; GOLD INLAY. Figures 951 to 954 illustrate a mesio-occlusal cavity preparation in an upper left first molar for John Stephens, at the age of 35, in which the decay had extended farther than usual to the gingival, due to a recession of the gum. The restoration was made with a gold inlay.



FIG. 951.



FIG. 952.



FIG. 953.

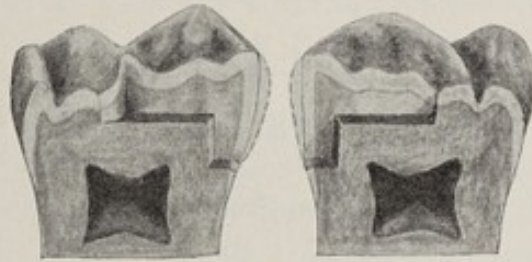


FIG. 954.

This cavity again calls attention to the necessity of having all walls at proper inclinations, in order that a wax pattern may be withdrawn without danger of distortion. All walls may be seen in the direct view in Figure 951; the inclinations of the buccal and lingual walls are shown in Figure 952, and the inclinations of the axial and distal walls in the enlarged drawings in Figure 954. The restoration is shown in Figure 953.

Class 3. Proximal Decays in Incisors and Cuspids, Which Do Not Require the Restoration of the Incisal Angle.

ILLUSTRATIONS: FIGURES 961-1011.

PROXIMAL decays in the incisors and cuspids, like those in the proximal surfaces of the bicuspid and molars, usually occur later than those in pits and fissures and earlier than those in buccal and labial surfaces. Comparative tabulations of the time and frequency of occurrence of proximal decays in the anterior with those of the posterior teeth show great variations. In the aggregate the liability is about equal. The mesial surfaces of the upper central incisors are found decayed more often than other proximal surfaces in the anterior teeth.

The upper lateral incisors require very careful attention during the childhood period. The small size of the crowns of these teeth and the comparatively larger size of the pulp chambers, coupled with occasional decays in lingual pits, present great danger of pulp involvements, both directly by caries and indirectly from thermal shock. The roots are often irregular in form, thus complicating the placing of good root canal fillings, and increasing the possibility of apical infections after pulp treatments. The very early discovery of decays is quite as important for the conservation of these teeth as it is for the first permanent molars.

Statements which have been made regarding the maintenance of proper contacts and the prophylactic value of correct proximal surface forms in the treatment of bicuspid and molars, apply to the anterior teeth. Gingival irritation and detachments of the peridental membrane during the early adult period are often responsible for movements of these teeth and their unsightly appearance later in life. This can be prevented in large measure by the maintenance of good contacts.

The preparation of cavities of this class is more complicated than any other, because of the difficulties of access. Likewise, there are special problems in connection with the placing of each type of restoration. Except for neglected decays, the cavities may be prepared for gold foil restorations with less sacrifice of tooth structure than for either porcelain or gold inlays, and gold foil restorations are likely to last longer. This is the only material which, in the

hands of the large percentage of operators, has satisfied the requirements for permanent operations in cavities of this class.

The effort to meet the esthetic desires of patients in placing restorations of this class presents a most difficult problem for the dentist who has set up for himself the objective of conserving the teeth throughout life. He has at hand a reliable and thoroughly tried method of treatment in the use of gold foil, yet in many cases he has allowed his better judgment to be swayed to the use of silicate cement by the patient's and his own very natural desire for a better esthetic result. The use of this material during the early adult period has too often resulted in the involvement of many pulps, the establishment of serious inflammations of the gingivae, and the gradual loss of tooth structure by recurrence of decay, eventually requiring a porcelain jacket crown or the loss of the tooth.

The conscientious dentist should acquaint himself with the data at hand regarding the physical properties of the silicate cements, as presented in the chapter on materials in Volume II. He should follow the further studies in progress at the Bureau of Standards and elsewhere, and, in addition, keep an exact record of every restoration that he makes, with subsequent memoranda as to discolorations, conditions of contacts, replacements and all other information which will serve as a guide for his future use of the material.

The physical properties and esthetic qualities of the materials that may be used in these cavities have been discussed. The selection in each case should take into consideration the age of the patient, the degree of susceptibility and the extent to which the particular restoration will be exposed to view.

THERMAL SENSITIVENESS is met with more frequently in the management of cavities in the upper incisors than any other teeth, apparently for the reason that they are most exposed to hot and cold food and drinks, and to cold air during the winter months. Precautions against this should be taken wherever possible. The conditions make the use of zinc phosphate or other non-conducting material under these restorations more difficult than in other teeth. The cavities, even when deep for the locality, are still so broad compared with their depth, and the requirements for anchorage are so imperative, that there seems to be no room for the cement. A piece of quill may be used, as it is just as effective as a non-conductor, and does not occupy appreciable space, or a varnish, made for the purpose, may be applied to the dentin. Careful instruction to patients regarding the danger of thermal sensitiveness and the means at their command of avoiding it, is, after all, the most effective protection.

Prevention and Immunization; Proximal Decays in Incisors and Cuspids.

MAINTENANCE OF GOOD CONTACTS. The same general rules apply to the proximal surfaces of the anterior as to the posterior teeth. These include the same consideration of the teeth as a group in the maintenance of contacts. Abnormal forms of the upper lateral incisors may add to the difficulties encountered. In an occasional case, in which the lateral is of a conical form and the gingiva is inflamed, one is justified in placing a porcelain jacket crown. Fortunately, food less often becomes impacted between the anterior as compared with the posterior teeth and when it does, the patient has less difficulty in removing it.

MODIFICATION OF CONTOUR OF MESIAL SURFACES OF THE UPPER CENTRAL INCISORS. The flatness of the mesial surfaces of the upper central incisors in the gingivo-incisal direction is often a cause of early decays. Mary Brown's case was typical and was marked for

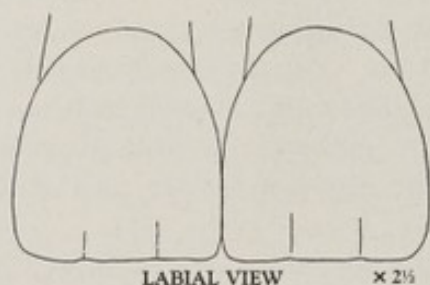


FIG. 961.

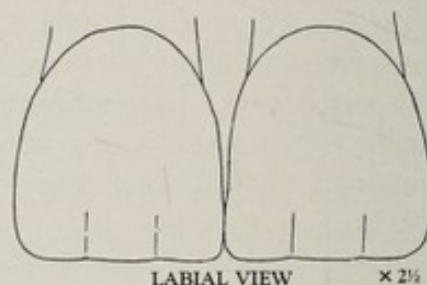


FIG. 962.

correction on her examination card at the age of twelve. See Figure 772. The mesial surfaces of these teeth were almost parallel and in actual contact or so very close for almost four millimeters that a ligature would drag for the entire distance when passed through the contact. The labial view of these teeth is illustrated in Figure 961.

In such cases a fibre of stringy food will occasionally be caught between the teeth and will remain for a time before it is dislodged or removed. Eventually this will weaken the contact and particles of food will be wedged between the teeth more frequently. Decay is likely to occur much farther gingivally than usual. In all cases in which the contour of the surfaces may be so modified that the contact will be of normal form, the danger of the occurrence of caries will be reduced. This is a very simple procedure.

A separator was placed to gain sufficient space for a fairly coarse sand-paper strip. The width of the strip was such that the gingival portion of the area of close contact might be cut away without touching the enamel in the position of the normal contact.

The same amount was trimmed from both mesial surfaces to make the teeth symmetrical and fine strips were used to polish the surfaces. The change in contour is illustrated in Figure 962.

IMMUNIZATION WITH SILVER NITRATE. The immunization of these surfaces with silver nitrate has been fully presented and illustrated in the general discussion of the preventive treatment of caries. So far as records are available, the use of silver nitrate is more effective in the treatment of proximal surfaces of the anterior teeth than any other. This appears to be due to the more intensive study of the technic of applying the solution to these surfaces. It should be generally effective in all locations if it is so applied that etched surfaces of enamel are impregnated with silver.

Restorations; Proximal Decays in Incisors and Cuspids, which do not involve the Incisal Angle.

SMALL PROXIMAL DECAY, UPPER CENTRAL INCISOR, GOLD FOIL.

In examining Mary Brown's mouth at the age of seventeen, See Figure 908, small decays were discovered in the distal surface of the upper right central incisor, also in the distal surface of the upper right lateral incisor. Both restorations were made with gold foil.

The cavity in the distal surface of the upper right central incisor is shown in the illustration, Figure 963. The enamel rods had fallen away in the central area and when dried, the surrounding area was white and chalky, as indicated by dots in the illustra-



FIG. 963.



FIG. 964.

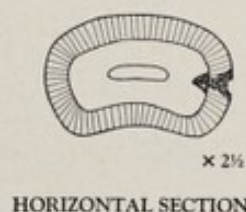


FIG. 965.

tion. The position of the contact point is indicated by an X. The extent of the decay in the dentin is shown in the mesio-distal section, Figure 964, also in the horizontal section, Figure 965. This decay was discovered early, before very much of the dentin was involved, yet the enamel had been undermined to a limited extent in all directions, including the enamel which formed the contact. The opportunity was presented to prepare the smallest cavity that would satisfy the requirements of extension for prevention.

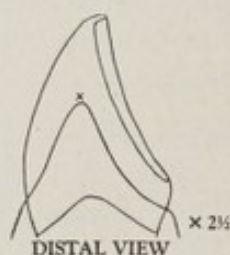


FIG. 966.



FIG. 967.

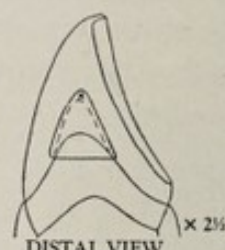


FIG. 968.

The normal relations of the contact point, the margin of the gingivae and the cemental line are indicated in Figure 966. In Figure 967 the position to which the margin of the gingivae had receded is shown, also the area of liability is indicated by the broken line, which corresponds with the line of the normal margin of the gingivae, as shown in Figure 966. This slight recession of the crests of the gingivae is very common during the early adult period and is not due to weak contacts. In this case the contact was sufficiently tight that no food was being forced between the teeth. In Figure 968 the outline of the cavity is indicated by the line drawn to the labial and lingual beyond the area of liability; it also includes the contact point and the gingival margin is extended sufficiently to be covered by the gingiva. It therefore fulfills the requirements of extension for prevention.

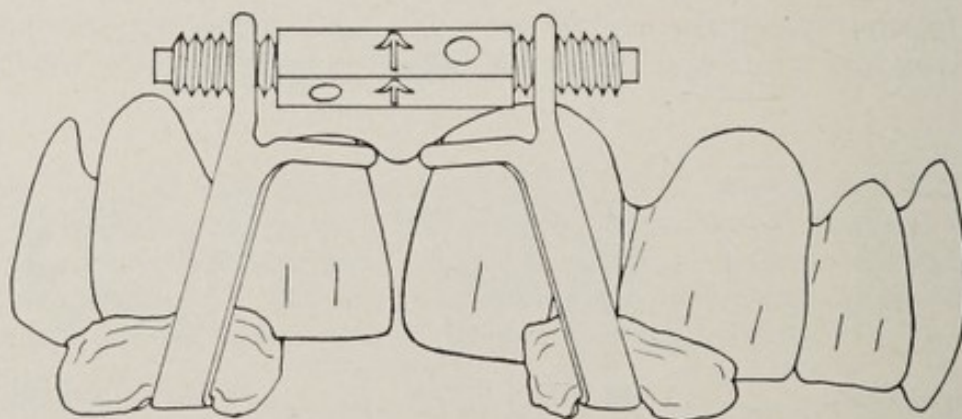


FIG. 969.

APPLICATION OF RUBBER DAM AND SEPARATION. In view of the fact that the separator would be required at once in order to gain access for the preparation of the cavity, the rubber dam was applied over the six anterior teeth, the holes being punched as illustrated in Figure 551. The contacts were in good form and there was no difficulty in passing the rubber through them nor in turning the edges of the holes gingivally. A ligature was not used. The chair was tipped well back, the operator stood in the right side in front position, and used the first grasp.

There was so little actual penetration of the enamel that proper access was not possible without a little separation of the teeth. This was obtained with the Ferrier separator, the bows being securely propped with pure base-plate gutta-percha, so that the jaws could not impinge on the gingivae and cause pain. The adjusting screws were tightened only enough to provide access with small excavators, and this slight movement was not painful. Sufficient separation to permit a fine polishing strip to be passed between the teeth, was all that was necessary for breaking away the enamel which had been undermined by decay. Additional separation was gained as required for the further preparation of the cavity and for the placing and finishing of the restoration, by the occasional slight tightening of the screws as the operation progressed. Figure 969 is a labial view of the anterior teeth with the separator in place; Figure 970 is an incisal view.

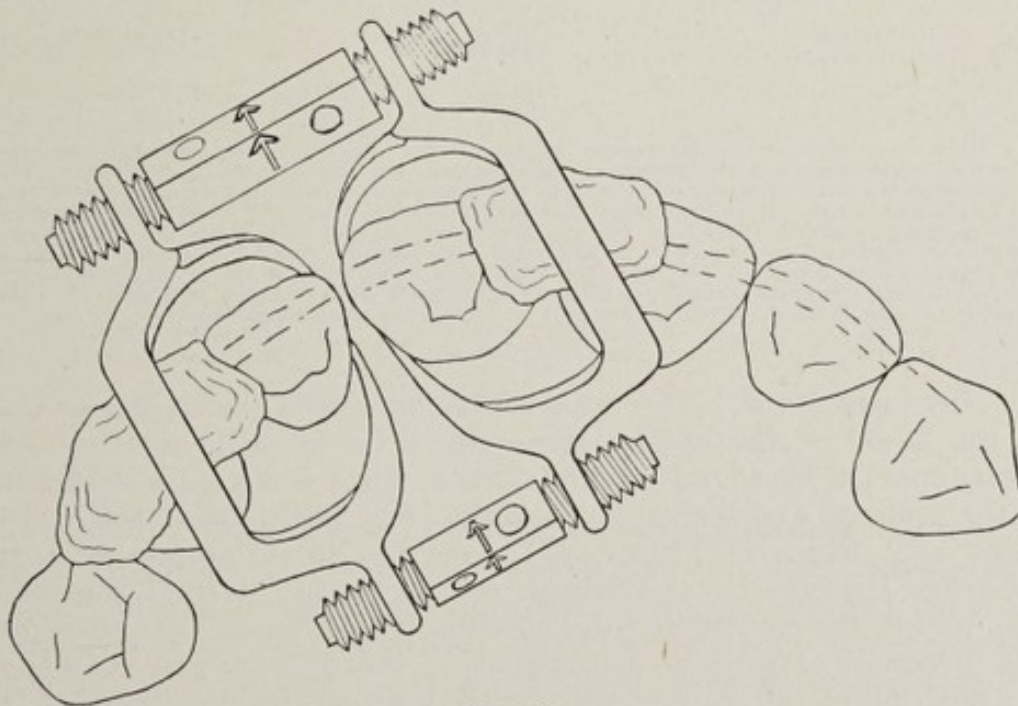


FIG. 970.

In many cases, after the initial tightening of the adjusting screws, the spring of the separator jaws will very gradually move the single rooted teeth as far as may be desired without discomfort. A word of caution should be expressed relative to the tightening of the adjusting screws when the separator is applied to single rooted teeth. These teeth move rather easily, particularly in the mouths of children, and it should seldom be necessary to use much force. If too much force is applied, the teeth may be moved sufficiently to injure the investing tissues. The safe plan is the one mentioned of securing very little separation in the beginning and then turning

the adjusting screws a little more — often half a turn — occasionally, as may be required.

It is suggested that, in referring to this instrument in the presence of a patient, it should preferably be called a brace or a support, rather than a separator. The word support suggests helpfulness, while the word separator suggests something painful. The instrument does serve as a support to the teeth while gold is being condensed, and there should be no pain of consequence if the adjustment is properly made.

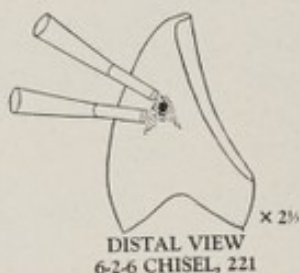


FIG. 971.



FIG. 972.

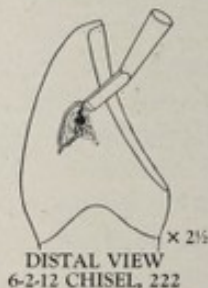


FIG. 973.

NOTE:—For each of the illustrations in this volume, which show the technical procedures in cavity preparation and the placing of restorations, the direction from which the surface or section of the tooth is viewed is indicated. If an instrument is shown, its name and formula are listed, also the manufacturer's stock number. The magnification of each drawing, as compared with the tooth, is also given. In all cases in which the instruments are not drawn in perspective, the measurements with a millimeter scale will be found to correspond with the drawings; most of which are $2\frac{1}{2}$ times the actual size. The blade of the chisel 2 mm. long in Figure 972 should measure 5 mm.; the 6 tenths width blade of the hatchet in Figure 977 should measure $1\frac{1}{2}$ mm., and the 6 tenths mm. bur in Figure 975 should also measure $1\frac{1}{2}$ mm.

OUTLINE FORM. The 6-2-6 chisel was used to cut the enamel to the labial of the cavity, removing little by little all that was not supported by sound dentin. This cutting was continued as far to the gingival and incisal as possible. Two positions of the instrument are shown in Figure 971. As the incisal angle was approached the chisel was slightly rotated so that part of the blade was within the cavity, and the position of the handle was such that the direction of force in cutting away the undermined enamel in the position of the contact was nearly parallel to the margin of the cavity. See Figure 972. The lingual enamel was then broken away in similar manner with the 6-2-12 chisel, as shown in Figure 973.

The 6-2-12 right beveled hatchet was placed between the teeth to break off the undermined enamel to the gingival of the cavity. The edge of the blade was placed in the position shown in Figure 974, and the angle of the blade with the shank was placed against the mesial surface of the lateral incisor, which was used as a fulcrum, in order that, with a prying motion, the rods at the edge of the cavity were broken into the cavity. Very small flakes were split off and this was continued so long as additional enamel could be easily removed.

ANESTHESIA. Heretofore, the best plan of eliminating pain in the preparation of cavities of this class has been the infiltration of the area about the apex of the root with procain. A few practitioners seem to have used this method very successfully, yet the large majority have employed it only occasionally. Hartman's solution promises to be quite as satisfactory in desensitizing the anterior as the posterior teeth, as it is only necessary to place a small piece of cotton, moistened with the solution, in contact with the dentin. It should, therefore, be used in all cases in which the cutting of the dentin is painful. In this case it was applied as soon as the cavity was sufficiently opened with the hand excavators to permit a very small piece of cotton to be placed in contact with the dentin.

CONTINUATION OF OUTLINE FORM. A 6 tenths mm. inverted cone bur was placed in the cavity from the labio-incisal direction and a series of three or four short cuts were made toward the

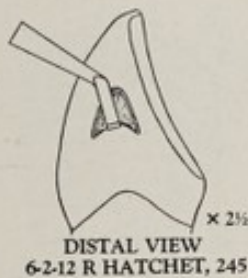


FIG. 974.

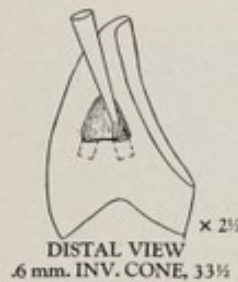


FIG. 975.

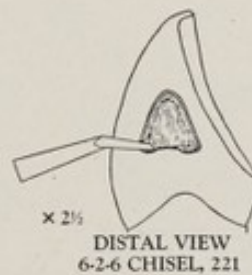


FIG. 976.

linguo-gingival angle, to establish the outline form of the cavity in that direction. A similar cut was made toward the labio-lingual angle, also with the labial approach. The undermined enamel on either side of these cuts was then chipped away with the chisels previously mentioned. See Figure 975. Two additional cuts were made in the incisal direction from the linguo-gingival and labio-lingual angles, the bur following the dento-enamel junction toward the incisal and undermining the enamel to the lingual and labial. A final cut with the bur was made along the dento-enamel junction in the gingival portion of the cavity to connect the extremities of the two previous cuts in order that the gingival wall would be in the horizontal plane. The labial and lingual enamel was broken down with the chisels previously used. The 6-2-6 chisel was also used to cut away the enamel at the gingival, with an approach from the labial, almost at right angles to the long axis of the tooth, as illustrated in Figure 976. This completed the outline form of the cavity.

In many cases the best approach for the bur in making the cuts described, will be through the lingual, instead of the labial embrasure, while in others the gingivo-labial angle will be most conveniently reached from the lingual and the gingivo-lingual angle from the labial approach.

RETENTION FORM. Preliminary to the preparation of the incisal retention the axial wall was cut a little deeper in the incisal region, the axio-labial and axio-lingual line angles were squared out in the incisal portion of the cavity. The 6-2-23 bibeveled hatchet was used for the axio-labial angle as shown in the horizontal section, Figure 977, the handle being in a position at approximately right angles to the labial surface of the tooth. The axio-lingual line angle was squared out with the 6-2-23 chisel, held almost parallel with the long axis of the tooth, with the blade entering the cavity from the lingual embrasure. The position of the blade is shown in the mesio-distal section, Figure 978. The cutting



Fig. 977.



Fig. 978.



Fig. 979.

with both instruments was toward the incisal and converged to meet at the incisal angle, where the axial wall was cut deeper than elsewhere in the cavity, as also shown in Figure 978.

There are many variations in the use of these instruments in preparing retention form. For the cutting just described, in many cases the 6-2-23 chisel may be used to square out both the axio-labial and axio-lingual line angles, and it may on occasion reach either angle with an approach through either the labial or lingual embrasure. Similarly, the 6-2-23 hatchet may also, with the labial approach, conveniently reach both the axio-labial and axio-lingual line angles, or it may reach either line angle with the lingual approach, the handle being held nearly parallel to the long axis of the tooth. In some situations one or the other of these instruments will be in such position that the edge of the blade will be against the labial wall with one angle of the blade moving along the axio-labial line angle, while in others the edge of the blade will be against the axial wall, with one angle of the blade following the same line angle. The positions of convenient use depend upon the

direction of the long axis of the tooth—whether it is protruding or retruding, on the extent to which the patient can open the mouth, on the depth of the embrasure and the size of the cavity.

INCISAL RETENTION GROOVE. The incisal retention was cut entirely in the dentin, with the 3-2-28 bibeveled hatchet, which was placed with the end of the blade in the axio-labial line angle, with the edge directed incisally. It was then moved incisally and around the incisal portion of the cavity to meet the axio-lingual line angle, the instrument being turned on the axis of its shaft as it was moved around the angle. Sometimes it is more convenient to make this cut with the approach from the lingual side of the tooth, in other cases a part is made from the labial approach and part from the lingual. The form of the incisal retention, in a mesio-distal section, is illustrated in Figure 979. The position of the 3-2-28 hatchet is also shown. It should be noted that the blade is directed considerably toward the median line of the tooth, to avoid the possibility of undermining the incisal enamel.



FIG. 980.



FIG. 981.



FIG. 982.

It is desirable to have several 28 angle bibeveled hatchets, with different lengths of blades, in order to have at hand exactly the right length for a given case. This can be done by keeping on hand several 3-2-28 instruments, the blades of which will become shorter and shorter with frequent sharpening. An assortment of four lengths—2 mm., 1½ mm., 1 mm., and ¾ mm. will answer every purpose.

TESTING THE INCISAL ANCHORAGE. The incisal retention was tested with the 5-2-23 hand pressure condenser, to be certain that it was ample. The instrument was placed in the groove with the nib directed incisally and resisted an effort to remove it by pulling in the direction of the handle. It was necessary to withdraw the nib from the undercut by a lateral movement first; and this lateral movement indicated the depth of the undercut. See Figure 980. This test should always be made, as one may be deceived in an endeavor to judge the depth of the retention with the hatchet, as the sharp angle of its edge may engage the dentin in any position.

RETENTION IN THE GINGIVAL PORTION OF THE CAVITY. The gingival half of the axio-labial line angle was squared out with a 6-2-6 chisel with a push motion, the approach being from the lingual. See Figure 981. The same instrument may be used for the corresponding portion of the axio-lingual line angle. In this case, the right beveled 6-2-6 hatchet was used, the approach being from the labial and the cutting toward the gingival, as the handle was slightly rotated. Figure 982. The axio-gingival line angle was squared out with the 6-2-6 chisel introduced from the labial and cutting with a scraping motion from lingual to labial.

The 6-2-12 chisel may often be conveniently used to square out the axio-lingual line angle, instead of the 6-2-6 chisel and in some cases this instrument will be preferred for the axio-gingival line angle. The latter angle may be squared out with an inverted cone bur. The angle formers introduced by Dr. Charles E. Woodbury, see Figure 290, which are chisels with the cutting edges at an angle with the length of the blade, are preferred by some operators for forming sharp line angles in these cavities, and these angles may be slightly undercut if desired. If for any reason the incisal retention, in a particular case, should not be considered fully adequate and could not be made so, without danger of undermining the enamel to either the labial or lingual in the incisal portion of the tooth, additional retention should be made with a bur at the gingivo-axio-labial and gingivo-axio-lingual point angles.



