THE

SURGICAL, MECHANICAL, AND MEDICAL TREATMENT

OF

THE TEETH.

LONDON:
WALTON AND MITCHELL,
Wardour-st., Oxford-st.

OPINIONS OF THE PRESS.

Morning Herald, August 28th, 1846.

"The various and complicated operations of dentistry, and the intimate connection that exists between the healthy or diseased state of the teeth and the other portions of the human economy, demand an amount of surgical skill, aided by the almost equally valuable dexterity of the practised mechanician, which has long been asserted and admitted on the Continent and in the United States of America. In this country it is only within the last few years that the dental branch of surgery has received that share of attention and consideration which would enable the medical man fully to understand and efficiently to treat the irregularities, malformations, and derangements to which these important organs are liable.

"Doubtless one cause of the difficulty which the practitioner in this department has to contend with, has arisen from the morbid delicacy which exists, or, at least, did exist, on the subject of supplying the loss of teeth by artificial means. The sufferer is too often tempted to have recourse to remedies the real value of which is only discovered when serious mischief has ensued. This repugnance is, we believe, fast disappearing, and a further step in the right direction is the present work, the first published in this country, in which information is imparted to the public generally, on what has, hitherto, been a sealed book—the mechanical branch of dentistry. While it conveys in perspicuous language, divested of all professional technicalities, a mass of information on the subject of the teeth, which will enable any one to preserve them in health and beauty, and to arrest the progress of caries when it attacks them; it is still more valuable as a complete *vade mecum* for the young surgeon-dentist; the whole of the mechanical arrangements and apparatus for correcting irregularities of the teeth, engrafting or pivoting artificial teeth on the natural roots, constructing artificial palates, taking models, making plates, &c. &c., being fully and minutely described. . . . .

"The following extracts—'on the best means of preserving the teeth in a healthy state'—will show our readers that there is a complete absence of all professional cant and exclusiveness in Mr. Robinson's work. . . .

"The remarks upon the mechanical treatment of irregularities, are also valuable, and well worthy the consideration of the surgeon-dentist. Pointing out what is erroneous or objectionable in the present system, giving a variety of cases of mal-position and irregularity, the improved mechanical appliances with which he has met them, and the results, &c. . . .

"The success which has attended Mr. Robinson's practice would lead us to infer that even the most unpromising cases are not in the hands of a skilful dentist altogether unmanageable by mechanical means. The suggestions 'on the prevention of irregularities' will be found useful to all. . . . .

"The work is embellished with a large number of engravings, representing the various stages of growth, malformation and decay of the teeth, the improved mechanical instruments invented by the author, and their mode of application."

Morning Post, July 20th, 1846.

"The book will be found particularly useful to mothers; for not only are all the incidents of teething minutely described, but engravings are given, showing the exact position in which the first and second teeth should make their appearance; and remedies for every malformation or deficiency prescribed. The chapter which establishes that the colour, &c., of the teeth may be regarded as evidence of a consumptive habit and a scrofulous tendency, and that which exposes the danger of mistaking nervous affections of the face for neuralgia or tic doloureux, are well worthy the attention of medical men. . . . .

"One hundred and thirty-nine carefully drawn engravings elucidate this work, and the proofs adduced of cures effectually performed in cases generally deemed incurable, offer pleasing assurances of relief to many suffering under irregularly formed and diseased teeth."

Observer, July 12*th*, 1846.

"Not merely one of the most valuable, but *the* most valuable work which has yet appeared in connection with that branch of the human economy represented by the teeth. The book is divided into two parts, the first being purely theoretical, and containing the anatomical and surgical department of the dental art, the second being wholly practical, and in that capacity including the whole cycle of what is designated as 'mechanical dentistry' . . . Of these the former contains a mass of the most valuable information and advice, while the latter fully communicates 'whatever useful or peculiar knowledge the author possesses in the practice of his art to the profession and the public,' without equivocation and without reserve; which is precisely as it should be with all honest professors of science and liberal followers of art.

"Among the most important as well as most interesting facts in this elegant and useful volume is that which propounds an additional diagnosis of consumption in its primary stage: and so offers an opportunity of grappling with that most fearful of all human maladies in its incipient condition, and all but a certainty of arresting its desolating progress. . . . .

" In publishing this work Mr. Robinson has done good service to the community at large, as well as to the profession of dentistry, both in a moral and physical point of view. As a practical manual, it is invaluable to the public as much as to the professors of the dental art; while, in a moral sense, it may be described as equal in extent, and almost equal in execution, to those productions in which a single subject of science is made available for the illustration of the omnipotence of the Deity, and of which Sir Charles Bell's *Bridgewater Treatise* upon *The Hand* offers the principal exemplar in the English language."

Spectator, July 4th, 1846.

" This volume differs from other books on the subject of dental surgery, chiefly in the neatness of its many plates and the extent of its range, which commences with the state of the art among the ancients, and terminates with a full but strictly practical account of the mechanical part of the dentist's profession."

Sunday Times, July 19*th,* 1846.

" The work before us contains an elaborate and well arranged treatise on the various modes of treating the teeth. . . . .

" The volume also contains a valuable exposition of the principles of mechanical dentistry. . . . . It appears to have been written with great care, and displays much professional research."

Atlas, July 18*th,* 1846.

" It is always with caution that we notice medical books put forth in a popular form; they are so often published with a sinister aim, either in respect of the profession, or the public. But in this instance there is apparently no ground for mistrust. Mr. Robinson's volume is decidedly a clear, intelligent, and scientific performance." . . . .

"Most of us have at some period or other of our lives felt the painful truth of this observation: and there are few who would not gladly be spared the necessity for another 'absolute prostration.' To such we would say,—Read this work of Mr. Robinson's. . . . .

"Mr. Robinson has been most minute in his advice—most comprehensive in his instructions. The patient and the practitioner are alike under heavy obligations to him for his painstaking, and will we dare say, recognize his services by consulting his work on every possible occasion." . . . .

Pharmaceutical Journal, August 1st, 1846.

"Without pretending to possess a knowledge of dental surgery, which is out of our province, we find in the above work the evidence of labour, and a minute classification of every branch of this important subject; . . . . comprizing historical, anatomical, physiological, chemical, medical, surgical, and mechanical information."

Dublin Medical Press, September 2nd, 1846.

"Mr. Robinson's treatise consists of two parts: the first is devoted to the anatomy, physiology, surgical and medical treatment of the teeth. The second (which is entirely novel in works published in this country) is upon mechanical dentistry: each process and manipulation is familiarly illustrated: the various kinds of artificial teeth are described: and the methods of adapting and of fixing them are demonstrated. Both parts are profusely illustrated with wood-cuts and diagrams. . . . .

"In conclusion we shall only remark, that we think very highly of Mr. Robinson's work. Besides being a complete manual of dental surgery, it contains much valuable information upon several points, which the medical student, and even the practitioner, is often too superficially informed upon."

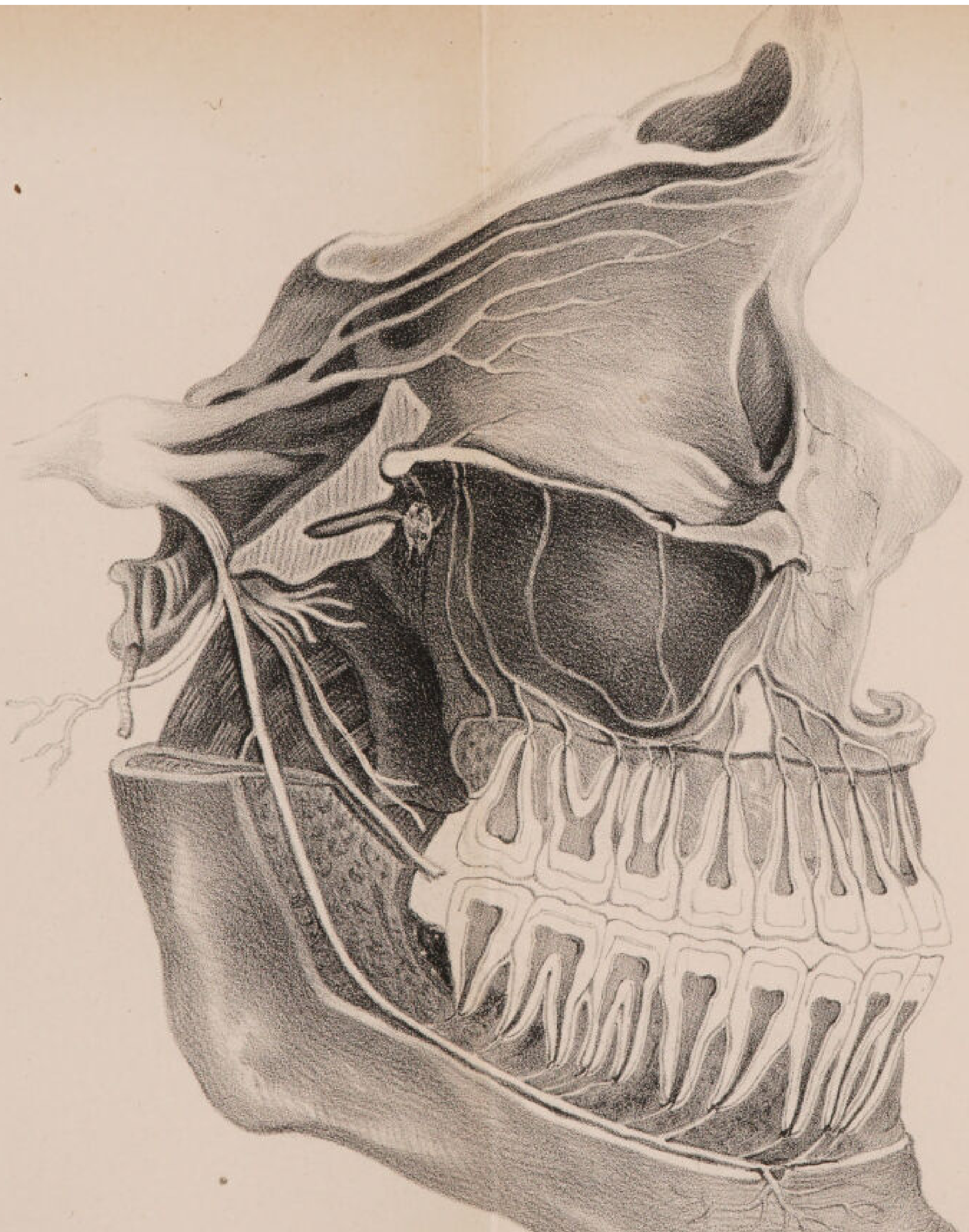
Monthly Journal of Medical Sciences, Oct., 1846.

"Mr. Robinson has performed his task in a very creditable manner, and produced a work which will be very useful to the student who devotes himself to this department of the profession, and also to the general practitioner, who is often called upon to perform operations on the teeth and gums. . . . .

"The portion of the work devoted to mechanical dentistry embraces much useful information." . . .

Dental Intelligencer, (Philadelphia, U. S.) Sept., 1846.

"The work is beautifully printed on good paper, and in every respect handsomely got up, and as creditable as it undoubtedly is to the publishers, it is equally so to the author. It is well written, and embodies a vast amount of valuable information, embracing, as it does, almost every subject coming within the proper province of dental surgery. It is intended for the general as well as the professional reader, and hence the author has very judiciously, so far as practicable, avoided the use of technicalities." . . . .



Longitudinal Section of the Teeth of a Young person, exhibiting their internal structure in connexion with the Nerves of the Head and Face.

M & N Hanhart, lith Printers

THE SURGICAL, MECHANICAL, AND MEDICAL TREATMENT OF THE TEETH:

INCLUDING DENTAL MECHANICS.

ILLUSTRATED WITH

ONE HUNDRED AND THIRTY-NINE ENGRAVINGS,

(DRAWN BY FELIX ROFFE, AND EXECUTED BY W. CLEGHORN.)

BY

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SECOND EDITION.

LONDON:

W. WEBSTER, 60, PICCADILLY;

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1846.

"DENTIUM CURAM HABETO, UT BENE DIGERAS, ET DIU VIVAS." (BAGLIVI, OPERA, PINELS EDITION, p. 112.)

"NO ART IS COMPLETE, UNLESS ANOTHER ART, THAT OF CONSTRUCTING THE TOOLS AND FITTING THEM FOR THE PURPOSES OF THE ART, IS EMBODIED IN IT." (JOHN MILL, A SYSTEM OF LOGIC, INTRODUCTION, § 7.)

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PART II.

MECHANICAL DENTISTRY.

PREFACE.

In submitting the following Work on the Teeth to the suffrages of the profession and the public, the author may be allowed to make a few remarks in explanation of its nature and scope.

If it be right to measure value by utility, then the teeth will take high rank among the parts of our outward system. For their offices are sufficiently universal. Thus they perform the first process on the food, being indispensable to adult digestion; and by comminuting the same, they minister to the sense of taste, which is null and void unless objects be reduced to a size adequate to the gustatory sensoria: moreover their soundness is essential to comfort in eating: and again, their healthy state and regular position are requisite to beauty in man and woman, and to the perfection of the voice. These considerations, which might easily be extended, are enough to justify any one in making the teeth a distinct object of attention.

Accordingly, it is not surprising that a multitude of works have been written on the teeth. Indeed the number is so great, that it may seem as if the field were sufficiently occupied, without the present attempt. A little consideration, however, will serve to shew that this is not the case.

In the first place, we must not be deceived by mere number of books, which is often no test of the quantity of useful information existing upon a given subject: moreover if we estimate by original matter, putting aside those publications that are but copies of others, we shall find that the number of standard works on dentism is by no means great. In the second place, in England, even from works of admitted excellency, that basis of the dental art,—the mechanical branch,—has been hitherto excluded.

Without desiring in any way to disparage the admired labours of others, we have, in our work, endeavoured to give our own observations in preference to copying from sources already extant: and it has also been our aim to write in common terms wherever it was possible. For the time has come when the arts and sciences should be appreciated by the public, which will hardly think worse of the professions for ceasing to speak an unintelligible language. As however it is impossible wholly to avoid technicalities, we have appended to the volume a Glossary of those we have been constrained to use.

Part I. of the work contains the anatomical and surgical department of the dental art; and teaches the means of treating the teeth when diseased, of turning them to the best account in cases of partial decay, and otherwise of keeping them in health and beauty. The illustrations to this Part, which are numerous, are particularly necessary, as some of the subjects and cases that have occurred to the author in the course of an extensive public and private practice, and which he desires to place prominently before the reader, are, it is believed, new, and could not so well be understood by a bare description.

Part II., which is intended rather for the student and practitioner than for the general reader, contains the art of mechanical dentistry with all the improvements of the present day. Each process of manipulation connected with the teeth is described and illustrated. The various kinds of artificial teeth are also treated of, and the means of adapting and fixing them are shewn, not only by words, but by suitable diagrams and wood-cuts. In this department of the book, it has been the author's aim to raise the character of the dentist as a mechanician, and to carry whatever useful or peculiar knowledge he himself may possess to the doors of all his worthy brethren in the profession.

In conclusion it may be observed, that the importance of the dental art, and the consequent success of skilful dental practitioners, has attracted into the profession a number of persons of dubious character, who are rather studious of gain, by whatever means obtained, than of honestly practising their assumed calling. Dentistry, however, is not peculiar in this, for it is a common complaint in all professions. The fact has distinctly influenced our intentions in the following pages. We have hoped, by combining perspicuity with a full and detailed consideration of our art, to furnish some safeguard to the public against the class of persons before hinted at: and for this purpose we have pointed out some of the indefensible practices of which they are guilty; such as the substitution for gold of other metals electro-gilt; the employment of impure gold, &c., &c., &c.

It is our belief that all the professions exist primarily for the public, and this is the only reply we can make to any who may think that we have too explicitly divulged the secrets of our noble art.

7, Gower Street, Bedford Square,
June, 1846.

PART I.

THE SURGICAL, MECHANICAL, AND MEDICAL TREATMENT OF THE TEETH.

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CHAPTER I.

THE HISTORY OF THE DENTAL ART.

THE origin of medicine, like that of many other arts, is involved in considerable obscurity. To heal the sick, mitigate the pangs of suffering humanity, and stand between disease and death, were considered god-like attributes; and therefore the ancients, who leant to the theological rather than to the natural truth of things, affirmed medicine to be a divine emanation, and impersonated it firstly in Apollo, and next in his son Æsculapius; and thus its early history is mixed up with mythology and poetry.

Although we cannot imagine a state of society so happy as to be free from pain, disease, and death; although accidents, the changes incident to the growth and decay of the human body, the invasions of pestilence and the casualties of battle, must at all times have called attention to medicine, and rendered the *practice* of the art a necessity, still we have no authentic history of its rise and early progress.

Eusebius mentions Athotes, an Egyptian monarch, as having written several treatises on anatomy; but the existence of this king is doubted by others: and Thouth, an Egyptian, who according to Diodorus lived B.C. 2000, is generally supposed to be the first who wrote on medicine, which in his time was not cultivated as a separate art, but was practised indiscriminately by priests and warriors, poets and philosophers.

Although the increase of luxury, and consequently, of attention to personal appearance, must have rendered the subject of dentistry one of considerable importance; and although the eye and ear had long been objects of particular observation and separate practice; yet it is not till the time of Hippocrates that we meet with any notice of the diseases of the teeth, or of those who practised the art of dental surgery. This is the more extraordinary, as the significance of these organs,—to say nothing of their ornamental or useful functions,—was acknowledged in a remarkable manner by the ancient Egyptians, so that one of their most severe and infamous punishments consisted in the abstraction of a front tooth.

There is no doubt, however, that the manufacture of artificial teeth, and other branches of dentistry, existed after a fashion, much earlier than history informs us. The loss of a front tooth, whether by disease or not, would naturally, under the circumstances of Egyptian law, give rise to unpleasant suspicions, and every exertion might be expected to be made to supply the deficiency. Accordingly, Belzoni and others have discovered artificial teeth in the sarcophagi of the Egyptians. These, it is true, are rudely made, and from being of wood, are ill adapted for performing mastication: nevertheless it may fairly be inferred, that their effect on the articulation of the voice, and the support they afforded to their natural brethren, would suffice to point out dentistry as a pursuit for the ingenious and mechanical.

We have historical evidence, that in the palmy days of Greece and Rome, the diseases and general appearance of the teeth met with considerable attention.* Aristotle speaks of forceps for extracting the teeth.† Pliny also and Martial mention various

* At the commencement of the Christian era, we find, in the writings of Celsus, very explicit instructions respecting several important operations on the teeth: and during recent excavations at Pompeii and Herculaneum, various dental instruments have been discovered, much resembling some of those in use at the present day.

† "Quæstiones Mechanicæ," cap. xxii.

tooth-powders; and the wearing of artificial teeth evoked the satire of more than one Roman poet.*

Among the Greeks, a peculiar affection called stupor of the teeth, is particularly described, in connexion with the presence of tartar. This people looked upon dentition as a mysterious and significant event; and those who died before its fulfilment were denied the funeral honours of the adult, and ignominiously buried, instead of being burned in the usual manner.

As a *distinct* art, however, dentism received but little attention from the ancients. The writings of Hippocrates and Galen, which formed the medico-dental text-books, contain receipts for electuaries, powders, and elixirs for beautifying the teeth, but nothing on what may be called the proper art and science of dentism.

In the early part of the eleventh century, Albucasis, an Arabian physician, wrote on diseases of the teeth, and gave drawings of a number of instruments used in his time for extracting, scraping, and the other dental operations then in practice. But it was not till the end of the sixteenth century that the art began to receive that undivided attention

* Martial makes habitual allusions to artificial teeth as worn by the ladies of Rome in his time.

to which it is entitled both by its difficulty and usefulness.

No less than thirty-eight treatises on the subject were published about that time. These abound indeed with what is nowise useful at present, but still the spirit that produced them is an evidence that the subject was beginning to be considered of importance, and that time and experience alone were required to raise dental surgery to its proper station among the arts.

The first attempt to classify diseases of the teeth was made by M. Fouchard, of Paris, who has been denominated the Father of dental surgery. Before his time, the practitioners of the art seem to have considered the teeth merely in their mechanical phase, taking little account of them as complex organic structures, entering by their own vitality into the formation of the living body. M. Fouchard had the merit of directing attention not only to the construction and separate treatment of the teeth, but also to the indications which, in common with the adjacent parts, they furnish of the general health.

This was an important advance in the subject. For that the teeth not only represent the apparent, but also the *innate* fundamental constitution of individuals, is unquestionable: nay, so intimately are beauty and firmness in these organs connected with health, that the celebrated Delabarre, (to whom we are indebted for an excellent work on the subject,) recommends those mothers who have constitutionally bad teeth, to refrain from suckling their children, lest they entail not only bad teeth but debilitated constitutions on their offspring; and he points out, that in choosing a wet-nurse, "her eyes should be lively and animated; her hair and eyebrows brown or light-coloured; her lips red; her *teeth* sound and good; her gums hard, and well coloured."

We before mentioned that by the end of the sixteenth century, thirty-eight treatises had appeared on the teeth; but so much had the subject grown in consideration at the end of the eighteenth century, that no less than one hundred and fifty-eight works connected with it had then been given to the European public.

To enumerate these works would be inconsistent with our plan, but it may not be amiss to notice a few of the most important. Thus Bunon published in 1723, Mouton in 1746, Le Cluse in 1755, Bourdet in 1758, Bunon again in 1759. In 1766, the celebrated work of Jourdain made its appearance, and in 1770 Thomas Berdmore produced a work on the teeth, which by its value and importance obtained him the appointment of dentist to George III.

About this period, the famous John Hunter turned his attention to the subject, and presented the world with his "Natural History of the Teeth;" a production which, while it enlarged the sphere of dental knowledge, piqued the pride and roused the ambition of the English practitioners of the art.

The inaugural Dissertation on the Structure of the Teeth of man and animals, published in 1798 by Robert Blake, gives evidence of the rapid strides that had been made in the anatomy and physiology of the teeth. This work was soon followed by others, and at the commencement of the nineteenth century, the surgeon-dentists of this country were fully entitled to rank with the practitioners of the other branches of surgery.

The most important of the works of our own time are those of Fox, 1803, Bell, 1829, Nasmyth, 1839, Owen, 1840; also those of Snell, Waite, Robertson, Jobson, and Koecker; besides which, we might enumerate several smaller works by Saunders, Clendon, White, and others, and many valuable detached papers in transactions and periodical publications.

Within the last century, dentistry has advanced far more rapidly in the United States than in any other country. Thus we have Gardette in 1821, Parmly, L. S. Parmly, and Flagg in 1822, Trenor, 1828, Fitch, 1829, Brown, 1833, Spooner, 1836, Goddard, 1843; and in 1845, Dr. Harris, one of the editors of the *American Journal and Library of Dental Science,* published a most able and comprehensive work, entitled the *Principles and Practice of Dental Surgery.* And many other productions on the subject have appeared in America, and especially in the periodical just alluded to.

That some of the opinions of the ancients respecting the teeth should be useless for our purposes, is by no means surprising. Hippocrates describes them as glutinous extracts, from which the fatty part has been burnt up by heat, and affirms that they are harder than the other bones, because they have no heat in them. It is hard to appreciate the meaning of this at the present day. Aristotle, however, (who, as is usual on all subjects, has some excellent generalizations respecting the teeth of man and animals,) declares them to be the only bones that grow through the whole of life; because, as he says, they would soon be worn away by attrition, unless they were continually renewed.* This at all events is intelligible and

* "De Generatione Animalium," lib. ii., cap. vi.

suggestive, whatever may be thought of the conclusion which Aristotle deduces from it. He adds, that the growth is manifest in those teeth that have lost their corresponding opposites in the other jaw.

Before concluding we may be allowed a word respecting the present state of dental art and science. The conditions of success appear to be not different in this from what they are in other branches of knowledge and practice. They are all summed up in one phrase, UNITED LABOURS. Whatever of discrepancy there is in the works of our chief authorities, is greatly owing to the isolation in which they studied, and to the want of a general means of collating their ideas. Again, whatever of progress we find in that country which takes the lead in the dental art, appears to be due to an absence of prejudice and jealousy which allows free communication of ideas, and association of common interests, among the members of the profession. For the association of dentists in America has not only given its members generally a *status* in society unknown to dentists elsewhere,—has not only repressed those characters who intrude themselves upon the public here, and given merit its station and honesty its preëminence,—but has also contributed largely to the advanced state in which dental science stands in the United States. It is painful to think that we do not yet possess the same advantages in England. The names of Harris, Brown, Parmly, Maynard, Greenwood, Goddard and Haydon, shine high over our heads in these respects, and present us with bright examples of brotherly good feeling, scientific excellence, and practical success.