FIG. 983.



FIG. 984.



FIG. 985.

The depth of cutting in the dentin was not more than 1 mm. at any point, except the incisal retention where it was necessary to have an undercut a little more than 5 tenths mm. in width, with at least a 5 tenths mm. of dentin between this undercut and the enamel. This was entirely to the incisal of the pulp. It is occasionally necessary to cut the gingival starting points deeper for better retention. They are located far to the gingival where the labio-lingual diameter of the tooth is sufficient to permit them to be cut well into the dentin, without endangering the pulp.

STARTING POINTS. Points for anchoring the first pieces of gold were made with a 6 tenths mm. inverted cone bur, by placing it in first one and then the other of the two point angles just men-

tioned and pressing the bur laterally into the axio-lingual and axio-labial line angles, then gradually withdrawing it in the incisal direction. The end of the bur was held at the level of the gingival wall while the lateral cut was made and was not pressed into the gingival wall. See Figure 983.

If it should be desired to secure additional retention in this part of the cavity, the starting points should be cut deeper by pressing the head of the bur gingivally, or by enlarging the starting point with lateral pressure on the bur.

The carious dentin had all been removed, and there was no special requirement for convenience form. In some cases it is desirable to extend the lingual wall a little farther than is demanded under the rules of extension for prevention, in order to obtain better access from that direction.

FINISH OF THE ENAMEL WALL. The 9-3-6 and 9-3-12 chisels were used to finish the labial and lingual walls, including the curve of the incisal margin, and bevel the cavo-surface angle. See Figure 984. The 9-3-12 right and left hatchets were used for the gingival wall, one from the labial direction, the other from the lingual as shown in Figure 985. The bevel of the cavo-surface angle was made in a continuous curve to connect the bevel of the labial wall with that of the gingival wall, also to connect the bevel of the lingual wall with that of the gingival wall.

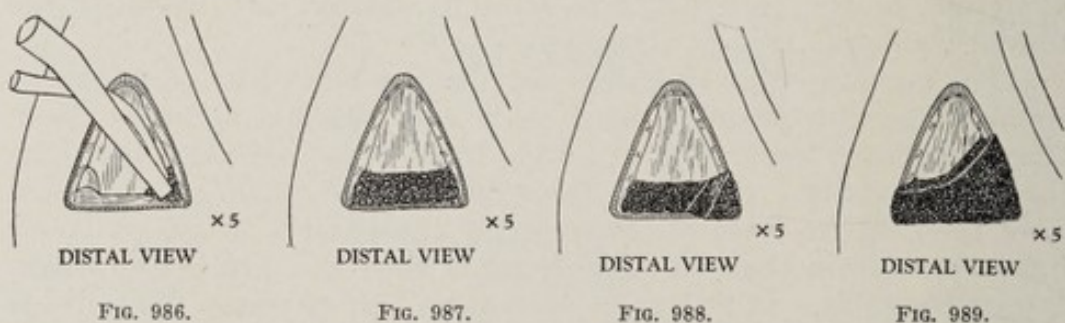
The cutting edges of these instruments were first tested to be certain that they were as keen as it was possible to make them. They were then used with a planing motion parallel with the margin of the cavity. Care had been taken in preparing the outline form to note the lines of cleavage of the enamel in all positions and to be certain that the enamel walls were inclined in the direction of the rods. It was only necessary, therefore, to plane these walls perfectly smooth, and bevel each cavo-surface angle, using light pressure, to properly finish them.

RESTORATION WITH GOLD FOIL. One should determine, while preparing the cavity, whether the gold is to be condensed from the labial or lingual approach, and the condensers to be used should be tried in the various positions to be certain that the access is satisfactory. One approach is about as convenient as the other for most operators; the chair and the patient's head being tipped well back for the lingual approach, and considerably less for the labial. The access for the condensers to the gingival point angles, and to the axio-labial and axio-lingual line angles, particularly, should be determined.

When everything was in readiness to start the restoration, the adjustment screws of the separator were turned one-quarter turn, to gain a little better access for the condensers. In this case, the labial approach was satisfactory, and the first piece of gold was therefore placed in the gingivo-axio-lingual angle, and folded

into a small mass before it was pressed into the starting point. The 5-10-3 condenser and the holding instrument were used, as shown in Figure 986, and the first two or three pieces of gold were condensed by hand pressure. Thereafter the assistant used a hand mallet. The gold was built about equally on the axial and lingual walls, but a little farther out from the point angle on the gingival wall, until the margin of the gingival wall was closely approached. The building was continued along the axio-gingival line angle to the gingivo-axio-labial point angle. See Figure 987. The holding instrument was then laid aside, and the 10x3-3-3 parallelogram condenser was used.

THE LINGUO-GINGIVAL MARGIN. The next step, and a very important one, was the completion of the linguo-gingival portion of the cavity, including the full contour of the gold along the margin. See Figure 988. The lingual portion of the gingival margin and a little of the gingival portion of the lingual margin were covered before the gold was built very far to the incisal on the lingual and axial walls, in order to avoid the possibility of having to use hand pressure to condense gold along the linguo-gingival margin, which



is often necessary if the surface of the condensed gold is inclined too much toward the incisal.

The remainder of the gingival wall was then covered, building incisally along the axial wall at the same time, but not so high as the gold already condensed against the lingual wall, which was kept in advance of the axial wall, because this was more convenient with the labial approach. See Figure 989. From this point gold was added more rapidly along the lingual wall, gradually building to the form shown in Figure 990.

ADAPTATION TO THE LABIAL WALL. The adaptation and condensation of gold along the axio-labial line angle was accomplished for the most part with the 5x10-1-0 parallelogram bayonet condenser, held with the shaft in the disto-incisal direction and inclined slightly to the lingual. The very short nib of this instrument

was placed in the labial embrasure so that it could be held at an angle of 6 centigrades to the labial wall. See Figure 991. The 5-1-23 hand condenser was used for one portion of the labial wall near the incisal, where the proper direction of force could not be applied with the bayonet condenser. As the incisal angle was approached, additional gold was condensed against the axial wall to connect with that which had been previously built along the axio-lingual line angle.

THE INCISAL RETENTION. When the building along the axio-labial line angle and the axial wall approached the incisal, the 5-2-23 hand condenser was placed in the incisal retention groove to be certain that the gold was not being built so close as to interfere with the manipulation of this instrument in all parts of the groove from lingual to labial around the incisal angle. The hand condenser was then used with heavy pressure to secure the best possible con-

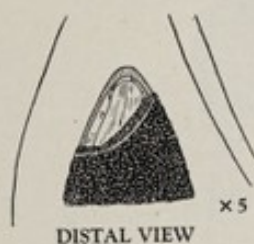


Fig. 990.

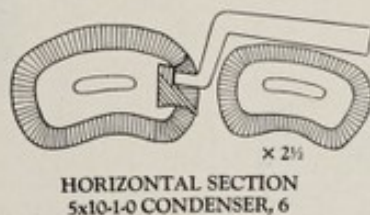


Fig. 991.



Fig. 992.

densation into the depth of the groove, and in fact for every particle of gold in this portion of the cavity, since it constituted the principal retention for the restoration. See Figure 992.

BUILDING THE CONTACT. The separator was tightened the least bit more before the gold that was to form the contact was added, in order to make this area more prominent and allow for a slight reduction of the surface in polishing. The gold was condensed with heavier mallet blows on the 7½-10-3 instrument, being particularly careful to build the most solid mass possible against the enamel of the mesial surface of the lateral incisor, in order that it would be very hard and resist the tendency to wear as a result of the slight rubbing of the contacts of the teeth against each other. The condenser was held very nearly parallel to the long axis of the tooth, and was inclined, first a little to the labial, then a little to the lingual, to secure the best possible condensation about the contact area.

AFTER-CONDENSATION. Finally the 15x5-5-12 foot condenser was used for the after-condensation of the gold along the margin of the gingival wall. The handle of the instrument was held very

nearly perpendicular to the distal surface of the tooth, with the toe reaching into the interproximal space. The toe was inclined slightly to the gingival and the gold along the labial half of the gingival margin was very thoroughly condensed with rather heavy blows of the mallet. The instrument was used in the same manner from the lingual approach.

The pair of quadrangle foot condensers, illustrated in Figure 398, were originally designed for the after-condensation along the gingival margin and are so shaped as to "reach around" the bows of the separator. The bows of the new Ferrier separators permit better access, and the foot condenser may generally be used instead of the quadrangle instruments.



FIG. 993.



FIG. 994.



FIG. 995.



FIG. 996.

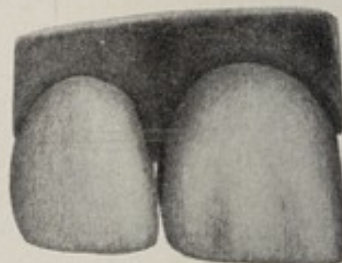


FIG. 997.

FINISHING THE RESTORATION. The steps in trimming and polishing of this restoration were practically the same as have been described and illustrated for proximal restorations in the bicuspid and therefore will not be repeated here.

The completed restoration is shown in Figure 993, also in Figure 994 after it was polished. The mesio-distal section, Figure 995, shows the incisal retention and the contour, while the horizontal section, which is in a plane a little to the occlusal of the gingival wall, shows the position of the axial wall and the two starting points. See Figure 996. The slight showing of gold in the labial view, Figure 997, is acceptable to most patients when they fully understand the comparative value of gold foil and other materials in conserving the anterior teeth.

DISTAL DECAY, UPPER LATERAL INCISOR; GOLD FOIL.

A cavity in the distal of the upper right lateral incisor was also marked on Miss Brown's chart. The general details of the preparation and restoration were similar to that of the central incisor. Only two points are recorded as deserving special consideration.

First: As compared with the central incisor, the thickness of the dentin is less and the pulp chamber larger in proportion to the size of the crowns of the two teeth, which suggests the importance of the most critical examinations to discover cavities early and the greatest care in cavity preparation to avoid near approach to the pulp. A special cavity varnish to prevent thermal shock, should be applied to the dentinal walls of the cavity, if there is any question as to the future safety of the pulp. This should be applied before the enamel walls are finished, or if applied afterward, all enamel walls should be carefully scraped, with very sharp instruments, to be certain that none of the varnish remains on them.

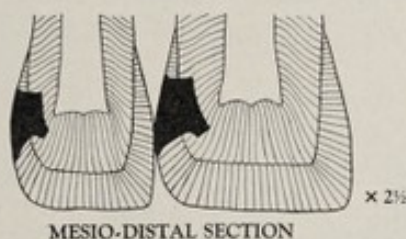


FIG. 998.

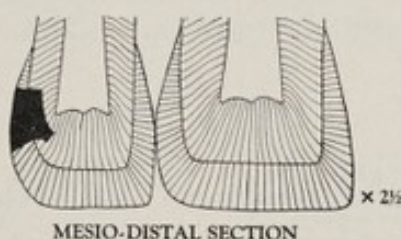


FIG. 999.

Second: The incisal enamel wall of cavities in the distal surface of the lateral incisor should be prepared at a considerably different angle from similar cavities in the central incisor, due to the difference in the direction of the enamel rods. The rod inclinations should be definitely determined in each case, otherwise a few short ends of rods may fall away and the restoration will have to be replaced. See Figures 998 and 999. The thickness of the dentin and the sizes of the pulp chambers in the two teeth may also be compared in these illustrations. The incisal margin of the cavity in the distal surface of the lateral incisor in Figure 999 was so prepared as to leave short ends of rods exposed at the surface. The preparation in Figure 998 is correct. These may be compared with the restoration in the distal surface of the central incisor in Figure 998.

MESIAL DECAY, UPPER CENTRAL INCISOR; PORCELAIN INLAY.

There was recorded on Thomas Johnson's examination card at the age of sixteen, Figure 871, a mesial decay in the upper right

central incisor and his mother was anxious that gold should not be used, therefore the restoration was made with a porcelain inlay.

In recent years the tendency has been to simplify the technic for porcelain restorations in the anterior teeth. The cavity is prepared in such form that an impression may be taken in modeling compound or a wax pattern may be made, and the remaining steps are then carried out in the laboratory. Still more recently, with the improvement of refractory investment materials, which will not shrink when heated to 2000° F. or higher, porcelain restorations are being made without swaging a platinum matrix. The cavity form is reproduced in the refractory material and the porcelain is baked in direct contact with it, using porcelain bodies that fuse at about 1800° F. The technic is given for both methods in the chapter on the manipulation of materials for restorations.

The cavity preparation for porcelain restorations in the incisor teeth is less complicated than that for gold foil, since the cavity must be prepared without undercuts. It must first be decided whether the finished restoration is to be placed from the labial or the lingual direction. If one desires to follow the recom-

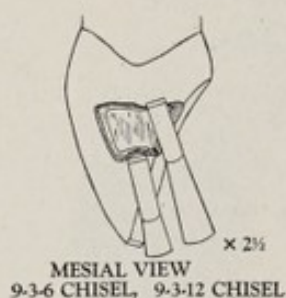


Fig. 1000.

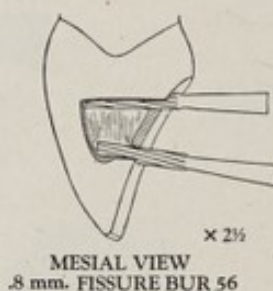


Fig. 1001.

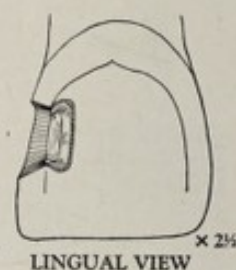


Fig. 1002.

mendation that the labial margin shall be near the labio-mesial or labio-distal angle of the tooth, the approach should be from the labial. However, a closer fit of the porcelain is possible by the technic in which the platinum matrix is not used, and the cement line is very largely eliminated. This makes it practical to prepare cavities from the lingual approach which do not include more cutting of the labial enamel than is considered absolutely necessary to meet the requirements of extension for prevention. In cases in which the habit of thorough brushing of the teeth is well established, the labial extensions of cavities may be slightly less than were formerly required.

It is not practicable to use an impression technic in cases in which the cavity includes any part of both the labial and lingual marginal ridges. It may be cut well beyond the marginal ridge on the lingual surface, but should not extend to the labial limit of the proximal surface, as it is necessary that the surface form of

the tooth about the margins be included in the impression as a guide in contouring the restoration. The reverse is true of the cavity preparation, if the impression is to be taken from the labial.

CAVITY PREPARATION. This cavity was prepared with the lingual approach, and the undermined enamel was first broken down with chisels as for a gold foil restoration. The decay had not extended sufficiently into the lingual embrasure to permit the placing of the smallest inverted cone bur in the cavity. Therefore, a stone about 2 mm. in diameter was used to grind away a little of the enamel of the lingual marginal ridge to the lingual of the cavity of decay, exposing a small area of dentin, so that an inverted cone bur could be used in the dentin. A bur was then used from the lingual approach to undermine the enamel of the proximal surface, enlarging the cavity to include a little of the lingual marginal ridge, the object being to cut the incisal and gingival walls through to the lingual surface, with the gingival wall in the horizontal plane and the incisal wall inclined incisally from labial to lingual, in order that a wax pattern might be withdrawn in the lingual direction. The undermined enamel was chipped away with the 9-3-6 and 9-3-12 chisels, operating from the lingual. See Figure 1000.

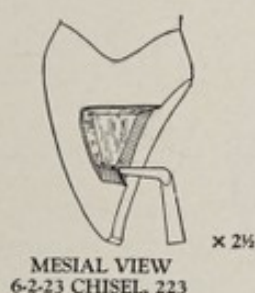


FIG. 1003.



FIG. 1004.

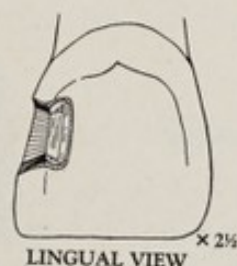


FIG. 1005.

A fissure bur, 8 tenths mm. in diameter, was then placed in a contra-angle hand-piece of precision make, with a shaft which runs very true, and the retention form of the cavity was prepared by making slight undercuts along the axio-incisal and axio-lingual line angles. The bur was pressed to the labial only as far as was necessary to square out the axio-labial line angle. Figure 1001 illustrates the positions of the fissure bur in cutting toward the incisal and toward the gingival. Figure 1002 is a lingual view showing the outline form.

The axio-incisal line angle was made sharp with a 6-2-23 chisel, with a push motion from the lingual, the handle being held almost parallel to the long axis of the tooth. See Figure 1003. The right 9-3-12 hatchet was used for the axio-lingual line angle, also with a push motion from the lingual, the handle being held in a

position below the upper left cuspid. The position of the blade is shown in Figure 1004. The enamel walls were all prepared in the direction of the rods, but the cavo-surface angle was not beveled. A lingual view of the prepared cavity is shown in Figure 1005.

WAX PATTERN AND PORCELAIN INLAY. The technic of preparing the wax pattern and the various steps in making the porcelain inlay are discussed in connection with the illustrations, Figures 483 to 487.

PROXIMAL DECAY, UPPER CENTRAL INCISOR, GOLD INLAY.

A restoration with a gold inlay may be made for a small proximal cavity in an incisor, with the same cavity preparation which has been described for a porcelain restoration, to be inserted from the lingual. It would hardly seem desirable to sacrifice so much of the lingual enamel if gold is to be used for the restoration, when a better restoration can be made with gold foil in a cavity which may be prepared within the limits of the proximal surface. However, in cases in which extensive decay has undermined the lingual marginal ridge a gold inlay of this type could be used. A gold inlay, in a cavity prepared in this form, is more definitely indicated for distal decays in cuspids, upper or lower.



FIG. 1006.



FIG. 1007.

DISTAL DECAY, UPPER CUSPID, GOLD INLAY.

William Fisher, for whom restorations were made for pit cavities in three first molars when he was twelve, had no additional decays during the several years that followed. He was in for examination about once in nine months, and was then away two years attending preparatory school. He did not respond to recall notices during the vacation periods. In view of his high degree of immunity, this was not surprising. He returned, however, at the age of twenty, when decays were discovered in the mesial surface of both upper central incisors and in the distal surface of the upper left cuspid.

CAVITY PREPARATION. There was a definite opening through the enamel in the cuspid, and lateral spreading of caries in the dentin had undermined the lingual marginal ridge. A cavity for

a gold inlay was prepared with a lingual step. After the undermined enamel had been broken down with chisels, which included the cutting away of a part of the lingual marginal ridge, an inverted cone bur was placed in the cavity from the lingual and a cut was made through the remainder of the marginal ridge to the lingual surface of the tooth. Then with a 1 mm. inverted cone bur in the contra-angle hand-piece, a portion of the enamel of the lingual surface was undermined and removed in the form of a slight dove tail. The depth of this cutting in the dentin was less than half the length of the head of the bur. The enamel forming the margins was split off in the direction of the rods with a 9-3-12 chisel, to determine the proper inclination for the enamel walls. A fissure bur was then carried around this step to be certain that all surrounding walls in the dentin were very slightly inclined outward, in order that a wax pattern could be withdrawn. The axial wall of the proximal portion of the cavity was prepared with a slight convexity, from labial to lingual, over the position of the pulp, it being planned that the pattern would be withdrawn in a disto-lingual direction—more to the lingual than the distal. The direction of withdrawal was controlled by the convexity of the mesial surface of the first bicuspid from the contact point to the mesio-lingual surface angle. The axio-labial line angle was slightly undercut, as was the axio-mesial line angle of the step portion. A disto-lingual view of the cavity is shown in Figure 1006, a disto-labial view in Figure 1007.

LARGE MESIAL DECAY, UPPER CENTRAL INCISOR; SILICATE CEMENT.

On the occasion of the first examination of Miss Gertrude Wilson, at the age of 22, there was every indication that her teeth had been neglected. The restorations then present were all unusually large; three teeth had been extracted, and the radiographs showed root fillings in two of the upper molars. There was a gingival third decay in the labial surface of the upper left central incisor and an extensive decay in the mesial surface of the upper right central, which had probably been progressing for several years. A large silicate cement restoration had been placed in the mesial surface of the left central by a previous operator. After some discussion as to the material to be used for the restoration in the upper right central, it was decided to use silicate cement for that cavity and also for the gingival third cavity in the left central incisor. All operations performed for Miss Wilson are listed on the chart, Figure 1135.

CAVITY PREPARATION. The cavity in the upper right central incisor is illustrated in Figure 1008. The enamel was extensively undermined by caries in all directions, requiring that the outline form be much larger than would be necessary to comply with the rules of extension for prevention. It included the lingual

marginal ridge. Fortunately, both the labial and incisal enamel plates were strong and some of this enamel was not cut away, but was left without dentin to support it. When all of the carious dentin was removed, both the labial and incisal enamel walls were considerably undercut. Silicate cement appears to give less support to the incisal angle of a tooth than any other material used for restorations, yet the circumstances in this case limited the choice to silicate cement or a porcelain jacket crown.

The first cutting with chisels enlarged the cavity as shown in Figure 1009. A bur was used to square out the gingival wall and prepare undercuts for anchorage at the axio-gingivo-labial and axio-gingivo-lingual point angles, which were cut rather deep distally to the labial and lingual of the pulp. The bur was drawn incisally from the lingual point angle, to improve the retention form along the axio-lingual line angle. This line angle was made sharp with chisels and was continued to meet the incisal retention, which was prepared in the form of a groove connecting the axio-lingual and axio-labial line angles, as previously described and illustrated in Figure 979.



FIG. 1008.



FIG. 1009.



FIG. 1010.



FIG. 1011.

The rubber dam was applied to the six upper front teeth, and the enamel wall was finished in the direction of the rods, but the cavo-surface angle was not beveled. The prepared cavity is shown in Figure 1010. The pulp was not exposed. It had receded, as shown by the radiograph, and the building of secondary dentin must have been in part of the hyaline type, as the tooth was not sensitive to cutting instruments and the decay was sufficiently deep to have reached a pulp chamber of normal size for her age.

RESTORATION WITH SILICATE CEMENT. A Ferrier separator was placed for the double purpose of gaining separation and serving as a support for a modeling compound impression of the lingual surface of the tooth, which in turn held the lingual end of the celluloid strip while the restoration was placed.

The separator might have been placed earlier, in order that the modeling compound impression could have been made of the lingual surface of the tooth before any of the marginal ridge was cut away. However, there was the possibility that the pulp might

be exposed and the cavity preparation was completed first. Gutta-percha was therefore placed in the cavity and the contour of the lingual surface was reproduced, care being taken that there was no overlap at the margins. The lingual surfaces of both incisors were then lightly coated with cocoa-butter before the modeling compound impression was made. It was pressed against the lingual jaws of the separator, without forcing it under them. The modeling compound was then removed and replaced to hold the lingual end of the celluloid strip.

The technic of placing the restoration is given in detail in the chapter on the manipulation of materials and will not be repeated here. The finished restoration is shown in Figure 1011.

Class 4. Proximal Decays in the Incisors and Cuspids Which Require the Restoration of the Incisal Angle

ILLUSTRATIONS: FIGURES 1014-1034.

CASES in which the angle of an incisor or cuspid tooth has been lost, or has become so weakened by decay that it can not be retained safely, present considerable differences of condition. The mesio-incisal angles of the upper central incisors are much more frequently involved than other incisal angles of the anterior teeth. The distal surfaces of the central incisors may also require the restoration of the angle, but less often, due to the fact that the disto-incisal angle is more rounded in form and the contact point is farther from the incisal edge. In fact the distal angle is rarely involved by caries, except in neglected cases. The above statements apply to the relative involvements of the mesio-incisal as compared with the disto-incisal angle of the lateral incisors, although the angles of the lateral incisors are less frequently lost. However, the smaller size of these teeth increases the difficulty of treatment. Cuspids occasionally present similar conditions, as a result of neglected decays. The lower incisors much less frequently require the restoration of an incisal angle, due primarily to the fact that the incidence of caries in these teeth is so low.

THE CONDITIONS UNDER WHICH CARIES MAY CAUSE THE LOSS OF THE INCISAL ANGLE may be summarized as follows: (1) The mesial surfaces of the central incisors may come together at a considerable angle and make contact very close to the incisal edge. Decay starting immediately to the gingival of this contact may involve the angle, causing it to break away while the decay is yet small. (2) The surfaces of the teeth may be in close proximation for a considerable distance from the incisal edge and the decay may begin a little farther to the gingival and yet be confined mostly to the incisal portion, and undermine the incisal enamel. (3) When the contact is in the normal position and decays are not discovered early, lateral decay in the dentin may undermine the enamel of the incisal angle. (4) Recurrence of decay about the incisal portion of a restoration may involve the incisal enamel. (5) Decay beginning in any position on the mesial surface may reach the pulp; its removal will be required, and eventually the incisal angle will be weakened as a result of the change which gradually occurs in the dentin.

In recent years the extensive use of silicate cement for restorations in proximal cavities in the anterior teeth has resulted in the loss of the incisal angle in many cases. Apparently, this is due in part to the shrinkage of this material, which permits recurrence of decay involving the cavity walls, and in part to the fact that it does not give good support to the incisal angle of the tooth.

FRACTURES OF THE ANTERIOR TEETH, particularly the upper incisors, which may involve one or both incisal angles, or the entire incisal portion of the crown, present special difficulties in pulp conservation and in making restorations. These occur most often during the childhood period.

Restorations; Proximal Decays in the Incisors and Cuspids which require the Restoration of the Incisal Angle.

Four principal problems require consideration in cases in which the incisal angle must be restored: the danger to the pulp from exposure or near exposure by caries, or from thermal shock; the retention form of the cavity; the ability of the material selected for the restoration to withstand the stress to which it will be subjected; and the appearance.

The preparation of cavities of this class in long teeth, that are thin labio-lingually in the incisal portion of their crowns, is complicated in the matter of securing good retention, while conserving the pulp and leaving intact as much as possible of the labial enamel plate near the incisal edge, with good dentin to support it.

Restorations for persons who show their teeth very little or who are more concerned as to the utility than the esthetics, may be made of gold foil in cases in which the prepared cavities are not too large, otherwise gold inlays should be used. The use of platinum-gold foil for the incisal and labial portions of these restorations will give a color less yellow than pure gold and better resistance to attrition. A hard casting gold should be used for inlays. If the casting alloy contains platinum, the color will be less objectionable.

The plans of repair in these several conditions will differ with the amount of substance lost, and the opportunities offered for anchorage in the remaining parts of the tooth. In each of these the position of the pulp in relation to the incisal edge, whether it is near to or far from it, becomes important. The pulp extends farther toward the incisal edge, and is larger in young people than in older persons. In teeth with very thin incisal edges, the pulp extends proportionally nearer the incisal edge than in thick teeth, and especially it extends nearer the incisal edge of the dentin, leaving less room for anchorage in the dentin between the pulp and the incisal enamel. The longer and thinner labio-lingually the

crown, the shorter proportionally the distance from the incisal edge of the pulp to the incisal edge of the dentin.

Two principal plans are available for restorations: First, by preparing a step at the incisal edge of the tooth, which corresponds in general plan to the step preparation for proximo-occlusal restorations in the bicusps and molars. The incisal step is prepared, for the most part, by cutting away the lingual enamel sufficiently to prepare a step in the dentin without weakening the support of the labial enamel. The second plan is to prepare a step in the lingual surface, about midway the length of the crown. In addition, there are a limited number of cases in which sufficient anchorage may be secured in the dentin by undercutting the incisal edge. In this case the cavity preparation is a modification of that for a proximal decay which does not involve the incisal angle, and the restoration would be with gold foil. When both incisal angles of the same tooth are lost, a porcelain jacket crown will usually be indicated.

Cases in which the incisal angle is accidentally broken off present many of the same problems in treatment as those in which the angle is lost on account of caries. The treatment of these accident cases will be discussed later.

MESIAL DECAY, UPPER CENTRAL INCISOR; GOLD FOIL.

INCISAL STEP PREPARATION. As has already been reported, William Fisher returned for examination at the age of twenty, after a lapse of about three years, and decays were found in the mesial surfaces of both upper central incisors. In breaking down the enamel in preparing these cavities, it was soon discovered that the lateral decay in the dentin had undermined the enamel of the incisal angle of the left central incisor. The contact point had been in about the normal position, and the undermining of the angle was without doubt the result of his neglect. Like many other people, he could not, for some reason, be sufficiently impressed with the importance of examinations at regular intervals.

The decay in the right central incisor was less extensive and the incisal angle was not involved. A restoration was made in this tooth, after the cavity was prepared in the left central, but before the restoration was placed in that tooth, in order to take advantage of the better access provided by the large prepared cavity. The cavity in the upper left central incisor was prepared by forming a step in the incisal edge of the tooth.

PREPARATION OF PROXIMAL PORTION. The proximal portion of the cavity was prepared similar to that for a simple proximal decay, excepting the retention groove at the incisal. The instrumentation was less complicated on account of the better access, due to the fact that the incisal angle was cut away as the first procedure. The undermined enamel, including that of the incisal edge,

was chipped away with the 9-3-6 and 9-3-12 chisels. An 8 tenths mm. inverted cone bur in the straight hand-piece was then held almost parallel to the long axis of the tooth and several cuts were made to undermine the enamel and extend the cavity to the labio-gingival and linguo-gingival as far as the lateral decay in the dentin had undermined the enamel in the central portion of the mesial surface. This gave opportunity to make ample undercuts at the gingival for anchorage. After the enamel was further broken down with the chisels previously mentioned, the inverted cone bur, again held parallel to the long axis of the tooth and with the end against the gingival wall, was first used to square out the axio-gingival line angle, and was then pressed laterally into the dentin to the labial and to the lingual of the pulp to provide starting points and good anchorage. In each case the bur was drawn incisally, continuing the anchorage in the form of a groove for some distance along the axio-labial and axio-lingual line angles. These line angles were then made sharp with the 9-3-6 chisel with a push motion from incisal to gingival. The blade of the chisel was first held against the axial wall and then against the labial wall in squaring out the axio-labial line angle; a similar procedure was followed in squaring out the axio-lingual angle. This cutting left the axial wall convex from labial to lingual, thus giving the greatest possible protection to the pulp. A horizontal section of the tooth, a little to the incisal of the gingival wall of the cavity, shows the convexity of the axial wall, and the gingival retention at the axio-labio-gingival and the axio-linguo-gingival, in relation to the pulp. See Figure 1014.

The weak incisal angle had been cut away to, and a little beyond, the mesial labial groove. This groove, although not very apparent, is a weak line in the enamel at which it most often breaks, and it should, as a rule, be included when the angle is so weak as to require removal. This is more necessary in connection with the preparation of an incisal step, which tends to weaken the support of the labial enamel plate. In view of the fact that the central incisors were considerably longer than the lateral incisors, a little of the enamel was ground from the incisal of both central incisors with a fine stone in the engine. The remaining incisal edge was thicker labio-lingually and the edge of the restoration would thus be stronger.

THE INCISAL STEP. The first operation in preparing the incisal step was to grind away the incisal edge of the middle lobe of the left central to, and a little beyond, the distal labial developmental line. This cutting, more from the lingual than the labial, was continued until the incisal edge of the dentin was exposed to a labio-lingual width of about 1 mm. The stone was held in such

position that the cut surface was inclined from labial to lingual in approximately the direction of the labial enamel rods.

The extent of this cutting, in each case, depends upon the thickness of the incisal edge of the tooth. The incisal enamel is longer in a thin tooth, and more must be ground away before the dentin is reached. In the average case, about one millimeter should be cut from the labial plate of enamel.

A groove was then cut in the incisal edge of the dentin across its middle lobe between the labial and lingual enamel plates. An 8 tenths mm. inverted cone bur was held with its shaft parallel with the long axis of the tooth; the side of the bur was placed in contact with the dentin of the axial wall of the proximal portion of the cavity and made to enter the dentin near the lingual dento-enamel junction; it was first pressed distally about 1 mm. and then drawn out in the inciso-lingual direction, breaking out the enamel of the lingual plate. This movement was repeated in cut after cut until a groove was cut across the middle lobe. See Figure 1015.



FIG. 1014.



FIG. 1015.

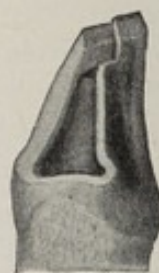


FIG. 1016.

In this cutting with the bur, sufficient dentin was left to support the labial enamel plate. The bur was again passed along the slight groove, cutting it deeper, keeping it close to the lingual rather than the labial enamel plate, eventually forming a groove in the dentin between the labial and lingual plates. In making this groove, as much dentin as possible was left to support the labial enamel plate, with less, yet sufficient to support the shorter lingual enamel plate. The depth of the cutting toward the pulp of the tooth was determined very largely by the position of the pulp chamber as shown by a radiograph, and the thickness of the dentin labio-lingually. This groove was squared out with a 1 mm. fissure bur and its walls were made parallel. No undercuts or pits were made in the step portion of the cavity. Its depth in the dentin, measured on the lingual wall, was slightly greater than the labio-lingual breadth of the groove. The line of junction of the pulpal and axial walls was rounded to give greater strength to the restoration in this position. The labial and lingual enamel walls of the step portion of the cavity were so prepared that they were inclined toward

the incisal in the direction of the enamel rods and the cavo-surface angles were beveled with chisels. The distal wall of the incisal step, the margin of which crossed the incisal edge of the tooth from labial to lingual, was cut diagonally with the linguo-incisal angle farther to the distal than the labial, in order to insure more even wear of the gold and the tooth along the incisal margin. The prepared cavity is shown in Figure 1016.

In cases where there has been such wear of the incisal edges of the teeth that the dentin is exposed, the step should include all of the exposed dentin. Very little cutting from the lingual enamel plate will be needed, and generally none from the labial.

In the management of this class of cases, it should be remembered that in such large cavities, the bulk of gold in close proximity to the pulp is liable, through its conductivity of thermal changes, to set up irritation that will destroy the pulp. The extent to which the pulp has receded should always be determined with radiographs.



FIG. 1017.



FIG. 1018.



FIG. 1019.

GOLD FOIL RESTORATION; PLATINUM FOIL. The condensation of gold foil followed the same general plan as for a mesio-occlusal restoration in the upper first bicuspid for Frank Hines. See illustrations 897 to 903 and accompanying text. The first pieces of gold were condensed in the axio-linguo-gingival angle and the building was continued in the proximal portion until the level of the incisal step was reached. A new start was then made in the distal portion of the incisal step and the building progressed mesially until it was joined with the proximal portion. The building of the gold is indicated by the lines in the mesio-distal section of the tooth, Figure 1017, also the lamination of the gold to make the strongest possible incisal angle is shown in Figure 1018. Platinum gold foil was used for the incisal portion of the restoration, also for the labial surface which would be exposed to view, partly for the purpose of improving the color, and partly in order that the incisal edge would better withstand the stress of the bite. The showing of gold along the incisal edge of the tooth was considerably reduced by rounding the labio-incisal edge with disks, so that light would be reflected downward. The finished restoration is shown in Figure 1019.



FIG. 1020.

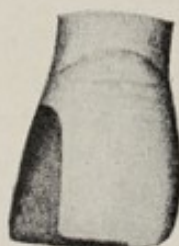


FIG. 1021.

MESIAL DECAY, UPPER CENTRAL INCISOR; GOLD INLAY.

INCISAL STEP PREPARATION. A gold inlay would be preferred by many dentists to a gold foil restoration in the cavity just described. The preparation of the cavity would be along the same general lines. The incisal step should be cut a little wider and slightly deeper, and the lingual wall shorter. The labial and lingual dentin walls should be inclined outward. As mentioned for the previous preparation, the incisal margin of the distal wall should cross the incisal edge of the tooth at an angle, to cause the tooth and the gold to wear more evenly where they join. The wax pattern should usually be withdrawn in the linguo-incisal direction, which requires that the lingual wall of both the step and the proximal portion be inclined lingually. The prepared cavity is shown in Figure 1020, the finished restoration in Figure 1021.



FIG. 1022.



FIG. 1023.

LINGUAL STEP PREPARATION. A preparation for a mesial cavity in an upper left central incisor, similar to that illustrated for the distal of a cuspid in Figures 1006 and 1007, may be made without cutting away the incisal edge of the enamel which forms the central lobe of the tooth. With this preparation, less gold will show at the incisal edge. Such a restoration should preferably be used for teeth that are rather thick in the labio-lingual diameter. The position of the lingual step is partially controlled by the direction of the enamel rods on the lingual surface which must form a part of the incisal wall of the step. In incisors which have very long crowns, and are thin labio-lingually, the enamel rods incline very sharply to the incisal for a considerable distance away from the

incisal edge of the tooth and the dentin between the labial and lingual plates of the enamel is very thin. Therefore the step must be placed farther to the gingival than in teeth which are thick labio-lingually, both to secure good retention form and in order to have the incisal margin of the restoration sufficiently strong. This preparation is shown in Figure 1022 and the labial view of the restoration in Figure 1023.



FIG. 1024.



FIG. 1025.

MESIAL AND DISTAL DECAYS IN UPPER CENTRAL INCISORS, WITH RESTORATION OF BOTH INCISAL ANGLES; GOLD INLAY. Cases in which both incisal angles are involved are usually best treated with porcelain jacket crowns. However, there will be an occasional case in which the patient will prefer a mesio-disto-incisal gold inlay. Particularly, persons who show their teeth very little, or who have no special interest from the esthetic viewpoint, may prefer the gold inlay. The preparation of such a cavity is illustrated in Figures 1024 and 1025.

GOLD INLAY WITH ANCHORAGE IN THE PULP CHAMBER. In an occasional case of this class, when the pulp of the tooth has been removed, it may be advantageous from the viewpoint of both appearance and retention to make a gold inlay with anchorage in the pulp chamber.

The weakened angle should be cut away to and a little beyond the mesial labial groove, but no step should be cut along the incisal edge of the tooth. Instead, the incisal portion of the pulp chamber should be opened to become a part of a deep lingual step as retention form for the restoration. If additional retention is required, a post should be fitted in the root canal and so bent that it will not be very close to the incisal wall of the lingual portion of the cavity when in position in the canal. It should project about $\frac{1}{4}$ inch beyond the lingual surface of the tooth. A wax pattern of the cavity should then be made, using a copper band to confine the wax while it is pressed to place. After this has been trimmed to form, the post, held in a pair of flat-nose pliers, should be heated and plunged through the wax to its proper position in the root canal. The temperature of the post should be such that it will

melt the wax sufficiently to permit it to be plunged through with gentle pressure, yet it must not be so hot that it will soften the wax enough to disturb its general contour. After the wax is chilled, the post and wax pattern should be removed together and the inlay should be cast about the post. The extension of the post through the lingual step should not be cut off until after the casting is made, as it will assist in holding the post securely in the mold.

FRACTURED INCISORS.

There are many cases in which the incisor teeth, and particularly the upper central incisors, are fractured as the result of accidents. These are not limited to a particular age group; babies fall from their perambulators or cribs, children fall while roller skating, slip on the ice, fall down stairs, etc., etc. Older persons receive blows on the incisors from hockey sticks, tennis rackets, baseballs, etc., and automobile and other accidents account for many.

The majority of cases occur during the childhood period and the treatment may be complicated in many ways: (1) by the death of the pulp from the force of the blow which may crush the tissues about the apex of the root, (2) by a fracture of the alveolar process, particularly the labial plate; (3) by fractures of the root, (4) by the near approach to or exposure of the pulp, (5) by the fact that the root is not fully formed, precluding the possibility of making a root canal filling, (6) by infection of the periapical tissues, (7) by the facial disfigurement due to the prominence of the teeth.

A radiograph should be made to learn the proximity of the fracture to the pulp, whether the root may be fractured, also the extent to which the root is developed, the condition of the apical end of the canal, and the condition of the periapical tissues.

TREATMENT. If the supporting structures of the tooth are inflamed and swollen, treatment should generally be delayed for a few days. If the tooth is loose, it may be temporarily held in place with a wire looped about it and the neighboring teeth, and a splint may be made later, if necessary. If the root is fractured, it will usually be necessary to extract it, although occasional cases are reported in which the fracture is united by the building of new cementum.

If the pulp is exposed, the stage of development of the root will usually be the guide as to whether the tooth should be extracted or an attempt made to save it by capping the pulp, or by removing the pulp and making a root-canal filling.

If the pulp is not exposed, and the root is not completed, the primary concern must be for the conservation of the pulp and no

immediate effort should be made to restore the portion of the crown that was broken away. The dentin of the fractured area should be protected with cement. If the condition is such that a cement restoration will likely be broken away, a gold or platinum cap should be cemented over the incisal portion, to remain until the root is fully formed. It should be remembered that it requires about a year, after the root has attained its full length, for the gradual reduction in size of the apical foramen.

Cases occur occasionally in which the pulp retains its vitality even though widely exposed, and completes the formation of the root. The completely open end of the canal precludes the possibility of strangulation of the pulp and permits free circulation to the inflamed area. Under these conditions the pulp tissue may react similarly to other soft tissues, and retain its vitality for months, or in some cases indefinitely. It seems wise, therefore, in cases in which the roots are incomplete, to do everything possible to maintain the vitality of the pulp. On the other hand, if pulps are exposed by a fracture of the crown after the root is fully formed, they should be removed at once, to avoid apical infection. The lack of sensation or lack of response of a pulp to tests, within twenty-four hours after an injury does not always indicate that the pulp is dead. It may be in such a condition of shock—or similar to shock—that it does not respond; some hours later, it may respond to an electrical or thermal test.

Many of these cases should be carried along with temporary treatment for years beyond the time when the root has developed to its full length. This will depend on the nature of the break and its proximity to the pulp. It will often be advantageous to delay until the size of the pulp chamber has been considerably reduced by the natural gradual building of more dentin. In cases in which there is a question of jeopardizing the continued vitality of the pulp, nothing should be done until the patient is from fifteen to eighteen years of age. In the meantime the building of the dentin should be watched with occasional radiographs and the vitality of the pulp should be tested at intervals.

If the pulp should die when the root canal is so incomplete that it is funnel shaped, and the making of a good root canal filling is out of the question, the tooth should be extracted at once. If, when the pulp dies, the root has grown to practically its full length and the canal is slightly smaller at the apex than elsewhere, although not reduced to the small size of the normal foramen, a root canal filling should be made. It should be immediately radiographed to determine whether the root filling is the best that can be made under the conditions presenting and subsequent radiographic examination should be made at intervals thereafter.

RESTORATIONS. The most difficult restorations from the esthetic viewpoint are those in which the fracture is such as to cause

serious disfigurement without involving the pulp. There may be no other sign or symptom than the obvious fact that a piece of the tooth is missing. Very rarely, the piece of the tooth that was broken off may be cemented to place, possibly with one or two platinum pins imbedded in the piece and into the dentin of the crown. If a comparatively small piece of the tooth is missing, it will often be the best treatment to grind the incisal edges of both incisors and thus reduce the unsightliness of the defect. This grinding may be done at intervals during several years.

There may be sufficient dentin so that a cavity might be prepared and a restoration made, but the difficulty is to make a restoration that will look well. The mesio-incisal angle of an upper central incisor is the most unsightly place in the mouth for restoration made of gold. A porcelain inlay, with or without platinum pins to hold it in place, is the best treatment in many cases, although porcelain in this position presents unusual problems in translucency, which call for the most expert treatment if the restoration is so perfect in shade as to be unobserved. In this connection it should be said that a gold restoration, which is of comparatively small size, but which *reproduces the exact tooth form very perfectly*, will sometimes be the most satisfactory treatment, everything considered.

In an occasional case a silicate cement restoration may be made that will match the tooth perfectly, but it will require replacement at intervals. A lingual half-crown of gold, slightly overlapping the mesial or distal marginal ridges, or a gold inlay may be made to support a silicate cement restoration.

In cases in which only a small portion of the tooth is missing, the dentist hesitates to recommend the removal of all of the remaining enamel and its replacement with a porcelain jacket crown, and many patients will not consent to this procedure; at least, not until several attempts have been made by other methods without satisfactory result.

The more extensive the break, the more one is inclined to use a porcelain crown. However, if the pulp is vital, this operation should be delayed until the eighteenth year, or later if the patient will consent, for the recession of the pulp.

If the pulp dies and a root canal filling is made, a porcelain crown may be made at once, by placing a post in the canal as a support for a crown, a gold core being cast about the crown end of the post to duplicate the dentin portion of the crown.

In the last analysis, in cases in which the lost portion of the tooth is small, the most satisfactory result is likely to be attained by grinding the incisal edges of both central incisors, and possibly of the lateral incisors also, and in cases where the lost portion of the tooth is more extensive, by placing a porcelain jacket crown. Regardless of the treatment proposed, if the pulp is vital, one is

justified in temporizing by any measures whatsoever to gain time until sufficient recession of the pulp has occurred.

RADIOGRAPHS OF FRACTURED INCISORS. Several radiographs are reproduced to illustrate the variety of conditions which present. Figure 1026 shows fractures of the mesio-incisal angles of both central incisors without involvement of the pulp of either tooth in the mouth of a boy eight years of age. The roots are only partially formed and the death of either pulp would necessitate the removal of the tooth. Therefore, nothing should be done to further endanger the vitality of the pulp.



FIG. 1026.



FIG. 1027.



FIG. 1028.

Figure 1027 is a case in which the right incisor was fractured and entirely dislodged, while the mesio-incisal angle of the left incisor was broken off without involvement of the pulp. The patient was 14 years old and the root was fully formed. In this case, a removable appliance was recommended to replace the right incisor until this boy should be eighteen years old, when a porcelain jacket crown might be made for the fractured tooth, or it might be used as an abutment for a two-tooth bridge.

The case illustrated in Figure 1028 shows a fracture of an upper right central in the mouth of a boy eight years old. The tooth was fractured almost squarely across and the pulp was very nearly exposed. The root ends were wide open. This case was treated by cementing a platinum half crown over the remainder of the enamel crown, with as little showing of platinum on the labial as was possible and yet have ample retention.

The next case, Figure 1029, was a boy of 9 years. A large portion of the crown was missing, the pulp was exposed and the root end was wide open. In this case the effort was made to retain the vitality of the pulp by capping. Eugenol was applied for a week. The exposure was then capped with a wafer of pink base-plate gutta-percha which had been moistened with eucalyptol. A plati-

num half crown was then cemented on. The final outcome of this case has not been reported, although the pulp responded three months after the accident.

The radiograph shown in Figure 1030 is of a girl 10 years old. The incisal ends of both teeth are broken off and both pulps are exposed. The root canals are somewhat narrowed near the apices, but the roots are not completed. Eugenol was sealed in the crown ends of both canals before the radiograph was taken. The pulp tissue was vital at the time and it was not removed. The further history of this case is not known. The pulps probably died, in which case root canal fillings were in order, although it seems doubtful whether the roots will remain indefinitely without causing



FIG. 1029.



FIG. 1030.



FIG. 1031.

sufficient irritation that apical infection will likely occur. Such cases should be checked with radiographs every few months for a year or more and annually thereafter.

Figure 1031 is a radiograph of an untreated case in which the crown of the left central was fractured, exposing the pulp, which died. The root was fully formed and the prompt removal of the pulp, followed by a good root canal filling, might have saved this tooth and its neighbors, all three of which appear to be involved in the abscess that evidently resulted from infection of the pulp of the left central incisor.

FRACTURED ROOT. A very unusual case of a fracture of the root of an upper central incisor is shown in Figures 1032, 1033 and 1034. The case is reported by Dr. Emil Mueller. This tooth was fractured by a blow in September, 1933, when the patient was twenty years old. The patient noticed that the tooth was loose, but it was not painful and he did not see a dentist. Dr. Mueller first saw the case in April, 1934, seven months after the accident, when the radiograph reproduced in Figure 1032 was taken. It shows a transverse fracture, very little above the crest of the



FIG. 1032.



FIG. 1033.



FIG. 1934.

alveolar process, with slight absorption of the edge of the process on the mesial side. The crown was loose and could be moved with the patient's tongue but was not painful. There was a definite response to an electric test for the vitality of the pulp. A splint was, therefore, placed, as shown in Figure 1033. This was removed in November, 1934, having been on about seven months. When the splint was removed, the crown was as firm in its position as that of the other central incisor and the pulp again responded to a vitality test. Evidently the portions of the root on either side of the fracture had been united with cementum.

Class 5. Gingival Third Decays in Labial, Buccal and Lingual Surfaces of the Teeth.

ILLUSTRATIONS: FIGURES 1036-1052.

C AVITIES of the fifth class include those occurring in the buccal and lingual surfaces of the bicuspid and molars—not pit cavities, and in the labial surfaces of the incisors and cuspids. They are, therefore, all smooth-surface cavities. They are infrequent in lingual surfaces. In order of occurrence, these are usually later in life than decays of other classes, although occasionally they occur very early and may appear at any time, depending largely upon the home care. In the molars, these cavities occur in the smooth portion of the enamel to the gingival of the pit, generally in the gingival third of the surface close to the gum margin. They are somewhat rare before the age of sixteen or eighteen, and are oftener seen at from eighteen to twenty-five. When they begin very early, they are difficult cavities to treat. They are not only difficult in themselves, but are coincident with cavities of the other classes, marking very intense susceptibility and complicating the case at an age when the patient is difficult to control.

In all of the teeth these cavities begin close to the gum margin. The distance from the cemental line will depend upon the length of the margin of the gum. When they occur early, the margin of the gum is long and the beginning is some distance away from the cemental line, leaving a good margin of enamel, provided the cavities have not been neglected until they have become so large that the enamel is undermined by decay of the dentin. Some, in which the decay of the enamel is slow, will be placed in better position by the further protrusion of the tooth, or the shortening of the gum margin, and decay will cease before penetration of the enamel has occurred. Such areas will become brown or black with the coming of immunity to the region, and remain as dark spots in the enamel. The exact position of the area of liability in this class of cavities differs considerably at different ages of the patient, being well removed from the cemental line toward the occlusal in the young and close to the cemental line in the adult.