In modern days odontology has become a science separate from the dental art. This is because the philosophical value of the teeth is so great as to make them one of the grand means of classification in natural history and comparative anatomy. The microscopic structure of these organs has also been noted with great patience and powers of research. Among those who contributed to the general science of the teeth in the sixteenth, seventeenth and eighteenth centuries, Eustachius, Malpighi and Leeuwenhoek stand preëminent; and among the best odontologists of our own time are Owen, Nasmyth, Goodsir, Müller, the Cuviers, Rosseau, Purkenji, and especially Retzius.

CHAPTER II.

THE FIRST SET OF TEETH.

EVERY parent should have at least a general knowledge of the development and anatomy of the first teeth, not only from its scientific interest, but also from its great importance in the management of children. The time for their first appearance, as well as for many of the other processes of nature, is subject to considerable variation. And although some authors have endeavoured to shew that the teeth furnish a test of age, yet there are many cases on record of children having been born with one, two, or more of these organs. Whatever history may sanction, Shakspeare committed no physiological error in attributing such a peculiarity to his hero, Richard, who is made to say, "I was born with teeth." The same is stated of Louis XIV., of France, in whom the presence of a tooth at his birth, seemed to forbode his future greatness. In our own day, Dr. Crump described before the American society of dental-surgeons, the case of a child whose jaws at birth exhibited the full deciduous denture.

The deciduous or milk teeth, originally produced by a process of secretion, are contained within their alveoli or sockets at birth: the forms of ten of them of a bony substance being distinctly visible in either jaw. As ossification proceeds, they assume a more perfect character. Their investing membrane secretes a fluid, from which a white substance is deposited upon the pulp; this is the enamel, which is at first of a consistence scarcely harder than chalk, but acquires such a degree of hardness by age, that a file is soon worn smooth in cutting it.

After birth, the growth of the teeth is rapid, and they cannot long be confined within their alveolar cavities or cells. Still however, as before observed, the time of their outward appearance is uncertain, depending on the health and constitution of the child, and on a variety of other circumstances. During their growth, the fangs are the only parts that lengthen; and as this takes place, the sockets grow around and more closely invest them.

The twenty deciduous teeth—ten in the upper and ten in the lower jaw—generally make their appearance in the following order:—

The two lower, followed by the two upper centrals, from the 4th to the 8th month.

The two lateral incisors in each jaw, from the 7th to the 11th month.

The four anterior molars, two in each jaw, from the 12th to the 18th month.

The four canines, two in each jaw, from the 16th to the 22nd month.

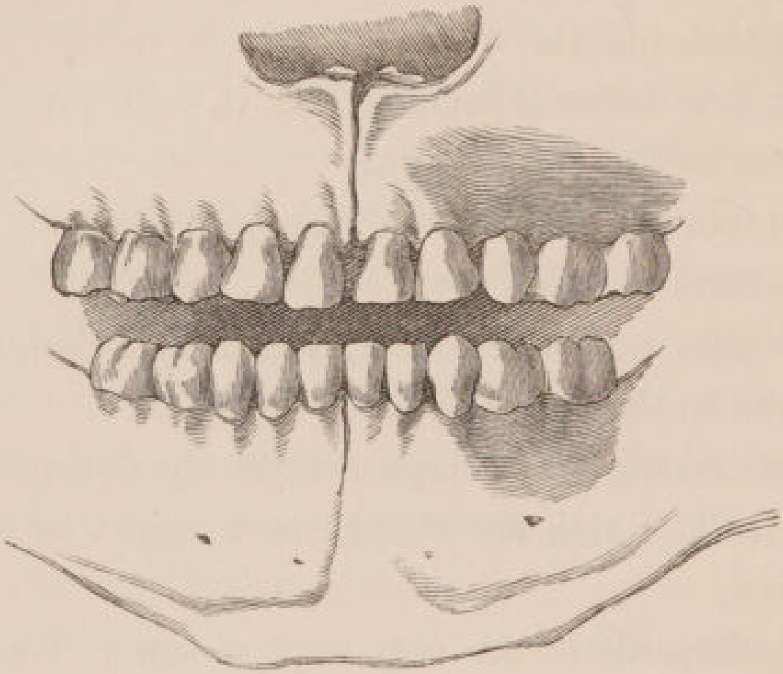
The four posterior molars, two in each jaw, from the 19th to the 38th month.

These furnish the complement of the deciduous or milk teeth, which are twenty in number, or ten in each jaw.

But these dates are only approximate. We have seen children that have attained the age of twelve months, or even sixteen, without cutting a tooth; and Lefoulon mentions a young girl of seven years of age, whose lower central teeth had not appeared; while on the other hand, as we before observed, there are many instances on record where children have been born with teeth.

Nature occasionally varies the order as well as the time in which the teeth appear; sometimes the top incisors appear before those of the lower jaw; at other times, the canine teeth precede the lateral.

Perhaps, as a general rule, the first set of teeth may be said to be perfect by the third or fourth year, when they present this appearance.



INFANTILE DISEASES FROM TEETHING.

The period of teething is one of pain and danger to the child, and of care and anxiety to the mother; for though in favourable cases, the symptoms are slightly marked, and limited to swelling and redness of the gums, increased flow of saliva, and slight affection of the bowels, yet it frequently happens,

sure exerted and the resistance offered to it: under which circumstances the constitution of the child may reproduce the latent seeds of consumption or scrofula, or of other diseases which may have laid dormant for generations; and thus either the little sufferer may be worn out by constant pain and irritation, or his future health, strength, and perchance his intellects, may be irrevocably impaired.

In one child we meet with hurried and oppressed respiration, giving evidence of congestion of the lungs: in another, the head is affected, and delirium, convulsions, or perhaps hydrocephalus is the result.

Some infants have glandular swellings in the throat, with their concomitant evils; others are worn out by the slow fire of irritative fever.

This catalogue of infantine pains and miseries, fearful though it be, we are bound in honesty to set down, not, however, to alarm parents, but to shew that the process of teething is a most important one, and demands the greatest care and attention.

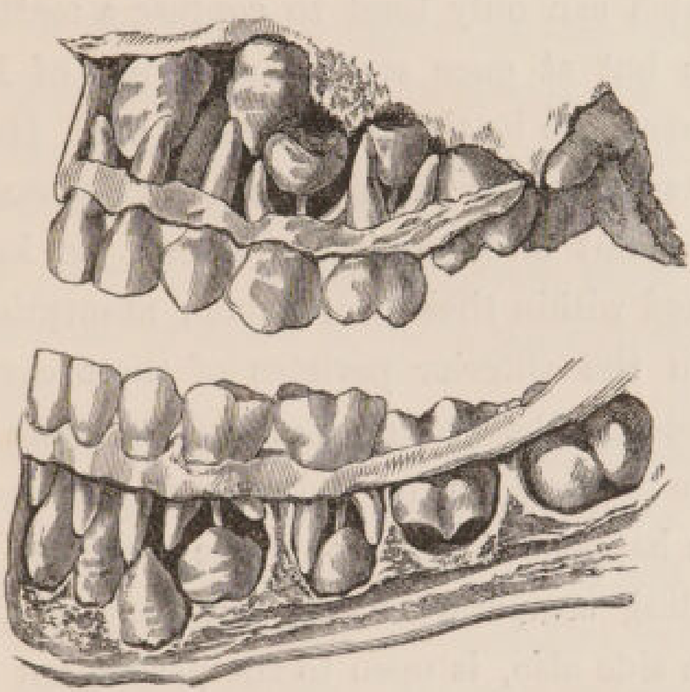
Nature frequently throws off the excess of irritation by means of her own, and thus it is that eruptions on the skin, breakings out behind the ears, and diarrhœa, are constant accompaniments of dentition.

While, however, we would urge upon mothers the duty of watching their tender infants through the

PROGRESS OF THE SECOND OR PERMANENT TEETH IN THE JAWS, AT THE COMPLETION OF THE FIRST.

When all the deciduous or milk teeth are complete, and arranged in their respective places, and even before this, during the period of their growth, the second set is already in the course of preparation. In the whole of them ossification has considerably proceeded; the four top and bottom front teeth are in an advanced state of formation; the four anterior molars are nearly perfect, and the remainder are in different stages of development: while the rudiments of the wisdom teeth remain embedded in the alveoli.

At the age of six years there are generally no less than forty-eight teeth in the two jaws: twenty deciduous teeth, all perfect; and twenty-eight permanent teeth in various stages of evolution, and in separate and distinct cells, as represented in the following cut. On reference to this it will be observed, that the whole of the second set lies somewhat behind the first, and is confined in a narrower circle; so that as the second set increase in size, they must necessarily crowd the jaw, and ultimately force the first set out of their places. Although the second teeth are in distinct cells, their connection with the first set is continued by means of a



cord (see plate), through a small opening at the bottom of the sockets of the deciduous teeth. This communication serves to supply the former with vitality; viz., blood-vessels, arteries, and nerves: and hence the necessity of preserving the first teeth as long as possible,—a subject to which I shall more particularly allude when speaking of the causes of irregularity (pp. 36—39).

SHEDDING THE FIRST TEETH.

I shall not enter upon the various and conflicting opinions that have been broached on this subject, and which can only tend to confuse a matter really simple; but at once state the opinion of Mr. Bell, which seems to be the most rational one. He asserts, that as soon as the second teeth have advanced to a certain point of formation, and can no longer be contained within their own alveoli, absorption takes place in the anterior parietes of these cavities, by which means the teeth are allowed to come in some measure forward. In consequence of this absorption, it often happens that not only the socket of the corresponding temporary tooth, but that of the tooth on each side also, is open to the permanent one.

Absorption now commences at the root of the temporary tooth, generally on that part nearest its successor; and this goes on by degrees as the latter advances, until the root is completely removed. The crown at length falls off, leaving room for the permanent tooth to supply its place.

The absorption of the root seldom, if ever, commences at its extremity, but generally at a considerable distance from it, and often near the neck. When a portion of the root has been removed, it has somewhat the appearance of being broken; but a little observation will soon enable any one instantly to detect the difference.

No precise time can be fixed when this important

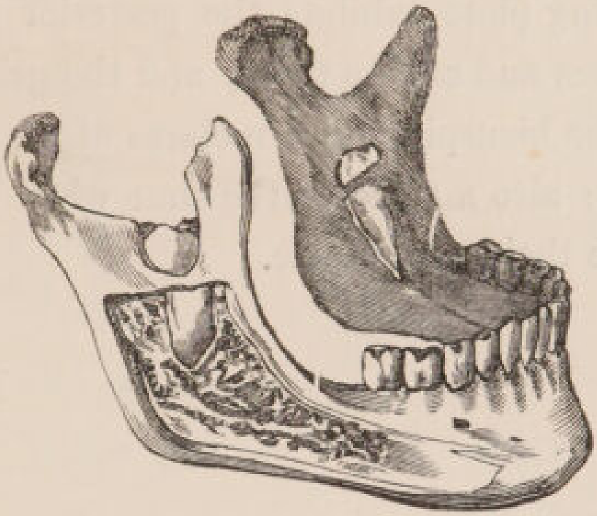
ance of the second teeth takes place at from *six* to *eight* years of age, commencing with the first anterior permanent grinders, the cutting of which usually precedes the shedding of the two central incisors of the lower jaw.

The following table will shew, as accurately as the subject admits, the order in which the permanent teeth appear :

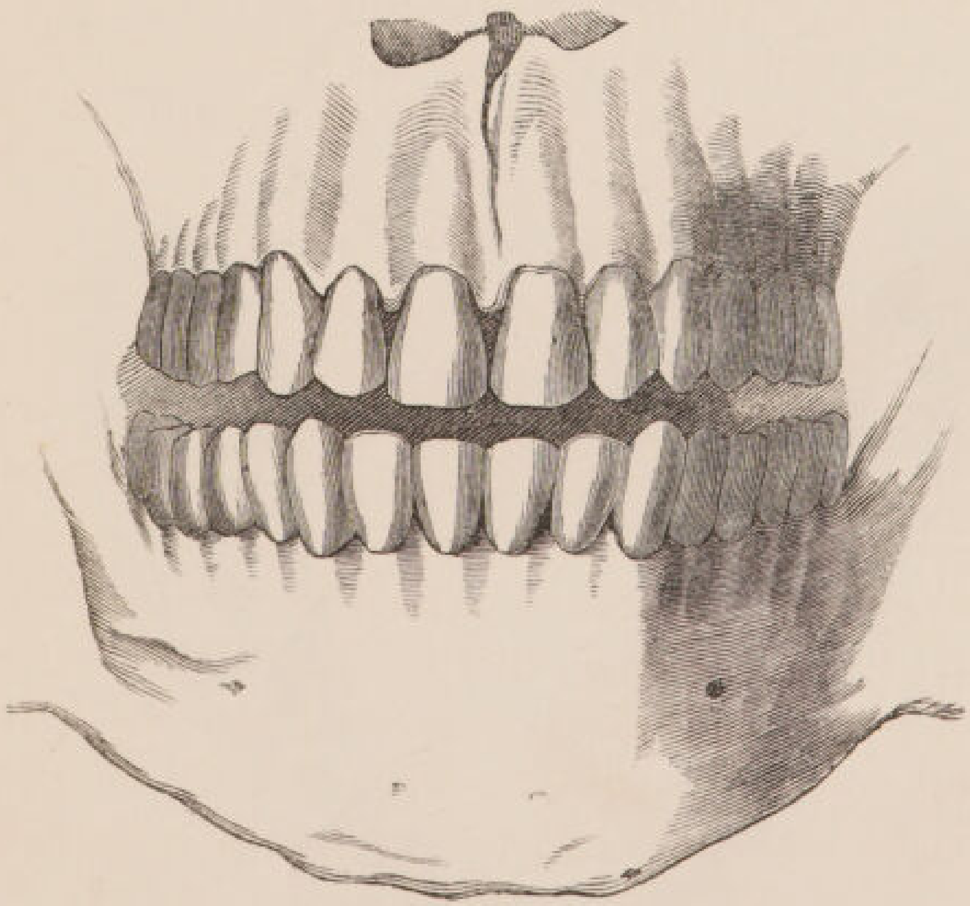
			Years of Age.
4	Anterior Molares	from	6 to 7
4	Four Central Incisores, two in each jaw......	,,	7 to 7½
4	Lateral Incisores, on each side of the preceding	,,	7 to 8
4	Anterior Bicuspides	,,	8 to 9
4	Posterior Bicuspides	,,	10 to 12
4	Cuspidati	,,	11 to 13
4	Second Molares	,,	12 to 14
4	Third Molares (or Wisdom Teeth)	,,	18 to 30
32			

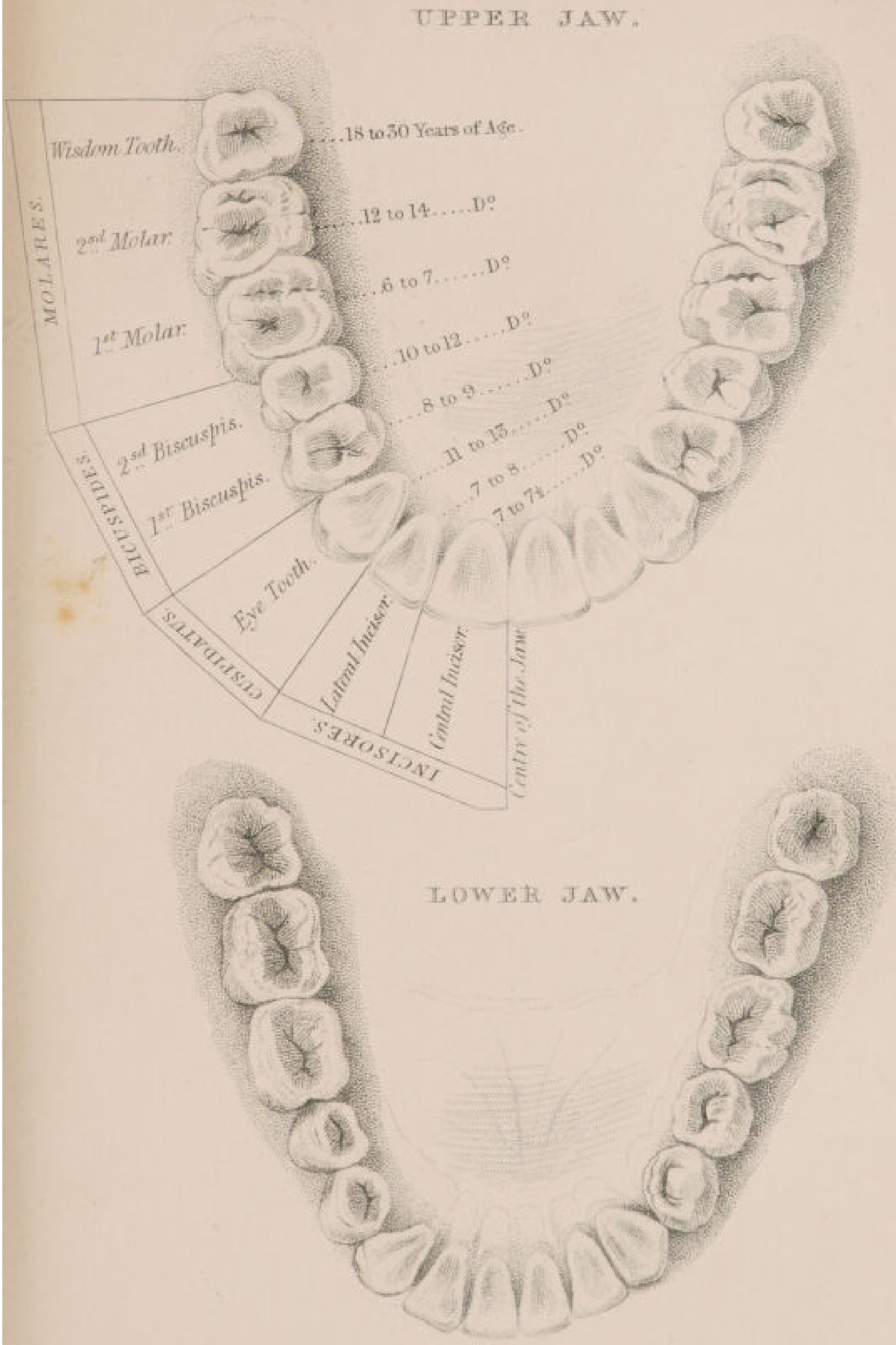
These latter teeth, however, do not always appear in the order above indicated, and moreover occasionally they come forth in the most singular positions.

In the following cut it will be observed, that instead of the wisdom teeth being near the second molars at the back of the jaw (indicated by the white line), they have made their appearance considerably above, and out of, the natural situation.



The annexed wood-cut represents a front view of a complete set of adult permanent teeth. And





A COMPLETE SET
OF
PERMANENT TEETH.

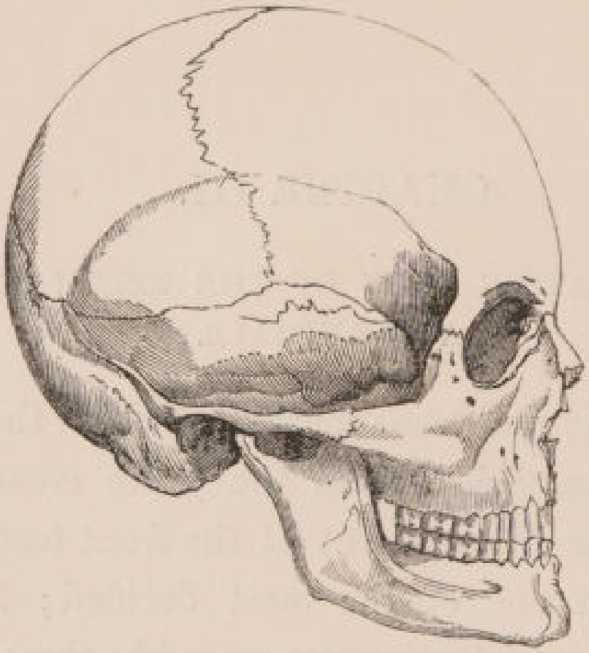
CHAPTER III.

A COMPARATIVE VIEW OF THE TEETH OF MAN AND ANIMALS.

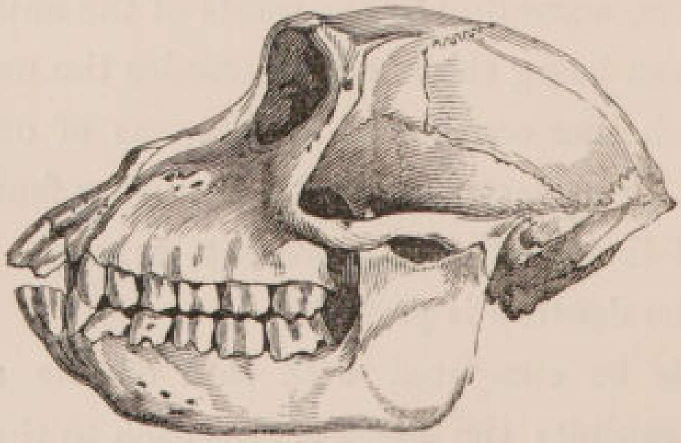
Amongst the numerous marks by which the human race is distinguished from the brute creation, the perpendicular arrangement of the front teeth of the lower jaw is one of the most decided; for however the human teeth may resemble those of animals in size and position, the development of the chin shews that the erect posture is natural to man alone. In man again the teeth are of a uniform length and continuity of series; which is not the case as regards other animals, in which the *canine* teeth are observed to be of greater or less extent than the others, according to the wants of the animal. In the human being the hand supersedes the use of the teeth, whether considered as weapons of offence or defence, or as instruments for procuring food.

The following figure represents a human skull in which the denture is perfect.

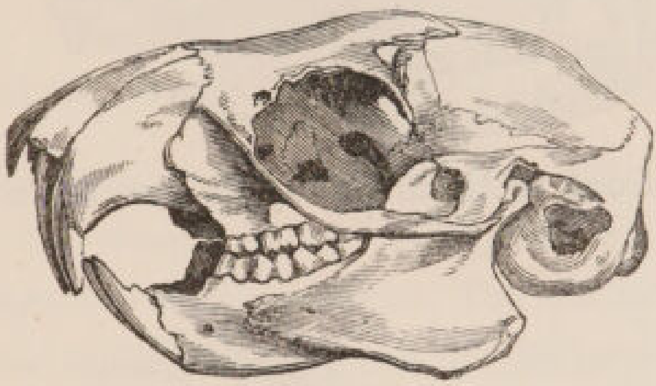
If this be compared with that of the monkey, (which exhibits the nearest approach to the human



form,) it will be found that, while in both cases the teeth are equal in number, in the monkey the lower teeth diverge upwards and outwards instead of upwards perpendicularly; and that the canines are considerably longer than the others, and than those of the corresponding class in man.



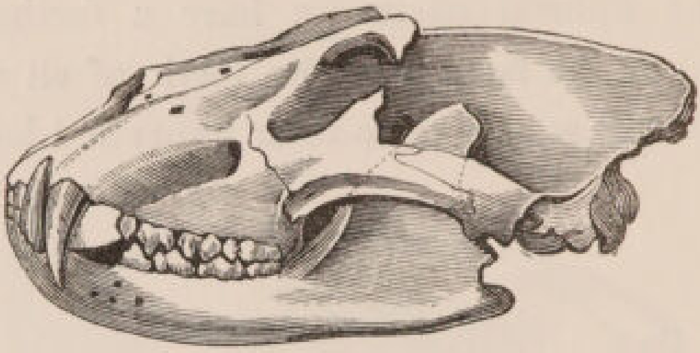
In the squirrel again we have a further confirmation of the fact, that the teeth of all animals are developed according to their wants and habits.