The first appearance of decay in the enamel is usually in the form of a narrow strip of whitening and softening close to, and following, the curve of the border of the gum margin, or just at that point of the surface that is least perfectly cleaned by the fric-

tion of mastication. The extent of the area of beginning decay will correspond with the area of uncleanness of the surface. Occasionally this is quite broad occluso-gingivally, but more generally it is narrow, and not infrequently it is reduced to a mere line less than a millimeter in breadth. Mesio-distally, or along the border of the gum, this line varies much in length, but is rarely less than one-third the breadth of the surface, but more often occupies two-thirds the breadth. The first penetration of the enamel is usually central to this area, but not infrequently extended in a line of minute breaks, which unite, as they enlarge, forming an elongated cavity. Unless cavities have gained considerable size before they are seen, there is always a streak of softened enamel running away from the cavity to the mesial and to the distal, in which the decay has not yet reached the dentin.

In the preparation of buccal and labial cavities for restorations, good management requires that all of the area of uncleanness be removed at once, including, of course, the last traces of softened enamel, no matter how sound and perfect the dentin may be beneath. When cavities are properly extended, these restorations are almost as certain of long endurance as restorations in occlusal cavities. The main point in their successful treatment is the careful study of the local conditions in relation to susceptibility and so preparing the cavity as to meet these conditions. This becomes a matter of judgment in each individual case, and upon this judgment success or failure depends. It is safer to cut a little too wide than to fall a little short.

The greatest difficulties are met with when these decays occur in the teeth of young persons. In such cases the teeth are more apt to be hypersensitive and the patient difficult to control. The requirements for extension of the cavities are much greater than in older persons. The susceptibility to decay is greater. More time must elapse before there is relief by the coming of immunity, and for these reasons more is required of the restoration. Also the margin of the gum is long in young persons and becomes shorter as age advances, and if these cavities are not extended well to the gingival, the gingival margin will become uncovered by the normal recession of the gingivae. Under such conditions recurrence of decay along this margin is certain if the susceptibility continues and good cleanliness is not maintained.

When these cavities occur in numbers, with many proximal decays that interfere with chewing food, and are neglected, the conditions become the worst that are met with in dental practice. Such conditions are very infrequent, as a result of the general improvement in mouth hygiene. These patients usually eat food of the softest variety, often mostly starchy foods; cleaning by mastication fails, artificial cleaning is entirely neglected, cavities of decay are filled with fermentable material, hyperesthesia is greatly increased, and gingival third decays become general. All buccal

or labial cavities should be fully opened by removing overhanging enamel, and left as wide open as possible in order to admit free washing, both in artificial cleaning and by the saliva, for a few days. The softened dentin should then be removed with very sharp spoons, in most cases with one single deep sweep of the instrument for each cavity. Restorations should be made with zinc phosphate cement to remain for several months until the hypersensitiveness has subsided.

Prevention and Immunization; Gingival Third Decays

CARE BY THE PATIENT. The most effective preventive treatment for decays of this class is the daily attention by the patient in the use of the tooth brush. The full area of liability of every surface may be cleaned with the brush, except in very occasional cases of individual teeth, and the dentist should be ever watchful of the patient's care.

AMMONIATED SILVER NITRATE. This solution may be effectively used to immunize beginning decays of this class in the posterior teeth. If the areas are dried in making examinations, a beginning decay of the enamel will appear as a white line or band of greater or less length to the occlusal of and parallel to the margin of the gingiva. In some cases these areas may be kept dry by packing the mouth with gauze rolls, in others a rubber dam should be applied. The latter method is generally to be preferred.

Restorations; Gingival Third Decays.

Cavities of this type in the lingual surfaces of the teeth are so infrequent that mention of them seems to be all that is necessary. The differences in position call for some differences in instrumentation between these and similar cavities of the buccal and labial surfaces. While the principles of their preparation are the same, the lingual surfaces are awkwardly situated for the use of instruments and often call for differences in the particular instruments employed.

These cavities are all on surfaces that are freely exposed to view and are without natural covering of any kind. They begin in the enamel, close to the line of the free margin of the gum. All are inclined to spread on the surface of the enamel in directions along the gum margin either way from the starting point. This fact forms the real key to the extensions necessary for the prevention of further spread of decay in all cavities of this class. Therefore, in the treatment of gingival third cavities, all principal extensions must be in a direction along the free border of the gum.

In many cases the line of whitening of the enamel is very narrow and may extend from mesial to distal along the gum line almost to the angles of the tooth before there is any sign of the falling away of enamel rods, forming a cavity. Sometimes the enamel is very white and easily seen before the teeth are cleaned and dried, and may be of the consistency of chalk in some parts of the surface. In other cases there is a central cavity through the enamel before there is much spreading of the whitened area. These cavities are apt to be very sensitive for the reason that the preparation of practically the entire cavity is most advantageously done with a bur in the most sensitive portion of the dentin, which has been only very slightly affected by caries.

Single cavities — several at one appointment — may be desensitized with Hartman's solution. The rubber dam should be in place to protect the gingivae from the caustic action of this solution.

Whenever a patient has a considerable number of decays of this type, the first effort should usually be to sufficiently prepare all of the cavities and place temporary restorations to relieve the sensitiveness, thus permitting the patient to brush these surfaces properly and to use the teeth vigorously in chewing. In such cases it may be best to use a procain nerve block for the lower teeth, or infiltration for several upper teeth, and prepare all the cavities in each anesthetized area at one time. Temporary restorations may be made with gutta-percha, with copper or zinc cement, or with a special cement composed of oxide of zinc and eugenol. These may be replaced with permanent restorations at a time to suit the convenience of the patient, using Hartman's solution to desensitize each of them for the completion of the cavity preparation.

OXIDE OF ZINC AND EUGENOL CEMENT.* This cement, which has been used for many years as a temporary restoration in sensitive cavities, consists, by weight, of 10 parts of chemically pure zinc oxide and $1\frac{1}{2}$ parts of pulverized yellow resin. The liquid used is eugenol. Resin hastens the setting and makes the cement somewhat harder. As this is mixed to a pasty consistency, a few fibres of cotton may be incorporated into the mix to act as a binder and facilitate its removal from the cavity. The mouth may be packed with cotton rolls and the cavity should be thoroughly dried. The cement should be packed into the cavity with a suitable amalgam condenser. It is desirable to apply a little dry powder on the end of the instrument to prevent the cement from sticking to it. The saliva should then be allowed to come in contact with the cement to hasten its setting. It may then be trimmed to form with sharp instruments. To remove the cement, a groove should be cut with a bur and it may then be lifted out with an excavator.

*Dr. S. Blair Luckie, *Dental Items of Interest*, 1898, vol. 20, p. 490.

GINGIVAL THIRD DECAY, UPPER FIRST MOLAR; GOLD FOIL.

Four gingival third areas were marked on William Fisher's examination card at the age of 24; they were on the buccal surface of the upper left first and second bicuspids and first and second molars. There was an actual cavity in the first molar; the other three teeth were slightly etched and were not noticeable until they were dry. He was handed a mouth mirror and the areas were pointed out to him. He was told that it would be necessary to make a restoration in the first molar, but he might prevent further progress in the other teeth by properly brushing them thoroughly twice each day.

After the rubber dam was applied the second bicuspid and second molar were immunized with silver nitrate. The etching of the first bicuspid was a narrow line which could be controlled with proper brushing.



FIG. 1036.

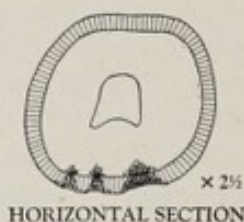


FIG. 1037.

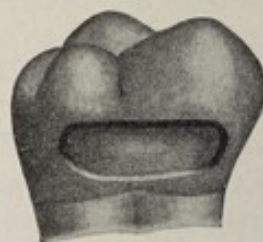


FIG. 1038.

The decay in the buccal surface of the first molar was typical of the beginning decays in gingival third positions. Figure 1036 shows the condition of the enamel at this stage, with the rubber dam in place and the tooth dry. At three points within the line of injury from mesial to distal, some enamel rods had fallen away. The surrounding enamel was of a whitish gray color, fading out at the margins into the normal color of the teeth.

APPLICATION OF RUBBER DAM, HATCH CLAMP. A number 18 clamp was placed on the second molar and the rubber dam was applied from the second molar to the first bicuspid. The hole for the first molar was punched slightly out of line to the buccal, as illustrated in Figure 552 for the first bicuspid, so that the rubber might be stretched to the gingival without being pulled away from the neighboring teeth. The third molar was fully erupted, and the distal edge of the hole which had been placed over the clamp, overlapped the distal surface of the second molar. A ligature was placed to the distal of the bow of the clamp and drawn mesially to the position of the distal surface of the second molar. The flap of the rubber was pushed distally to the position of the contact with a beaver-tail burnisher and was drawn into the interproximal space

with the ligature. The clamp was then removed in order that a Hatch clamp might be placed on the first molar, to hold the rubber away from the gingival margin of the cavity. The technic of placing the clamp is described in a previous chapter.

DESENSITIZER. After it was certain that the rubber dam was tight about the teeth over which it was applied, Hartman's desensitizer was applied to the largest of the decayed areas. In doing this, a pellet of cotton, not much larger than the area of decay, was used and most of the solution was expressed from it before it was applied to the tooth. This was done in order that there would be no excess to spread to the gingival area and possibly come into contact with some portion of the gingivae, which might be exposed along the margin of the rubber. There was no pain when the bur first entered the dentin, but the patient complained when the bur approached the distal extremity of the area. Another application was made and the remainder of the cavity was prepared without pain.

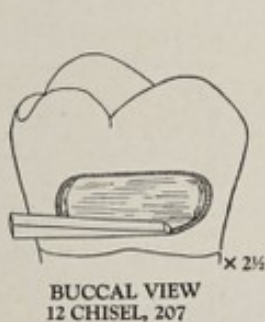


FIG. 1039.



FIG. 1040.

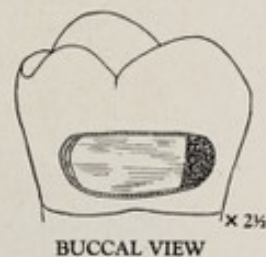


FIG. 1041.

OUTLINE FORM. Figure 1037 is a horizontal section of this tooth, showing a very slight involvement of the dentin in three places, where caries had penetrated the enamel. The undermined enamel was not to be considered in preparing outline form in this case as it was much less extensive than the surface involvement. Therefore, the usual procedure of breaking down unsupported enamel could not be followed. However, the cementing substance had been dissolved from between the rods to varying depths and most of this chalky enamel was removed with the 15-8-12 spoons, making two or three cuts with heavy pressure. A 1 mm. inverted cone bur was then placed in about the center of the cavity, at right angles to the buccal surface. It was first pressed into the dentin and then laterally to the mesial and then to the distal, forming a slot to the full extent of the whitened area of enamel and a little beyond. Further cuts were made to the occlusal and to the gingival of the first, also at the mesial and distal extremities of the cavity, to include the entire area of liability to decay. All of this was done

in a series of short cuts to avoid heat from friction. Undermined portions of the enamel were chipped away and the walls were made smooth with straight chisel 18.

The gingivae had already receded to about the normal position for the age of the patient, 20 years, yet the margin was placed well under the margin of the gingiva, in order that a little further recession, which would probably occur with advancing years, would not expose the enamel to the gingival of the restoration. See Figure 1038.

In considering the application of the principles of extension for prevention in cavities of this class, attention is called to the fact that the outline of the cavity in this surface would have been the same if the area of decay and the extent of the whitened enamel had involved only the central third of the surface from mesial to distal. Unless the full area of liability to decay is included in the outline of the cavity, colonies of organisms will become established on the surface of the restoration and will grow beyond the mesial and distal margins and decay will begin in those positions.

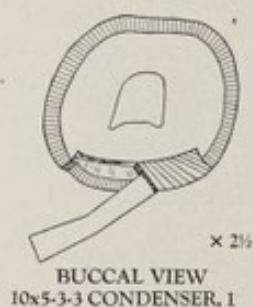


Fig. 1042.

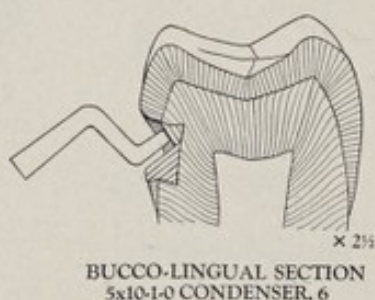


Fig. 1043.

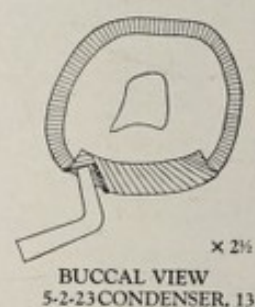


Fig. 1044.

RETENTION FORM, STARTING POINTS. The inverted cone bur was again used to secure retention form by making undercuts along the axio-gingival and axio-occlusal line angles. Starting points for anchoring the first pieces of gold foil were made in the axio-disto-gingival and axio-disto-occlusal point angles.

There are two advantages in making the principal retention form in these cavities by undercutting the occlusal and gingival walls, rather than at the mesial and distal extremities of the cavity. As the gold is condensed it is progressively made secure between the occlusal and gingival walls, and in cases in which the extension to the mesial or distal might fail to include the full area of liability and there should be a recurrence of decay, an additional small restoration may be made without disturbing the retention of the first restoration.

The carious dentin had all been removed and there was no special requirement for convenience form.

FINISH OF THE ENAMEL WALL. The gingival and occlusal walls were finished, including the bevel of the cavo-surface angle, with the straight chisel 12, cutting from mesial to distal. See Figure 1039. The distal wall was finished with the same instrument with a scraping motion. For the mesial wall, the 15(95)-8-12 margin trimmers were used as shown in Figure 1040. This wall might have been finished with a binangle chisel 12-6-6.

PLACING THE RESTORATION. The first pieces of gold were anchored in the axio-disto-gingival angle and it required the addition of only a few pieces to build along the short distal wall to the axio-disto-occlusal angle. See Figure 1041. As soon as the distal margin was covered, the gold was built mesially, being condensed into the undercuts along the axio-gingival and axio-occlusal line angles as it progressed. The parallelogram condenser 10x5-3-3 was used to condense the bulk of the gold, as illustrated in Figure 1042, a change being made from time to time to the parallelogram bayonet 5x10-1-0, by which a better direction of force was obtained for adapting the gold to the occlusal wall. See Figure 1043. The adaptation to the short mesial wall was obtained with the hand pressure condenser 5-2-23, as shown in Figure 1044.

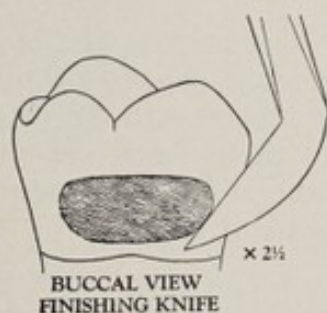


FIG. 1045.



FIG. 1046.

FINISHING. The restoration was trimmed to form with finishing files and fine stones. The finishing files were used first to make the surface of the gold smooth and to trim away most of the excess gold which overlapped the margins. The restoration was then trimmed to approximately its final form with fine grit stones. The excess of gold remaining along the gingival margin was trimmed with a gold finishing knife. See Figure 1045. Disks were used for the polishing, the contra-angle hand piece being used to apply the disks at the best angles along the gingival and mesial margins. The finished restoration is shown in Figure 1046.

RESTORATION WITH AMALGAM. The cavity, as prepared, would be suitable for a restoration with amalgam, except that the starting points would not be required. As amalgam is condensed into cavities of this form, the best adaptations are secured if considerable

pressure is maintained on the entire surface of the restoration, or as nearly the entire surface as may be practicable. If the restoration is large, two condensing instruments may be used, or one condensing instrument and any other heavy flat instrument with which pressure may be conveniently made. The pressure should be direct, without lateral movement. The surface should not be burnished while the amalgam is plastic, as a burnishing movement would be likely to draw the amalgam away from one wall while pressing it against the opposite wall.

RESTORATION WITH GOLD INLAY. Two modifications should be made in this cavity for a restoration to be made with a gold inlay. The axial wall should be cut a little deeper to give better retention and the surrounding walls should be inclined outward. As decays of this type are larger, gold inlays or amalgam are generally preferred. When lateral decay in the dentin has extended so far to the gingival that a rubber dam may not be placed, it is always questionable whether the gingival wall can be kept dry while placing an amalgam restoration, and the chances of success favor the use of a gold inlay.

GINGIVAL DECAYS, LOWER BICUSPIDS; GOLD FOIL.

When gingival third decays occur in the cuspids and bicuspid, gold foil should generally be the restoration of choice, except in the case of those decays in the upper teeth where esthetic considerations contra-indicate its use. Cavities in these teeth are prepared in the same manner as described for the upper first molar and the technic of placing the restoration is identical.

GINGIVAL DECAY, UPPER INCISOR; PORCELAIN INLAY.

For an unexplainable reason, a decay was present in the gingival third of the labial surface of the upper left central incisor when Miss Brown's teeth were examined just before her twenty-third birthday. While she had continuously been susceptible to caries, she took excellent care of her teeth and had been faithful in returning for periodic care, yet this decay had apparently occurred since the previous examination, about seven months before. Possibly the area was etched at that time, but was overlooked. It is oftentimes impossible to see an etched area unless the tooth is thoroughly dry.

A few enamel rods had fallen away in the central portion of the whitened area, forming a cavity. In this particular case the cavity was mostly to the mesial of the central line of the tooth. See Figure 1050. This occurs in a good many cases, but the greater number spread about as much to the distal as to the mesial and follow the free border of the gum in the form of a crescent.

APPLICATION OF RUBBER DAM. In order to use Hartman's desensitizer, the rubber dam was applied over the six upper anterior teeth, the hole for the upper left central incisor being punched a little to the labial of the line of the other holes, and with a slight extra space between it and the holes for the teeth on either side, to be certain that it would not expose the gingivae when it was drawn beyond the gingival margin of the cavity. The Hatch clamp was then adjusted.

DESENSITIZER. Hartman's solution was used. The crowns of the several teeth were dried by swabbing them with cotton. A small pellet of cotton, *very slightly moistened* with the solution, was applied to the decayed area. It is essential that none of the solution be allowed to escape on the surface of the enamel, on account of the danger of injury to the soft tissues. The cavity was prepared without discomfort to the patient, except when the bur approached the distal margin of the surface, where it was slightly painful. A second application was not made.

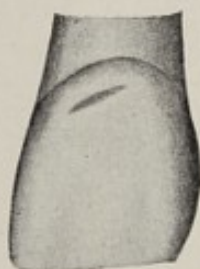


FIG. 1050.

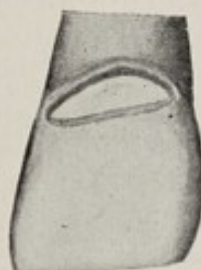


FIG. 1051.

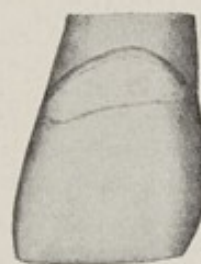


FIG. 1052.

OUTLINE FORM. The partially decayed enamel in the central area was removed almost entirely by one or two sweeps with a 15-8-12 spoon. There had occurred no lateral decay of consequence in the dentin and for this reason, no special consideration was given to it as it would all be removed in preparing the outline and retention form. A 1 mm. inverted cone bur was placed in the center of the area with its end perpendicular to the axial wall, and cuts were made, first to the distal, then to the mesial, to the full extent of the vulnerable area. The cavity was then extended gingivally in order to place that margin where it would be covered by the gingiva, also incisally to include all of the etched enamel, but no farther. Following each cut the enamel was chipped away with straight chisel 12, with which the enamel walls were all prepared with an outward inclination, corresponding to the direction of the rods. No extension toward the incisal was required because there is little or no disposition for decay to occur in that direction. See Figure 1051.

RETENTION FORM. For this cavity, retention form was made with a 1 mm. fissure bur, held at right angles to the labial surface

of the tooth and moved around the cavity clockwise to give all walls a slight outward inclination, and make the line angles sharp where the surrounding walls met the axial wall. The depth in the dentin was increased as much as the safety of the pulp would permit to give better retention for the porcelain restoration, and the central portion of the axial wall was cut to the same depth as the other parts of this wall with binangle chisel 12-6-6. This depth of the cavity provided for greater bulk of porcelain and reduced the danger of breaking the inlay when pressing it to place.

FINISH OF THE ENAMEL WALL. A gauze roll was placed under the upper lip in order that the tooth might be dried with warm air to be certain that there were no whitened areas of enamel which had not been included in the cavity. This also gave better opportunity to see the condition of the enamel walls in finishing them. The enamel walls were trimmed smooth with chisels 12 and 12-6-6, but the cavo-surface angle was not beveled. However, the mesial and distal enamel walls were made smooth at angles slightly more inclined outward than the direction of the rods.

RESTORATION WITH PORCELAIN INLAY. The technic of making a porcelain inlay for a gingival third cavity in the labial surface has been described and illustrated in the chapter on the manipulation of materials. See Figures 483 to 486, inclusive, with accompanying descriptions. After etching the cavity side with hydrofluoric acid, the inlay was first tried in the cavity to be certain of the fit, also to examine its surface contours and margins in relation to the surface of the tooth. It was found necessary to grind a little from the surface along the mesial margin and the inlay was returned to the electric furnace for reglazing. It was then cemented to place, using a zinc phosphate cement. The cement was mixed thin, and the inlay was very gradually pressed into place by rocking it back and forth, gradually displacing the excess of cement. Two small pieces of soft wood were used to maintain pressure on the porcelain until the excess of cement on the surface of the tooth had become hard. The restoration is shown in Figure 1052.

If pressure is not maintained until the cement sets, the inlay will usually rise a little out of the cavity, slightly opening the margins, which will result in early discoloration as a result of the gradual washing out of the cement.

GINGIVAL DECAY, UPPER INCISOR; SILICATE CEMENT.

A gingival third decay in the labial surface of the upper left central incisor was recorded when Miss Gertrude Wilson appeared for her first examination at the age of twenty-two. See Figure 1135. A large silicate restoration had been previously placed in the mesial surface of this tooth and it was therefore decided to make the gingival restoration of the same material.

CAVITY PREPARATION. The preparation of this cavity was practically the same as for the porcelain restoration for Miss Brown. There were three points of difference: A fissure bur was not used to so cut the surrounding walls that they would be inclined outward; instead, the mesial and distal walls were left with a slight undercut made by the inverted cone bur, and the incisal and gingival walls were undercut a little more to obtain good retention form. The cavity was not cut so deep, as that would be of no advantage in view of the retention form just mentioned.

RESTORATION. A rubber dam was placed, also a Hatch clamp as illustrated in Figures 589 to 593. The cavity was then filled with inlay wax, which was trimmed to the proper labial contour of the tooth. This wax, and the labial surface of the tooth, were moistened with cocoa-butter, and an impression of the entire labial surface was made with modeling compound. In doing this, the round end of an ordinary pen was trimmed on either side, leaving a slight projection in the center, which could be placed against the gingival enamel of the tooth, between the points of the Hatch clamp. The pen was bent in the direction of the convex side, to make an acute angle of about 12 centigrades at the junction of the pointed portion and the end that is ordinarily slipped into the holder. The pointed portion was used as a handle. Modeling compound was then melted into the concave side of the part with the rounded end, and an impression was taken of the labial surface of the tooth, including the wax, by placing the end projection between the points of the Hatch clamp and pressing the modeling compound against the tooth. This was held in place for about three minutes. The modeling compound was removed with the pen. The inlay wax was then removed from the cavity and the silicate cement was placed without much excess over the amount necessary to fill the cavity. The modeling compound was then replaced and held firmly against the labial surface with the pen until the cement had set.

When the compound was removed, it was found that only a very thin film covered the enamel immediately around the restoration. This was removed with a finishing knife, which was also used to trim away an extremely slight excess of cement along the gingival margin. After another five minutes the restoration was covered with a film of varnish prepared for the purpose and the patient was dismissed.

The Adult Period

ILLUSTRATIONS: FIGURES 1061-1128.

THIS period has been arbitrarily set to begin about the twenty-fifth year and continue throughout the life of the individual. The most prominent clinical aspects of this period are: (1) lessened susceptibility to caries; (2) periods of unusual susceptibility; (3) neglected decays, (4) the repair and replacement of operations; (5) secondary extensions of decay of proximal surfaces, due to conditions which permit lodgments of food between the teeth, including the movements of teeth following extraction or after the placing of restorations, and broad flat contacts; (6) excessive wear of proximal surfaces of the teeth and of restorations; (7) movements of teeth due to uneven occlusal wear; (8) inflammations of the supporting structures, which may prevent the maintenance of proper contacts and thus induce decays by food lodgments; (9) excessive recession of the gingivae and alveolar process, often followed by caries close to or beyond the cemental line; (10) erosion, which may provide opportunity for new decays in eroded areas; (11) abrasion of the teeth, which occasionally progresses until the entire occlusal or incisal enamel is lost.