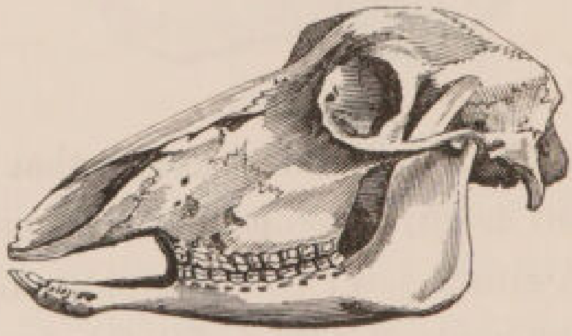
In this sketch it will be observed that there are only two front teeth, accompanied by a certain protuberance in either jaw; the bicuspides being deficient, and the molares, which fill the back part of the jaw, being separated from them by a considerable interval.

Again, on comparing the skull and denture of the lion with that of man, it will be found that the canine and incisor teeth are strikingly different, particularly the former; which, being intended in the lion to rend and tear the prey, for the previous mastication of which the animal has no mechanical contrivances, are developed very strongly indeed.

In the sheep, on the contrary, as the representative of another class of animals, it is remarkable



that the front teeth in the upper jaw are altogether wanting.



In short, we may take the whole animal creation, and we shall find the same appropriate arrangement; proving incontestably that the teeth of all animals are peculiarly adapted to their several wants, habits, and necessities.

CHAPTER IV.

THE CAUSES OF IRREGULARITY OF THE TEETH.

IRREGULARITIES of arrangement can only be said to affect the second set of teeth, and are of two kinds, *temporary* and permanent. The first kind arises from a too rapid advancement of the second teeth before a corresponding absorption of the first has taken place; by which the second are forced into unnatural positions, and pierce the gum either before, behind, or in some cases on the sides of, the temporary ones. The second kind of irregularity arises from the increased size of the second teeth as compared with the first, and from their coming forth before a sufficient expansion has taken place in the jaws to permit of the teeth piercing the gum in a regular manner.

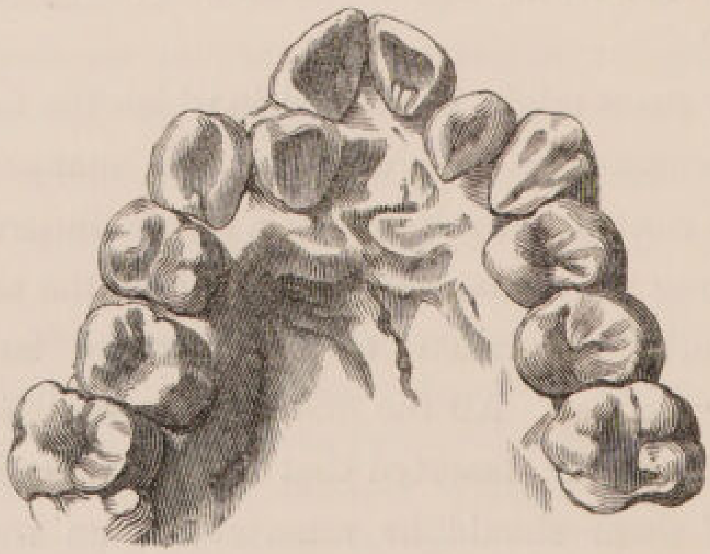
These irregularities are chiefly confined to the front of the mouth, though cases do occur, and that, frequently, in which the bicuspides are affected in the above manner. Moreover many cases which at first come under the denomination of temporary, may, if allowed to continue beyond a certain time, become

the too early extraction of the *first* teeth before the second are sufficiently developed to take their places; which is frequently practised under the idea of preventing deformity. That this practice, however, is more often the cause of permanent deformities of the second denture than any other, may be easily proved. For how often do we meet with otherwise beautiful faces, the contour of which has been irremediably destroyed by it! The practice itself cannot be too severely reprobated; nor can those who indulge in it be allowed to remain within the pale of civilized dentism.

What can be more painful than to see a naturally well-formed mouth permanently disfigured by the practitioner to whose care it has been entrusted, and who, with the professed design of preventing, actually entails an irremoveable deformity on his patient?

Many cases might be related in which the face has been permanently disfigured in this manner, but we shall content ourselves with a single illustration.

A young gentleman, six years of age (the son of a nobleman), was taken to a dentist to have his mouth examined. All the first teeth were firm. The dentist, however, asserted that it was necessary that some of them should be removed, or an irregular permanent set would otherwise result. He very dextrously extracted *eight* front teeth, four from each jaw, and dismissed the patient with a wish to see him *when* the second teeth had come through. Twenty-two months, however, elapsed before this occurred; and during the interval the alveolar processes had collapsed, and the teeth gradually made their appearance, some of them half-way down the jaw at the centre, others protruding at an angle of forty-five degrees. All this, it was asserted, would soon come right if a *few more* were extracted. The four canines and two temporary grinders were now removed. Thus in less than two years this operator had removed the whole of the front teeth; and when I saw the boy, at which time he was *thirteen* years of age, his mouth was as represented in the annexed cut. The arch and



angles were beautifully developed, and allowed ample room for the increased size of the teeth. Now surely this is a lamentable case. The general reader will readily appreciate the false grounds of the practice itself, by referring to the wood-cut, p. 25, which shews the intimate connection between the first or deciduous and the second or permanent teeth.

THE MECHANICAL TREATMENT OF IRREGULARITIES OF THE SECOND TEETH.

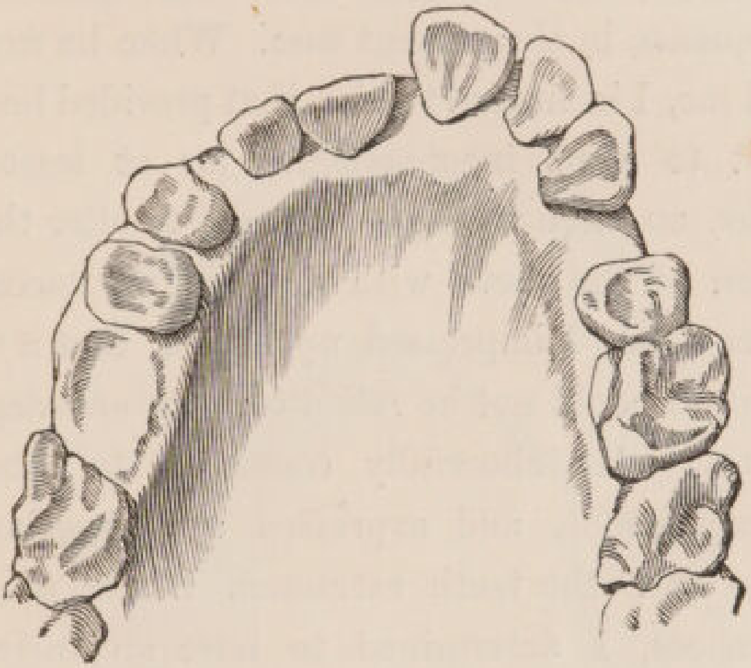
There is no branch of the dental art on which there exists greater diversity of opinion than on the treatment of irregularities of the second dentition. Not only are mechanical contrivances constantly made use of, which are erroneous in principle, and consequently do harm instead of good; but the time at which really useful means may be employed with advantage is by no means settled among dental practitioners. The subject is one of the greatest importance, not only as regards comfort and personal appearance, but the possession of a free and perfect enunciation. We shall therefore devote a chapter to its illustration.

Numerous works have been written on the proper treatment of irregularities of the teeth; and each author, though differing from his brethren perhaps in everything else, lays down the principle that no alteration in the position of the teeth can be effected after the age of fourteen.

Mr. Bell, indeed, mentions a patient, whom he successfully treated in a case of the kind between the ages of 19 and 20; but the prevailing opinion is, that it is useless to interfere with irregularities of the teeth after fifteen or sixteen years of age.

I had, however, for some years been impressed with an opinion, that irregularities of the human teeth were susceptible of great improvement, if not of complete cure, at a much later period than the generality of the profession seemed willing to allow; and in this opinion I have since been confirmed by the successful results of practice. In the *British Quarterly Journal of Dental Surgery* I first published a paper on the subject, which had the effect not only of altering the methods employed, but of fixing the time at which means may be used with complete success at a much later period of life than that commonly assigned.

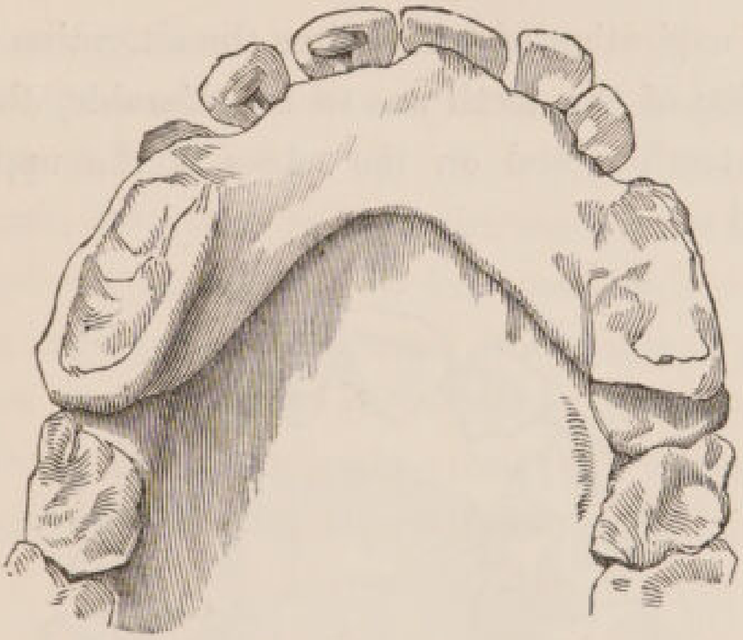
I therefore subjoin the following cases, selected from many others, as illustrative of what may be done in malpositions that would formerly have been thought hopeless.



Case I. The above drawing represents the upper jaw of a gentleman, twenty-eight years of age, as it appeared when he first applied to me.

The maxillary arch was contracted; the palate more hollow than usual; and the four incisors, but more particularly the right central and lateral, inclined so much inwards, that in shutting the mouth the under teeth came completely in front of the upper.

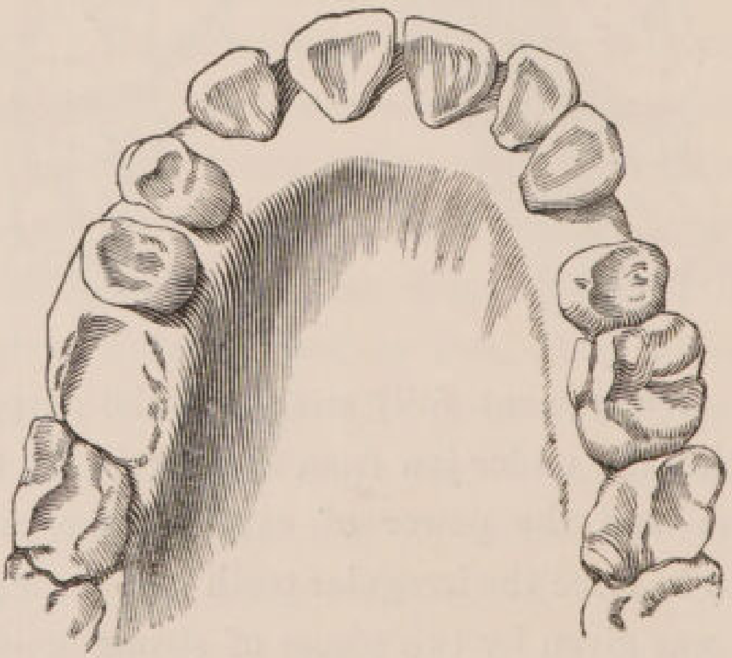
The patient being a barrister, it was of moment that he should have this deformity removed, since it so interfered with the free use of his tongue, as to render his speech thick and inarticulate; and as the arts of elocution and persuasion are aided by a pleasing physiognomy, so the latter was of unusual consequence in the present case. When he first consulted me, I intimated to him, that provided he would submit to some inconvenience for at least three months, an attempt might be made to alter the malposition of the teeth with a chance of success: at the same time I impressed upon him, that a favourable result could not be relied on with any degree of certainty. He cheerfully consented to submit to the experiment, and expressed a wish, should it fail, to have the teeth extracted. Under these circumstances, I determined to have an instrument made that should be free from the objections to which those hitherto used by Fox, Bell, and others, are liable. It consisted of a piece of hippopotamus (dentine) carefully fitted to a model of the anterior part of the palate and internal surface of the upper teeth, the edges being rounded off so as to make it as comfortable as possible to the tongue. It extended in the form of a bar behind the four incisors, beyond which it was flattened, so as to form at each extremity a sort of cap, which on the left side was carried over the crowns of the bicuspis and first molar tooth; and on the right, after passing over the bicuspides, accommodated itself to the space left by the removal of the first molar tooth, which had been extracted at a former period.



This arrangement fully answered the purpose of preventing the under jaw from closing in its former position; and the power of exerting the pressure requisite to force the irregular teeth into their proper places, was given by two pieces of strong gold wire screwed into the bone. Immediately behind those teeth these wires were turned and flattened, so as to present a button-like surface to the posterior aspect of the same teeth, with which they were brought into contact every time the mouth closed.

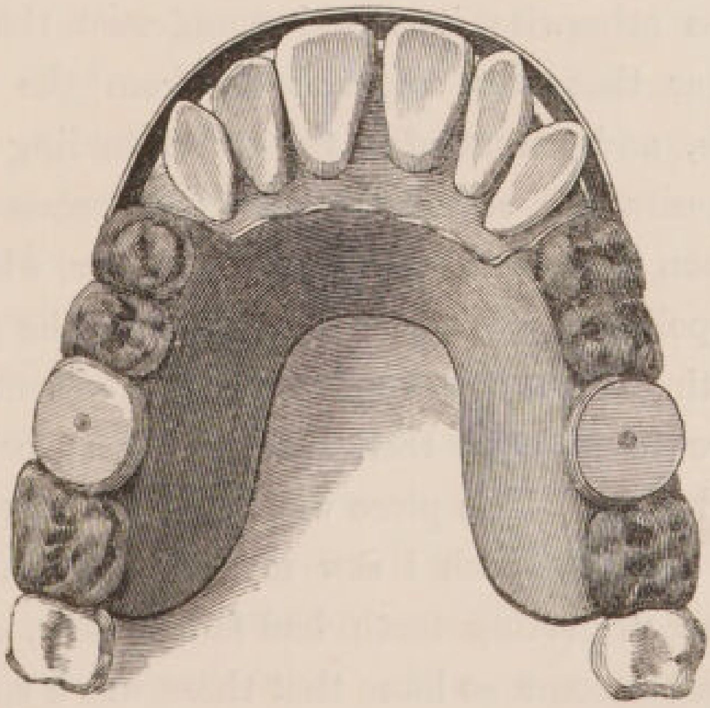
The instrument was firmly retained in its place by means of two broad clasps inserted into the bone, and fastened round the second bicuspides.

This drawing represents the piece described when in the mouth. The patient wore it for six weeks; at the expiration of which time the alteration in the direction of the teeth was so considerable, that the under teeth closed on the edges of the upper deformed ones.



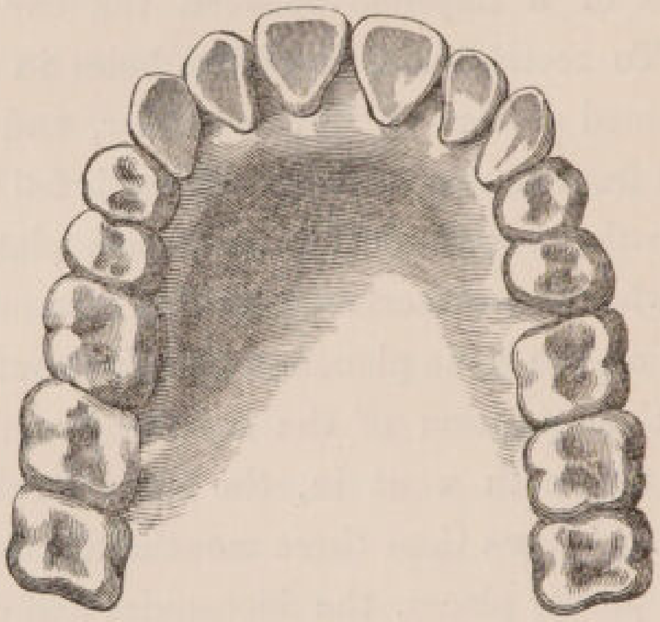
In order to complete the cure, it was necessary to have a new piece made, considerably thicker at that part intended to exert pressure; this was worn for seven weeks longer, when it was found to have fully accomplished its purpose. The patient did not complain of inconvenience while under treatment, and four years have now elapsed since the successful result was obtained, the teeth having permanently retained their improved position, as represented in the preceding cut.

II. Another case which came under my care, shortly after the publication of the above, was that of a gentleman, 29 years of age, the son of one of our most eminent barristers. In this case the six front teeth in the upper jaw projected at an angle of nearly forty-five degrees, their edges being almost parallel with the tip of his nose, while there was a considerable separation on each side of the mouth between

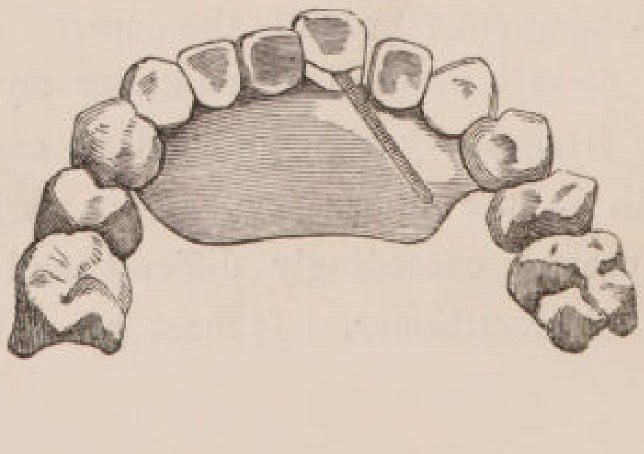


the first bicuspid and canine teeth. The preceding wood-cut represents the position of the teeth at the time he applied to me.

Here it will be observed that the mechanism employed was the reverse of the preceding: thus a plate was made and accurately fitted to extend and cap the whole of the teeth, from the bicuspids on each side to the second molar or grinder; on the plate of which was rivetted a small piece of hippopotamus, to prevent the approximation of the jaws in their former position, and to act as a lever when they came into contact. On the inside of the mouth the plate extended behind the teeth, being cut away from the front against the irregular ones, as otherwise it would counteract the effect of a bar that was soldered on from the second bicuspis, and extended to the corresponding one on the opposite side, so as to produce the necessary pressure when the mouth was closed. This bar, which was highly polished, was adjusted in front to the projecting teeth. When first applied, it required some slight pressure to get the teeth within the space of the bar and plate. This piece was worn for three days, at the end of which I saw my patient, and found that the projecting teeth had fallen back, and the plate had become so loose that there was a space the



from a too crowded state of the second denture, the tooth being developed in an oblique direction, the cutting edge forming almost a direct angle with the dental arch. This peculiarity invariably causes a disagreeable protrusion of the lip, rendering it liable to laceration and contusion. I have succeeded in effecting a permanent cure of it by the use of the annexed instrument, which was



first suggested by Mr. Brewster and employed by Mr. Saunders in this country. The mode of treatment by means of the instrument here represented, is as follows.

To the palate and gum is accurately fitted a gold plate, extending as far as the first bicuspid tooth on either side. To sustain the plate in this position, holes are made in it, and ligatures of dentist's twist passed through them, and secured round the neck of each first bicuspid tooth. By this means a fixed point is obtained, from which the requisite traction can be constantly made to act in any direction on the irregular tooth.

The method by which a continued traction is effected, is simply by attaching one end of a piece of lightly-coiled gold wire, in the shape of a spiral spring, to some point near the posterior margin of the plate, the wire being put into a state of tension by a silk ligature fastened to the irregular tooth.

The spring is connected to the plate by screwing it on to a piece of wire bent at right angles, and soldered into the plate at such a point as will give the desired traction. As from time to time the tooth is drawn inwards, and the traction of the spring diminished, one or more of the coils may be removed, until the irregular tooth has been brought into the normal position.

In those cases where both the front teeth are affected with this kind of irregularity, the operator should only turn one at a time; allowing a sufficient period to elapse to permit the first to become tight in its socket, before attempting to reduce the other.

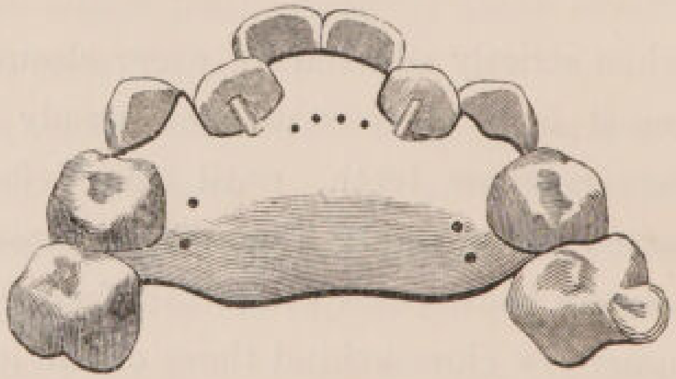
Cases frequently occur in which the *two upper centrals* are developed so far back in the dental arch, that the under teeth came in front of them every time the jaws are closed.

In its earlier stages this malposition may be easily corrected, but when it is left until the growth of the teeth is complete, it can never be remedied without the aid of mechanical means to bring the misplaced teeth into their proper and regular position.

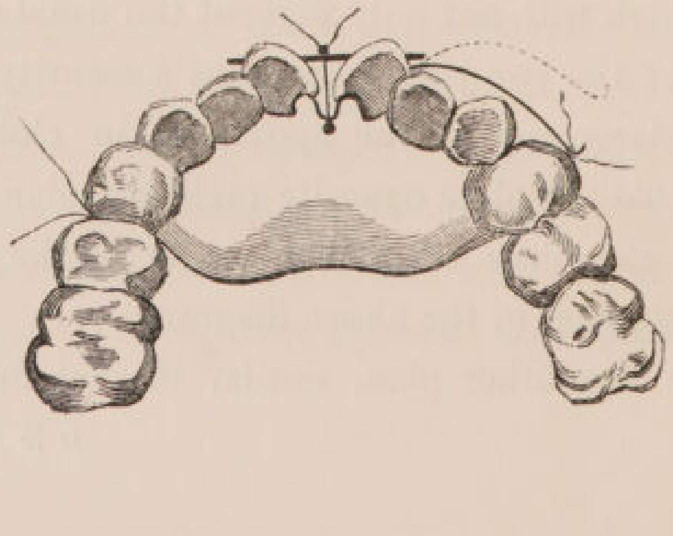
To effect this, a plate of gold is accurately fitted to the lower teeth, on their external and internal surfaces and edges. To the upper margin of this, another portion of the same material is soldered, constituting an inclined plane, prolonged so far into the mouth, that when the lower jaw is thrown forward, it shall still extend behind the deformed teeth; as here represented in the following engraving.

It is clear then, that by this mechanical arrange-

tioned (pp. 43, 44), which I have adopted most successfully in cases where the two laterals only in the upper jaw are within the dental arch; the dentine being secured by ligatures of dentist's twist to the adjoining teeth. As the teeth are brought outwards, the difference of space is made up by drilling holes opposite the irregular teeth, and inserting pieces of compressed hickory every two or three days, so as to continue the pressure until the cure is effected.



It is however necessary in all these cases to cap one or more of the back teeth, to prevent the jaws from coming in contact.



Sometimes it happens that the two front teeth in the upper jaw present themselves in a transverse position, as above represented. To remedy this unsightly deformity, a plate of gold is constructed, and attached to the first bicuspid tooth on each side, and being prolonged against the internal angles of the irregular teeth, forms a direct point from which the necessary counter-pressure may be exerted. This must be managed as follows. A hole being drilled through the plate opposite to the division between the central teeth, a ligature is passed through it, and tied to an elastic gold bar placed on their anterior surfaces; extending, if necessary, on both sides for rather more than the width of the teeth: the ligature being renewed as often as it is necessary.

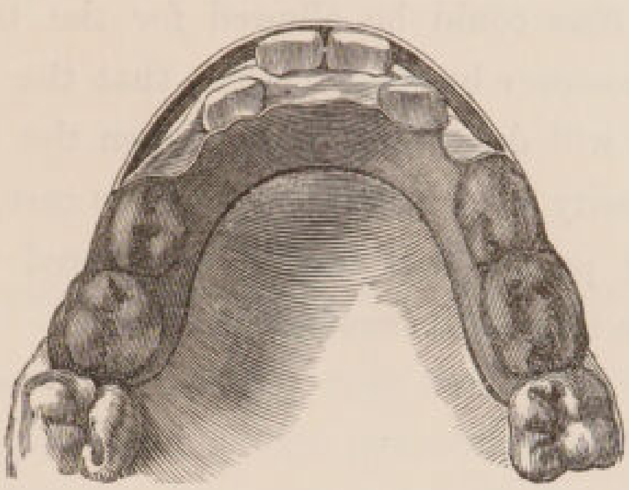
In less complicated cases of the same kind, bars of gold may be so arranged as to exert pressure on the internal and external surfaces of the irregular teeth; the bars being firmly brought together by a ligature passing between them; but to prevent the internal bar from slipping, it is necessary to solder a small piece of gold to it at right angles, extending with a slight curve; from which is fastened a ligature around the neck of each tooth. By this means the bars cannot fail to be retained in their proper position.

This deformity may also be remedied in another way, which is represented in the above engraving. A plate of gold is adapted to the irregular teeth, and united to an elastic bar in such a manner, that when the free end of the bar is unfixed, it will spring into the position indicated by the dotted line. Thus constituting an elastic lever, the bar is to be fastened by strong ligatures of dentist's twist to one or more of the molar or bicuspid teeth; by which means not only can one irregular tooth on that side of the mouth be brought gradually into its proper position, but, if necessary, two, three, or even four can be reduced at the same time.

If it be required in similar cases to alter the relative position of the tooth, the use of the spiral spring may be sometimes advantageously substituted for the above plan.

In other cases, as when the two central incisors of the lower jaw have been developed outside the dental circle, and when the corresponding teeth at the top close behind them, I have successfully employed the apparatus represented in the following cut.

The spiral spring may be employed with perfect success in all similar cases, either in the upper or lower jaw, by substituting a flat or circular spiral



spring for the bar; in which case each end of the spring is fastened to a piece of wire, bent at right angles, and soldered to the outside of the plate on each side of the mouth. As the teeth are pressed in, the length of the spring must be reduced, until the irregular teeth are brought behind those of the other jaw.

It is impossible to give all the varieties of malposition that occur in practice, or to describe the mechanical means by which reduction is to be effected in every case. We have therefore mentioned those cases that are most frequent; leaving it to the ingenuity and inventive genius of the practical dentist to vary his arrangements according to the circumstances of each individual case: and we shall only remark in conclusion, that we have seldom seen a case that was entirely unmanageable by mechanical means, provided *time* could be allowed for the treatment. It must however be remembered, that the length of the time will depend, not only upon the extent of the deformity and the difficulty of the case, but also upon the period that has been suffered to elapse before the treatment was commenced.

CHAPTER V.

PREVENTION OF IRREGULARITIES OF THE TEETH.

The preservation of the first teeth is so essential to the proper development and arrangement of the second, that in no instance ought the former to be removed without the advice of a dentist, under whose care the child should be placed at six years of age. The following rules will be of use in examining the mouth with a view to prevent irregularities.

The arch of the jaw should be well developed; its angles should present a semi-circular form; the front temporary teeth, which *originally* were crowded, being somewhat separated from each other, so as to indicate a gradual expansion of the jaw; the first permanent molar teeth should be well formed, of moderate size, without any prominence of the gum behind the temporary teeth to shew the advance of the permanent. If the teeth of a child resemble those of one of his parents, the arch of whose jaw is broad and well defined, and whose teeth are of a regular character, the circumstance may be consi-

The two front teeth in each jaw occasionally overlap each other, either from a too crowded state of the teeth themselves, or from a want of expansion of the jaws: in this case the removal of the two lateral incisors on each side is necessary to give space for the permanent front teeth to come forward.

Occasionally the lateral teeth themselves, or those on each side the two front teeth, lap over the latter: in such cases the *deciduous* canine teeth should be extracted. But if it appears probable that the jaw will expand, which can only be ascertained by an examination of its arch, then these teeth should not be removed till a later period, as they tend to preserve the shape of the arch itself.

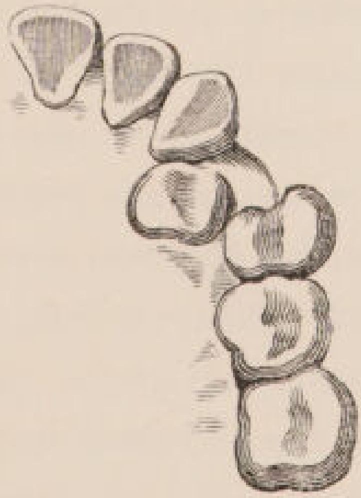
Irregularities are, however, more frequently met with in the cuspidates, which are the last teeth to make their appearance in the front of the jaw; and to these irregularities I would particularly direct attention, as on the preservation and proper development of the cuspidates, the beauty and contour of the face materially depend. The cuspidate, canine or eye-teeth are the key-stones of the dental arch; remove them, and you have an imperfect, unsafe and distorted structure.

The cuspidates, as we before observed, are the last to make their appearance in the *front* of the mouth,

inwards or outwards from their natural position. To remedy these cases, it is necessary to remove the deciduous molares; and then, should not sufficient room be given, the first permanent molar teeth also, *if* they be decayed; if not, the second bicuspides: by either of which plans sufficient space will be made for the first bicuspid teeth to take up their proper stations.

It must be kept in mind, however, that it is better to sacrifice the second bicuspis than a *sound* permanent molar.

The following cut exhibits the bicuspid teeth at the time, and in the position, of which we are speaking.



There are occasionally other malpositions of the teeth, but they occur so seldom, that it is unnecessary to describe them; they all require the skill of the dentist to remedy them, and in the treatment of all he must bear in mind, that lesser evils are to be preferred to greater, that nature can only be conquered by submission, and that the laws of the animal economy are to be consulted and obeyed, but not subverted.

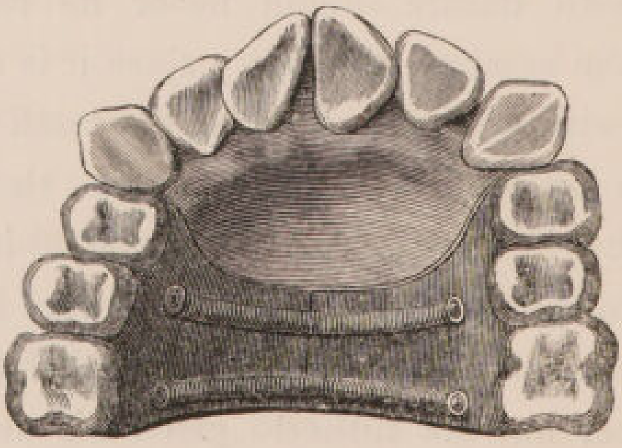
CHAPTER VI.

NEW INSTRUMENTS FOR EXPANDING THE ANGLES OF THE JAWS.

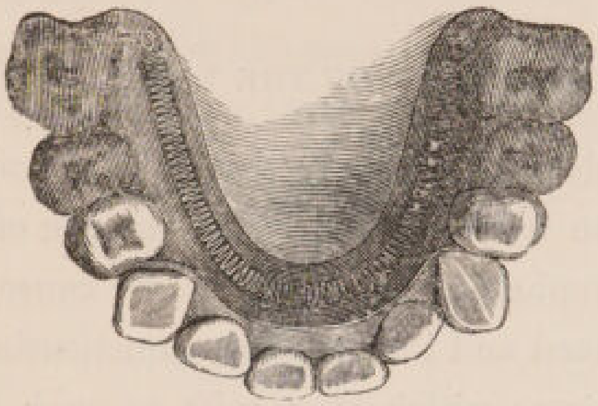
On a reference to the causes of irregularity, it will be seen that one of the greatest of them consists in the non-expansion of the angles of the jaws sufficiently to admit the increased size of the second teeth. From this circumstance it frequently happens, that in a deep excavated palate, two, three, or even four of the second teeth are sacrificed by the practitioner, in order to allow the remainder to assume anything like a regular position. Yet such interference with nature should never be resorted to without the greatest necessity; since it is frequently attended with disastrous results; the teeth permitted to remain not only losing in a measure their natural support, but in some cases being rendered inadequate to perform the duties for which they were intended.

It is remarkable, on this subject, that the dental practitioner has not hitherto given his attention to one of the most important points of mechanico-surgical dentism. Those who have investigated the art theoretically, are numerous; nor have others been wanting, to frame hypotheses concerning the structure of the teeth, and the causes of caries: but while theories and speculations have thus furnished matter for argument, practical dentism has been left to shift for itself; and dentists, content with proving themselves clever theorists, have too much neglected real questions and improvements. This has been the case in every branch of the art, but more particularly in the one under consideration.

The annexed wood-cuts represent two instruments by which we have been enabled to make the contour of the teeth perfect, in some instances without sacrificing a single permanent tooth, in most cases, by the sacrifice of one only on each side. The first cut shews the upper jaw, with a plate adapted to the



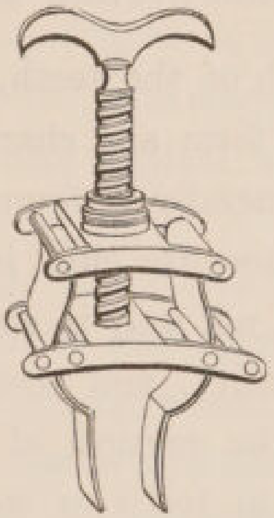
curvature of the palate, in the centre of which plate is a hinge; on each side are eyelets with points, to which are attached *weak* spiral springs, their strength being increased or diminished as the angles of the jaw expand. The second cut represents the lower



jaw, and its action is similar to the former, but the construction is different, inasmuch as the springs employed are flat, and the back teeth are capped. The best time for the employment of these instruments is from the ninth to the twelfth year; but they may be used also with great, if not equal advantage, until the sixteenth or seventeenth year. In the former interval, however, when the whole frame is undergoing the expansive process, nature more decidedly assists our mechanical means, and the effect produced is greater.

The representation of the instruments shews at once their purpose and mode of application; but cases will occur in which a modification and extension of the same principles will be necessary, and

in the lower part of the torniquet, their superior recurved extremities resting under the rollers of the bridge, and the other ends being brought into contact by a gentle curvature, it is only necessary to turn the screw in order to separate these latter to the required extent, which may be done very gradually.



A glance at the accompanying figure, which represents the plates slightly separated, will render this description perfectly intelligible.

CHAPTER VII.

THE COLOUR OF THE TEETH A TEST OF CONSUMPTION, ETC.

During the growth of the teeth, important changes take place in their form and character. When perfected, they will generally be found to resemble those of the parent to whom the child is most like in other respects; and this, not only in size and arrangement, but in colour, density, and tendency to resist, or give way before, the ravages of decay. There are family likenesses in teeth as well as in face and person; and we not only frequently meet with families in which early and premature decay of these organs seems to be hereditary, but with others whose teeth appear to set time at defiance.

It is a well-established fact that *consumption, scrofula,* and many other diseases, are also hereditary; and that although they frequently lie dormant for generations, so as to lull all suspicion on the subject, the action of some exciting cause reproduces them, and a formidable disease suddenly makes its appearance. This may occur at any period of life, but does so more frequently between the ages of fourteen and twenty-five; when it often happens that the complaint (I speak more particularly of consumption) has made fatal progress, before serious attention is called to it, or measures are taken to arrest its progress. The probability is, that were the predisposition known, a greater degree of care and watchfulness would be employed, the disease earlier detected, and remedial measures applied under far more favourable auspices.

This subject, then, *The colour of the teeth as a test of consumptive habit and scrofulous tendency*, is certainly one of importance, although from its novelty it may at first sight appear hypothetical.

It is a well ascertained fact, that certain peculiarities in the chemical structure of the bones are in some cases hereditary; that whole families are found that have a predisposition to mollities ossium, or softening of the bones, from a deficiency of their earthy base; while in other families the bones are preternaturally brittle from a superabundance of the same principle. And when we consider the nature of the teeth, and the time and manner of their formation, it is more than probable (reasoning from analogy), that they too are subject to a variety of influences, not only as regards their shape and position, but as regards their chemical structure; and that hence they may serve as valuable criteria, both of an unnatural state of the humors, and of certain constitutional tendencies and predispositions.

In animals that are not subject to the influence of sophistication or disease, there is little variety in the appearance of the teeth; those of animals of the same class (making allowance for age) being of the same strength and density. In human beings, on the contrary, the case is different; and as the secretions of the body vary with circumstances, health and diet, so we have every variety not only in the form and position, but also in the density and colour of the dental organs. The natural deduction from this is, since the phthisical diathesis produces uniform results on the secretions of the body, and transmits certain peculiarities to the progeny of its unfortunate possessors, that it will act in the same uniform manner on the teeth, which may thus become valuable indications of disease. And this applies not only to consumption, but to many other hereditary complaints. If the subject be scientifically pursued, and medical men give the benefit of their knowledge and experience to further this important aid to diagnosis, the time may come when the above indications will point out danger in time to avert it, and many cases of phthisis pulmonalis that would at present be considered incurable, will be brought within the pale of successful treatment. Moreover, as no important inquiry can be carried on without producing contingent benefits, the collateral advantages to medical science will probably be great.

And here I think it right to state, that my opinions on this subject, although new to the world, are founded on close observation, and on the incontrovertible facts supplied by an extensive practice. Others whose attention is now first called to the point will no doubt have ample opportunities of testing its truth by their own experience.

It has been observed by most authors who have written on the teeth, but more particularly by Dr. C. Harris, of Baltimore, that the teeth of consumptive and scrofulous persons have either a beautiful crystalline appearance, and are of a whiteness almost resembling alabaster, or of a clear pearly character, with the enamel slightly tinged with blue, or frequently of a very pale yellow or orange colour; particularly in the early stages of the disease. As the disease advances, the colour of the teeth is changed, and the osseous structure becomes softer and darker, approaching a deep yellow. Still later on again, when death is at hand, the structure of the teeth is affected in proportion both in colour and density. In those cases where I have had opportunities of examining teeth recently extracted from the mouth of a person who has died of consumption, and have made sections of them, I have found them peculiarly characteristic of the disease, and contradistinguished from those of persons who have died of other diseases; inasmuch as a complete softening has taken place, the bone resembling decayed sponge in texture, and being of a darkish orange-colour; while in non-consumptive teeth the bone was of a lightish grey, without any change having taken place in density of structure. Observations, however, have not hitherto been made till the disease was confirmed, and the patient beyond hope of recovery; although we are well persuaded that the dental symptoms may be used as means of detecting the *latent seeds* of consumption or scrofula.*

* "The teeth furnish very considerable characteristics of scrofulous habits: either they are badly formed as to their common outline; their surfaces are corrugated and discoloured; or, if they be well shapen individually, their enamel is very thin and preternaturally white, and the spaces between the teeth are unusually wide. It is wise to observe the teeth of nurses; for I should always question the fitness of a wet-nurse with a bad set of teeth, however other circumstances may be in her favour." (*View of the Alimentary Organs*, by Thomas Hare; page 228. London, 1821.)

In all cases in which I have observed the above indications in the teeth of children, (transmitting light through them to ensure accuracy,) I have found on enquiry that either consumption or scrofula has existed, though perhaps generations back, in the family of one or other of the parents of such children; and this it was that first led me to consider, that certain appearances in the teeth might become availably diagnostic of the above dangerous complaints. Since then, my first conceptions have too often been realized by these very diseases shewing themselves in the suspected cases, sometimes owing to the action of an exciting cause;* sometimes where no cause was assignable; for we all know that consumption frequently appears as a genuine idiopathic malady.

It has been well remarked by Delabarre, when speaking of the physical characteristics of the teeth,

* "Let it be supposed, for instance, that the lungs are a child's weak part, and that, under ordinary circumstances, he would have a cough during dentition; let him be exposed to cold whilst cutting his teeth, and not only will he be more disposed to take cold at such time, but the fever will be much more likely to put on the form of inflammation of the lungs than under ordinary circumstances. Here then dentition acts as a violent predisposing cause of disease." (Hayden *on Diseases of Children*, p. 47. London, 1819.)

same organs we may read the signs of consumption and scrofula, long before they have assumed their defined characters, and become established diseases, incurable by physic.

We would therefore impress on the minds of parents, the duty, in suspected cases, of submitting the teeth of their children, at from seven to ten years of age, to the examination of a dentist; so that if the teeth display the abnormal colour and signs we have described, no time may be lost in taking medical advice while yet available; in short, while attention to climate, temperature and diet may accomplish for the health, what at a later period medicine itself would be powerless to attain.

It is remarkable that the colour of the decayed parts of the teeth in persons of consumptive habit, differs considerably from the colour in common caries.* Thus in some cases there is a complete and

* "The colour of dental caries, however, may be, and doubtless is, in some cases, influenced by other circumstances; but as to what these are, I profess myself ignorant. They may consist in some peculiar modification of the agents, upon the chemical action of which on the organs, the disease is dependent; but this is mere conjecture, and the solution of the question still remains for future investigation." (Dr. C. Harris, *On the Characteristics of the Teeth and Gums*, page 50. 1845.)

peculiar softening of the bone, extending beyond the diseased part, and accompanied more or less by a pale orange or yellow colour; but which softening does not arise, as is sometimes thought, from the acrid qualities of the saliva, acting chemically upon the calcareous portion of the tooth, and leaving only the gelatinous substance: for in these cases analysis gives the same proportion of earthy salts and gelatinous substance, as in a tooth decaying under any other disease, in which acrid qualities are not present in the secretions of the mouth. In other cases again we have the calcareous deposit (tartar) coloured in a peculiar manner in this disease.*

As we before observed, the precautionary examination of the teeth should not be neglected between the seventh and tenth years. For during this interval, the second set is so far complete, that its physical character may be clearly ascertained. Enough however has been said, to shew that the knowledge thus acquired is of great importance, independently of mechanical considerations, from the

* "The colour, consistence and quantity of salivary calculus or tartar as it is most commonly called, vary in different temperaments, and . . . the state of the general health exercises a considerable influence [upon them]. They therefore furnish diagnostics, important both to the physician and dental surgeon." (*Ibid.*, page 87.)

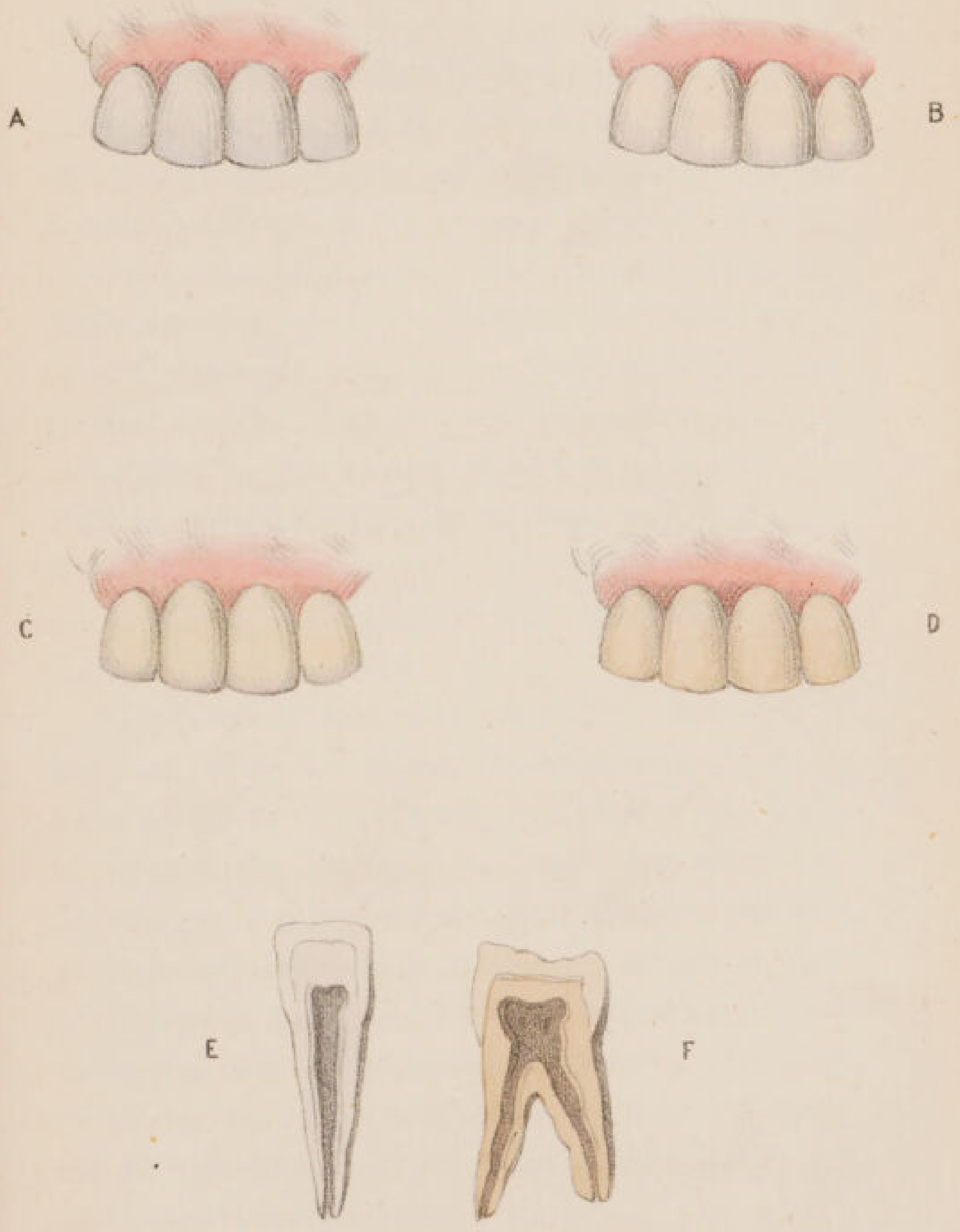
light which it affords respecting the health of the whole system.

In concluding this subject we may fairly remark, that when we claim for the teeth a considerable rank among what may be called diagnostic organs, we by no means are without analogies in what has been already established by the consent of the medical world. Thus in many respects the nails and the hair are similar to the teeth, as possessing a low degree of vitality, and as being seated external to the skin or common membrane. And it is well known that the nails have long furnished marks by which consumptive tendencies are recognized; and that the hair, to say the least, is peculiarly representative of the state of the body, and varies in its condition as the latter varies. Moreover, the teeth are situated in the mouth, in which extreme cavity, all the parts being naked, and the blood shewing itself as respects quantity and colour through the thin windows of the mucous surface, nearly every organ becomes indicative of the state of the system. Thus the lips, by their colour, moisture, &c., plainly represent the general health and vigour. The tongue, by an innumerable multitude of signs, does the same. And as if the whole of this oral region concurred to utter forth what is concealed in other parts of the body, the voice itself is one of the great characteristics of strength or weakness, health or disease. Thus in adding the teeth to the other organs of the mouth as representatives of general physical conditions—in thus adding them from experience and observation—we do what might have been expected even previous to the induction from which we profess to derive all our knowledge.

The annexed drawings represent the different colours and stages attending disease of the teeth, in a person of consumptive and scrofulous habit. A, the predisposition; B, the first stage; C, the second; D, the third and last; F, the internal structure after death; E, after death from some other cause.

DO THE TEETH INDICATE THE AGE?

This question for some time engaged the attention of Mr. Saunders, who inspected the mouths of 1046 children, to ascertain whether any appearances furnished by the teeth are sufficient to guide us to a sure knowledge of the age of the individual. He was examined on the subject before a Committee of the House of Commons on Lord Ashley's "Factory Bill," and the result of his enquiries is given in a



THE COLOR OF THE TEETH THE TEST OF CONSUMPTION.