The special conditions under which caries occurs are very different from the early adult years and the treatment is also different. Prevention consists mainly in the early discovery and correction, whenever possible, of those conditions which induce new decays.

For decays of the same types as occur in the young adult period, there are no differences of consequence in the general plans of preparing cavities and making restorations. The teeth of most adults are less sensitive and from almost every viewpoint the performance of the operations is easier for both patient and dentist.

SUSCEPTIBILITY. The large majority of persons develop a considerable immunity to caries between the ages of twenty and thirty, which increases as time passes. They seldom have more than an occasional new decay, except as the result of conditions peculiar to this period. A limited number will continue for years with a moderate degree of susceptibility, while a few will show no change from the susceptibility of the childhood period.

The advance in immunity with the years becomes more apparent

when adult patients are further classified into several age groups. For each older group, there are found fewer decays of the type found in early adult life and a larger percentage of decays occurring as the result of conditions peculiar to persons of advanced age. An analysis of these conditions makes it apparent that the masticating mechanism is in fact a machine that is subjected to hard use day after day—every day—year after year; that it has certain parts that wear and require adjustment, and may eventually break down completely as a result of wear or neglect, or both.

In an occasional case there will occur a rather sudden change from comparative immunity to a high degree of susceptibility. This may occur following a severe illness, a period of mental stress due to financial or other worries, or as a result of other conditions which upset the normal bodily functions. Women are often more susceptible during and after pregnancy. It has been the experience of many dentists in recent years that their patients, both men and women, who suffered severe financial losses during the world depression, had become more susceptible to caries, apparently due in part to worry and in part to neglect of the customary care of their mouths.

Persons who have enjoyed a high degree of immunity throughout the young adult period, which has continued for years afterward, may have many pits and fissures which have not decayed. These are usually much darkened or actually black. This dark color occurs where some slight softening of the enamel has taken place earlier, and is often mistaken for active decay. It is rather an evidence of immunity. But there may be an active area of decay beneath this dark coloring, and this must be determined by the explorer. While the dark color is evidence of conditions unfavorable to decay, decay having begun, may be continuing. Very many pits show evidence of some slight softening in early youth, which is stopped by the coming of immunity or some change of local conditions. Then these become dark in color and so remain without further change. These should not be interfered with, as they are just as safe without any restoration.

Patients from twenty-five to forty years of age, often present themselves with a number of slowly progressive proximal cavities in the bicuspid and molars, or cavities in which restorations have failed. They require little else than the careful performance of routine operations after a study of the conditions upon which the rules of extension for prevention should be applied in individual cavities.

Proximal areas in the anterior teeth follow much the same course as those in the molars and bicuspid. There is an occasional new decay which progresses slowly, but offers no particular

problem in its care. A restoration may occasionally fail, because the wear of the incisal edge may expose the incisal retention.

Gingival third decays occurring during the adult period may be divided into two groups; those that occur in the enamel while the gingivae are comparatively normal, and those occurring after a considerable recession of the gingivae. The former present no difficulty in treatment, unless they are neglected until lateral decay in the dentin has undermined enamel close to the cemental line, or has possibly undermined more or less of the cementum, so that the cavity extends considerably beyond the margin of the gingiva. The second group present the difficulty of maintaining dryness, also the probability of recurrence of decay as the recession of the gum continues.

Prevention and Immunization; Adult Period

MAINTENANCE OF CONTACTS. In the presentation of cases and the discussion of conditions which contribute to secondary decays of proximal surfaces and cause injury to the interproximal tissues, consideration is given in this chapter to the *correction* of these conditions by the establishment of proper contacts and embrasure widths. Much can be accomplished in the prevention of the decays that are peculiar to this period, which in the main result from either natural or induced recessions of the gingivae. These conditions are less likely to occur if the teeth have had good care during the childhood and early adult period, particularly in the matter of *maintaining* contacts. Extensive clinical experience is necessary to appreciate the almost continuous attention that must be given to this problem in the mouths of most persons as they grow older. Many mouths will come to require more attention to contacts, as a matter of preventing disease of the soft tissues, than in relation to caries. A patient may be dismissed with all contacts in good order, only to find six months later that a change has occurred which has resulted in one or more weak contacts. There is opportunity for much ingenuity in meeting the many situations which present and good judgment is required to determine whether or not an operation to restore a contact is likely to be successful. Systematic plans, which may be effectively employed, are presented elsewhere.

IMMUNIZATION WITH SILVER NITRATE. When the susceptibility of the childhood period persists or when there is a change from the comparative immunity of the adult period, silver nitrate should be used as previously described for proximal and gingival third areas, and particularly for decays occurring because of recession of the gingivae. In cases of general recession of the gingivae, there may occur a succession of decays, involving many teeth, which are extremely difficult to manage by placing restorations. This is due

to the fact that the continued recession exposes more and more of the enamel or cementum beyond the gingival margin of the restoration and new decays occur. When these decays are discovered early, they may be successfully treated with silver nitrate.

Restorations; Adult Period

PERIODS OF UNUSUAL SUSCEPTIBILITY. Recurrences of susceptibility after comparative immunity has become established, are seen in occasional cases, also rather rapid changes from lifelong immunity to high susceptibility, which are usually temporary. During the childhood period the large majority of persons are susceptible in greater or lesser degree and the immune child is the exception. In the adult period, the tendency is toward a reversal of conditions and the very susceptible person becomes the exception. Persons who have developed a considerable immunity or who have always been on the immune side may rather suddenly become highly susceptible and require the attention of the childhood period. Two cases will be reported.

SUSCEPTIBILITY OF PREGNANCY; CASE REPORT. Patient Mary Brown was married at twenty-four and her future record appears under the name of Mrs. Mary Horner. Her first baby was born two years later. She reported her condition at about the fourth month, the occasion of her recall for examination, and her mouth was in excellent condition. She was cautioned to be especially faithful and thorough in the brushing of her teeth. She was on a diet regimen prescribed by her physician. However, at the next visit, three months after the birth of the baby, the gingival third areas of the buccal surfaces of practically every bicuspid and molar showed a streak of whitened enamel parallel with the margin of the gingivae. Some of the enamel rods had fallen away in the upper left first and second molars and the lower left first molar. There were also two proximal decays—distal of the upper right second bicuspid and distal of the upper left first molar. When these cavities were partly prepared and the rubber dam was applied, an inspection of the adjacent surfaces of the approximating teeth revealed slight beginning decays of the enamel and both were treated with silver nitrate. Silver nitrate was also applied to all other proximal surfaces in which restorations had not been previously placed, and to all gingival third areas in the bicuspids and molars, except the upper bicuspids, which were very slightly etched and were visible only when dry. The patient's attention was called to all of the gingival third areas and she was urged to pay especial attention to their thorough brushing.

The question may be raised whether gingival third decays, occurring during and immediately after pregnancy, may result primarily from interruption of the usual routine of thorough brush-

ing, due to the multitude of new duties and diversions which command the attention of the mother during this period or to actual changes related directly to pregnancy. When no other decays occur, it may be fair to presume that lack of attention is a considerable factor. However, the occurrence of several new decays in proximal surfaces, is a rather definite indication of an increase in susceptibility due to the pregnancy.

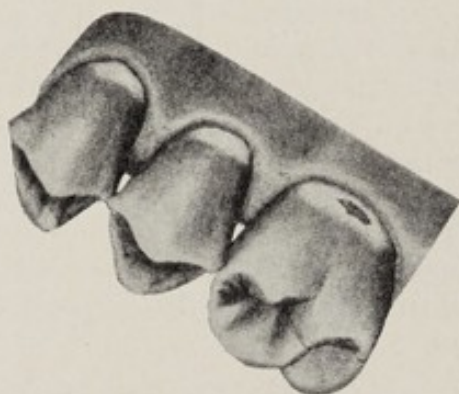


FIG. 1061.

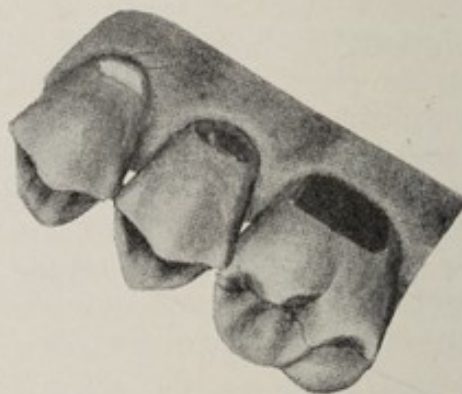


FIG. 1062.

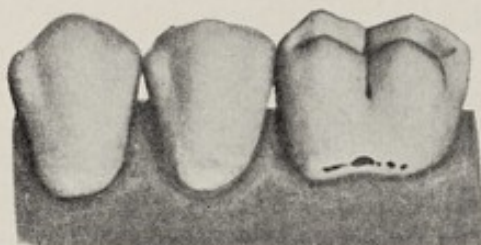


FIG. 1063.

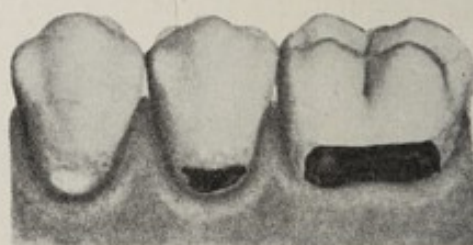


FIG. 1064.

The treatment of the bicuspids and first molars on the left side is illustrated. Figure 1061 represents the condition of the upper bicuspids and first molar, Figure 1063 the corresponding lower teeth. The white areas on the upper bicuspids were not apparent until the enamel was dried with an air blast; an explorer would glide over the surfaces. The condition of the lower bicuspids was practically the same although the whitened areas were smaller. Some of the rods had fallen away in the central area in both the first molars. Silver nitrate was applied to all of these areas except the first bicuspids, which were entrusted to the care of the patient. The application of the silver nitrate to the molars was to obtund the sensitiveness of these teeth, and the preparation of the cavities was delayed for about a month. After treatment, the teeth appeared as in Figures 1062 and 1064.

The patient's attention was called to the importance of the inclusion in the diet of foods which required vigorous mastication as an important factor in reducing her susceptibility to caries. No new decays were discovered at the next examination four months later.

Fisher, William 6212 S. Harrison St.
 NAME NUMBER 2627 RES. TEL. South 1146 NPIR ADDRESS Chicago. 21
 BUS. TEL. Cen. 6742 EXAM. NO. 11-12-38
 AGE 38 DATE May 39
 NEXT EXAM

Susceptibility following severe typhoid, fall of 1937

OCCUSION N
 123 PATIENT CARE
 REFERRED BY
 REPORT TO

CARIES 123
 123 GINGIVAE

FIG. 1065. Twenty-first examination for William Fisher: Patient No. 2627, age 38; report of severe illness with typhoid fever about a year previously; occlusion normal, patient care fair, susceptibility high, gingivae moderately inflamed; deposits of salivary calculus on lingual surfaces of lower incisors and cuspids and upper left first and second molars. Decays: mesial surface upper right second molar, mesial and distal of upper right lateral incisor, mesial surfaces of both upper central incisors, distal of upper right central and mesial of lateral incisor, mesial and distal surfaces of both upper left bicuspids and mesial of first molar, mesial of both lower right bicuspids. The pulps were exposed in the upper left second bicuspid and in the lower right second bicuspid. Previous operations were checked and a full set of radiographs was made. See chapter on oral diagnosis in Volume I for explanation of chart.

FIG. 1065. Twenty-first examination for William Fisher: Patient No. 2627, age 38; report of severe illness with typhoid fever about a year previously; occlusion normal, patient care fair, susceptibility high, gingivae moderately inflamed; deposits of salivary calculus on lingual surfaces of lower incisors and cuspids and upper left first and second molars. Decays: mesial surface upper right second molar, mesial and distal of upper right lateral incisor, mesial surfaces of both upper central incisors, distal of upper right central and mesial of lateral incisor, mesial and distal surfaces of both upper left bicuspids and mesial of first molar, mesial of both lower right bicuspids. The pulps were exposed in the upper left second bicuspid and in the lower right second bicuspid. Previous operations were checked and a full set of radiographs was made. See chapter on oral diagnosis in Volume I for explanation of chart.

SUSCEPTIBILITY FOLLOWING TYPHOID FEVER, CASE REPORT. At 38, William Fisher had been practically immune for more than ten years. During that period, he had been on a yearly recall list, without requiring other service than the removal of slight deposits of salivary calculus and cleaning. He was taken sick with typhoid fever about the time when he should have returned for periodic care, and, after a severe illness, was sent to California for several months. He regained his normal health and vigor very slowly and postponed his return for dental examination until more than a year had elapsed—two years after his previous examination. He complained of pain in the upper jaw, which he could not locate in a particular tooth. The examination revealed fourteen cavities of decay, and two pulps were found to be exposed by caries. In addition, there were three gingival third areas in molars that were treated with silver nitrate. The examination record is shown in Figure 1065.

Because of the pain on the upper left side, the cavities in the teeth in that region received first attention. The treatment of the upper left bicuspid and first molar will be reported. They are illustrated in Figure 1066. There were large proximal decays in the mesial and distal surfaces of the first and second bicuspid and the mesial surface of the first molar. The most extensive decays were in the first bicuspid; both marginal ridges had been undermined, also much of the occlusal surface. The patient had known for some time that there were a number of cavities, but had postponed making an appointment because of his general physical condition. There was a gold foil restoration in the occlusal surface of the first molar, which had been placed when Mr. Fisher was thirteen years old.

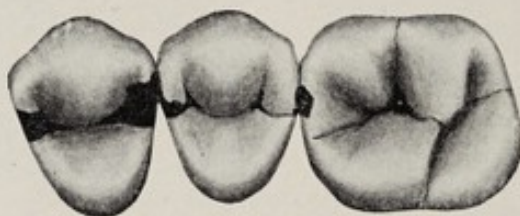


FIG. 1066.

CAVITY PREPARATION. It was decided to begin with the first bicuspid. The openings through the occlusal surface were so large as to indicate that much of the occlusal enamel was undermined. A 1 mm. inverted cone bur was placed in the mesial decayed area and the enamel along the central groove was quickly broken out with two or three cuts. There was much carious dentin underneath, but the two decayed areas — mesial and distal — had not joined. The enamel to the buccal and lingual was split off in large pieces well toward the cusps with straight chisel 18.

A rubber dam was placed at once, from first molar to the lateral incisor, and much of the decay was lifted out with the 15-8-12 spoons, care being exercised to avoid the pulp. It was soon apparent that the pulp was in all probability involved, and since the distal decay was the more extensive, it received first attention. The carious dentin farthest from the pulp was removed without causing pain, then, in an effort to remove that overlying the pulp, the lingual horn was exposed. This caused a sharp pain. The pulp tissue bled freely. A sedative was applied and at the next appointment, the pulp was anesthetised and removed, using pressure anesthesia.

In view of the fact that it might require a number of weeks to make so many permanent restorations as were required, the decay was removed from all other teeth as the next procedure. In doing this, the pulp of the lower right second bicuspid was found

to be exposed by caries and was removed. Silver nitrate was applied to the other bicuspid and molar cavities as an obtundant, and they were filled with pink base-plate gutta-percha, which is very much better to use than the temporary stopping or cement in bicuspid and molar cavities, because it is sufficiently tough that it wears very slowly and maintains tight contacts. Due to Mr. Fisher's physical condition, the placing of the permanent restorations was spread over a period of five months.

The care of the upper left bicuspid and molars was continued at a subsequent appointment. The distal cavity in the second bicuspid appeared to be smaller than that in the mesial surface and for that reason an opening was made through the enamel of the distal pit, cutting slightly to the mesial into a small area of normal dentin. Pressure anesthesia was at once employed to anesthetise this pulp. The bur was then used to connect the mesial and distal decays. The pulp was not endangered and a mesio-disto-occlusal cavity was prepared for a gold inlay. This was accomplished practically without pain.



FIG. 1067.



FIG. 1068.

At the next appointment, the mesio-occlusal cavity in the first molar was prepared. The small gold foil restoration, placed twenty-five years previously, was removed from the central fossa and the cavity was extended slightly along the mesial groove. This was painful. The dentin was desensitized with an application of Dr. Hartman's solution. The bur was then inserted in the mesial area of decay and cuts were made distally to the occlusal cavity. The preparation of the cavity was completed along the same general lines as previously described. Wax patterns were made for the mesio-disto-occlusal cavity in the second bicuspid and the mesio-occlusal cavity in the first molar, using thin copper bands to confine the wax while it was pressed into the cavity in each case.

After the first bicuspid root canals had been filled, the cavity was prepared as shown in Figure 1067, cutting away both cusps to protect the buccal and lingual portions of the crown from being fractured. It will be noted that the entire occlusal surface of the tooth was restored in order that the stress of mastication would come on the gold, as illustrated in Figure 1068.

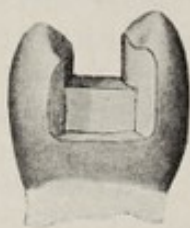


FIG. 1069.



FIG. 1070.

The prepared cavity in the second bicuspid is shown in Figure 1069 and the restoration in Figure 1070. If this preparation had been used for the first bicuspid, from which the pulp was removed, there would have been great danger that a cusp would be broken off, as illustrated in Figure 939.

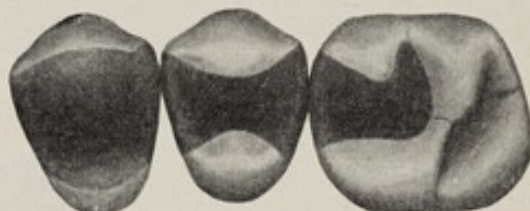


FIG. 1071.

By comparison of the embrasure widths in Figures 1066 and 1071, it will be noted that they are wider in Figure 1071. Of the three inlays, that for the second bicuspid was placed last. After it was fitted to the cavity, a Ferrier separator, with the extra long bars illustrated in Figure 504, was placed with one pair of jaws to the mesial of the first molar, and the other pair to the distal of the first bicuspid. The turning of the adjusting screws moved the first molar and first bicuspid slightly away from the second bicuspid, and contact points were built out on the second bicuspid inlay to hold the space gained by the separator, which was not removed until after the inlay was cemented to place. Thus the contacts from the second molar to the cuspid were all made tight by this operation. The occlusion was immediately tested and very minor adjustments were made by grinding inclined planes to avoid the possible shifting of the lower teeth as a result of the slight change in the position of the upper teeth.

When this mouth was examined about six months after the above mentioned operations were completed, two new cavities were found, and three more within the following two years. After that, complete immunity was regained and no further decays occurred during the next twelve years. The return of his immunity was coordinate with the improvement in his physical condition.

Neglected Decays

Neglected decays are common in the mouths of patients of all ages, unless there is a definite arrangement for periodic recalls by the dentist. Patients who have not accepted the recall plan are inclined to delay making appointments until they have pain and frequently the dentist finds an exposed pulp. These cases were not reported under the young adult period in order to stress the practicability of carrying children through that period without pulp involvement when the arrangement for periodic care prevails. It should be understood, however, that cases of neglected decays are frequent at all ages.

A number of neglected decays, which will be reported, were in the teeth of Miss Gertrude Wilson, for whom the first examination was made when she was twenty-two. At that time three teeth were missing and most of the restorations then in place were large, indicating neglect. In addition, the radiographs showed that two pulps had been removed. She would not allow her name to be placed on a recall list, and did not return until six years later; she had been to another practitioner two or three times in the meantime. Thereafter appointments were made by her at intervals of from two to five years when she had herself discovered a cavity. Apparently, she had been only moderately susceptible most of her life and decays progressed rather slowly. With regular care, all of her teeth should have been conserved without the loss of a pulp.

The restorations made in her teeth by the author for neglected decays are all entered on one chart, which shows the condition of her teeth at the age of forty-eight, see Figure 1135. These operations were made over a period of twenty-five years. A number of operations for neglected decays for a single patient were selected, as these give a better idea of the damage that results to the denture from lack of regular attention.

The following decays are listed on the card: a large occlusal cavity in the lower right first molar, mesial and occlusal decays in lower left second molar with pulp exposed, mesial upper right second molar, mesial upper left first bicuspid, mesial upper right central incisor and distal of lateral incisor.

Miss Wilson's teeth were not very sensitive and all cavities were prepared without attempting to secure anesthesia, except in cases when pulps were exposed.

OCCLUSAL DECAY, LOWER MOLAR; AMALGAM.

Figure 1074 illustrates a neglected decay of the occlusal surface of a lower right first molar, when Miss Wilson was 28 years old. It was not until the enamel about the occlusal pit had been weakened by backward decay and had been broken into the cavity

that she sought treatment. Caries had evidently progressed very slowly as the dentin was yellow-brown. The decay had penetrated every fissure in the occlusal surface and had then undermined the enamel in all directions. Fortunately the decay had not reached sufficient depth to endanger the pulp. The tooth had not been painful at any time.

CAVITY PREPARATION. The cavity preparation was a very simple procedure. Much of the enamel was split off with the 18-9-6 chisel, but some of it was too strong to be easily broken away, although it was undermined. A cut was made along each fissure with a 1 mm. inverted cone bur, and the cavity was cut to proper outline form with the chisel. The lingual groove was very deeply fissured and was opened to the marginal ridge, to find the lingual enamel plate undermined, requiring that the cavity be cut through to the lingual surface. See Figure 1075.



FIG. 1074.



FIG. 1075.



FIG. 1076.

Retention form was obtained with a 1.2 mm. fissure bur in the contra-angle hand-piece, held parallel with the long axis of the tooth, and carried all around the cavity to make the surrounding walls smooth and to square out the line angles of junction with the pulpal wall. A little carious dentin remained near the center of the pulpal wall; this was removed with a 15-8-12 spoon. A 9-3-23 bibeveled hatchet was used to test the condition of the dentin just below the dento-enamel junction and several very small bits of carious dentin were found, which had not been removed in the cutting with the fissure bur. The enamel overlying these extensions in the dentin was cut away.

The rubber dam was applied to the first and second molars and both bicuspid, with a clamp on the second molar, and cement was placed in the central area from which the deeper decay had been removed. The enamel wall was then finished with chisels.

AMALGAM RESTORATION. By using heavy pressure it was possible to force a piece of thin, stiff matrix material through the second bicuspid-first molar contact, and the lingual end was pressed hard against the lingual surface of the molar, to supply a wall where the lingual enamel had been removed, while the amalgam was condensed, in order to secure good adaptation in that portion of the cavity. The finished restoration is shown in Figure 1076.

OCCLUSAL AND MESIAL DECAYS, LOWER MOLAR; AMALGAM.

Miss Wilson made an appointment at the age of thirty-five, when she complained of pain in the lower left jaw, evidently caused by an inflammation of the pulp of the lower left second molar, which had a large cavity, involving both the mesial and occlusal surfaces. The marginal ridge and much of the occlusal enamel had been broken away in chewing. This cavity was filled with pieces of enamel and food debris. Decay had also penetrated the central pit and the distal groove. See Figure 1077.

CAVITY PREPARATION. Most of the occlusal enamel, including the mesio-buccal cusp, was split off in rather large pieces with the 18-9-6 binangle chisel. A bur was not used. There was little doubt but that the pulp would be exposed, therefore the rubber dam was applied at once, using the fifth grasp to place it over a special clamp on the second molar; it included the bicuspid; the first molar was missing. The decayed dentin was removed with the 15-8-12



FIG. 1077.

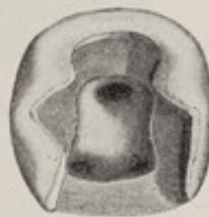


FIG. 1078.



FIG. 1079.

spoons. After as much had been removed as was thought practicable without exposing the pulp, the mesio-buccal horn was approached, as it was presumed that caries had penetrated closer in that region than elsewhere. Most of the decay was cut away to the mesial of the pulp and the exposure was made with a spoon at the mesio-buccal angle of the pulp chamber. The pulp bled a little. Eugenol was sealed in the tooth and at the next appointment the pulp was anesthetised and removed, a fissure bur being used in the contra-angle hand-piece to cut away all dentin overlying the pulp cavity.

After the root canal fillings were made, the pulp chamber was partly filled with cement. The cavity walls were squared up with the fissure bur and the gingival wall was cut in the same plane as the pulpal wall. The enamel walls were smoothly finished and all cavo-surface angles were beveled. Figure 1078 shows the finished cavity, before the cement was placed in the pulp chamber.

AMALGAM RESTORATION. The first molar was missing and it was therefore only necessary to adjust and tie a matrix about the

tooth to supply a mesial wall, against which the amalgam was condensed. The finished restoration is shown in Figure 1079.

MESIAL DECAY, UPPER BICUSPID; GOLD INLAY.

The neglected decay in the mesial of the upper left first bicuspid, illustrated in Figure 1080, was discovered at the same time that Miss Wilson complained of the lower left second molar, although it was more than eight months after the amalgam restorations had been placed in the lower molars when she returned. Decay had undermined the marginal ridge, but the tooth had not been painful. Apparently the decay began because the contact had been weakened by a very slight labial movement of the cuspid, which had allowed stringy foods to catch. The open cavity is shown in Figure 1081.