M. & N. Hanhart lith. Printers.

work by Mr. Charles Wing, entitled, *The Factory System.*

Whether the elaborate statistics in this work are considered satisfactory by the philanthropic persons interested in factory labour, I do not know; but for myself, I confess that the above point is anything but proved in the affirmative. The development of the teeth depends upon a variety of circumstances,—upon the constitution, habits, mode of living, and general health. This at once makes us sceptical of our ability to deduce from them any invariable conclusions respecting the age of their possessor; and the endless variety of cases which are met with in public and private practice tend to confirm us in disbelief on this subject.

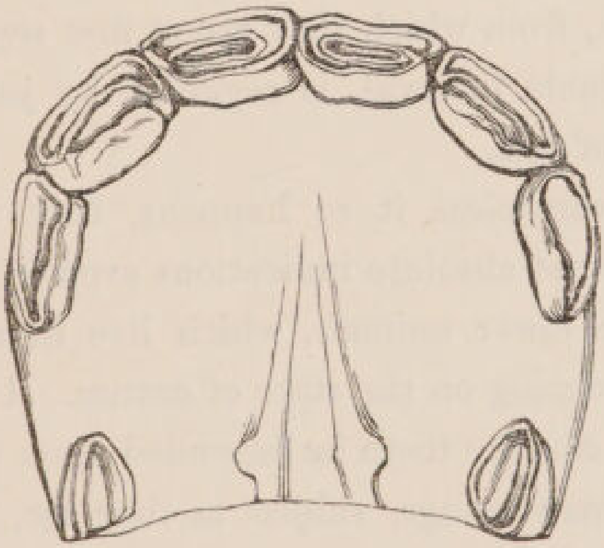
Mr. Saunders, it is true, takes the other side of the case, being led thereto by comparing the development of the human teeth with that of the teeth of animals; but he seems to forget that brute animals live in a comparatively natural state, and that consequently their organizations are subject to more fixed rules than the human frame, acted upon, as it is, by a variety of influences (whether arising from social conditions, from the mind, or from the external universe,) which largely interfere with its organic and physical evolution.

Thus the age of the horse, up to a certain period, is inferred from certain marks on the teeth, and when these marks are obliterated, or as it is technically called, *filled up*, the animal is said to be *aged*; after which the age can no longer be correctly guessed by reference to the teeth.

To illustrate this, we will now describe the anatomical characters of the horse's tooth. A longitudinal section of an incisor before it has been worn down by use, is represented below. It will here be

seen that the cutting edge is bifurcate, presenting an anterior and posterior wall. These walls are separated by a deep fissure, which is lined and partially filled with cementum that extends into the tooth about an inch, or in some cases more; the dentine or osseous portion maintaining throughout a uniform appearance. Now until the tooth is so far worn as to obliterate this *mark* constituted by the interposition of the cementum, the age of the horse may be inferred from the teeth, but afterwards this is not the case, as we said above.

The mark disappears from the horse's teeth in the order of their original formation; first therefore from the centrals, then from the laterals, and lastly from the posterior incisors; so that in the seventh year there is a palpable difference in the appearance of the different teeth; the mark being obliterated in some, and still remaining in others.



This mark is occasionally simulated for the purpose of deception, by cauterizing the centre of the surface of the tooth; but whoever knows that where the mark is natural, the enamel lining it may always be felt, will not easily be imposed upon by this artifice.

The form and position of the tush, or remains of the cuspid tooth, are also used as collateral evidences of age in horses. This tooth is originally conical, but in a great measure ceases to be so as it is worn down. The conical shape is sometimes restored by filing, but the difference between the natural and artificial cone may be detected by feeling for the slight longitudinal concavity on its inner surface. Moreover, the approximation of the tushes to the front teeth, from which they are at first separated by a considerable interval, is regarded by judges as a good test of age.

But nevertheless it so happens, that the above marks are not absolute indications even in the horse among the lower animals, which live in a state so nearly bordering on the state of nature. How much less, then, can the teeth be depended upon as tests of age in human beings, subject as they are, as we before observed, to such immense vicissitudes, physical, social, and mental. It is not, however, our intention to deny, that certain loose general inferences on the subject of age may be obtained from the teeth, and consequently that these organs may furnish probable and supplementary indications on an average of numerous instances; but still we do not admit the validity of these indications in particular cases; and as practical knowledge applies to particulars, we should be sorry to see judicial arguments founded upon so insecure a foundation as the view that the teeth proclaim the age of the individual.

CHAPTER VIII.

THE CAUSE OF CARIES.

This affection of the teeth, which causes their premature destruction, and is attended at times with considerable pain, is not confined to any age or to either sex. It generally indeed attacks the young, and is rarely met with past the age of sixty, but this is by no means an invariable rule.

The opinions on the cause of this disease are almost as numerous as the authors who have treated of it; though rich as we consequently are in such opinions, the real question is as much a matter of doubt as when Hunter first promulgated his sentiments on the subject. For the reader's edification, or amusement, we shall prove these assertions out of the mouths of the most eminent of those who have favoured the world with their views.

"Who shall decide when doctors disagree?"

Hunter (1778) says: "This decay does not seem to be so entirely the effect of *accident* as might be imagined: it sometimes takes place in the teeth in pairs, in which case we may suppose it owing to an original cause, coming into action at its stated time,—the corresponding teeth being in pairs with respect to the disease, as well as to situation, shape, &c."

He further says: "This disease has not hitherto been accounted for: if it had been always on the inside of the cavity, it might have been supposed to be owing to a deficiency of nourishment, from some fault in the vascular system; but as it begins most commonly externally, in a part where the teeth, in their most sound state, receive little or no nourishment, we cannot refer it to that cause; we may therefore reasonably suppose that it is a disease arising originally in the tooth itself."

Ruspini (1784): "Various are the species of *caries;* almost every part of the teeth is affected by it, and both internal and external causes produce it. A *caries* may be divided into soft, superficial, deep, and dry: it attacks the *root,* the *neck,* or the *crown* of the teeth. The *caries* that proceeds from internal causes, namely, the scurvy, &c., *generally* affects the root of the tooth, often the internal surface, sometimes the external, and even the inward cavity of the body [of the tooth]."

Gerbeaux, of Paris (1802), says "that diseases of the teeth among many individuals originate in organic disposition, which may be transmitted from fathers to their children."

According to *Fox* (1813), "The proximate cause of caries appears to be, an inflammation in the bone of the *crown* of the tooth, which, on account of its peculiar structure, terminates in mortification. The chief predisposition to this disease, consists in a defective formation, of either the enamel or bony part of the teeth. . . .

"It is not in our power to alter the laws of nature, or change the natural constitution of man; we can only obviate evils, by attending to the causes which produce them; and it is in this manner we can, in a very great measure, preserve the teeth from disease."

Hertz (1815) observes: "Heat, to a certain degree, is highly detrimental to the vitality of the teeth; hence we find that those animals, who live chiefly on hot food, are most subject to carious teeth. Increased circulation in the gums, whether the effect of mercury, or general fever of the system, is also very injurious to the teeth, and hence caries of the teeth is a common consequence of salivation and inflammatory fever."

Bew (1819): "To those who only casually glance at the teeth primary or permanent, with healthy gums, fitly arranged in their several sockets for the purposes of mastication, aided by the conviction of sight and feeling, that they are the hardest substance in our system, how inexplicable and irreconcilable to credibility must it appear, that these *very hard* substances, with their *flinty coatings*, date their destruction from completion, by *lateral pressure against each other*."

Parmly (1820): "The premature decay of the teeth, is the consequence of uncleanliness, which acts upon them in the same manner as on other parts, by sapping and corroding the vital energy, and thereby causing them to moulder away."

Clarke (1829) says, that "caries or rottenness of the teeth, in every instance, commences externally, and that external remedies will arrest, if not prevent, it altogether. . . . When indentation or such like inequality occurs on the surfaces of the teeth, the juices of the mouth then become stagnant; their properties change, and they exert a pernicious influence, aided by the putrefying particles of animal and vegetable substances which likewise necessarily lodge there."

Bell, in 1835, states, that the true proximate cause of dental gangrene [caries] is inflammation, which appears, according to him, to take place in the following manner: "When from cold, or from any other cause, a tooth becomes inflamed, the part which suffers the most severely is unable, from its possessing comparatively but a small degree of vital power, to recover from the effects of inflammation, and mortification of that part is the consequence. The situation in which gangrene invariably makes its first appearance, immediately under the enamel, upon the surface of the bone, is, I think, explicable only with the view I have taken of the structure of the teeth and the nature of this disease. As the vessels and nerves which supply the bone of the teeth, are principally derived from the internal membrane, it is natural to conclude, that in so dense a structure, the organization would be less perfect in those parts which are farthest removed from its source."

Saunders (1837) says: "That very general and distressing disease of the teeth which is familiarly known by the term caries or decay, may be referred to two distinct sets of causes, one of which may be termed constitutional or predisposing, and the other, developing or exciting causes. Under the former are included all those hereditary predispositions to disease which may be sometimes observed in a certain tooth, or class of teeth, in certain members of a family. . . . These organs are predisposed to disease, from interruptions and commotions in the system occurring during their formation. Of this class are all those ailments and affections which make up the catalogue of infantile diseases, and which, by producing an irregular or vitiated condition of the secretions, interfere more or less with the proper action of the parts concerned in the production or formation of the teeth. The exciting or developing causes of disease consist in subjecting the teeth to violent and unnatural action and uses, such as cracking nuts, biting hard substances, &c."

Robertson (1840): "Upon examination it will be found that there are fissures formed in the enamel of the teeth, in consequence of the irregular distribution of that substance upon their surfaces; and that there are also interstices produced by the crowded position of the teeth, and the irregularity of their shape. In these situations particles of food are retained, which undergo a process of decomposition, and acquire the property of corroding, disuniting, and thereby destroying, the earthy and animal substance of which the teeth are composed. This is the cause of the destruction of the teeth, commonly called 'caries,' and it is not the result of inflammation either in the membrane or the bone of the tooth," &c.

White (1844): "The principal and direct cause of caries is the corrosive action of external agents:

among these, undoubtedly, the acid formed in the mouth by the decomposition of vegetable matter is one of the principal. In the depressions upon the grinding surfaces of the molar teeth the food finds a lodgement, and continues from day to day until the acid has formed and acted upon the enamel, which is frequently imperfect in those parts."

Harris (1845): "If the decay of the teeth is not referable to inflammation in their bony structure, to what is it to be ascribed? The inference is, that it is the result of the action of chemical agents, and when we take into consideration that the fluids of the mouth, when in a morbid condition, are capable of decomposing their enamels, if not possessed of more than ordinary density, and that the disease frequently commences upon this outer covering, the conclusion is at once irresistible. . . . As I have before remarked, caries is always upon their external surfaces, sometimes upon the enamel, but most frequently upon the bone within the indentations on the grinding faces of the bicuspides and molares; and on the approximal sides of the teeth, where this outer covering is frequently so fractured by the pressure that is exerted upon it, that the juices of the mouth find ready access to the subjacent osseous tissue. The destruction of the organs may be gradually going on here for months, and even years, without any notable signs of its existence: and the commencement of the disease in these places had led many to suppose that it had its origin within their osseous structure. . . . . Among the indirect causes, therefore, of caries, the following may be enumerated:—putrescent particles of vegetable or animal matter between the teeth; depositions of tartar; a febrile or irritable state of the body; a mercurial diathesis of the general system; artificial teeth, improperly inserted, or of bad materials; roots of teeth; irregularity in the arrangement of the teeth; too great a pressure of the teeth against each other; and, in short, everything that is productive of irritation to the alveolar and dental membranes or gums."

The above extracts may be considered sufficient to shew how little is really known of the causes of caries. And now, having cited the opinions of others, I shall perhaps be expected to register my own. The field of speculation, however, is well enough occupied without it: and moreover any view would be practically worthless, unless it enabled us to foresee the disorganization of the teeth, which we cannot do at present. I will nevertheless commit myself so far as to observe, that the nearest approach

lity enables it to resist chemical agencies; and that the measure in which the latter govern it, determines the departure from health and soundness. The greatest instance of this is seen in the difference between the living and the dead body. The former is bathed in gaseous compounds, which have a powerful tendency to act upon it; but its life restrains them, and their chemical affinities are controlled. In the dead body, on the other hand, the surrounding atmosphere, moisture, &c., at once exert their peculiar forces, and decomposition is the result. And therefore it appears to us, that chemical operations of the saliva upon the teeth, *presuppose* diminished vitality in those organs, otherwise such operations would be held in check. And for this reason it is that we regard even the chemical theory as less than half the truth on this subject of caries.

THE CAUSES AND TREATMENT OF TOOTH-ACHE.

Tooth-ache is a term applied indiscriminately in common discourse to all pains affecting the teeth and jaws. It may arise, however, from very different causes; as from exposure of the dental nerve, from fungus of the pulp, from the confinement of pus in the internal cavity of a tooth, from disease of the membrane covering the fang (periosteum), from sympathy, &c., &c., &c. When a tooth is sound, its nerve is confined in a thick bony covering, which effectually shields it from injury, but often the nerve is exposed by disease to the action of air, fluids, food, or irritants of any kind, and in this event the most intense pain may result, proportioned to the degree of nervous lesion. When tooth-ache originates in inflammation of the internal pulp from any of the above causes, the pain is sharp, lanciating and throbbing, and is not increased by pressure upon the part affected.

Sometimes inflammation takes place in the cavity of the tooth, and the nerve suppurates. Pain may be felt for months before suppuration occurs, though the latter more generally commences on the first or second paroxysm. But invariably sooner or later the *crown* of the tooth decays, and the nerve is completely exposed.

Next after tooth-ache arising from exposure of the nerve, that which depends upon the confinement of pus in the dental cavity is the most frequent. In the commencement of these cases the pain is felt only when hot or cold liquid passes over the affected tooth, but gradually a steady gnawing pain supervenes, the tooth becomes sore and tender, seems a little loose and longer than the others, and pain darts from it along the nerves to the temple, the ear, the side of the head, and to the neighbouring teeth in both jaws. When a tooth first grows painful in this way, it is about to suppurate; when it appears longer than the rest, loose, and exceedingly sore, the nerve *has* suppurated, and the pus is already oozing from the end of the fang where the vessels and nerves enter. When the cheek begins to swell, it is a sign that the matter is spreading between the alveolus and its lining membrane; which occasions the throbbing pain felt during the formation of alveolar abscess.

It is by the same process, when the fang of a diseased tooth is near the antrum, that true abscess of that cavity takes place.

Pain, however, may exist, the nerve may suppurate, and the face swell, and both the pain and swelling again subside, without the formation of abscess; in which case the matter insinuates itself between the end of the fang and its membranous covering, there forming a sac about the size of a pea or a little larger. In the course of time this sac will burst, and discharge its pus between the fang and the alveolar process.

In tooth-ache arising from inflammation and thickening of the membranous covering of the end of the fang, and resulting in the formation of pus, the pain is confined to the tooth, the nerve of which has suppurated, and produced alveolar abscess. In these cases, the suppuration of the nerve and the formation of an abscess are always primary causes of the disease. The pain is generally dull and heavy; the tooth becomes a little sore, and loose; immediately over and all along the fang the gums are much inflamed, and of a *bluish* tinge. When the pain becomes throbbing, matter is in course of formation, and partial filling up of the alveolar process takes place, forming what is termed a gum-boil. In some cases of the kind, if allowed to proceed unchecked, part of the alveolar process is absorbed, and a fistulous opening forms on the outside of the cheek.

Fungus of the pulp is a small tumor of a deep red colour, either in the canal of the fang,—in which case it is so minute as to be often mistaken for the nerve itself; or else in the cavity of the crown, which it generally fills when it is present there. It is very soft, bleeds freely on the slightest touch, and varies in size from a pin's head to a large pea. Sometimes it is quite insensitive; in other cases exquisitely sensitive; but the pain it occasions is not accompanied by the dartings and throbbings that characterize genuine affections of the nerve. No other disease of the mouth renders the breath so disagreeably offensive as the fungus of which we are now speaking.

All the above kinds of tooth-ache, with the exception of the last (sympathetic tooth-ache), are of an inflammatory character, and require to be treated on the antiphlogistic plan. Cold water is the best application to them; and this, if the *crown* of the tooth be affected, will generally afford immediate relief. On the other hand, if the inflammation be lower down, the cold water will at first increase the pain, but if persevered in, will eventually relieve it. Where the inflammatory action runs high, and the pain is very severe, it will be necessary to resort to more active treatment: leeches should be freely applied to the gums, a brisk purge administered, and lowering regimen be strictly enforced. Should it appear impossible to prevent suppuration, and should the patient object at the time to the removal of the tooth, warm fomentations containing a proportion of opium or henbane should be applied to the parts, and as soon as the matter has formed, the tooth should be *at once* extracted.

The cause of the *peculiar* pain of tooth-ache appears to consist in the circumstance, that the dental vessels and nerves are confined in bony canals, which during inflammation do not admit of vascular congestion without producing severe compression of the nervous fibres. In this way we can account for the fact, that conditions which increase the vascular action of the system, are very apt to be attended with tooth-ache. In pregnancy, it is well known, that the blood, when drawn, exhibits the characteristic buffy coat of inflammation; in pregnancy, therefore, tooth-ache is a common affection. With respect to the cause of the pain, the teeth follow the same law as many other organs,—as the ear, the bones generally, &c.,—in which the distress is pretty nearly proportioned to the unyielding nature of the parts. In this way it happens, that structures which are least vital or sensitive in health, become the seats of agonizing pain during inflammation, which tends to expand them violently, according to the laws of the pressure of fluids; a pressure which we all know to be so great.

The treatment of tooth-ache from exposure of the nerve, must be simply *palliative*. The essential oils, mineral acids, creosote, and a variety of stimulants, have been used, with more or less success, to benumb or destroy the sensibility of the part. It is not well, however, to apply them indiscriminately, for in some

mouth, the disease generally returns, whatever may have been done, after the expiration of a few months.

When pus has collected in the inner cavity of a tooth, when the face is swollen, and there is throbbing pain, the tooth must be removed. At an early period, the tooth may be trepanned or drilled, and the matter thus discharged; a plan which may be successful in some cases even where pus has begun to ooze from the end of the fang.

Tooth-ache arising from disease of the periosteum or covering of the fang, may generally be relieved by the application of leeches to the gum, and the administration of sedatives internally; or by making an incision through the gum the entire length of the fang, and then applying a roasted fig or a bruised raisin.

It remains for us to notice tooth-ache arising *from sympathy;* an affection due to the intimate unity of the nervous system, all the parts of which are in mutual connexion with each other.

As one instance of the kind, during the formation of alveolar abscess, the surrounding parts are frequently affected with pain and inflammation; all the teeth suffering in turn, although but a single one is generally the prime seat of the disease.

Sympathetic tooth-ache is most frequent during pregnancy, and may arise from increased or diminished action of the general system. Sometimes it proceeds from a tooth already diseased, and, where this is the cause, it should, if possible, be at once removed. But care is requisite here to judge correctly, for pain from teeth thus affected may generally be removed by appropriate means. Moreover, we have known hundreds of cases in which tooth after tooth was removed without affording relief; and it was only when the teeth of the patient and the reputation of the practitioner were sacrificed, that the real cause of the disease was rightly suspected to be, not in the mouth, but in the general state of the system.

the most favourable time for stopping is at the commencement of decay, when a spot *first* appears on the surface of the enamel, or a discolouration is observed between the teeth on the external surface. Although, however, this is the best time for the operation, it may be performed with every probability of success at a later period, even when the tooth is so far decayed as to expose the nerve and give considerable pain. In these neglected cases, a judicious application of the palliative treatment before referred to, must be made, and the irritability of the exposed nerve allayed, before stopping is attempted. This object may be gained, even though the patient have suffered many paroxysms of pain, and thus the tooth may be rendered capable of bearing without inconvenience any pressure necessary in the operation.

We can safely assert, that there are comparatively few cases (provided the surrounding parts be healthy) in which this operation may not be employed with advantage, and extraction thereby avoided, and the services of a valuable tooth secured for years.

Extraction is frequently resorted to, not from absolute necessity, but because it is readier and shorter than stopping; of course we cannot commend the practitioners who save themselves trouble by this alternative.

of calcareous salts. Owen asserts that in excavating the decayed portion of a tooth, the above tubes are divided; and that after the stopping is introduced, they exude a thin firm layer of calcareous matter, which intervenes between the material employed for filling the cavity and the exposed extremities of the tubular orifices.

EXCAVATING CARIOUS PORTIONS.

During the process of excavation, the cavity should be frequently syringed with warm water, to remove any minute fragments of diseased bone; and before the stopping is introduced, the same cavity should be carefully rinsed out with a little eau-de-Cologne or other spirit, and then dried with a small piece of lint or cotton. If the least moisture be allowed to remain, it will not only prevent the close packing of the stopping material, but will frequently cause the latter to fall out.

The instruments used for stopping vary much in size and shape, according to the taste of the operator, who has them so constructed as to enable him to use them with facility upon any part of a tooth. It is unnecessary for us to allude to them more particularly, than to say, that the dentist should be provided with a sufficient variety to suit any probable case.

The cavity having been well prepared, a quantity of gold-leaf is cut in strips varying from half an inch to an inch in width. One of these strips is now loosely folded, and the end of it introduced by a proper instrument to the bottom of the cavity. In the next place, the remainder of the gold, on the outside of the cavity, is folded on the first, and then carried to the side of the cavity, from whence the folding should be commenced; and so on always to the same side; taking care, as each fold is inserted, that it comes in close contact with the bottom, and with the metal first and subsequently introduced. The last part of each fold should be left somewhat higher than the outer rim of the orifice or cavity. This kind of packing is to be continued until every part of the cavity is perfectly filled, when an instrument nearly the size of the orifice should be employed, to give the whole solidity, by pressing it firmly toward the bottom. After this, a small, round, sharp instrument should be applied to the edges of the stopping, to force it into close contact with the sides of the orifice. If more gold than necessary has been used, the overplus may be scraped or filed down level with the enamel of the tooth. In the last place, the surface is to be highly polished with a burnisher.

In the upper jaw, the lateral edges of the front teeth are frequently affected with caries. In the early stages of the disease it is necessary to stop them with *gold,* but without having recourse to the file for the purpose of enlarging the division between them, as is generally done, to enable the operator to use his instruments with facility. In young persons of from ten to eighteen years of age, the use of the file should if possible be avoided; for the friction caused by it cannot fail to occasion considerable derangement of structures so delicately organized as the teeth, and even in some cases may result in their destruction.

Where it is necessary to stop the front teeth in young persons, it is best to separate them by means of a thin piece of *Indian rubber,* stretched to the utmost, in which state it is inserted between them, and allowed to collapse. By renewing this every second day for a week, it will be found that ample space is gained to enable the operator to stop the teeth without difficulty. After the operation is performed, the teeth will in a few hours return to the natural position, without having sustained the slightest injury.

Well-stopped teeth have been known to last, and be serviceable, for forty years, without pain or inconvenience.

It is a rule, that the operation must not be attempted so long as a vestige of pain continues. A course of palliative treatment must always be undergone previously, whenever internal inflammation is present.

MATERIALS USED FOR STOPPING.

Much has been written respecting the materials which are proper to be used for stopping the teeth, and those practitioners have been generally condemned who employ anything but gold for the purpose. The cements particularly are considered unsuitable materials. The American dentists, always in earnest, have gone so far as to exclude from their Society any one who employs cement stopping.

That pure gold-leaf is not only the *best*, but the *only* material that ought, as a rule, to be employed in this operation, we ourselves have no doubt. Its toughness and ductility, the readiness with which it can be packed in the tooth, and particularly that noble quality by which it resists oxidation and the chemical agency of the salts of the saliva,—all these circumstances mark it out as especially fitted for stopping the teeth. It need scarcely be observed, that where leaf gold is used, the plate or leaf should bear some proportion in substance to the size of the cavity to be filled; that it should be comparatively thick, if the cavity be large, and thin in proportion as the latter is small in extent.

Notwithstanding the plain superiority of gold, several other materials are used for stopping, which on account of their cheapness, and the facility with which they can be placed in the teeth, have (unfortunately for the public) many professional advocates. Most of these materials undergo chemical changes from the saliva, and are at once injurious to the teeth and to the general health.

Pure platina may be employed with *safety*. But the platina of commerce is often mixed with other metals; and in any case it is so much less ductile or manageable than gold, that it can seldom or ever be used with advantage.

Tin also undergoes but little change in the mouth, and may be used with comparative safety; but lead (which is occasionally employed) is readily acted upon by the saliva, and becomes highly poisonous. The same remark applies to silver-leaf. The salts of the mouth act upon it, and convert it into protoxide of silver.

Of the many compounds advertized for stopping, all are alike injurious and objectionable. Their cheapness is their only recommendation, and this is often hypothetical, considering that the health may be seriously injured by employing them. Among these censurable materials, we have the *mineral cement*, or Sir Isaac Newton's fusible metal, of which the toy termed the magic spoon is made. This metal, a compound of bismuth, lead and tin, is melted by being held a few seconds over a candle or spirit lamp, and is inserted into the tooth in a fluid state. The temperature required to fuse this metal is that of boiling water, and this heat is sufficient to produce inflammation in the tooth and its membranes. Moreover, the metal contracts on cooling, and admits the fluids of the mouth into the cavity of the tooth surrounding it.

The *fusible metal or cement* is similar to the mineral cement, except that it contains two parts of lead and a less proportion of bismuth and zinc.

The *mineral marmoretum, mineral succedaneum,* and *mineral petroleum,* are the same thing under different names, viz., silver filings made into an amalgam with mercury. This compound has all the disadvantages to which we adverted when speaking of lead and silver.

The *terro-metallic cement* is composed of three parts of sulphate of lime and one of rust (oxyd of iron), and is inserted into the tooth in the form of a paste, which soon hardens, and in a few hours dries, crumbles, and falls out.

The celebrated *anodyne cement* is similar to the above, but with the addition of a small quantity of morphia.

Vegetable cements are composed of gum-mastic, ammoniacum, sandrack, &c., dissolved in spirits of wine, and evaporated to a proper consistence. A small piece of this residuum is placed in the tooth, where it requires renewing every two or three weeks.

From the above account it may appear, that gold is the only substance that is free from objection as a material for stopping. Nevertheless there are cases in which it is justifiable to use other materials; as those composed of vegetable gums, which are available chiefly as *temporary* stoppings until the condition of the tooth will allow of gold being employed.

ASBESTOS STOPPING.

This curious substance, named* from resisting the power of fire, is not acted upon by the strongest acids, either vegetable or mineral; indeed, in the present state of chemical knowledge, it has no known solvent. Its unchanging nature in the presence of chemical agency, marks it out as especially adapted for stopping, and it is further fitted for the purpose, inasmuch as it is a bad *conductor of heat*. The latter quality is particularly available in cases of decay, where the cavity is large, in which, if metal alone be used, its sudden expansion and contraction, and its property of concentrating and conveying heat, frequently produce great inconvenience. For it is a well-known fact, that when a large cavity is stopped with nothing but metal, considerable pain sometimes arises from taking liquids that are either above or below the natural heat of the body. In such cases a non-conductor of heat should be interposed between the lower part of the cavity and the metal, by which not only the quantity of the latter is diminished, but its contact with the tooth cut off. By attention to this hint, the operation of stopping

* From the Greek α, not, and σβεννυμι, I extinguish.

large cavities will be oftener successful than at present. Our own experience bears us out in this observation. In small cavities, however, asbestos is not required, because the expansion of the metallic stopping is too slight to have painful consequences.

CHAPTER X.

ALVEOLAR ABSCESS AND GUM-BOIL.

Of all the disorders to which the teeth and gums are liable, none is more painful, or, if allowed to proceed, more injurious to the surrounding parts, than alveolar abscess. It usually begins at the end of the fang, but occasionally even on the inside of the palate. A variety of causes may produce it, but the most frequent of these is irritation and local inflammation arising from the fang or root of a carious tooth. Even sound teeth, however, are liable to be attacked by it, either in consequence of cold, or mechanical violence, which frequently produces inflammation and thickening of the membranous covering of the fang. Whatever cause it may arise from, the inflammatory action should be relieved as speedily as possible, otherwise it may increase, and extending to the neighbouring parts, produce suppuration, and eventually absorption and exfoliation. In the latter case, the whole system is affected by the pain, and the matter issues, either externally or internally, in a constant discharge of fetid pus.

The treatment should commence when tenderness is first felt in the tooth or gum on closing the mouth, and should consist in the application of a leech to the gum, and in the exhibition of a saline purgative, or of an aperient pill composed of six grains of compound extract of colocynth, three grains of calomel, and three drops of oil of carraway, to be taken over night.

If the inflammation is reduced by these means, and neither pain nor tenderness remain, and the tooth has become comparatively firm, an astringent lotion, as follows, may now be employed to fix it: Dissolve one drachm of alum in a pint of water; to this add one ounce of tincture of rhatany, and three drachms of tincture of pellitory. Dilute this lotion with warm water, and wash the mouth with it three or four times a day.

On the other hand, if the disease has proceeded without recourse to proper remedies, or has been irritated and increased by *improper* applications, as creosote, oil of cloves, or any other strong stimulants, it then becomes imperative at once to remove the exciting cause, viz., the decayed tooth or stump. After this, the application of a roasted fig, or of warm water, will generally suffice to complete the cure.

The presence of a stump may generally be regarded

I questioned him whether he had ever had a tooth broken in the jaw, and he said that such a thing had occurred ten years previously in an attempt at extraction; but the gum had closed over the part, and he had felt no more of it. Upon introducing a small curved silver probe into the external opening, I found that it took the direction of the alveolar process, and came into contact with a hard substance, pressure upon which caused acute pain. There was now no doubt as to the cause of the disease.

Some difficulty existed respecting the best mode of removing the buried stump without producing permanent deformity. First, the integuments were carefully separated, and about a quarter of an inch of the external wall of the alveolar process was removed. This allowed the introduction of a strong curved and pointed elevator for extracting the stump. The extraction was effected, though by no means easily; after which the opening was injected with a lotion made by dissolving two grains of sulphate of zinc in two ounces of rose-water. In three weeks, by attention to the general health,—by the use of tonics and aperients, and a wholesome diet,—the opening closed; and the patient has ever since been free from his distressing complaint.

The following case occurred in private practice:

the subject of it was an interesting young lady, 17 years of age. She consulted me for a fetid discharge that issued constantly from a small opening immediately under the chin, and which had now existed for three years. During this time the disease had prevented her from appearing in society, and was attended by lancinating pains, which ran along both sides of the jaws to the ears and breasts. Medical advice had been taken, and the orifice had been repeatedly cauterized and poulticed, but without relieving the pain or healing the part.

On passing a curved probe up the sinus or opening, it went distinctly to the fangs of the two central teeth in the lower jaw, which to all appearance were perfectly healthy, but nevertheless, when they were sounded, the patient experienced paroxysms of pain similar to those she had been in the habit of feeling in the course of the disease.

She now remembered, that two years previous to the commencement of the discharge, she struck these two central teeth while playing with her sister. The accident caused some pain at the time, but this soon subsided, and no further notice was taken of the circumstance. Subsequently a small but painful pimple appeared under the chin, and eventually broke, forming the orifice already described.

She submitted at once to have the above teeth extracted. The parts were then injected daily with warm water, and by attention to her general health under the care of her medical attendant, she perfectly recovered; and I had the satisfaction of hearing some time afterwards, that she had returned to the country, and had not experienced any renewal of pain or inconvenience.

The following cut exhibits a case of alveolar abscess with exfoliation, arising from irritation.

In certain cases, particularly where treatment has been delayed, or improper applications employed, exfoliation takes place, and considerable loss of substance may result. The following cut represents a case of the kind that occurred in a child; in which

the alveolar process of the front deciduous molar and of the left permanent incisor has exfoliated.

Whenever pain or tenderness is felt in one or more of the teeth, the symptoms being similar to those we have mentioned, the sufferer should lose no time in consulting a dentist, who will at once carefully examine and *sound* the teeth, so as to ascertain the nature of the complaint before it is too late. Should it happen that the services of a dentist cannot be obtained, the remedies above described may be used with a good prospect of success.

When the disease of which we are treating exists in the upper jaw, it may assume a most serious form, particularly if it be caused by the irritation of a decayed tooth opposite the antrum. If a case of this kind be allowed to proceed, total destruction of the face, and fatal consequences, may be the result.*

* "The formation of abscess in this cavity might, however, in almost every instance, be prevented, by the timely adoption of proper treatment. On the occurrence of severe, deep-seated, and throbbing pain in the upper part of the alveolar ridge, or just above it, in the region of the antrum, such as has been described as attending the formation of abscess in this cavity, or in that of the alveolus of a superior molar; or if the tooth directly beneath the place where it was first felt, be considerably decayed, or its lining membrane exposed; or if it be dead, loose, or its socket much diseased, it should be immediately extracted. By this simple operation, the formation of

ral incisors in the upper jaw frequently decay at their sides at an early period; and hence it is that these, together with the canine teeth in the same jaw, demand the use of the file more frequently than the other teeth. It may, however, be successfully employed on the bicuspid and molar teeth, either upper or under.

Caries arising from any of the above causes, if allowed to extend beyond a certain limit, renders the operation of stopping difficult to the operator, and hazardous to the tooth, owing to the confined space in which the stopping instruments must be used. This difficulty is of common occurrence, particularly where the disease has advanced to the cutting edge of the tooth; and it makes it impracticable to form a cavity of proper size and shape to retain the metal. Even should it be surmounted to the operator's satisfaction, the walls of the cavity will most probably be broken down in the attempt to stop it, or the stopping will fall out in the course of a few months.

In cases requiring the use of the file, the dentist ought not, in our opinion, to content himself with merely dividing the teeth, but should continue the operation until the *whole* disease is eradicated, and the affected tooth has as white and smooth a surface as its sound neighbours. Where the operation can be managed, a considerable portion of a tooth (especially of the posterior part) may be taken away without perceptible disfigurement, and without making matters worse in the mouth. Undoubtedly we are no advocates for the removal of the enamel, which is the natural covering of the teeth; nevertheless necessity frequently compels us to resort to it as the only means of preservation. It is not requisite to use the file in all cases; in some the disease may be simply *scraped* away.

The teeth are more highly organized in young than in old subjects, and hence it is that the former are generally more liable to suffer pain from the operation of filing. Where this is the case, the operation may be deferred for a few days, and the parts treated in the manner we shall hereafter mention.

We find the teeth best adapted for the use of the file, to be the four front incisors, the canines, the bicuspids, and, if their position be favourable, the molars. In the latter, however, the caries has for the most part gone too deep before the patient discovers it, for the file to be available. Still it may be prudent to attempt the treatment by filing, though success is very uncertain, but where this fails, the teeth may notwithstanding be preserved by stopping.

The manner in which incipient caries between the two laterals or centrals may be removed with as little disfigurement as possible to the front aspect of the teeth, is as follows. First make a clear division down to the gum with a moderately thick file: then remove the caries from the back of the tooth with a bent scraper; and meanwhile support and steady the teeth with the left finger and thumb.

Having removed the caries, the dentist is next to employ a finer file to take off any roughness left by the first filing, so as to prevent foreign substances from lodging in the part; and he is then to employ a third and still finer file; and lastly, to polish the surface by means of a piece of common cane, with chalk and finely-powdered pumice-stone. If pain occur during the operation, he should immediately desist, and postpone it for a few days, and endeavour to allay irritation by occasionally applying a mixture of spirits of wine and morphia, as follows:

℞ Spt. Vini Rect., 3 drs.
Acet. Morphiæ, 3 grs.
Mix.

After the operation is completed, we always provide our patients with a piece of cane deprived of its bark, and the shape of which is represented in the following cut. This we request him to use night

and morning, to maintain the polish we have given, and to remove extraneous matter from the surface of the tooth; as otherwise such matter might produce a recurrence of the disease.

Notwithstanding precautions, caries will sometimes renew its attack on the same tooth, but generally on some other part than the one already treated. Where such an event occurs, it is to be attributed to a general defect in the structure of the tooth.

Often, on dividing a tooth, a large cavity is discovered near its cutting edge; which cavity it is impossible to remove without destroying the tooth and disfiguring the patient. In these cases, gum-mastic steeped in warm water should be inserted: it will remain in the cavity for months, and can be renewed at pleasure by the patient himself. In many instances of the kind, I have found on examining the teeth three or four years afterwards that such cavities were perfectly free from disease.

CHAPTER XI.

SALIVARY CALCULUS OR TARTAR.

Tartar is a peculiar earthy deposit found almost universally on the teeth of all classes, ages, and constitutions. Some physiologists affirm it to be a peculiar secretion; among whom M. Serres is conspicuous, from having asserted that it has its own proper secretory glands. Jourdain thinks that it is secreted by glands scattered over the periosteum of the teeth. Others contend that it is nothing more than particles of food first dissolved in the saliva, and afterwards deposited on the teeth and other immoveable parts, whether natural or artificial, within the cavity of the mouth; being constantly formed on the gold, ivory &c., used in the formation of artificial teeth. It occurs however more particularly on the parts adjacent to the salivary ducts, as at the back of the lower incisors and on the outer surfaces of the upper molars.

The tartar, formed principally of inorganic phosphate of lime, is originally deposited over the whole surface of the teeth alike, whence it is removed from the prominent parts by the action of the tongue and lips. It has often been analyzed chemically. The results have been various, owing no doubt to a difference in the character of the deposition itself.

According to M. M. Vauquelin and Lanquor, tartar is composed of

Water	7	0
Salivary Mucus	13	0
Phosphate of Lime, with some trace of Magnesia	66	0
Carbonate of Lime	9	0
Animal Matter, soluble in muriatic acid	5	0
	100	0

Berzelius gives the following:

Salivary Matter	1	0
——— Mucus	12	5
Phosphates of Lime and Magnesia	79	0
Animal Matter, soluble in muriatic acid	7	5
	100	0

Under the microscope, tartar is seen to consist of numberless fossil animalcules embedded in, and intermixed with, the earthy phosphates and the other matter of which it is formed.

If a piece of tartar be taken from the mouth of a person who has fasted for some time, and from that part of the neck of the tooth embraced by the gum, and if it be submitted to the microscope, it is said a number of these animalcules will be discovered, and that their *debris* not only contributes to produce the tartar, but occasions the disagreeable fetor that so often attends any large accumulation of this substance. There are, however, several kinds of tartar, differing from each other not only in colour, density and chemical composition, but also in their effects on the teeth and the other parts with which they are in contact.

Thus there is a soft tartar, of a chalky consistence and light brown colour, which is generally found to accompany that delicacy of frame and skin which indicates a strumous or consumptive habit.

Another kind is met with, of a dark colour, approaching to black, much harder in consistence than the former, and which adheres firmly to the teeth, is much slower in depositing, and in time acquires an almost crystalline character.

There is also a third kind, less common, however, than the preceding, but far more destructive in its effects. It is generally of a dark green colour and small in quantity, but causes erosion and scaling off of the enamel.

The saliva itself sometimes assumes an acid character, and produces a slow and soft decay of the teeth. Occasionally those on one side of the mouth fall victims to this decay, and in many instances even the ivory plate of a set of artificial teeth is corroded on one side more than on the other. This arises no doubt from the secretion of one parotid gland being vitiated, while that of the opposite gland continues healthy.

The eight or ten varieties of tartar described and individualized by some authors, are but modifications of the three above mentioned, and are produced by the effect of medicines, by the constant use of tobacco, or by the stain of port and other wines, producing a difference in the colour and appearance of this substance.

The *first* kind of tartar then may be described as a chalky mass, having a slightly alkaline taste, and varying somewhat in colour, according to the habits of the person in whose mouth it is found.

The *second* is hard and firm, of considerable density and of a dark colour, and adheres to the teeth with great pertinacity.

The *third* kind is a thin film of matter of a greenish colour and very acrid character.

As far as the teeth are concerned, the first kind is perfectly innocent, for on its removal the surface of the enamel and the teeth themselves will be found uninjured.

Tartar is first deposited as a soft earthy matter, which becomes coherent by the agency of mucus and saliva, and occupies the angles formed by the edge of the gums and the necks of the teeth. If it be allowed to remain, it soon grows hard, and is a constant source of irritation to the gums, the edges of which gradually become inflamed and thickened, thus forming a ledge for a larger quantity of the deposit. This accumulates in every direction, upwards towards the crowns of the teeth, and downwards towards the gums, as well as between the gums and the teeth.

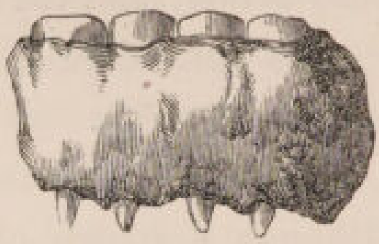
In some cases the accumulation takes place to such an extent, that the fangs are exposed, and the teeth themselves are only kept in their places by being cemented by the tartar to the adjoining teeth, and by the cord of vessels at the end of the fang, which then are much enlarged and form a strong and tough ligament.

It is clear therefore that tartar, however harmless in some respects, should never be left undisturbed, since its mechanical action, and the inflammation it produces in the gums and alveolar processes, will sooner or later destroy the teeth.

Some patients, it is true, object to the removal of this substance, although a source of inconvenience and injury to themselves, and of annoyance to others from the offensive smell which it gives to the breath. To such we would remark, that the operation of scaling is the most simple and innocent imaginable, and unaccompanied by pain; being in fact but the removal by appropriate instruments of an extraneous substance, which the tooth-brush is inadequate to bring away. But of this we shall speak more presently.

The third kind of tartar appears originally as a discoloured arch around the fronts of the teeth, close to the edges of the gum. It should be removed at once, and the enamel under it well polished, to prevent its re-deposit: otherwise it will repeat its attack on the enamel, and completely denude the teeth, the crystalline appearance of the enamel being destroyed, after which the subjacent osseous substance will suffer, and soon become carious.

The following engraving represents the loss of the four central teeth of the lower jaw from the accumulation of tartar.



The next cut represents the teeth of the lower jaw completely embedded in tartar. It is taken from a girl, 18 years of age, who applied for advice at the Metropolitan Hospital.

When tartar is present, there is more or less congestion and tumefaction of the gums, which acts as a powerful cause of injury to the teeth.

SCALING.

When tartar has accumulated on the teeth, it is essentially necessary, as we said before, that it should be at once removed. The operation of removing it must be performed with great care, and without any violence, for otherwise the enamel may be chipped or injured, and premature decay of the teeth ensue. As a rule, the patient ought to feel no pain during the operation.

The modes of using the scaling instruments will be readily suggested to the operator by their respective shapes.

When by their successive application the whole of the tartar has been removed, the teeth should be gently rubbed with a piece of cane deprived of its bark, and dipped in tooth-powder. This is necessary in order to remove the roughness that is always left, in consequence of small pieces of tartar escaping the instruments, and which, if it were not removed, would serve as the nucleus for a fresh deposit of the same kind; and moreover would communicate a very unpleasant sensation to the tongue.

In cases where the accumulation of tartar is so great as to cause inflammation and turgidity of the gums, with loosening of the teeth, it is well to remove a portion only at one sitting (and this, with more than ordinary care); and then to wait a few days until the teeth and gums have recovered from the first operation. In the meantime, much benefit

GUARDING THE TEETH AGAINST ACID MEDICINES.

We have just referred to the pernicious effects which the dilute mineral acids may exert on the dental organs. Now these acids are occasionally given internally as medicines, and are frequently ingredients in gargles and lotions for the mouth. But from what has been already stated, it is obvious that they cannot be long used thus without doing great and often lasting injury to the teeth. To prevent this, the dose about to be taken is sometimes placed in a glass tube, which is emptied of its contents at the back of the mouth. This however is an unsafe expedient, for the tube may break, and wound the adjacent parts; nor does it fully answer its purpose, since some of the acid is sure to mix with the saliva, and thus to diffuse itself over the whole mouth and teeth.

The best method to avoid the hurtful consequences arising from the exhibition of these acids, is to place in the mouth a few pieces of gum-arabic, or a few jujubes, some minutes before the medicine is taken, distributing the mucilage over the teeth by means of the tongue: then, quickly swallowing the medicine, immediately to wash out the mouth with water in which a small quantity of carbonate of soda or potass has been dissolved. In this case the vegetable gum sheathes the teeth without the acids being enabled to act upon it; after which, the alkali (soda or potass) neutralizes any small quantity of acid that may remain in the mouth, and that, when the mucilage is washed away, would otherwise injure the enamel.

CHAPTER XII.

EXTRACTION AND ITS INSTRUMENTS.

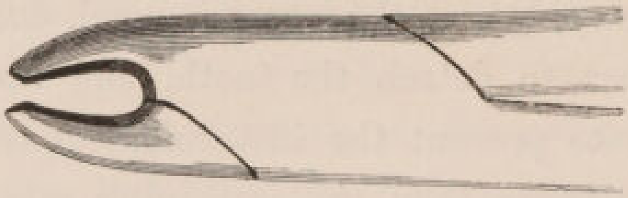
THE operation of extraction should never be resorted to in the early stage of caries, or until all other means have failed, or the surrounding parts are so diseased that it would be hazardous and useless to persist in filling the tooth, with the view of making it available for future use. Bushels of teeth are, we fear, taken out without proper forethought. But the dentist ought to be deeply impressed with the responsibility of his calling; and ought always to lean to the belief, that the teeth, like the rest of the frame, are meant to last for life, however the intentions of nature may be contravened by luxury, deleterious medicines, or want of early attention to cleanliness. At any rate he, the preserver of the teeth, should never debase his art, by making it consist entirely in the dextrous use of the key or forceps.

There are, however, many cases in which extraction is quite necessary, and in which it is the practi-

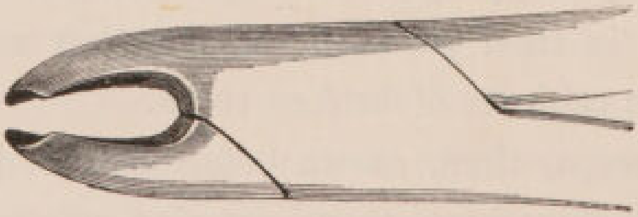
construction of forceps, we have no wish to deny. Their use, however, is limited, as their employment *should* be, to cases in which decay has only exposed the lining membrane of the tooth, leaving sufficient substance of bone to withstand their pressure. On the contrary, where the *crown* is much decayed, the mere effort to detach the tooth, and the pressure necessary to prevent the instrument from slipping, will be greater than the remaining substance can bear without breaking. For this reason we have our misgivings when we hear it said that the forceps alone is made use of in every case. Surely either extraction must be performed where the tooth might be saved by stopping; or the operators must be very fortunate in their patients; or else they must each have large cabinets of broken teeth.

The forceps, then, as we before observed, are admissible only where there remains enough of the bony structure of the tooth to resist their grasp. Where this is the case, they should be so constructed as to fit the neck of the tooth, which the inner surface of the blades should be sufficiently expanded to grasp without exerting pressure on the crown; and they should be of such a size as to afford an easy purchase to the hand of the operator. The latter should be provided with at least eight pairs of them, of different sizes and shapes, adapted to the different sizes and positions of the teeth.

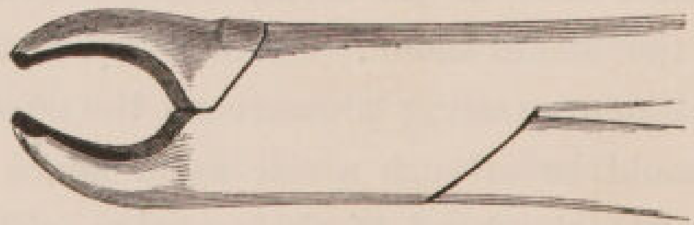
For the extraction of the upper incisors and cuspidates, one pair only is necessary, as in the following cut.



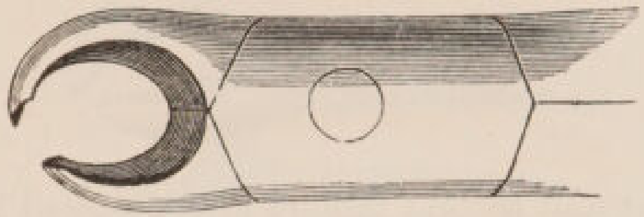
For the removal of the bicuspids in the upper jaw, the blades of the forceps should be slightly curved, and narrower in the inner groove of the blade than in the outer; as here represented.