FIG. 1080.



FIG. 1081.



FIG. 1082.



FIG. 1083.



FIG. 1084.

CAVITY PREPARATION. Figure 1082 illustrates the extent to which the undermined enamel was very easily cut back with chisels. Three cuts were then made with a 1 mm. inverted cone bur, which was placed within the cavity and the cuts were made outward through the enamel, one to the linguo-gingival, one to the bucco-gingival and one following the occlusal groove to the distal pit. The outline and retention forms were completed with chisels and hatchets of 12 and 18 widths of blade. It will be noted that the decay had undermined the enamel of the mesio-buccal angle of the tooth, which was cut away. The restoration, a gold inlay, is shown in Figures 1083 and 1084.

CONTACTS. The contact between the first and second bicuspid was weak, but neither of the proximating surfaces was decayed. When the time arrived to solder the gold on the inlay to form the

contact with the cuspid, a Ferrier separator was placed between the cuspid and first bicuspid and the adjusting bars were tightened sufficiently to close the contact between the bicuspids. This was tested with a ligature and found to be satisfactory. The separator was kept in place, without changing the adjusting screws, while gold was soldered on to make a proper contact with the cuspid, thus establishing tight contacts on both sides of the first bicuspid. After the inlay was cemented to place, the separator was removed and the occlusion tested to be certain that the slight shift of the upper teeth would not disturb the positions of the lower teeth.

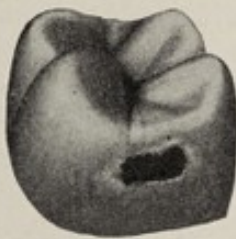


FIG. 1085.

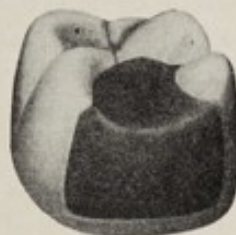


FIG. 1086.

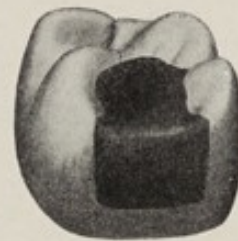


FIG. 1087.

MESIAL DECAY, UPPER FIRST MOLAR, GOLD INLAY.

At the age of 45, Miss Wilson again reported with a neglected decay which had exposed the pulp of the upper right first molar. The procedure was the same as reported for the lower left first molar.

In this case the contact with the second bicuspid was very broad as shown by the surface decay in Figure 1085. The whitened area to the buccal and lingual of the cavity marked the full width of the vulnerable area. However, in this case, the lateral decay in the dentin had gone much farther and it was necessary to prepare the cavity almost to the buccal and lingual angles of the tooth, as illustrated in Figure 1086. If this cavity had been discovered earlier, the restoration would have been as shown in Figure 1087, and the pulp would have remained vital.

PROXIMAL DECAYS IN INCISORS; SILICATE CEMENT.

When Miss Wilson was twenty-two, there was a large cavity in the mesial surface of the upper right central incisor. At that time there was also a very large restoration of silicate cement, the surface of which had washed away a little, in the mesial surface of the left central. A silicate cement restoration was placed in the right central at that time.

When Miss Wilson returned at the age of 28, both of these restorations had washed sufficiently to open the contact so that

food wedged between these teeth at each meal. The left central was decayed to the gingival of the silicate, and, after the cement was removed, it was discovered that the pulp was exposed. The pulp was removed and a root filling was made in due time.

New silicate restorations were made in both teeth. Figure 1088 illustrates the condition of the left central after the silicate cement had been removed and a little of the undermined enamel had been cut away. The prepared cavity is shown in Figure 1089 and the silicate restoration in Figure 1090.

Five years later when Miss Wilson was thirty-three, both of these restorations were replaced; this was the third restoration for the left central. There was no decay of consequence, but the cement had washed sufficiently to leave a definite ledge along the margins. The contact between the right central and lateral was weak and the proximating surfaces of both teeth were decayed. Silicate restorations were placed in treatment of these.



FIG. 1088.



FIG. 1089.

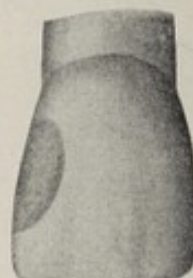


FIG. 1090.



FIG. 1091.



FIG. 1092.



FIG. 1093.

DISTAL DECAY, UPPER INCISOR; SILICATE CEMENT.

Miss Wilson returned for her next examination four years later, when there was a surprisingly large decay in the distal of the left lateral incisor. The left central incisor, from which the pulp was removed, had become a little darker than its neighbors; the silicate cement had changed to a still darker shade and had washed out about as before. The appearance of the tooth was objectionable, and a porcelain jacket crown was made for it. Notwithstanding her experience with this tooth, she insisted that

silicate cement be used for the lateral incisor, which was already far too large for a gold restoration. Figure 1091 illustrates the decay, Figure 1092 the prepared cavity and Figure 1093 the restoration.

When Miss Wilson was forty-eight, porcelain jacket crowns had been placed on both upper central incisors and silicate cement replacements were being made about every five years in the left lateral and the mesial surface of the right lateral.

The restorations, which had been placed in Miss Wilson's teeth by the author, up to the time she was forty-eight, are shown on the chart, Figure 1135. The teeth with root-fillings and those extracted, are also indicated.

Repair and Replacement of Restorations

It is to be expected that an unpredictable percentage of operations will fail or require future attention because of the many factors involved in their placement, which include the age, attitude and physical condition of the patient, the difficulties presenting in connection with the performance of the particular operation, the correct application of the principles of cavity preparation, the selection of the most appropriate material for each restoration and the perfection of the technic employed in its manipulation. Due attention must, in many cases, be paid to the esthetic requirements and to the fees, which may be in serious conflict with the choice of materials from the standpoint of permanence. In addition, the changing conditions of environment and the use of the teeth over many years may result in the loss of restorations which were apparently satisfactory from all viewpoints when they were made. Abrasion and erosion cause the loss of many excellent restorations.

The effort has been made in the writing of this work to emphasize all matters which require attention in the performance of each operation to insure the highest degree of permanence. Each operation that needs repair or replacement should be critically examined to determine the cause of its failure, in order that the percentage of such cases may be reduced in the future.

It seems unnecessary to enumerate the causes of failures. They consist in large measure of minor errors in technic, such as the improper inclination of an enamel wall, wrong direction of force in the adaptation of gold foil, insufficient retention, imperfection of margins of an inlay, washing out of cement with which an inlay was set, due to moisture on cavity walls at the time, etc., etc.

In the program for periodic general care there is included a check-up on all previous operations as a part of the examination of the mouth. This contemplates the early discovery of failures which

may cause recurrences of decay and their prompt correction by repairs or replacements, on the same principle that careful examinations are made to find original decays early, so that restorations may be made before serious damage occurs.

This examination of previous operations should also include the inspection of all occlusal restorations in relation to the bite and wear of the teeth. In the adult period particularly it will be found that gold restorations which were properly adjusted to the occlusion when they were placed, show evidence of too heavy contact with the cusps of opposing teeth, and in many cases margins which had been polished to even contour with the tooth surface, are higher because the tooth has worn more rapidly. Stones and disks should be used to correct these conditions in order to maintain the best occlusal forms and the most equitable distribution of force on the several teeth in mastication.

Secondary Extensions of Decay on Proximal Surfaces

These occur, in the main, as a result of conditions which permit fibrous foods to be forced past the contact positions and cause a gradual recession of the gingivae. Eventually a pocket is formed which holds a considerable amount of debris for a varying period after each meal. The proximal surface of the enamel of both teeth is thus made vulnerable to caries in a position considerably to the gingival of the position where proximal decays usually begin, and eventually beyond the position of the gingival margin of a proximal restoration. Decay beginning in this position is referred to as a secondary decay.

The secondary decay may be entirely overlooked, it may be discovered at the same time as the primary decay, or it may have made the greater progress and may be discovered first. If, for any reason, a slight opening of the contact should occur after the primary decay has made considerable progress in dissolving the cementing substance from between the enamel rods, without any of the rods having fallen out, further progress of this area of decay may be stopped. The forcing of stringy foods past the contact would very likely prevent the continued growth of a colony of organisms at that spot, so that the very condition which causes the secondary beginning may also put an end to the primary decay. However, in cases in which the primary decay has penetrated the enamel and enamel rods have fallen away, its progress in the dentin would continue regardless of surface conditions.

In the preparation of the primary cavity, the secondary decay may not be discovered, as the enamel of the gingival wall may seem to be sufficiently firm to the operator in using cutting instruments to prepare it. The existence of a pocket between the teeth should lead one to suspect a secondary decay. The examination

must finally be made by the eye in good light, the cavity being dry. If there is an extension of decay to the gingival, it will appear as a light, chalky line along the cavo-surface angle of the gingival wall, corresponding to the secondary penetration of the enamel. The cutting must be continued until this area of chalky enamel is removed.

If a restoration should be placed in the treatment of the primary decay without restoring a proper contact, or if the teeth should subsequently move slightly apart, conditions would be established for the occurrence of a secondary decay to the gingival of the restoration. This would usually involve the enamel immediately beyond the gingival margin of the restoration or, if the soft tissue should be destroyed with sufficient rapidity, the new area might be entirely beyond the restoration. In some cases, these secondary decays involve the cementum.



FIG. 1094.

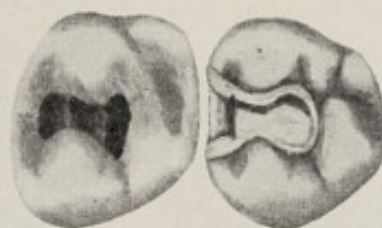


FIG. 1095.

WEAK CONTACT; SECONDARY DECAY

The conditions under which primary and secondary decays occur on a proximal surface of a tooth may be described in connection with the preparation of a cavity in the mesial surface of the upper right second molar for William Fisher, when 53 years of age. Figure 1094 is an occlusal view of the first and second molars. The third molar had been removed ten years previously and the second molar had relaxed its normal pressure on the first molar, weakening the contact. The teeth appeared to be in proper contact, as they do in the illustration, but a ligature could be passed through the contact very easily; the contact pressure was almost negative. The crest of the interproximal gum septum had been pressed gingivally and was slightly inflamed; it bled when touched lightly with an instrument. In response to an inquiry, Mr. Fisher stated that stringy foods, particularly chicken, caught between these teeth and he had had difficulty in keeping the space clean.

A small, sharp exploring tine was passed into the interproximal space with the point in contact with the enamel of the mesial surface of the second molar to the gingival of the contact; it did not glide over the surface, but caught a little and penetrated the enamel when pressure was applied. There was a beginning decay, but none of the enamel rods had fallen away. A mesio-occlusal

cavity was prepared, a rubber dam being placed before the enamel walls were finished. A glance at the gingival wall, after the cavity was dry, revealed a white area of enamel. See Figure 1095. All of the decay had not been removed. There evidently was a secondary decay which had been overlooked.

A section of a tooth with a similar decay is shown in Figure 1096. The area at A is the primary decay, which had not quite penetrated to the dento-enamel junction. The area at B is the secondary decay, which had progressed about half way to the dento-enamel junction. The cavity had been prepared as shown in Figure 1097, with the gingival wall cut through the secondary decay. It was this decayed enamel that appeared as a white area in the gingival wall. The proximal portion of the cavity was then extended to include all of the secondary decay, as shown in Figure 1098.

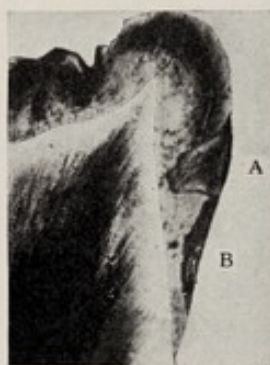


FIG. 1096.



FIG. 1097.



FIG. 1098.

The primary decay may have progressed about as far as the lower edge of the deep penetration at A, Figure 1096, before the third molar was extracted; also the contact between the first and second molars may have permitted stringy foods to be forced through soon afterward. In this case, the food fibres would have scoured the surface of the decayed enamel and further decay of that area would have ceased. However, the gum was pressed farther and farther gingivally, exposing more of the proximal surface of the tooth and a secondary decay began.

It should be quite clear that the secondary decay would have occurred in exactly the same manner if the primary decay had been discovered and a restoration had been made before the third molar was removed. The contact would have been weakened, fibrous foods would have been forced through, causing the recession of the gingiva and the secondary decay would have occurred to the gingival of the restoration.

MOVEMENTS OF TEETH FOLLOWING EXTRACTIONS OR WHEN PROXIMAL CONTACTS ARE NOT RESTORED.

When a tooth is extracted there is the tendency for the teeth on either side to move toward the space and thus open the contacts between them and their next neighbors. If the movement is extremely slight, the result may be a weak contact similar to the one just described, or an actual separation may occur. In either case food debris may be caught between the teeth. If the tooth continues to move, the space may become so wide that food will not be held between the teeth. The injury to the gum, followed by decay as far gingivally as the gum has receded, is the result of *impaction* of food between the teeth.

This condition will be illustrated by reporting another operation for William Fisher, when he was twenty-seven years old. The lower left first molar was missing when he first reported for examination at the age of twelve. It had been extracted two years previously. As often happens in such cases, the second molar had erupted farther mesially than normal. The second bicuspid remained in strong contact with the first bicuspid throughout the childhood period. Then it moved distally just far enough to open the bicuspid contact and allow food to catch. See Figure 1099.

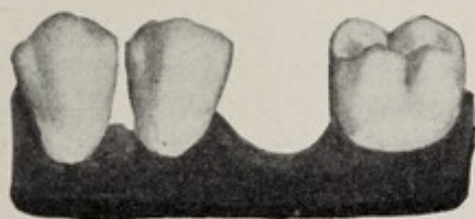


FIG. 1099.

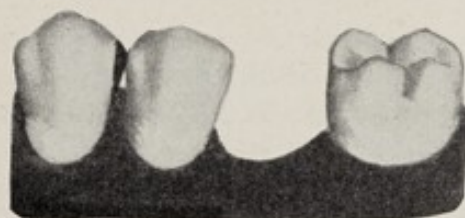


FIG. 1100.

A decay occurred in the distal surface of the first bicuspid; it was small on the surface of the enamel and had not penetrated very far in the dentin. A restoration was made with a gold inlay, and the convexity of the surface of the proximal portion was made greater than that of the tooth, thus making a tight contact with the second bicuspid, as shown in Figure 1100.

In making such a restoration, one should consider the possibility that the second bicuspid might continue to move distally, thus reopening the contact. The cusp relations of the upper and lower second bicuspid should be studied. In this case all of the upper teeth were present and there appeared to be little probability that further movement would occur. There was no indication for delaying the operation, as the mesial surface of the second bicuspid and the condition of the gingivae were both endangered.

It would have been the proper procedure to have placed such a restoration if the open contact had been discovered before the decay occurred. It would have prevented the irritation of the gingivae, and presumably, would have also prevented the decay. This question is discussed in Volume IV.

A very similar condition occurs when a proximal restoration is made which does not restore proper contact. If the contact is not sufficiently tight that a ligature will snap through, food may be forced past the contact and the gum will be injured. In some such cases, the proximating tooth will move sufficiently to close the contact where the restoration was placed, thus opening the contact on the opposite surface of the tooth that shifts. In other cases, both of the teeth concerned will move a little and three contacts may be weakened.

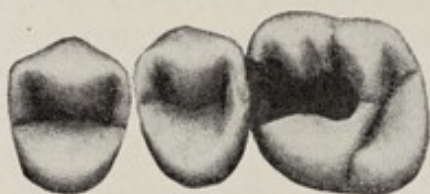


FIG. 1101.

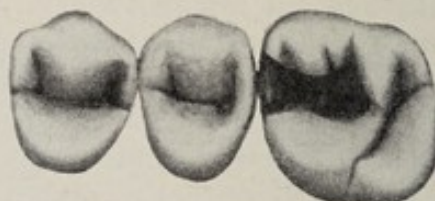


FIG. 1102.

This condition was well illustrated in the treatment of the mesial surface of the upper left first molar for Miss Wilson. On the occasion of her first appointment, at the age of 22, an open contact was noted between the upper left bicuspids, as shown in Figure 1101. There was a mesio-occlusal amalgam restoration in the first molar and a ligature, when passed through the second bicuspid-first molar contact, dragged sufficiently to indicate that it was much too broad. The first molar had not been restored to its full mesio-distal width; apparently a matrix, but not a separator, had been used in placing the amalgam and the restoration was too flat, leaving at the time a space corresponding to the thickness of the matrix between the restoration and the distal surface of the bicuspid. Subsequently the bicuspid had shifted distally closing this space and opening the contact between the bicuspids. A new decay had not occurred, and it was obvious that the treatment indicated was the removal and replacement of the amalgam restoration in the first molar. After the matrix was in place, a Ferrier separator was applied and the second bicuspid was moved to its proper place, in close contact with the first bicuspid, with additional separation to allow for the thickness of the matrix and the polishing of the amalgam. Figure 1102 shows the restoration in place. The contacts, proximal surface forms and embrasure widths in the two

illustrations should be compared to gain a clear understanding of the preventive service rendered by this operation. Food debris had been lodging between the bicuspid, causing injury to the gingivae, which might eventually lead to a serious infection of the peridental structures; it might also cause decay of both proximal surfaces. The flat contact between the second bicuspid and first molar endangered the bicuspid by broadening its area of liability to decay, while there was also the eventual danger to the gum septum from food fibres which would occasionally be caught between the broad flat surfaces. Conditions in both interproximal spaces were restored to normal.



FIG. 1103.

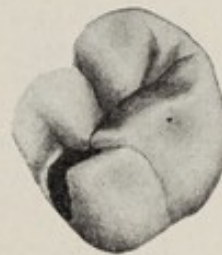


FIG. 1104.

BROAD FLAT CONTACT, DISTAL UPPER FIRST MOLAR

In this case the appearance of the upper first and second molars from the occlusal view, is shown in Figure 1103. The third molar had been extracted several years previously. The enamel of the distal marginal ridge of the first molar had been so weakened by backward decay that it had broken way under the stress of mastication. The mesial surface of the second molar was almost flat in the buccal-lingual direction, as was the central portion of the distal surface of the first molar, and it was quite apparent that the contact between these teeth had become gradually weaker and stringy foods had been forced between the teeth and held by the broad flat proximating surfaces. The teeth were close in contact, yet when an amalgam condenser was placed in the central fossa of the occlusal surface of the second molar and pressure was made distally, it required very little force to move the tooth sufficiently to slightly open the contact. The patient was requested to bite hard on a small piece of unvulcanized rubber placed between the occlusal surfaces of these teeth and their antagonists in the lower jaw, and it was observed that the second molar moved distally as pressure was exerted.

The decay in the distal of the first molar was very extensive. There had evidently been an occlusal decay along the disto-lingual groove, which had undermined the disto-lingual cusp. The open cavity is well illustrated in Figure 1104. The prepared cavity,



FIG. 1105.



FIG. 1106.



FIG. 1107.



FIG. 1108.

with the disto-lingual cusp entirely cut away, is shown in Figure 1105. It will be noted that the buccal margin of the proximal portion of the cavity was left in contact with the second molar. A Ferrier separator was placed just before the cavity preparation was completed and the teeth were moved apart sufficiently to give room to make the wax pattern. Base-plate gutta-percha was then packed into the cavity and allowed to become hard before the separator was removed. This held the slight separation that had been gained, and only a little more was required when the inlay was set. The restoration is illustrated from three points of view in Figures 1106, 1107 and 1108. Figure 1108 should be compared with Figure 1103 to note the difference in the embrasure widths before and after the operation.

EXCESSIVE WEAR OF PROXIMAL SURFACES.

In the consideration of the pathology of dental caries, the excessive wear of proximal surfaces of the bicuspid and molars was discussed. During the adult period the normally convex areas about the points of contact may be worn flat as a result of slight bucco-lingual movement of the teeth. The teeth gradually move mesially as the wear progresses and the facets become larger and larger. Food fibres are often caught and held between the flattened surfaces and are eventually forced through and depress the gum septum. Proximal restorations, after many years of service, may be similarly flattened by the repeated slight bucco-lingual movements of the teeth. They present the same problem as to the

catching of food and injury to the gingivae. Photographs of teeth with excessive wear of their proximal surfaces are reproduced in Figures 210 to 214 in Volume I.

As the years passed, the proximal surfaces of the bicuspid and molars in Frank Hines' mouth became very gradually more and more flattened until fairly broad facets were in contact. At the age of 50, the proximal restorations were also slightly worn, but very much less than the teeth. On the upper right side, where but one proximal restoration had been placed—a disto-occlusal gold inlay in the second bicuspid—the wear was greater than elsewhere, and the treatment of this region will be recorded. During his early adult years, the bicuspid was slightly rotated, but gradually assumed its normal position, apparently as a result of the wear and concomitant mesial movement of the teeth. An occlusal view of the bicuspid and molars is presented in Figure 1109.

There had occurred no decay of the proximal surfaces. The interproximal gingivae had been forced well down toward the cemental line and there was a depression between the first and second molars which exposed a little of the cementum. This was the only pocket of this nature in the mouth. The gingivae were slightly inflamed, but had not been painful. As in many cases of this type, the patient had become so inured to the presence of food between the teeth that he was apparently not aware of it. When asked whether he was bothered with food catching between his teeth, he replied "not at all." Such patients are not likely to appreciate the considerable service necessary for the correction of this condition. However, it is imperative if the teeth are to be conserved, and this fact should be impressed upon them.

TREATMENT. In this case the wear was not very great, and the treatment consisted of the separation of the teeth, the placing of two inlays and widening the embrasures with disks. A disto-occlusal cavity was prepared in the first bicuspid and a mesio-disto-occlusal cavity in the first molar. The buccal and lingual portions of the proximal surfaces of all four teeth were then disked off to widen the embrasures. A separator was applied between the bicuspid and the prepared cavity in the first molar permitted the second bicuspid to move distally without opposition, other than that offered by the bone of its socket. Only a very slight movement was required. The wax pattern for the cavity in the first bicuspid was made while the separator was in place and base-plate gutta-percha was packed into the cavity and allowed to become hard before the separator was removed. At the next appointment this inlay was cemented to place. One week later, a separator was placed between the second bicuspid and first molar and the mesio-disto-occlusal gutta-percha restoration was softened with a warm burnisher, then the separator bars were turned to gain a little separation—enough to show a slight space between the

gutta-percha and the second bicuspid. The gutta-percha was then packed against the second bicuspid and allowed to harden, in order to hold the separation that had been gained. The first molar was moved distally without pressure on the second molar, due to the previous preparation of the mesio-disto-occlusal cavity and the softening of the gutta-percha. A little additional separation was gained at each of two other appointments and a mesio-occlusal inlay was then placed in the mesio-disto-occlusal cavity, in order



FIG. 1109.

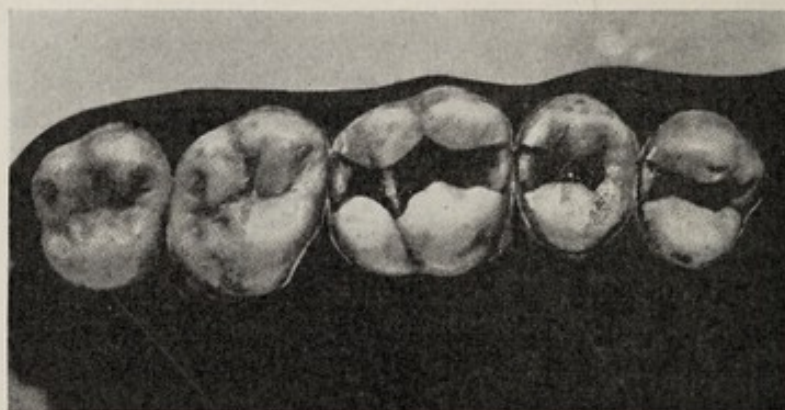


FIG. 1110.

to hold the first molar against mesial movement when the separator was applied between the molars. Two months elapsed before the disto-occlusal inlay was placed in the first molar, in order very gradually to secure sufficient movement of the second molar. In the meantime, the opposing lower teeth were being treated in the same way, progressing distally, as with the upper teeth, in order that the occlusion would not be seriously disturbed. The entire readjustment of the proximal surfaces on both sides of the mouth was spread over a full year, and was accomplished so slowly that the patient was not inconvenienced in mastication. The occlusal

view of the upper right teeth after the treatment was completed, as shown in Figure 1110, should be compared with Figure 1109, with particular attention to the forms of the embrasures.

MOVEMENTS OF TEETH DUE TO UNEVEN OCCLUSAL WEAR.

In adult life, movements of teeth occur as a result of uneven wear of occlusal surfaces. The movements of the mandible bring excessive lateral stress on certain teeth and tend to move the crowns, particularly, in a direction of the movement of the mandible. These movements, as compared with movements following extractions are usually in the buccal, labial or lingual direction. They are more likely to cause injury of the supporting structures of the teeth, rather than to cause caries. However, the cusp of a tooth in one arch may come to exert undue pressure between the cusps of two teeth in the opposite arch and cause the separation of these teeth. This happens more often in the cuspid-bicuspid region than elsewhere. Also the lateral movement of these teeth may reduce the contact pressure, particularly when the proximal surfaces of the teeth are rather convex.

INFLAMMATION OF THE SUPPORTING STRUCTURES.

Contacts may be weakened, or opened, as a result of inflammation of the interproximal supporting structures. As a general rule, the interproximal gingiva becomes inflamed because of leakage of food past the contact, from any of the causes mentioned. Infection follows, which gradually destroys the peridental membrane and the bone. As the condition progresses the teeth tend to move apart and open the space wider and wider. As the depth of the detachment of the peridental membrane increases, the opportunity to reestablish and maintain a good contact vanishes. There becomes established a vicious circle which too often ends in the loss of the teeth.

The movements of the teeth and inflammations of the supporting structures, together with their treatment, are discussed in Volume IV.

Caries in Cases of Excessive Recession of the Gums

In discussing the development, structure and functions of the gingivae and peridental membranes, attention is called to the change in the position of the margins of the gingivae with advancing years. The gingivae cover from half to a third of the axial surfaces of the teeth for a varying period after they erupt, become considerably shorter during the next five to ten years and are inclined thereafter to recede very gradually throughout life. In cases in which this recession is excessive, all of the supporting

structures participate; the alveolar process becomes shorter, the line of attachment of the peridental membrane recedes, as do the gingivae, and the cementum is exposed. The recession is likely to be more extensive on labial and buccal surfaces, than on the lingual and proximal surfaces. The extent to which the cementum is uncovered varies greatly; half or more of the roots may be laid bare in extreme cases. As applied to individual teeth, the cuspids are more often involved on their labial surfaces, and the cementum of a few or all of the incisors, upper or lower, may be exposed in varying degrees without corresponding change in the structures about the other teeth. There may be an excessive general recession, with about equal exposure of all surfaces of the roots of all of the teeth.

LABIAL AND BUCCAL SURFACE DECAYS.

Caries occurring in the cementum in cases of recession of the gums on the labial and buccal surfaces of one, two or more teeth is not very uncommon. These decays occasionally occur in mouths which appear to be otherwise immune. In many cases of recession, the exposed areas remain free from caries. When decay occurs, the area involved is usually broad and flat, occupying the surface of cementum exposed, sometimes encroaching upon the gingival portion of the enamel, and, in other cases, sharply limited by the cemental line. Often the progress is slow. It appears quite certain that the recession of the gum gives the opportunity for the caries, and as the recession of the gum is often progressive, so is the area involved in caries enlarged.

The dentist should treat a considerable proportion of these cases before much penetration has occurred, by the use of ammoniated silver nitrate. In other cases, the penetration of the dentin is rapid, forming a deep cavity, and a restoration must be made. Restorations of any kind in this position have been unsatisfactory for the reason that the recession of the gum is likely to be progressive, uncovering more and more of the cementum, and decay also occurs progressively in the part newly uncovered. The restoration fails to protect against recurrence of the decay and must be repeated at intervals so long as the recession continues. The restoration does successfully limit the penetration, however, and in that degree is successful.

TREATMENT WITH SILVER NITRATE. The treatment of decays of this type, which are discovered early and are in positions which are not exposed to view in speaking and laughing, is illustrated in the case of a lower right cuspid for William Fisher, in Figures 1111 and 1112. The surface of the cementum had been softened, but to very slight depth, as was determined with a sharp explorer. None of the softened tissue was removed. The essential point in

the treatment was to be certain that the area was thoroughly dried to its full depth, to assure penetration of the silver. A rubber dam was therefore placed, the hole for the cuspid being punched a little to the labial of the line of the other holes and with extra space between it and the neighboring holes, to avoid leakage when the rubber was stretched gingivally. The area was thoroughly dried with warm air and in this case silver nitrate crystals were pulverized and applied directly to the decayed area, which was then exposed to bright sunlight for five or six minutes. Figure 1111 is a reproduction of a photograph taken at the time the application was made, with the rubber dam and Hatch clamp in place. Figure 1112 is from a photograph taken subsequently.

All of these cases must be examined at intervals, as the continued recession of the gum offers opportunity for decay of the newly exposed cementum, which should be similarly treated with silver nitrate.

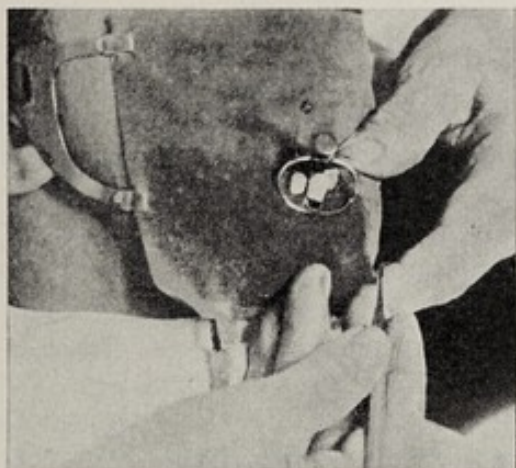


FIG. 1111.

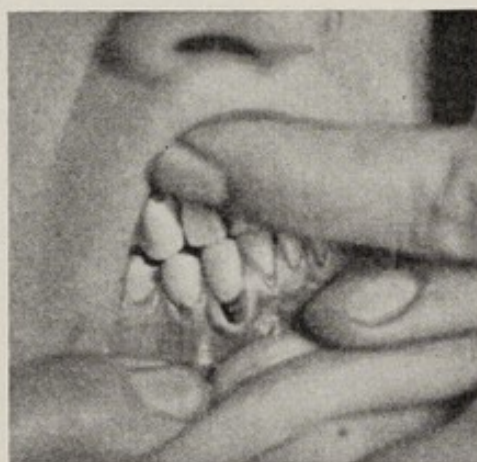


FIG. 1112.

RESTORATIONS. Cavity preparations for decays of this type call for the same technic as decays in the gingival third positions in the enamel, except that it is desirable to make the principal retention at the mesial and distal extremities of the cavity, rather than along the axio-occlusal and axio-gingival line angles. This is done in anticipation of probable recurrence of decay to the gingival. The selection of the material to be used for a particular restoration should depend primarily on the difficulties to be encountered in maintaining dryness of the cavity. If a rubber dam can be applied, amalgam may be used in the molars, also in the lower bicuspid and cuspids, while porcelain inlays, gold foil or silicate cement may be preferred for upper bicuspid, cuspids and incisors. Gold foil should not be used in positions where it will

show conspicuously. If the rubber dam can not be used, gold inlays or black copper cement should be selected for restorations that will not show, and a modified silicate cement for the upper anterior teeth. There is possibly a more definite indication for the use of silicate cement in cavities of this type than any other. It is best in appearance and very easy to replace in cases in which the gingiva recedes further and a new line of decay occurs.

Many of these decays are likely to occur in the same mouth and within a limited time. It is therefore questionable whether one is justified in placing a considerable number of restorations of the generally more permanent materials until the recession becomes very nearly stationary, or stops entirely.

PROXIMAL SURFACE DECAYS.

Caries may also occur in the proximal surfaces in cases in which there is a general recession of the gingivae and underlying structures. The general recession creates open spaces to the gingival of the interproximal contacts. The contacts may remain tight, thus preventing the forcing of foods past them, yet some debris will often collect in these spaces, gaining entrance from the buccal or lingual, and decays are likely to occur unless the exposed surfaces of the roots receive special and very thorough attention by the patient.

The teeth may shift a little, opening one or more contacts, thus establishing conditions more favorable to the accumulation of food debris in the interproximal space. However, in many cases of extensive recession of all of the supporting structures, the contacts remain tight, due to the building of additional cementum and bone of the alveolar process, which practically ankylose the roots in the bone. Several cases have been observed in which the recession had exposed so much of the roots that a beaver tail burnisher could be passed through the open space between the mesial and distal roots of the lower first molars, yet the teeth maintained their proper positions, the contacts were tight and the tissues were not inflamed.

The presence or absence of previously placed proximo-occlusal restorations have no bearing on the occurrence of decays close to or beyond the cemental line in one after another of the exposed surfaces.

Decays of proximal surfaces occurring as a result of a general recession of the gums, or following the induced recession in a single interproximal space from any of the several causes that have been mentioned, are, if possible, more difficult of management than decays involving the cementum of labial and buccal surfaces. Proximal decays are less often discovered in time for the effective use of silver nitrate, and when restorations are necessary, reliance must be placed on gauze packs for dryness, and the access is dif-

ficult for placing other than plastic restorations. A rubber dam may be more frequently employed in cases of general recession of the gums than in those where the impaction of food may have forced the recession of the gingiva of a single interproximal space.

TREATMENT. Figure 1114 illustrates the upper right molars in Mrs. Horner's (Mary Brown's) mouth at the age of 61. Small decays were discovered, partly in the enamel and partly in the cementum in the mesial surface of the first molar and the distal surface of the second bicuspid. The mesio-occlusal restoration in the second bicuspid, made of non-cohesive and cohesive foil, was placed when she was twenty years old. There were, in addition, five other proximal restorations in her teeth, all of which were in danger of being lost as a result of decays occurring to the



FIG. 1114.

gingival of the restorations. However, the likelihood of decays was the same for all other proximal surfaces. In fact, there were several surfaces in which areas of cementum had been slightly softened, in addition to the two with definite decays. These two decays were considered a danger signal and silver nitrate was applied to the cementum of all proximal surfaces in positions where the stain would not show. The patient was given a rubber bulb syringe to flush the spaces after meals and flat silk floss was recommended to be used each evening before retiring, as described in the treatment of such cases in Volume IV.

The two cavities were prepared in the same form as are gingival third decays in buccal surfaces, using the 9-3-12 and 6-2-23 chisels, and 9-3-12 and 6-2-23 hatchets for most of the preparation, being careful to make definite undercuts along the axio-buccal and axio-lingual line angles. In this case it was practicable to place the rubber dam. The holes were punched a little farther apart than the mesio-distal centers of the teeth, to be certain that the septi in the interproximal spaces would not be on stretch when applied. Amalgam restorations were made and silver nitrate was

applied to the other proximal surfaces of this bicuspid-molar group before the rubber was removed. The amalgam restorations were trimmed to form with the pair of right and left finishing knives, and were polished with fine sandpaper strips at a subsequent appointment. A rubber dam was applied to each of the other bicuspid-molar regions for the application of silver nitrate.

In some positions in the upper posterior teeth, gauze rolls may be used and cavities may be kept dry by the dentist with warm air, while the assistant mixes the amalgam. However, in the majority of cases a more satisfactory result is attained with black copper cement. If copper cement is used in the mouths of patients who are not on a regular recall list, they should be advised that these restorations wash out very gradually and therefore should be checked at least once every year.

Proximal decays occurring near the cemental line in the anterior teeth are usually of less difficult access and excellent restorations may often be made with gold foil. Silicate cement may be used in these cavities with the same results as in gingival third cavities in labial surfaces, providing dryness may be maintained while the cement is placed. In either case, a little washing of the material is not of as serious consequence, as in the case of silicate cement restorations in contact positions.

EROSION OF THE TEETH.

This condition, the treatment of which is fully discussed elsewhere, presents one additional complication to the care of the teeth during the adult period. Decays in eroded areas are infrequent, and the restorations, whether for caries or on account of the depth of the cutting, present no technical problem of consequence. When the erosion has cut so deep as to suggest a restoration, the building of secondary dentin has usually progressed to the point that the dentin is not sensitive, although in the earlier stages, it may be extremely painful to the slightest touch of an instrument.

Treatment of Abrasion of the Teeth

ILLUSTRATIONS: FIGURES 1116-1128.

ABRASION of the teeth is discussed in a chapter in Volume I. It may occur early in life, although it is usually seen in the mouths of older persons. Successful management of cases of abrasion depends very largely on early attention to each cusp area in which the dentin becomes exposed. When much progress of the abrasion has occurred, special difficulties are encountered in securing adequate retention in the dentin which has been softened, though not decayed, also in limiting the lateral movements of the mandible because of the flattening of cusps and in the closing of the bite.

TREATMENT OF ABRASION. This condition has not seemed to be very amenable to treatment. Efforts to develop reliable plans of procedure have been rather spasmodic and without sufficient observation and records. This subject needs further study, with models made when the treatment of each case is begun and during its progress over five, ten or fifteen years, in order to arrive at satisfactory conclusions regarding the advantages of this or that plan. The greatest difficulty is to make a prognosis, that will serve as a sufficient basis of treatment, early enough to render the best form of treatment effective. If, from the conditions presenting, one could foresee what the condition would be ten or twenty years later without treatment, it would place the whole matter in a different light.

There has been too much tendency to allow cases of abrasion to go on until the cusps have been so worn that the limitation of lateral mandibular excursions has been lost, and then undertake wholesale operations of reconstruction with large inlays, crowns and bridges. Observations of the results of such efforts have not given sufficient confidence in this practice to recommend it very favorably. It is a long and severe undertaking for both operator and patient, and within a few years some operation is likely to fail and make the case worse than if it had not been done. More conservative treatment, begun at an earlier period, should generally bring better results. In many cases, if taken early, much aid can be rendered by making restorations in certain teeth that will take the weight of the occlusion for a considerable time and save much of the wear of other teeth, or, in building up selected worn cusps, that will limit certain lateral and protrusive movements. Models should be prepared and careful selections should

be made of the particular teeth to receive restorations so that the two sides of the mouth will remain fairly and equally balanced to the pressure of the occlusion. Other certain worn cusps should be built up to prevent excessive movements of the mandible.

In cases of excessive wear, the general rule is that there has been a fault in the intercusping of the teeth in such a way as to permit too wide lateral motion. This is first brought to notice by the excessive wear for the time of life of certain cusps which have worn first at their points instead of upon their slopes, as should be the case if the intercusping were normal. Then the question of judiciously limiting this excessive lateral motion should be studied. It will often be found that the building up of the worn cusps will do most good. If there are several of them in opposite jaws that have slid over each other and have been worn in the process, these should be built up at once, making the restorations as hard and substantial as possible. These restorations will serve to slightly open the bite when the lateral movement has progressed sufficiently for proper mastication and thus delay the wear of other cusps for several years. If, later, the enamel of the points of others have worn until the dentin appears, they should be built up in the same way. In this way, hindrances to the abrasion may be continually placed which will serve to limit it and keep it within reasonable bounds.

In the case shown in Figure 134, in Volume I, in which the cusps are worn flat and the dentin has begun to be cupped out, if the cusps had been built up earlier, or as soon as the dentin was exposed, much of the wear on these and other teeth would have been prevented. As it stands, sufficient cavities might be cut and strong cusps built, which would intercusp with similar building on the lower teeth, so shaping them that the teeth would slide into full occlusion normally. The wear would thus be greatly limited upon all of the denture. This building should include both sides of the mouth. Generally, only a few teeth should be built up at one time. Later, other teeth may be treated as necessary, but on the same plan. To do this best, requires a careful study of the occlusion and of the motions of the lower jaw.

Such a plan of treatment greatly increases the usefulness of the teeth, without burdening the patient with extensive operations done at one time. The restorations are generally small and easily performed and they are spread over considerable time. Some will be worn away by the friction of mastication, and their replacement becomes necessary. First attention must usually be given to the cuspids, when the cusps are worn sufficiently to expose the dentin, or to the incisors, in which the cutting edges have been worn until more or less of the dentin is exposed. As the rule, however, the wear of incisor teeth should be limited by such care of the bicusps and molars as will relieve them of the stress of the occlusion, rather than by building restorations in them.

CASE OF ABRASION; EARLY TREATMENT

John Stevens, who had been very nearly immune to decay during the childhood period and had been entirely free from caries since he was twenty-two, was examined at the age of forty-five, to find slight abrasion of the incisors, cuspids and bicuspid on both sides of the arch, but more pronounced in the upper right cuspid and bicuspid. The cuspid, both cusps of the first bicuspid and the buccal cusp of the second bicuspid were worn sufficiently to expose the dentin, as shown in Figure 1116. The enamel of the lingual cusp of the second bicuspid was worn considerably, as were the incisal edges of the upper central incisors, but the dentin was not exposed.

OCCLUSAL VIEW $\times 2\frac{1}{2}$

FIG. 1116.

MESIO-DISTAL SECTIONS $\times 2\frac{1}{2}$

FIG. 1117.

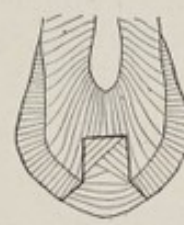
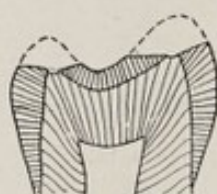


FIG. 1118

The various movements of the mandible and their extent were studied in the mouth and with models mounted on the articulator. The first restoration was made in the upper right cuspid. The extent of the abrasion is shown in the mesio-distal section of the crown in Figure 1117. It will be noted that there was a very slight cupping of the exposed dentin. The normal contour of the cusp is indicated by the broken line. A similar section in Figure 1118 illustrates the cavity preparation and the restoration. The cavity was cut sufficiently deep, with all line angles sharp, to give ample retention, and the enamel walls were so inclined as to be certain that no rod ends were exposed.

RESTORATION. The restoration was made in part with gold foil and in part with platinum-gold foil. Gold foil was condensed in the cavity to about the position of the dento-enamel junction, and the remainder was built of platinum-gold foil to make the hardest possible surface, in order that it might withstand the friction of mastication and the continued heavy striking of the lower teeth. It was built very solidly throughout, using heavier blows of the mallet than usual, on a $7\frac{1}{2}$ -10-3 point and changing occasionally to the 5-10-3, which was stepped over the entire surface to more thoroughly condense any small spots which might have been missed in stepping the larger point. The platinum-gold foil was laid on in small pieces, on which slightly heavier blows of the mallet were

used than on the pure gold. The height of the cusp was only partially restored and it was designed to relieve the pressure on the other teeth as the lateral movement of the lower teeth brought them in contact with it, by retarding the lateral movement and at the same time gradually opening the bite. To accomplish this over a period of time, required that the restoration be as hard as it was possible to make it. If it were less hard, it would wear more rapidly and its effect in delaying the progress of the abrasion would be lost in a shorter time. That portion of the gold which projected beyond the plane of the wear was the only part that was of value in attaining the desired objective, and this prominence of the restoration was as great as it could be made without inconvenience to the patient. In fact, it was made greater than would probably be comfortable. When the restoration was finished, the patient immediately complained that it interfered with the use of his teeth, but it was reduced as little as seemed absolutely necessary, and the reason for this interference was explained to him.



BUCCO-LINGUAL SECTIONS $\times 2\frac{1}{2}$

FIG. 1119



FIG. 1120.



FIG. 1121.



BUCCO-LINGUAL SECTIONS $\times 2\frac{1}{2}$

FIG. 1122.

ADDITIONAL RESTORATIONS IN THIS CASE. A similar restoration was placed in the upper left cuspid, although the dentin was not exposed. The wear was sufficient, however, to indicate that it would continue, and the restoration was made to limit the wear of the bicuspid. With these two restorations in place, the movements of the mandible were so limited as to relieve the wear on the incisors as well as the bicuspid, and the patient gradually became accustomed to the more limited movements of the mandible.

It was recognized from observation of these cases that it would be desirable to give the cuspids some assistance, and similar restorations were placed in both first bicuspid. The condition of the upper right first bicuspid is illustrated by the bucco-lingual section in Figure 1119. Two separate cavities were prepared in this tooth; the cavity outlines and the restorations are shown in Figure 1120. In mesio-distal sections, these cavity preparations and the restorations would appear very much the same as in the mesio-distal section of the cuspid. It will be noted that the buccal cusp restoration was built higher in relation to the wear than the lingual cusp. The buccal cusp, particularly, was overbuilt and then ground to correspond with the cuspid — so that the two would act together in relieving the occlusion.

A year later the buccal cusps of the second bicuspsids were similarly restored and three years later there was so much wear of the cuspid restorations that they were replaced. This case has been under observation and care by occasional replacements of the restorations over a period of nearly ten years, without wear of the molars sufficient to expose the dentin, and with but little additional wear of the incisors. The progress of the abrasion has not been stopped, but it has been reasonably controlled. Mr. Stephens' chart is shown in Figure 1136.

The difference in the problem confronting the dentist in the management of these cases when there is a little delay in beginning the treatment is illustrated in Figures 1121 and 1122. Comparison of Figure 1119 with Figure 1121 indicates that the wear in the latter is not very much more extensive than in the former. However, the extra wear of the enamel calls for a much broader exposure of the restoration to the stress of mastication, which in turn requires stronger retention. Usually, in such cases, there will be sufficient recession of the pulp to permit deep cutting in the dentin. In this case a gold inlay would be the restoration of choice.



FIG. 1123.

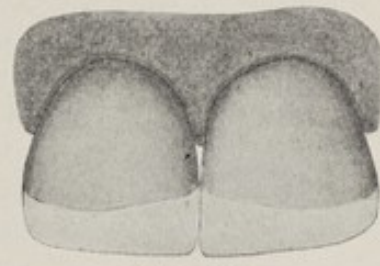


FIG. 1124.



FIG. 1125.



FIG. 1126.

CASE OF EXTENSIVE ABRASION OF INCISORS. The treatment of a case of extensive abrasion of the incisors is illustrated in Figures 1123-1128. Figure 1123 shows the abraded cutting edge of the central incisors, and Figure 1124 the amount of tooth tissue lost beyond what would be normal wear for the age of the patient. The lighter portion in Figure 1124 is that which has disappeared, and shortens the labial surfaces about one third. These teeth were prepared by cutting deeply into the dentin, forming a box-like cavity, so disposing the cutting as to give the strongest walls possible, with bulk enough of the material in the restoration to amply support the breadth of surface receiving the stress of the lower teeth. With the amount of abrasion here shown, it was safe to presume

that considerable recession of the pulp of the tooth had occurred, also that sufficient retention could be made without danger of exposing the pulp. This fact indicates that the case would have done better if a restoration had been made earlier and the present operation left to be done after the first had been worn out by the friction of mastication. The labial wall of the cavity was made much stronger than the lingual. At the angles of the cavity, fairly strong retention points were made so that the restoration would be retained until most of it should be worn away by friction. Otherwise the walls, after rounding in from the incisal, are about parallel. The prepared cavities are illustrated in Figure 1125. These should be compared with the labio-lingual section, Figure 1127, which shows the thickness of the labial and lingual dentin walls. Approximately the last one-fourth of these restorations was made with platinum-gold foil. In cases in which gold inlays are preferred, a hard alloy of gold should be used, preferably one containing sufficient platinum to make the showing of gold less objectionable. Figure 1126 shows the incisal view of the teeth as restored, and Figure 1128 the labial view.



FIG. 1127.

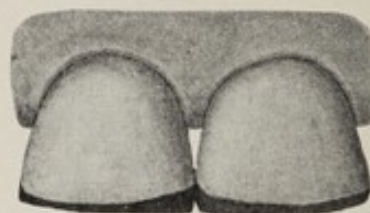


FIG. 1128.

By studying the cavity walls in Figure 1127, it will be noted that when this restoration shall have worn to about a certain point, the dentin on the labial, and to a lesser extent on the lingual, will again become exposed to abrasion. It will immediately begin to cup out by wearing deeper than the exposed enamel or the restoration. This wear may produce conditions which will demand the renewal of the restoration when it is only half or two-thirds worn.

OPENING THE BITE. In some instances, the bite has been opened to the normal, requiring a quarter-inch or more of separation of the incisors. Patients soon recover from the difficulty which occurs from the sudden additions to the length of the teeth. Some of these cases have done well for many years, but the larger number of those coming under the author's observation have met with mishaps which unexpectedly wrecked them in some important part. Difficulties are particularly apt to multiply when many pulps are removed. Removal of pulps and the filling of root-canals present unusual difficulties when much secondary dentin has been formed, reducing the size of pulp chamber and root-canals.

SUMMARY OF SERVICE

ILLUSTRATIONS: FIGURES 1131-1139.

A BRIEF summary of the service rendered for each of the six patients, who were chosen for the presentation of the clinical treatment of dental caries, is appended for the purpose of correlating the treatment over the period of years covered by the records. This summary indicates the importance, not only of taking good care of the temporary teeth and using every available means of prevention, but also of following a systematic program of service. It should also demonstrate the futility, in many cases, of attempts to give service of high quality, without reasonable cooperation of the patient. The effort has been made to stress the interrelation of caries with diseases of the dental pulp and peridental membrane, also the interrelation between the general physical condition of the patient and the condition of the mouth. This all serves to emphasize the point that the dentist, quite as much as the physician, must look many years ahead in the life of each patient for the final effect of the operations which he performs from day to day.

MRS. MARY HORNER (MISS MARY BROWN)

Mary Brown's first visit was at the age of four and a half years. She may be classed as one of those who continue throughout life with a moderate susceptibility, without apparent change toward immunity. Her last examination card was made at the age of 63.