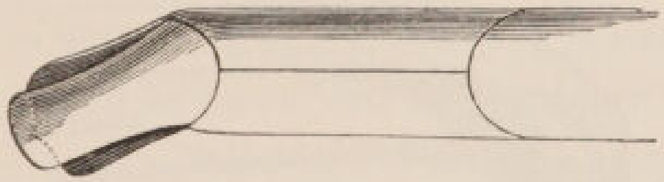


For the first molars the instrument may be either slightly curved, or straight, as follows.

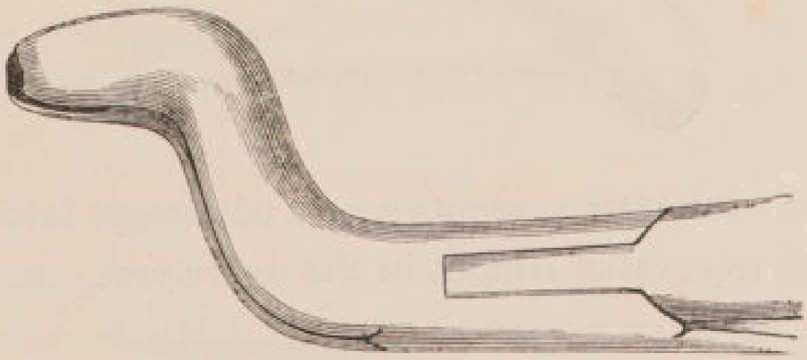


For the second molars the forceps should be considerably curved. The annexed drawings give a front and lateral view of the shape required.

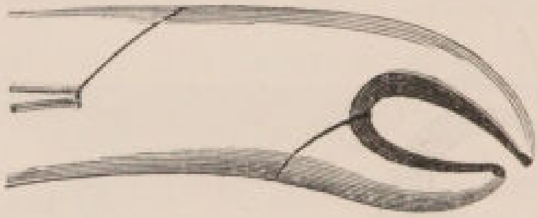




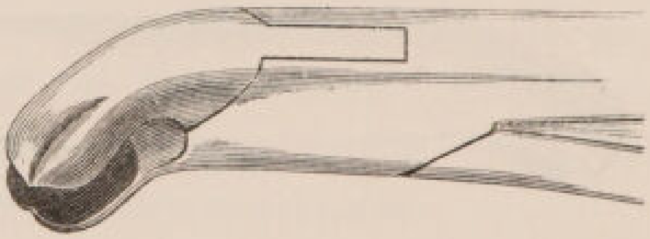
The dentes sapientiæ or wisdom teeth of the upper jaw, require for their extraction an instrument bent above the joint, so as to form two right angles, as below.



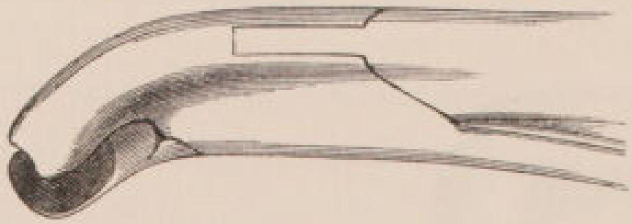
For the removal of the incisors, cuspidates, and bicuspids of the lower jaw, the hawk's-bill forceps is necessary.



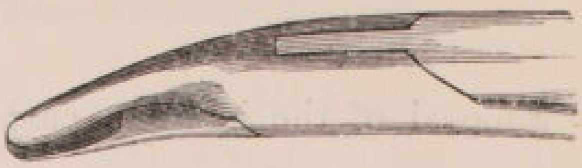
The first and second molars are extracted by means of a curved forceps.



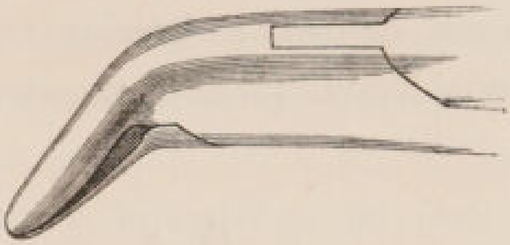
For extracting the dentes sapientiæ in the lower jaw, the forceps should be somewhat curved, with the mouth of the blades as here represented.



The next cut represents a pair of forceps intended for the removal of stumps in the upper jaw.



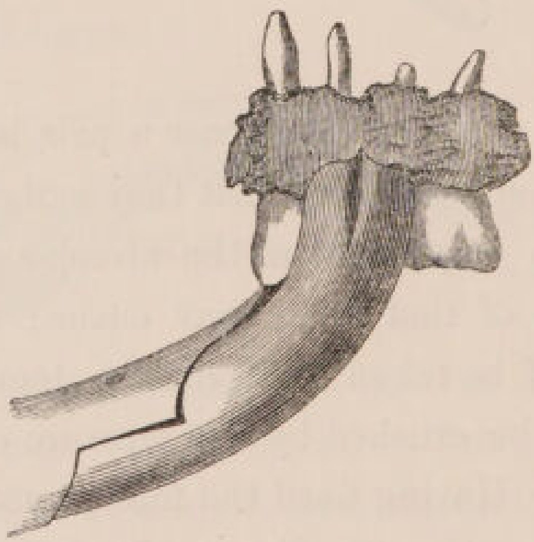
For the lower jaw, it will in most cases be necessary to have the forceps curved more nearly at right angles, as the following.



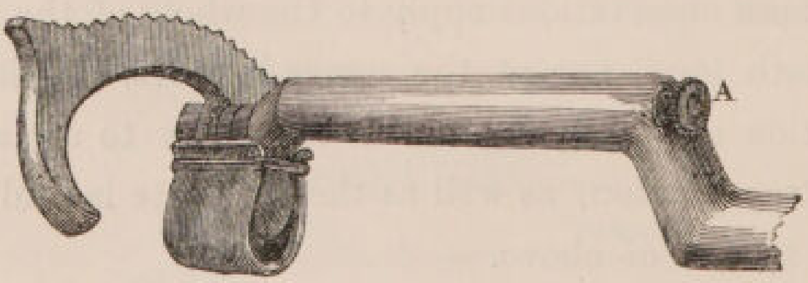
When in each particular case a pair is selected for use, care should be taken that they embrace the neck of the tooth only as far as the alveolar process, or a serious loss of that bone may ensue: while, if the crown itself be taken hold of, the tooth will in all probability be crushed by the pressure employed for its removal. Having fixed the forceps properly, alternate lateral motions tending to the perpendicular are given to them in quick succession; the one motion being designed to separate the tooth from its adhesions with the socket, the other, to draw it out of the same.

These observations apply to the whole of the teeth in both jaws, except the upper incisors, for the extraction of which latter it is necessary to use a half rotatory motion, as well as the alternate lateral motion spoken of above.

The following plate represents one of those accidents that may occasionally occur during the employment of the forceps; and in which, either from using too large an instrument, and taking hold of the alveolar process, or from embracing two of the teeth at once, a considerable piece of the alveolus has been torn away.



Wherever caries has destroyed the substance of the tooth, so as to leave only the walls or shell of the enamel on either side, the use of the key instrument becomes imperative.



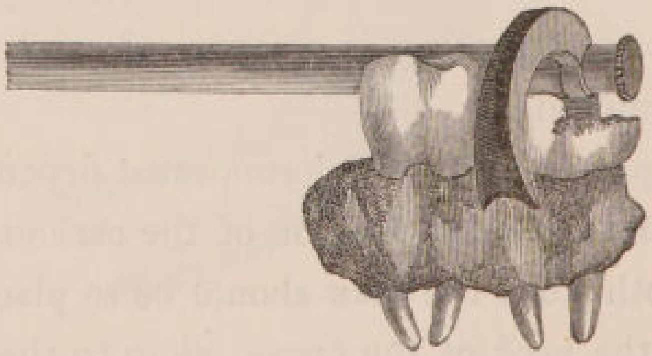
The fulcrum of this instrument is oval, and covered with Indian rubber, over which a padding of lint is wrapped, to prevent undue pressure against the soft parts. The claw should be long enough to reach easily over the crown of the tooth to the opposite part. For the convenience of shifting it to either side, the upper part of the shank is hollow, and has a spiral spring inserted in it, with a circular bolt attached, and passing through the end of the claw and the upper part of the fulcrum, at the extremity of which there is a small button, A, by pulling which the spiral spring is compressed, and the claw readily removed.

The application of the fulcrum must depend somewhat on the state and position of the carious portion of the tooth; but the claw should be so placed as to come on the *neck* of the organ, close to the edge of the alveolus, and parallel with the upper part of the fulcrum, the bite of the claw and this part of the fulcrum being in the same horizontal plane.

The operator, having properly adjusted the instrument according to the above directions, next, by gently and firmly turning the wrist (care being taken in the meantime that the claw or fulcrum does not slip), causes the upper part of the tooth to act as a powerful lever for moving the lower part and for dilating the corresponding portion of the socket, which by its lateral enlargement makes room for the tooth as it is raised by force out of its situation in the mouth.

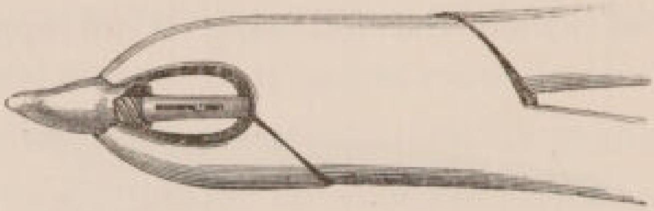
It is true that mischief may and sometimes does occur from unskilful use of the key as well as of the forceps, and the same may be said of every instrument used in surgery. This, however, is clearly no objection to one instrument more than to another.

Below we have figured one of the worst forms of careless application of the key.



EXTRACTION OF STUMPS.

For the removal of deeply-seated stumps in the back of the jaws, whether such stumps are products of disease, or remain after the improper or unsuccessful use of the forceps or key, an admirable instrument has been contrived by Mr. Bell, of the



The manner of using this instrument is by first grasping the upper extremity of the screw between the blades of the forceps, and gently turning the handles of the instrument so as to drive the screw into the root of the tooth as far up as possible; the blades are now opened, and pushed forward on the fang, which is grasped and extracted in the usual manner. On the advantages which this instrument has over every other for these cases, Dr. H. very justly insists, "It prevents the root from being crushed: it acts as a powerful lever when a lateral motion is given: it is likewise of service when the rotatory motion is made. It prevents the forceps from slipping or their action being lost, should even one side of the root give way in the act of extracting it; and it is used with equal advantage where one side of the root is entirely gone."

In our own practice we have had many opportunities of testing the merits of this invention, recent though it be, and we can safely affirm that it is one of the most valuable auxiliaries to the scientific practice of dental surgery ever introduced.

CHAPTER XIII.

NERVOUS AFFECTIONS OF THE FACE FREQUENTLY MISTAKEN FOR NEURALGIA OR TIC DOLOUREUX.

A REFERENCE to the frontispiece of the present work will shew the intimate connexion that subsists between the nerves of the teeth and those of the head, neck, brain, &c. Now when we consider this connexion, it will be scarcely surprising that nervous affections of the face are frequently mistaken as to their character, and treated as if they were constitutional and not local complaints. The fact is that comparatively few cases of true constitutional neuralgia are to be met with, though thousands are treated as such, which, if the teeth were closely examined, would be found to depend on deep-seated stumps, that possibly may have lain hid under the gum for years, and there have escaped the observation of both the patient and his medical attendant. Moreover, carious teeth will often cause an attack of neuralgia, perhaps in the face or neck, or at some considerable distance from the source, viz., the affected tooth, which at the time may itself be free from pain.

Derangement of the digestive organs may, and doubtless frequently does, give rise to neuralgic affections; yet in ninety-nine cases out of a hundred such affections are grounded on the irritation of a diseased tooth, excited either by exposure of the nerve, or else of the upper part of the teeth in consequence of recession of the gums, or by a diseased fang: and they are at first purely local in their character. After a time, it is true, general and constitutional symptoms set in, but even then the removal of the diseased tooth, or proper treatment of the fang, will frequently both put an end to the paroxysm, and prevent its return.

Medical authors assert, that genuine neuralgia may be known by the periodicity of its attacks; but this, like many other imperfect generalizations, has led the mind away from profitable observation; and caused the profession to disregard those diseased organs which are frequently the exciting and palpable sources of the nervous affections now under consideration. In consequence, the medical practitioner too often neglects an appeal to the teeth in cases where a proper examination, instituted before the disease has assumed a formidable character, might at once point to the relief of the patient by suggesting a removal of the cause of the suffering.

To shew the necessity there is, in cases of facial pain, for an examination of the teeth by a dentist, before any mode of treatment is decided upon, we here subjoin two cases that came under our care in private practice, and which, we hope, will convince the reader, from a practical ground, of the mutuality that exists between different parts of the nervous system.

Case I. We were consulted by a lady, about twenty-two years of age, who for eight months had suffered pain in the branches of the maxillary nerves, superior and inferior, which pain at first came on in *irregular* paroxysms, but had latterly been distinctly periodical, invariably commencing at 9 o'clock, a.m., and at 7, p.m. The severe character of the attacks generally lasted for about an hour. They seldom occurred at any other times than those above specified, unless the patient was suffering from indisposition or mental disquietude. Early during her sufferings she was persuaded to apply brandy and salt, with mustard poultices, &c., but these had no good effect. She then consulted an eminent physician, who ordered various preparations of iron combined with quinine, which medicines were continued for two months without the slightest relief. Belladonna was next tried, commencing with a grain night and morning, an hour before the paroxysms came on. Leeches and blisters were applied to the temples, with fomentations of poppies and chamomiles, and the dose of belladonna was increased by half a grain each time until three grains were taken twice a day. She now became so much affected with sickness, vertigo, dimness of sight, &c., that this treatment was discontinued, and ioduret of potass substituted, with the external use of veratrine.

These measures were pursued unsuccessfully for six weeks, when it was suggested by a medical friend that the disease possibly originated in a diseased tooth; and under this suggestion, we were consulted on the case.

On examination it was found, that all the teeth of the lower jaw, from the canines to the dentes sapientiæ, were carious; and that the first and second molars of the upper jaw were the same. It was very evident that this mass of caries was producing great irritation in the surrounding structures.

When the diseased teeth were sounded with a steel instrument, the paroxysm of pain recurred with its usual violence. We immediately removed the two bicuspids and two molars of the lower jaw, and ordered the following:

Acetate of Morphia, a quarter of a grain;
Camphor Mixture, an ounce and a half.

To be taken as a draught: Also this aperient:

Compound Extract of Colocynth, 6 grains.
Calomel, 2 grains.

Make into two pills; to be taken at bed-time.

These measures produced considerable relief, and in the course of a week the patient was so far recovered from the effects of the operation as to have the other diseased teeth removed, viz., the dentes sapientiæ of the lower jaw, and the first and second molars of the upper jaw.

The morphia draughts were continued for a few days, and ever since the patient has had no return of pain. A few months since we had the satisfaction of hearing that she was quite recovered, and had not experienced a moment's uneasiness in the jaw since the last operation.

The following case was sent to the Author by Mr. A. Kay, and presents a somewhat different character, although it is worth remark that it too had been mistaken for neuralgia. The effects of our local treatment are conveniently presented in the letter we received from the husband of the patient.

"Sir.—My wife promised to let you know the result of the operation you performed on her, of extracting ten diseased teeth, and of opening the abscess formed underneath; and certainly a most formidable operation it was for a person in her delicate state of health. Soon after her arrival here, she experienced considerable pain and soreness in her mouth, which I attributed to her travelling in the cold. She was somewhat discouraged in consequence. In a few days, however, the violent paroxysms she had hitherto suffered from, gradually abated, and she is at the present moment free from pain. Her general health is much improved, and she now feels satisfied that she took the proper step, as, though she has lost her teeth, she has gained what she values far beyond them, namely, ease, comfort and health. The gums are not quite healed yet, but appear perfectly free from disease, with the exception of that part around the two front teeth, which are much decayed, and which you said she would be obliged to have extracted, if any pain or uneasiness in the face returned. Thanking you for your kindness and attention,

"I am, Sir, yours, &c.,

"B. White.

"*Chapel Street, Halstead, Essex,*

"*April 7th,* 1845."

parity of reasoning, he must lose in reputation by overstepping that particular walk, and interfering with the duties of the physician or surgeon.

In general diseases, then, and more particularly those connected with first dentition, in which there is great constitutional derangement, the dentist should urge the necessity for consultation with a medical man. A person unacquainted with the details of the subject, would scarcely imagine the advantages that the patient may derive from this course, or how greatly the two practitioners may assist each other in forming a correct diagnosis. And although there are in all callings some of those whom a learned physician has happily denominated "omnipotent practitioners," yet the world will have but a slight opinion of the dental skill of one whom they find prescribing for every class of ailments to which the human body is liable, and at all opportunities exceeding the art he professes to practice.

"Ne sutor ultra crepidam," therefore, is an excellent motto, which we recommend to all our brethren, in the confidence that the maintenance of that division of labour on which dentistry is founded, and on which its recent advancement depends, is essential to the future welfare of the art and its cultivators;

being required alike by science and respectability, as well as by considerations of sound policy regarding the relations between dentistry and the other allied professions.

CHAPTER XIV.

VALUE AND IMPORTANCE OF THE TEETH AS CONNECTED WITH HEALTH, ETC.

HAVING pointed out as concisely as possible the various diseases to which the teeth are subject, and the modes of treatment, we shall now give a brief summary of the relations that these organs and their functions bear to health, comfort, personal appearance, and enunciation or speech.

And first as regards health. Before the food is taken into the stomach, it is necessary that it be comminuted, and mixed with a portion of saliva, so that afterwards it may be regularly and perfectly exposed to the action of the gastric juice.* Now the

* "It is estimated that about six ounces of saliva are secreted during the average time of a meal. It flows in greater quantity when the food is acrid and stimulating. It mixes with the mucus copiously secreted from the glands, and with the serous fluids exhaled by the exhalent arteries of the mouth. There can be no doubt that the saliva, mixing with the food by the motion of the jaws, absorbs oxygen, and unites to the alimentary substances a quantity of that gas fit to bring about the changes they are ultimately destined to undergo." (Richerand's *Physiology*, p. 96.)

teeth are the instruments by which this comminution is effected. Perhaps we cannot better illustrate the importance of the process, than by comparing the human teeth with those of the different classes of animals that feed on vegetable matter, and are either graminivorous, or herbivorous, or both. Let us, for this purpose, take the cow as an example.

This animal feeds hastily; to balance which circumstance, nature has provided it with more than a single stomach or receptacle for food. The stomach into which the food is first taken, has the power of returning it to the mouth, there to undergo a second and more perfect mastication, called rumination, or in common language, chewing the cud. After this the mass is fit for the true stomach, where its conversion into nourishment commences.

In animals of this class, the incisors or cutting teeth are thin and sharp, whereby they are enabled to crop the shortest grass, and to fill the stomach quickly; while the molars have large surfaces for effectually grinding the food when submitted to their action.

An equal necessity for perfect mastication exists in man, and thus the teeth, on which this depends, ought of course to be in a sound and healthy state. In fact, the provision that nature maintains for

that of deficient gustatory sensation, viz., indigestion, with its concomitant evils.* Moreover if the first part of the digestive process be not properly performed, the succeeding ones will be imperfect; and all this, because the teeth are defective.†

We have said that the teeth enable the food to become an object of the sense of taste, and it is equally true that they themselves are the sensories, or, at all events, the transmitters, of a fine and peculiar sense of touch. To be convinced of this we have only to recollect the pleasurable feeling associated with the comminution of many substances, some of which have but little taste, as nuts of all kinds, &c., &c., which have a singular effect upon the teeth. This sense appears to be something intermediate between touch and taste, and to explore the food by a middle feeling between that of the lips and that of the

* L. S. Parmly, *Lectures on the Natural History and Management of the Teeth*, p. 21. 8vo., London, 1820.

† Dr. Fitch attributes dyspepsy or indigestion to a diseased state of the teeth, preventing a proper mastication of the food; and to the ulcerated and putrid matter which passes from the teeth and gums, along with the aliment, to the stomach. He also says that the irritation produced by diseased teeth is often so great as to disturb the healthy functions of the system, and of the stomach in particular. (*On the Teeth*, p. 308.)

tongue. Its existence is often disagreeably proved by small pieces of cinders, little stones, and the like, coming between the grinding surfaces of the teeth, and which are most nicely apprehended by those organs.

It will not be disputed that perfection or imperfection of the teeth makes the greatest difference in the personal appearance of the individual. The loss of even a single front tooth spoils the symmetry of the mouth; but when the whole are gone, and the alveolar processes absorbed, two or three inches are taken from the length of the face; the nose and chin approximate; the skin runs into huge gathers and deep furrows; the cheeks protrude, the mouth loses its smile, and under these circumstances, the sweetest face becomes senile and deformed: we will not say ugly, because if the mind be well disposed, its amiability will still shine forth from the ruins of the physiognomy.

The accompanying engravings represent the same face with and without teeth.

Furthermore, the teeth are of great importance as organs of articulation; not less so indeed than the lips and tongue, which act in unison with the teeth in speech; the vibration of the tongue especially, as it strikes against the teeth, producing many of the

1, With the Teeth.

2, The same after loss of Teeth.

sounds of the human voice. This office of the teeth is well remarked upon by Aristotle, who says that "the character and number of the teeth in man are mainly ordered with a view to speech," and that "the front teeth contribute in a remarkable manner to the utterance of several of the letters of the alphabet."* To demonstrate this experimentally, the reader has only to pronounce the words, "the," "therefore," "those," "they," or "that," and he will perceive the vibratory action of the tongue against the teeth, and the manner in which the lips modulate the sound, and give it definite expression. Or again, he may observe the same words when uttered by persons who have lost their front teeth; when the effect will be found to resemble that which would be produced by a person speaking through a wooden tube.

And as the teeth contribute to the articulation of the voice, so they also transmit the voice to the ear of the individual uttering it, and give a loudness and distinctness to the sound as apprehended both by the internal and external auditory passages. This is readily proved by the familiar experiment of holding a poker between the teeth, having previously closed the ears, and applying the other end of the poker to a boiling kettle; in which case the sound of

* "De Partibus Animalium," lib. iii., cap. i.

the ebullition is conveyed through the teeth to the ear and head with the greatest clearness. It is impossible to do other than conclude from this, that whatever sounds strike upon the teeth, are at once conveyed by them to the ear, and perhaps to the whole cranial sounding board. And this may be one reason why those who are deaf, open their mouths to catch sounds by way of the internal ear: an action which is generally referred entirely to the presence in the mouth of the Eustachian tube, but which we are inclined to think depends also upon an instinctive feeling of the manner in which the teeth carry sounds to the auditory organs.

Hence it is that disagreeable sounds are said to "set the teeth on edge:" a fact respecting which many curious idiosyncrasies are observable. The husband of one of our patients is almost distracted, and exclaims that "his teeth are coming out of his head," if paper be creased by the nail in his presence; and others are affected in the most painful manner by the sound of cinders under the fire-shovel, &c., &c.: clearly proving that the teeth perform some universal offices as transmitters of sound; and which indeed are proverbially though not yet physiologically recognized; for common sense runs faster than science.

Such are a few of the wide offices of those humble and sometimes despised and neglected organs, the human teeth. Themselves organs of sensation, they contribute indispensably to the sensation of the next higher organ in the same series, viz., the tongue. And by the same act, we mean the comminution of the food, they perform what may be called the first digestion, which is necessary to the proper performance of the second digestion, or that of the stomach. Moreover, they build the face into beauty in woman and manliness in man; wonderfully completing both the softness of the feminine expression, and the firmness of the male. And if they give beauty to the face, they are also beautiful themselves both in form, colour and lucidity, so that the poets have well likened them to pearls, and spotless ivory and alabaster. Nay, their uses are higher or more intellectual still, for they have a share in forming the voice, which is the distinctive of the one being who is endowed by the Creator with a will and understanding; and thus they stand in that series of mechanism which brings the intellect into physical expressions, and enables man to converse with man, and to institute societies; which enables the orator and the preacher to guide and sway the minds of others; which utters truths, and communicates affections. Lastly, they contribute to give the speaker himself a clear hearing of his own voice, and thus to bring down self-consciousness into the lowest sphere, and to enable us to acquire intonation, and the utterance of our thoughts, with the greatest perfection.