Her final chart shows occlusal restorations in practically all of the teeth of both the temporary and permanent sets. There were, however, few fissures of consequence, and the restorations in pit cavities were usually small. She was originally on a program of recalls four times a year. When she was eight years old, it was changed to three times a year until she was twelve, and thereafter twice a year. She has been generally very faithful in keeping appointments and has in every way maintained a fine interest in the care and conservation of her teeth. She missed her recall appointments a number of times during the childhood period, when she had practically all of the more common childhood diseases. During her years in college, she failed to return home for the Christmas holidays on two successive years, and her recall schedule has been interrupted by much travel.

was made in the gingival third of the upper right second molar. Decays occurred in the occlusal surfaces of all of the molars, and these were generally treated by first removing the caries and placing black copper cement, followed later with more complete cavity preparation and amalgam restorations. There were two proximo-occlusal amalgam restorations. No pulps were lost.

Permanent Teeth: The occlusion was normal. The first treatment of the permanent teeth consisted of the modification of the contour of the mesial surfaces of the upper central incisors, which were very flat in the inciso-gingival direction, to improve the contact forms; also the application of silver nitrate to the occlusal surfaces of the molars. Gold foil restorations were placed in most of the pit cavities, including the buccal surfaces of both lower first molars. Four proximal restorations in the upper incisors were made with gold foil, also six proximo-occlusal restorations in the bicuspids, two of which were in treatment of distal decays. In three of these, non-cohesive foil was used to cover the gingival wall. A gold foil restoration was also made in a mesio-occlusal cavity in the upper left first molar. Gold inlays were used for all other proximo-occlusal restorations, also for a bucco-occlusal cavity in the lower right second molar. A porcelain restoration was placed in a gingival third cavity in the upper left central incisor. Four amalgam restorations were placed; one each in the gingival third of the buccal surface of the upper left second molar and the lower left first molar, also in the distal of the upper right second bicuspid and mesial of the first molar for decays occurring after the recession of the gingivae.

The large majority of these operations were performed during the childhood and young adult period; there was only an occasional restoration during the adult period. This patient was very susceptible for a few months after the birth of her first child, but no change was noted in connection with two other pregnancies. There occurred a gradual recession of the gingivae and other supporting structures, first noticed when she was forty-five. This continued until the cementum of all of the teeth was considerably exposed at sixty and several restorations were made in proximal surfaces to the gingival of those previously placed.

Both upper third molars and the lower right third molar were extracted soon after they were partially erupted. There was little difficulty in maintaining good contacts in this mouth. With the extensive recession of the gingivae, the teeth remained firm and the contacts tight. The patient used a rubber bulb syringe twice daily to cleanse the interproximal spaces.

No pulps were lost and no teeth were extracted, other than the third molars already mentioned.

The record of this patient should be compared with that of Miss Gertrude Wilson. The two presented about the same degree

tinuously in fine condition, due in part at least, to the vigorous use of his teeth in mastication. There were only the slightest deposits of salivary calculus on the lingual surfaces of the lower incisors after he was about thirty. Otherwise his teeth were usually so clean that it seemed hardly necessary to polish them.

Three examination charts are shown, made at the ages of 3, 8½ and 16 years. See Figures 652, 733 and 871. All restorations in his permanent teeth at the age of sixty are marked on the chart in Figure 1132; the restorations which had been placed in the temporary teeth are also indicated; for the sake of completeness. The following is a summary of his record:

Temporary Teeth: At the age of three, silver nitrate was applied to the occlusal surfaces of all four lower molars, which were very slightly defective in their formation. The applications were repeated at intervals during several years, and amalgam restorations were eventually made. Decays also occurred in the occlusal pits of the upper molars and these received similar treatment. There were two proximal decays, one in the distal of the upper left first molar and one in the distal of the lower right second molar, the latter occurring when he was eight years old. Amalgam restorations were made in both. Silver nitrate was applied to the mesial surface of the lower first permanent molar before the restoration was placed in the prepared cavity in the second temporary molar. There were a total of ten amalgam restorations, eight of which were in small pits.

Permanent Teeth: Silver nitrate was applied to the occlusal surfaces of both lower first molars soon after they erupted, and again four months later. This was probably unnecessary, although his high degree of immunity was not recognized at the time. Five pit decays were restored with gold foil, one each in the lower right first molar, the upper right first bicuspid, and the upper left second bicuspid, and two in the occlusal surface of the upper left first bicuspid. There occurred seven proximal decays, six of which were discovered at the examination recorded on the chart shown in Figure 871, when he was sixteen. Three of the operations are described; one in the mesial of the upper right first molar, which was restored with amalgam, one for the two decays in the upper left second bicuspid, for which a mesio-disto-occlusal inlay was made, and one in the mesial of the upper right central incisor, which was restored with a porcelain inlay. The other two, in the mesial of the lower right first bicuspid and distal of the cuspid, were restored with gold foil.

A total of thirteen restorations were made in the permanent teeth (counting the mesio-disto-occlusal inlay as two), during a period of fifty-seven years. No teeth were lost and all pulps remained vital. There were no gingival third decays in buccal or labial surfaces and but one incisor proximal decay.

This case was one of what may be termed natural immunity, resulting apparently from the enjoyment of vigorous health and a generally well balanced diet. It suggests what the practice of dentistry will be for a much larger number of persons when further advances shall have been made in prevention, including particularly the effective application of principles of diet, which are gradually becoming better understood by laymen, as well as by members of the profession.

Hines, Frank

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| NAME | RES. | ADDRESS |
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| BUS. | | EXAM. NO. |
| TEL. | | DATE |
| DATE OF BIRTH | | NEXT EXAM |
| AGE 5'5" | | |

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| DI | TE | PR | EV |
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| CA | SE | | TE |
| HOT | CRY | MO | ELS |
| | | PHO | TO |

FIG. 1133.

FRANK HINES.

This patient was first examined at the age of five, when sixteen decays were recorded. The teeth had apparently received very little attention, but fortunately the decays had not penetrated very deep and all of the cavities were prepared without involving a pulp. As often happens in cases of neglect of the temporary teeth, the susceptibility was much increased and would have resulted in the early loss of several of the molars, if a little more time had elapsed before he received attention. With a little deeper penetration, sensitiveness to mastication would have developed and the first permanent molars would have been placed in jeopardy if he had lost the habit of chewing his food thoroughly.

The cooperation of this boy was gained in the care of his teeth and his mother was persuaded to give him a well balanced diet, with sweets largely eliminated both at meals and between meals.

One is hardly justified in stating that this boy's interest in the care of his teeth and the watchfulness of his diet were responsible for the rather sudden decrease in susceptibility, as similar changes occur as a result of conditions which are not understood. However, there occurred but four additional decays in the temporary teeth and he developed an increasing immunity as the years passed.

Two examination charts, made at the ages of 5 and 17 years are shown in Figures 657 and 892. He was recalled for examinations four times a year until he was eight, then gradually changed to twice a year.

The restorations in both the temporary and permanent teeth are recorded on the chart in Figure 1133. The last examination was at the age of fifty-five.

Temporary teeth: On the occasion of the first examination at five years of age the lower right molars were in disto-occlusion and the distal surface of the second molar was ground to permit the lower first permanent molar to erupt sufficiently to the mesial that the cusps of the upper met the distal inclined planes of the lower and these teeth gradually came into their proper mesio-distal relation. The amalgam restorations included seven pit and five proximal decays in the molars. There were two incisor proximal decays, which were restored with cement. Two cement restorations were made for gingival third decays in the upper incisors. All of the temporary teeth were saved until lost by absorption of their roots and all pulps remained vital.

Permanent Teeth: The care of the permanent teeth presented very little difficulty. A decay which occurred in the distal surface of the lower right second temporary molar was apparently the cause of a decay in the mesial surface of the first permanent molar, which was treated by preparing a cavity which did not involve the marginal ridge, and an amalgam restoration was made. The temporary tooth was loose and was removed before the restoration was placed in the permanent molar. The embrasures between the upper first and second molars were widened with disks, when the patient was fifteen years of age. Gold foil restorations are recorded in the lingual pit of the upper right lateral incisor, the occlusal of the upper left first molar, and in the two pits in each of the lower second bicuspid, also in a mesio-occlusal cavity in the upper left first bicuspid, a mesio-occlusal cavity in the upper left first bicuspid and in a distal cavity in the lower right cuspid. Gold inlays were placed in the disto-occlusal of the upper right second bicuspid and disto-occlusal of the upper right first bicuspid, also a mesio-disto-occlusal restoration in the upper right first molar. Amalgam restorations were made for a mesio-occlusal cavity in the lower right second molar and a disto-occlusal cavity in the first molar.

In examining Mr. Hines' mouth when he was fifty years old, there was a notable inflammation of the gingivae in the upper right

bicuspid-molar region due to excessive wear of the proximal surfaces of the teeth, as a result of which fibrous foods were being caught and held between the teeth. This was corrected by placing two gold inlays and widening certain embrasures with disks, a very important service in conserving the supporting structures.

The care of this patient is typical of the change that is occurring in the practices of many dentists who are striving to use every available means of prevention. Particular reference is made to the care of the temporary teeth with two principal objectives — to prevent irregularities of the permanent teeth and to maintain the habit of vigorous mastication, in order that the permanent teeth, and especially the first permanent molars, shall have the benefit of the natural cleaning which results from heavy chewing. If one may judge from the observation of many cases which come to dental college clinics for treatment, it is fair to presume that this boy's mouth would have been wrecked by the early loss of the temporary molars, if the cooperation of both the boy and the mother had not been gained when the treatment of his teeth was undertaken at five years of age.

WILLIAM FISHER.

The first examination of this patient was at the age of twelve. He had been taken previously to two other dentists, one of whom had seen him at about the age of five, the other had extracted the lower left first permanent molar, because it was abscessed. His father stated that the temporary teeth had given the boy no trouble. There were no restorations in the permanent teeth, but small cavities were present in the occlusal surface of both upper first molars, in which gold foil restorations were made, and there was a large decay in the occlusal of the lower right first molar, which was restored with amalgam. The temporary teeth had all been shed except the two upper cuspids, which were loose. The bicuspids were not all quite fully erupted. The occlusion was normal.

An effort was made to impress the importance of regular examinations upon the father, and he agreed that he should be notified in six months. The appointment was sent, but the son did not come in until several weeks later. No cavities were found then, nor during the next five or six years. He was away at school for two years and did not return for examination until he was twenty, when there were three proximal decays in the upper anterior teeth. At twenty-four there were several slight gingival third decays and no other cavities were discovered until he was twenty-eight years of age. He became very susceptible following a severe illness with typhoid fever and fourteen decays were listed on his examination chart about a year after he was taken ill. In the preparation of these cavities, two pulps were found exposed by caries. During the next three years, two more decays occurred, but he rapidly re-

gained his high degree of immunity and no other decays were recorded until he was fifty-three, when there was one proximal cavity, due to a weak contact.

Two of his examination records, one at the age of 12, the other at the age of 38, are illustrated in Figures 815 and 1065.

Fisher, William

| | | |
|-------------|------|---------|
| NAME | RES. | ADDRESS |
| NUMBER 2627 | TEL. | NPIR |
| BUS. | | |
| TEL. | | |

AGE 53

DATE

NEXT EXAM

RIGHT

LEFT

OCCUSION

CARIES 123

PATIENT CARE 123

GINGIVAE 123

REFERRED BY

REPORT TO

PR SR EV

ES FI

MA TE

REG ORT RNT ENT ME MD

FILED ED INS TR FOR WD

FIG. 1134.

The operations placed in his permanent teeth are listed on the chart in Figure 1134. The majority were required for the one period of susceptibility following the attack of typhoid.

Three third molars — both uppers and the lower right — were extracted. Gold foil restorations were placed in the occlusal of the upper left first molar, in six proximal cavities in the upper anterior teeth, in mesio-occlusal cavities in the lower right first and second bicuspid and in the gingival third of the buccal surface of the upper left first molar. Other gingival third areas were treated with silver nitrate. Gold inlays were used in the occlusal of the upper right first molar and for all other proximal restorations listed. Two proximal decays resulted from weak contacts due to the extraction of neighboring teeth; the contacts were restored when the inlays were placed. One large amalgam restoration was made in the occlusal of the lower right first molar.

The most striking lesson in this case was the extreme susceptibility following the attack of typhoid fever, and the recovery of

the patient's immunity as he regained good health. It also served to emphasize the difficulty of maintaining a recall system for persons who are nearly or quite immune. If he had not been free from decay for so many years previous to his illness, he probably would have called for examination as soon as he was able, instead of delaying for nearly two years from the time of his previous visit. The dentist should make every effort to persuade patients of the near immune group that they should have examination appointments at least once a year, as their teeth are generally less sensitive than those of more susceptible persons, and caries is likely to progress without attracting their attention until the enamel breaks away on account of backward decay, or a pulp is exposed.

Wilson, Miss Gertrude

| | | |
|-------------|------|-----------|
| NAME | RES. | ADDRESS |
| NUMBER 4218 | TEL. | NPIR |
| BUS. | | EXAM. NO. |
| TEL. | | DATE |
| AGE 48 | | NEXT EXAM |

RIGHT

LEFT

| | | | |
|--------------|--|----------|--|
| OCCLUSION | | CRIES | |
| 123 | | 123 | |
| PATIENT CARE | | GINGIVAE | |
| REFERRED BY | | | |
| REPORT TO | | | |
| D | | D | |
| NM | | NM | |
| CA SE | | CA SE | |
| HOT RAY | | HOT RAY | |
| MOD ELS | | MOD ELS | |
| PHOTO | | PHOTO | |
| FIL | | FIL | |
| ED | | ED | |
| INS | | INS | |
| TR | | TR | |
| FOR | | FOR | |
| WD | | WD | |

FIG. 1135.

MISS GERTRUDE WILSON.

Miss Wilson was selected as a good representative of a type of person for whom the dentist can not give service that is very satisfactory, either to the patient or to himself. Apparently she was continuously susceptible to caries in mild degree from childhood until the time of her last examination at the age of forty-eight. Her first appointment was at twenty-two. She was a woman who was interested in civic affairs, a vigorous worker in several women's organizations, holding prominent offices and committee chairmanships. She several times refused to have her name placed

on a recall list, insisting that she would herself make an appointment at the designated time, but she always delayed, presumably on account of the pressure of other matters, until pain or an open cavity caused her to make an appointment.

She had lost three teeth and the pulps of two others before her first appointment with the author, and three more pulps were exposed by caries between the ages of twenty-two and forty-eight. Every decay showed definite evidence of neglect — always undermined enamel, weakened further by backward decay, and every restoration was much larger than average for the particular type of cavity. A record of the condition of her teeth at the age of forty-eight is presented in Figure 1135.

This patient was rated as slightly less susceptible than Mrs. Mary Horner (Mary Brown), yet her lack of attention to her teeth resulted in a badly crippled denture at the time when she needed it most. There are twenty-five restorations in Mrs. Horner's teeth, as compared with seventeen and two crowns for Miss Wilson, yet Mrs. Horner has lost no teeth, other than third molars, and all pulps are vital, while Miss Wilson has lost three teeth, in addition to the third molars, also the pulps of five other teeth. The difference in the result in the two cases is largely due to the fact that none of the several dentists, including the author, to whom Miss Wilson applied for treatment, succeeded in convincing her that her teeth could not be conserved without better interest and cooperation on her part. Her intentions were always good, but she invariably postponed making an appointment until a more convenient time, which never came. In the end, such service is usually a disappointment to both parties.

JOHN STEPHENS.

This patient was introduced for the particular purpose of calling attention to the early treatment of a case of abrasion. He had been very nearly immune to caries from early childhood, having had no decay of the temporary teeth and none of the permanent teeth until his eighteenth year. Beginning at that time, several decays occurred during a period of about four years, when his immunity was regained and continued to the time of his last examination at the age of fifty-five. A gold foil restoration had been placed in the buccal pit of the upper left first molar, and an amalgam in an occluso-buccal cavity in the second molar. Mesio-occlusal restorations with gold inlays had been made in both upper first molars, also in a disto-occlusal cavity in the upper right second bicuspid.

At forty-five there was a definite beginning of what promised to be a case of extensive abrasion, which was kept under control,

Stephens, John

| | | | |
|-------------|------|---------|-----------|
| NAME | RES. | ADDRESS | EXAM. NO. |
| NUMBER 3686 | TEL. | NPIR | |
| BUS. | | | |
| TEL. | | | |

AGE 55

DATE

NEXT EXAM

RIGHT

LEFT

OCCUSION

123

PATIENT CARE

REFERRED BY

REPORT TO

CARIES

123

123

GINGIVAE

NP

DATE

WIM

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FIG. 1136.

with very little additional wear, over a period of ten years. This was accomplished by making restorations of platinum foil soon after the dentin of the upper right cuspid became exposed, and by so building both the cuspids and the buccal cusps of the first bicuspid that the excursions of the lower jaw were limited.

The restorations placed for Mr. Stephens are indicated on the chart. Figure 1136.

Case Report; Age 28, Sixty Restorations

ILLUSTRATIONS: FIGURES 1137-1139.

As an illustration of the proposition that the program which has been presented for the conservation of the teeth may be effectively applied, there has been selected from the author's files the record of the patient for whom the largest number of restorations have been made for one person during the period of thirty-five years of practice. The patient's first appointment was in 1910 at 3 years of age; she was 28 in 1935 and there are at the present writing sixty restorations in her teeth, counting each mesio-disto-occlusal restoration as two. She has been continuously susceptible since childhood, although there have been no new decays in the past three years. The vitality of the pulps in both upper incisors was destroyed by an accident — a blow from a hockey stick — at the age of 17; all other pulps are vital. The upper right first bicuspid was deeply impacted and was removed on the recommendation of an orthodontist. The lower molars and second bicuspid on that side are in disto-occlusion; the upper second bicuspid is in contact with the cuspid, and the other contacts on the upper right side are tight. The occlusion is otherwise normal.

Hundreds of similar records from the files of many practitioners might be presented. It is the author's conviction that success in the conservation of the teeth of susceptible persons is based primarily on a broad understanding of the clinical aspects of the pathology of caries and its interrelations with the diseases of the supporting structures. With such an understanding, there must be a well organized plan of patient management and the coordinated use of every means which may be helpful, as applied to each individual. This includes sustained interest and mutual confidence on the part of the patient and dentist.

A high degree of technical skill is undoubtedly an important factor in carrying out such a program, yet those who are most expert technically will fail unless that skill is directed by a conception of the pathology, in which the time factor is of great importance. In serving the child of six, the dentist must be thinking sixty years ahead.

If the dentist's ambition is to achieve this objective he will gain great satisfaction from the fact that he finds very little to be done in the way of restorative service for many patients, as they

return time after time. However, his greatest joy comes from the successful management of cases of the type reported here.

OCCURRENCE OF DECAY. The degree of susceptibility of this patient may be judged somewhat from the time at which the various decays were discovered. These are given for each year, as follows:

- Age 3: Occlusal lower right temporary first molar.
 4: Occlusal, lower left and both upper temporary first molars.
 5: Distal, both lower first and mesial both lower second molars; distal upper right molar.
 6: Mesial, both lower temporary first molars, mesial both upper temporary second molars.
 7: Occlusal, all four permanent first molars.
 8: Distal, both lower temporary second molars; distal upper temporary left cuspid.
 Buccal pits, both lower permanent first molars.
 9: No new decays.
 10: Buccal pit, upper left permanent first molar.
 11: Mesial, both lower and the upper left permanent first molars; distal, both lower second bicuspid; mesial and distal, both upper central incisors and left lateral, also mesial right lateral.
 12: Occlusal, lower left second molar.
 13: Mesial, upper right first molar; mesial and distal upper right second bicuspid; distal upper left cuspid, mesial and distal upper left first bicuspid and mesial of second bicuspid; gingival third on buccal and lingual pit, upper left first molar.
 14: Occlusal, both upper and lower right second molars; buccal pits in both lower second molars; mesial and gingival third on buccal, both upper second molars; distal, upper left first molar; distal, upper left second bicuspid; distal and gingival third on lingual, lower left first molar; mesial and distal, lower left first bicuspid; mesial lower left central.
 15: No new decays.
 16: No new decays.
 17: Mesial, lower left first bicuspid.
 18: Distal, lower right first molar; mesial, lower left second molar.
 19: No new decays.
 20: Gingival third on buccal, lower right first and second molars.
 21: Distal, upper right cuspid; buccal pit, upper right second molar.
 22: Distal, upper right first molar; distal, lower right first bicuspid; gingival third on buccal, lower left second molar.
 23: Distal, upper right lateral; distal, lower left second molar; occlusal lower left third molar.
 24: Mesial, also lingual pit, lower right second molar.
 25: Mesial, upper right cuspid; mesial, lower left second molar.
 26: No new decays.
 27: No new decays.
 28: No new decays.

No new decays were discovered during the 10th, 15th, 16th or 19th years, nor during the past three years. There were 12

new decays during the 11th year, 9 during the 13th and 15 during the 14th year. In almost every case the decay was discovered early, was removed promptly and temporary restorations of copper cement or base-plate gutta-percha were made. These were replaced at frequent intervals. There was unusual delay in placing permanent restorations, due to the fact that the patient was in the hands of first one, and then a second orthodontist, and considerable time was lost on account of the necessity of making the change. The cooperation of the patient in home care was generally below average during the childhood period.

A chart of the restorations in place in 1935 is shown in Figure 1137, and a full set of radiographs is reproduced in Figures 1138 and 1139. In preparing the radiographic illustrations, enlarged negative prints were made of each of the films, and these were cut and fitted together to make a single photograph of the teeth of each arch. These were again photographed and positive prints were made, which are reproduced in the engravings. These two illustrations are, in effect, panoramic radiographs of the teeth of each arch. The films showed little contrast between the teeth and the restorations, particularly in the molar region, and it was inconvenient for the patient to have new films made when they were needed for the engraver. Therefore, the photographs were retouched to make the outlines of the restorations clear, also along the lines where the several sections join.

These illustrations are presented to show the extent to which restorations have been necessary, also the conditions of the supporting structures, as evidenced by the positions of the interproximal crests of the alveolar process, and the normal structure of the bone about the apices of the roots as a reflection of the vitality of the pulps. In the films, the bone appears to be in perfect condition about the roots of the upper central incisors, from which the pulps were removed in 1924. Every proximal surface in the upper teeth has a restoration, except the distal surface of the upper second molars. In the lower arch, all proximal surfaces of the bicuspid and molars have restorations except two—the distal of the lower right second molar and the mesial of the lower right first bicuspid.

From the radiographs, it might be thought that there was much gold exposed to view on the labial surfaces of the incisors. As a matter of fact, these cavities were cut rather widely to the lingual and very slightly toward the labial, so that but one shows sufficiently to be noticeable, even on rather close inspection. In connection with this writing, the patient was requested to come in for particular examination of this point. This patient is married and has one child.

The chart, Figure 1137, shows the condition of the mouth when the radiographs were made in October, 1935. Opposite each restoration, either on the inside or outside of the chart, the letter "F" indicates gold foil, the letter "I" a gold inlay, the letter "A" an amalgam restoration. In each case the letter is followed by the age of the patient and the year when the restoration was placed. Where a replacement was necessary, the year, in which the second operation was made, is entered. For example the gold foil restoration in the distal of the upper right cuspid was placed in 1922, and a gold foil replacement was made in 1933. Twenty-one gold foil restorations have been made and two have been replaced. Sixteen of these were made in 1922, 1923 and 1924. There are 25 gold inlays, of which 10 are replacements. Three of these were cases in which proximo-occlusal inlays, which were in good condition, were removed in order that a mesio-disto-occlusal inlay could be placed, when the opposite proximal surface decayed. There are 14 amalgam restorations, made at various times since 1917; ten are in gingival third positions in molars and 4 in buccal or lingual pits. None of these have been replaced. Nine of the sixty restorations have required replacement.

In such a case, a high percentage of replacements should be expected, as many of the operations were performed under exceptionally difficult circumstances.

The first molars give the best picture of the degree of susceptibility in this case. There occurred twenty-seven decays in these four teeth. The occlusal restorations were removed when proximal decays necessitated the placing of proximo-occlusal restorations. At the present time the upper left molar has mesio-occlusal and disto-occlusal gold inlays, gold foil in the lingual pit, amalgam in the buccal pit and in the gingival third of both the buccal and the lingual surfaces. The lower left molar has mesio-occlusal and disto-occlusal gold inlays, gold foil in the buccal pit, amalgam in the lingual pit and in the gingival third of both the buccal and lingual surfaces. The right molars have restorations in the same positions as those on the left side, except that the lingual surfaces have no gingival third restorations and there is none in the lingual pit of the lower molar. There are twenty-one restorations in the four first molars.

The main consideration in this case is the fact that the teeth have been conserved to the age of 28, with the contacts and periodontal membranes all in good condition, and without the loss of a pulp, except those in the upper central incisors, which were destroyed as a result of an accident. If the teeth may be conserved in such a case, there would seem to be no question but that success should be certain in a high percentage of cases, provided there is reasonable cooperation on the part of the patient.

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