All these uses clearly demonstrate that the teeth, like the body and its organs generally, are a trust, for the proper maintenance and administration of which we are deeply responsible: they also shew, that by regarding the teeth from the purposes they serve, we may have higher views of them, and appreciate their importance more correctly, than could be the case if we based our induction simply upon their anatomy, physiology, and microscopic characters; neglecting the broad and common-sense facts we have stated above. Wherefore although we justly value the contributions of the anatomist to dental science, yet we hold that the eyes of the anatomist and microscopist require to be armed by a recognition of the great and practical effects which the teeth produce; after which they will be more competent than now to look upon many knotty questions, such as the organization of the enamel, &c., &c., &c. Let us not then neglect the broad features of our case, which are, after all, the most instructive, and the most nearly allied to the *practice* of our art.

THE MEANS OF PRESERVING THE TEETH.

Notwithstanding the considerations adduced in the preceding section, and with the main details of which almost every one is acquainted, yet few persons are induced to acquire that easy knowledge which is necessary to effect the preservation of the teeth, or if they do acquire it, few are found to follow it up with the diligence requisite to success. Probably they so far sacrifice to cleanliness as to brush their teeth once a day, but having done this, and being satisfied that the teeth perform their duties for the present, no pains are taken to ensure their services for a prolonged future, or to prevent them from falling into a dilapidation which renders them worse than useless. Too often, for instance, a dentifrice is used that makes the teeth white for the time, but at the expence of tooth-ache and decay in the time to come; or tartar is allowed to accumulate, or the beginning of caries is neglected, &c., &c. Were it possible for us to impress upon the public the importance of care and attention to the subject, to cause them to avail themselves of proper precautions for the preservation of the teeth, and to convince them of the need there is for a periodical visit to the dentist, we are sure that a large amount of pain and misery would be avoided, and many teeth would last for life which are at present sacrificed before manhood even commences.

The reluctance commonly felt by patients to apply to the practitioner, is, we admit, unfortunately grounded in many cases upon a knowledge of the unprincipled acts of some of those usurious pretenders who disgrace the dental profession. Numerous individuals are afraid, and not without justice, to place themselves under the dentist; they have perhaps had sad experience already of the "tender mercies" of a certain class of operators, or they have heard accounts, too authentic to be doubted, of suffering and injury undergone by their immediate friends and relatives. Thus the whole profession (and with it the public) suffers for the improprieties of a few of its members; and a benign art becomes a bugbear to those whom it is intended to benefit. Nothing can altogether remedy this but an improvement in the profession itself, by which it shall purge itself of that dross which it at present contains. In the meantime we beseech the public not to throw away a real good because it has been abused, but to be more than ever careful in the choice of their dentist, valuing character more than either cheapness or notoriety. If they do this, they will have in their own hands the power of commanding justice and skill whenever they require them.

Actual pain is too frequently the only thing that will compel the patient to apply to his dental adviser, and many a valuable tooth is ruined on this account. For the teeth differ somewhat from other organs, insomuch that in them disease may have made considerable progress before pain is urgent. So long as decay is confined to the enamel and bone, the patient is not aware of the ravages that are going on, and probably not till such decay has destroyed the bony substance, and exposed the internal cavity of the tooth, is his attention called to the subject.

We advise that children should be early habituated to take care of their teeth, in order to ensure proper attention to them in after life.* At five years old they may begin to use a tooth-brush, which should

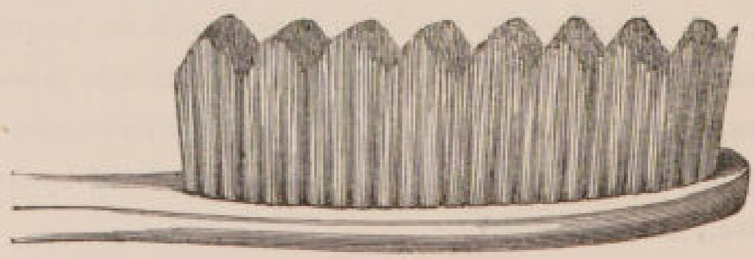
* "It is a religious precept," says Tournefort, in his 'Voyage to the Levant,' "among the Mussulmen, to make a little ablution with the face turned towards Mecca; to rinse the mouth thrice, and clean the teeth with a brush. This shews how highly this custom is esteemed among a people, who formerly were forbidden, according to Menavius, to have a tooth extracted without permission from the emperor. Let children be taught by their parents the proper degree of care necessary for their teeth; they generally imitate them even in their sports; here the agreeable lesson will be converted into a useful habit." (Duval, *The Dentiste de la Jeunesse*, translated by Atkinson, p. 75; 8vo., Leeds, 1820.)

be employed at least once a day. This brush must be of middling firmness, two degrees harder than goat's-hair.

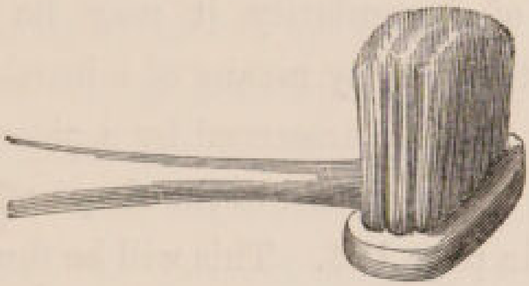
Particular regard should be paid to the grinding surfaces of the double teeth as they make their appearance in the mouth, for their unevenness often causes them to retain particles of food, and thus makes them very subject to decay. These teeth require a rather hard brush with long elastic bristles, which should be used after every meal, to remove any remains of animal or vegetable matter before decomposition commences.

The lateral edges and posterior surfaces of the teeth also require great care, as particles of food and deposits of tartar are apt to lodge between them. To cleanse these parts effectually, the brushes must be moved not only across the teeth, but upwards and downwards, confining the action to no one particular direction.

The annexed representation shews a brush intended for the lateral edges, anterior surfaces and crowns of the teeth.



The following is a brush suited for the posterior surfaces of the incisors and upper centrals.



The bristles ought to be sufficiently long and elastic to penetrate into the interstices between the teeth. The opinion that using a brush with this intent removes the gums from the necks of the teeth, is erroneous; the fact being, that where the gums are relaxed, spongy, and liable to bleed, the above is one of the best means of restoring them to healthy action, and causing them to adhere more firmly.

As we before observed, the teeth should be cleaned and brushed after each meal, using either the Quinine Dentifrice, camphorated chalk, or a powder composed of the following:

Orris root, ¼ ounce,
Gum-myrrh, ¼ ounce,
Nutmeg, finely powdered, 1 scruple,
Chalk, 1 ounce. Mix.

These tooth-powders should be used at least once a day, the best time being in the morning. Occasionally the gums should be brushed with a little spirits of camphor or eau-de-Cologne, which may be dropped on the brush, and applied after the tooth-powder.

In cases of irregularity it may be difficult to keep the teeth clean by means of a brush alone: and the end may then be answered by a piece of cane deprived of its bark, and cut to the shape of a wedge, as represented in page 124. This will be found available in situations that are not to be reached by a brush.

Those who wish to preserve their teeth should on no account use a *metallic* tooth-pick. If it be necessary to use one at all, those made of quill, and sold at the stationers' shops, are the only safe ones.

When the gums are tender, or the teeth loose, the astringent lotion before referred to (page 134) should be used twice or thrice a day, in the proportion of half a teaspoonful to a wine glassful of warm water.

Thus the means of preserving the teeth are few and simple, and yet if fully acted upon, they will be found to be efficacious. Cleanliness, in one form or another, embraces them all. Is it too much to require this of civilized people, who would be shocked at the necessity for the recommendation if it applied to their hands, faces, or other parts of their persons? This much we will say, that the attention which is paid to cleanliness, of the teeth especially, is in exact proportion to the civilization of the individual, or to his height in the social scale. If his teeth are green, brown and stinking; if they are embedded in tartar, or half eaten up by caries, his feelings must be blunt indeed if he can go into society without knowing that he is an outrage in the eyes and noses of his acquaintance. The *morale* of such a person requires serious correction. As "cleanliness is next to godliness," so *his* uncleanness is akin to considerable perversity. Let him by all means mend his manners; apply to his dentist to have his teeth set right; bestow due pains afterwards to keep them right; and bring up his children, and influence his friends, to follow well the path of dental rectitude.

In conclusion it may be observed, that the food of the upper and middle classes, which is generally rich, and therefore liable to offensive decomposition, nay, which is often partially decomposed when it comes to table, necessitates far greater attention to keep the teeth clean, than the simple fare of the labouring family.

ARTIFICIAL TEETH.

We have hitherto endeavoured to point out, by a variety of considerations, the necessity of retaining the teeth in the mouth as long as possible, and we have suggested all the means we are aware of, to keep them in health, and also to renovate them artificially after disease has actually taken effect. Often, however, notwithstanding the precautions of the patient, and the best efforts of the dentist, these ornaments of the human face are prematurely lost or destroyed, and mastication, the dignity or beauty of the face,* and the perfection of the voice, seem to be gone beyond recall. What is to be done under such afflicting circumstances? Is the dental art beneficent enough to furnish a substitute for these invaluable organs; a remedy against the annoying and sad consequences of their removal from the mouth? Are health, beauty, and utterance indebted to it for so great a boon? Artificial teeth are the answers to these interesting questions.

It is right however to warn the patient, that under no circumstances will artificial teeth be equal in use to those given by nature; for the sense of touch

* For the mouth is not the only feature impaired by the loss of the teeth: all the other parts of the countenance become more or less dilapidated. The nose loses its support; the face, from the forehead downwards, is shortened, and its natural beauty destroyed. A deep pit is formed under the cheek-bone; the lower jaw is drawn upwards, and the lips inwards; for the fibres of the principal muscles of the face change their oblique direction, and run into the mouth nearly at right angles. Moreover, from the absence of that fulcrum which the teeth afforded to other and antagonist muscles, wrinkles are distributed over the whole surface, completing the picture of deformed and decadent age.

Thirdly, on the suitableness of the materials employed in their construction; for improper materials cause irritation of the gums, ulceration and sloughing of the soft parts; effects that are by no means unfrequent from the employment of gold with a large alloy of copper, of silver, pinchbeck, gilded brass, &c., &c.

Fourthly, on such an adjustment as will give solidity and firmness, and on such a close adaptation as will prevent the lodgement of food between the artificial material and the gum; by which, if it took place, a taint would be imparted to the breath.

Having given an outline of the conditions on which the success of artificial teeth depends, we shall now proceed to speak of the various kinds of them employed, and of the basis on which they are fixed; for one kind of tooth or base is not adapted for every case; since the health of the patient, the state of the gums, irritability of temperament, the chemical qualities of the saliva, &c., &c., are each modifying circumstances which demand the attention of the dentist, and by a proper consideration of which only, he can ensure success, and comfort to the patient.

Whenever a tooth is lost, its place should be supplied, as soon as possible, by an artificial one, so constructed as to support the adjoining teeth, and to preserve the contour and symmetry of the face.

We commence our enumeration of the different kinds of artificial teeth, with the human tooth. These have been long in use, and are generally set on a gold base or palate plate, or in sockets made of the tusk of the hippopotamus *(i.e.* dentine), or occasionally of that of the walrus, which are accurately fitted to the gum on which the teeth are placed. Each of these plans answers excellently in particular cases.

The next kind is the tooth of the hippopotamus shaped to resemble the teeth, with the natural covering of enamel left on.

This kind of teeth is objectionable, as the enamel presents an unnatural whiteness at first, which soon changes in the mouth to a light transparent blue, and affords altogether a bad imitation of the natural teeth.

The same substance, shaped into the form of teeth, is also used with the enamel removed; but if it be of inferior quality, a few weeks use only is required to destroy its natural whiteness, and few months will have passed before it bears a striking resemblance to Honduras mahogany.

These are the *cheap* teeth commonly advertised at £5 and £10 a set; the tooth of the walrus, which is of still inferior quality, being in many cases substituted for hippopotamus.

Besides the substances above described, artificial teeth are also formed of a kind of fret; a vitreous substance similar to that used for glazing china at the potteries. Various mordents are mixed with this substance to give it the different tinges of the human teeth, which it then resembles with an exactness that it would be impossible to give an idea of. The teeth constructed of it are fixed on gold, or in the ivory of the hippopotamus, in the same manner as human teeth. Those who are further curious on this subject may refer onwards to our mechanical treatise for a more full explanation.

These teeth possess great advantages over all other artificial teeth. They neither decay, change, nor are in any way affected or acted on by the juices of the mouth or by acid medicines. Moreover they are especially enduring. They are liable, however, to one objection. In short cases, where the approximation of the jaws is such as not to admit a sufficient *substance* of tooth at the back to resist pressure, they are liable to fracture; and if this happens to the patient when at table or in company, it places him of course in no very enviable predicament.

They are now manufactured in this country by many persons, who supply the dentists: they are also imported in immense numbers from Brussels; and are advertised under various names, as, "Incorrodible Teeth," "Silicious Mineral Teeth," "New Invention Mineral," &c., &c., &c.; all of which are one thing under many names.

Another description of teeth, called the French Mineral, has long been in use in this country. These are admirably adapted for short cases in which the former kind is liable to fracture.

Great improvements have been made within a few years in the structure of these teeth. Formerly they were indeed artificial as contradistinguished from natural; for they resembled real teeth neither in shape nor colour. Now they are made of exquisite beauty and correctness.

In cases where it is necessary to supply deficiency of structure arising from absorption of the alveoli, these teeth are manufactured with an artificial gum. They are chiefly prepared by Mr. Stockton, of Philadelphia, U.S., who has brought them to the greatest perfection. But from their being little known to dentists, they are not in general use in this country.

From the foregoing observations it may be gathered, that there is no particular kind of teeth adapted for every case; for all inorganic substances undergo more or less decomposition in the mouth according to the vitiation of the saliva; and each mechanical case that presents itself to the dentist, gives a different approximation of the jaws, so that it becomes necessary to adapt the teeth to the mouth, and not, as some dental conjurors would persuade us, the mouth to the teeth. It is absurd to suppose that one kind of teeth will suit all mouths. The practitioner of our art should always keep this in mind, and follow nature with pliant skill; making use of those materials that are best adapted to the comfort of each patient in the several departments of mastication, enunciation, and personal appearance.

PIVOTED TEETH.

The operation of pivoting teeth may be said to have originated out of one of a more questionable character suggested by John Hunter,—I allude to the transferring of a tooth from one person's mouth into that of another,—an operation that was performed with various results, but which under any circumstances was revolting, and sometimes also dangerous, inasmuch as serious diseases were thereby transplanted with the tooth, and the dentist became chargeable with aggravating the ills that flesh is heir to.

The operation itself was simply what we have stated; the transplanted tooth being retained *in situ* until it grew fixed. It produced so many ill effects, and was found so inefficient in result, that it soon fell into desuetude, and the operation of pivoting arose out of its ashes.

This operation is confined to those teeth that have single fangs, and indeed is seldom performed on any but the front and canine teeth. When caries has so far destroyed the crown of these teeth that it is impossible to stop them, and they present an unsightly appearance in the mouth, the remains of the crown are either filed or cut off, and the natural canal of the fang taken advantage of, for the insertion of a gold pin, to which a crown of the exact size, shape and colour of the remaining teeth, is fixed and fitted; the gold pin being forced into the natural opening, and retained there by means of mastic varnish and silk. This operation requires care and judgment to prevent subsequent inflammation and swelling of the face, particularly in nervous and irritable patients.

The parts themselves and the general system should be prepared for the operation by local bleeding, or else this should be resorted to immediately afterwards, in order to allay inflammatory action; otherwise the most excruciating suffering may follow, with eventual loss of the fang from suppuration. Artificial teeth, when properly fixed in this manner, have been known to last thirty and forty years without the slightest inconvenience or discolouration. The accompanying wood-cut represents a front tooth engrafted by the late Mr. Waite, and which the patient

had in his mouth for thirty years, and then lost by absorption of the fang; through the end of which, the gold pin to which the crown is attached is here seen protruding.

PART II.

MECHANICAL DENTISTRY.

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MECHANICAL DENTISTRY.

INTRODUCTORY REMARKS.

It is certainly remarkable, as we said above (pp. 1, 2), that while in this country there are many excellent works on dental surgery, there should not be even so much as *one* on the mechanical branch of the profession; and the more so, as our brethren in America have already communicated to the world a mass of sound information upon this necessary and useful department of the dental art.*

The causes of our deficiency in this respect are various.

Foremost among these is the fact, that dentistry is too often separated from mechanics; and that the dentist is only very partially informed concerning the lower processes of his art, upon which, however, so much of its success depends. Thus the artizan and

* To the ingenious and scientific Dr. Brown, of New York, I am indebted for the method of fixing, &c., the American mineral teeth.

mechanic has become in many cases the sole depository of a knowledge that his employer, the dentist, ought, of right, to be thoroughly acquainted with. The knowledge, therefore, has remained traditional, and the art of printing has not yet reached it in England. Many other branches of practical science are in the same condition, and have not hitherto had the benefit of the daylight and free air afforded to every subject by the printing-press.

This state of things it is our hope to remedy. For it must be remembered that the art of dentism is essentially mechanical, and that for this very reason it has been constituted a separate branch of practice; so that no man can be considered an accomplished practitioner who is not to the same extent a mechanic, both theoretically and *practically*. For putting out of sight the adaptation of artificial work to the mouth, which will occasionally draw largely on the knowledge, ingenuity, and experience of the practitioner; even the every-day operations of stopping, scaling, filing and extracting, cannot be well or safely performed by any but one who is versed in the laws and resources of mechanics.

The whole art of dentism is so intimately connected with mechanics, that a man may be a good anatomist, physiologist, and pathologist, yet, unless he be at home in the science and manipulations of mechanics,—unless he be mechanically-minded and mechanically-handed,—he must necessarily be a bad dentist; nay, however well he may write prescriptions and give advice, he must practice his art with disadvantage both to himself and to his patients.

We are aware that many dentists consider the mechanical branch of the art as beneath professional dignity, and some even *pride* themselves on their ignorance of what is the greatest aid to practice. The latter are men whom we cannot hope to conciliate, and for whom real and correct knowledge exists in vain. We are well content to bear their strictures, and we appeal from them to the good sense of the public, of the medical profession generally, and of all the most enlightened practitioners of the dental art.

We feel that secrecy is in no way necessary to the success of our calling; that by divulging with honest freedom whatever we know, we strike the most effectual blow against fraud and quackery, at the same time that we expose the knowledge for which we are indebted to our ancestors and to our own minds, to that wholesome action of public opinion, by which gradually error is sifted away, truth made brighter, invention added to and improved, complex things simplified, and the basis of all arts widened, until at length their benefits become available to the great mass of the people. And if at any time we have spoken with enthusiasm of our art, it is because we are devoted to it with sincere admiration. In it, as in a perfect though minute mirror, we contemplate the whole of surgery: it is the most definite, precisely because it is the most mechanical, of the healing arts: it in a manner embraces them all; and in proportion as it is perfected, it must become an illustration and example of the pitch to which medico-chirurgical science generally ought to endeavour to attain.

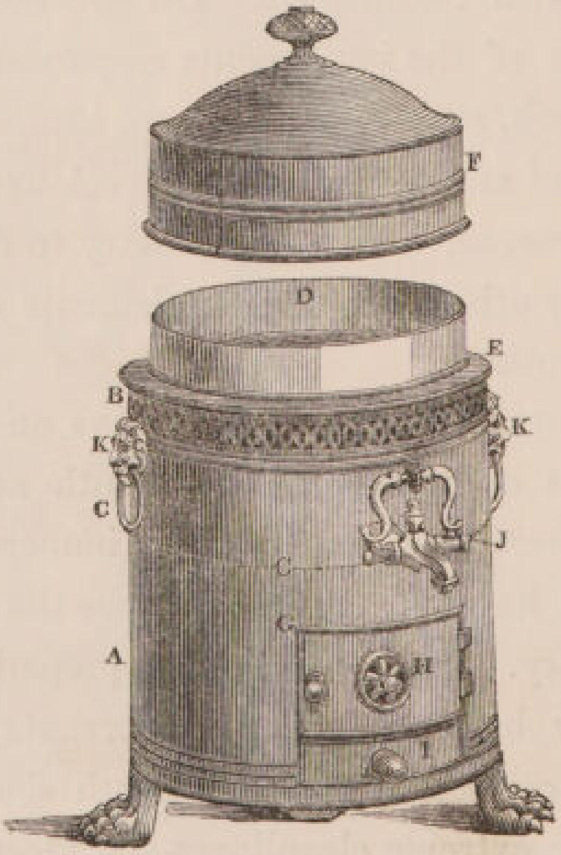
MECHANICAL DENTISTRY.

The art of mechanical dentistry consists in the construction and adaptation of sets, and parts of sets, of artificial teeth; in the application of mechanical means for the correction of irregularity of the teeth; in engrafting or pivoting artificial crowns of teeth on the natural roots that remain in the mouth; in constructing artificial palates; in taking impressions or models of the gums, and of deficiencies of the teeth; in casting; making plates; soldering; fitting bone; inserting teeth in bone; filing; polishing; besides many other branches, which it is our intention to explain in the following treatise in such detail as is necessary for practice.

We shall presume that the student is provided with a work-bench, and lathe attached, similar to the one here represented, the size of which is 24 inches in length by 12 in breadth, and 33 in height; while around the upper board or table, at the edge, is fixed a small beading, A, to prevent the tools, &c., from falling off. From the centre of the plank, B, is cut

invented an apparatus that not only facilitates the preparation of the wax, but makes the operation more agreeable to the patient, by obviating any unpleasant suspicion of the wax having been manipulated by dirty hands. The following engraving represents this apparatus.

It consists of a cylindrical outer case, A, made of thick block tin japanned, 12½ inches in height, and 32 in circumference, and perforated at the top, B. Into this cylinder is fixed an inner vessel or boiler, 4 inches in depth, and 28 in circumference;

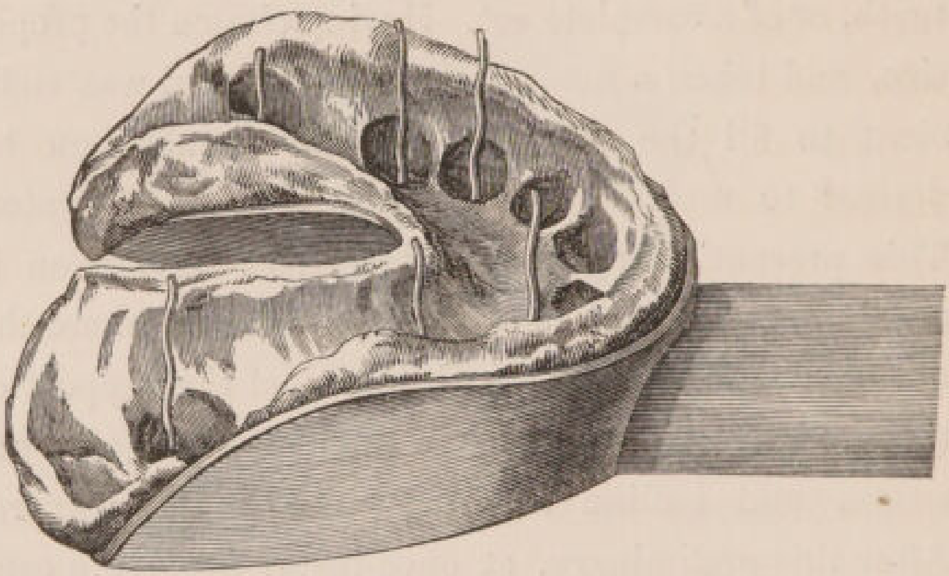


the bottom of it being indicated by the dotted line, CC. To this is made to fit accurately a moveable vessel, D, 3¾ inches in depth, and supported by a rim resting on the ledge, E; the bottom of this second vessel is perforated in a manner similar to the common domestic steamer. The whole is surmounted with a cover, F. Within two inches of the bottom of the apparatus is a door, G, 5 inches in width, and 3½ in height, in the centre of which is a small moveable ventilator, H. Underneath this door is a drawer, I, with two divisions, one containing lucifer-matches, the other covered by a piece of finely-perforated tin for igniting them. J is a tap inserted into the boiler, about a quarter of an inch from the bottom, for drawing off the water. On each side are handles, K. The apparatus is supported by three feet, and is 19 inches in height.

The boiler is heated by a spirit lamp with three burners, and is supported on the inside of the outer cylinder by two pieces of tin, extending to the opposite side of the cylinder, with a stop for the purpose of keeping the lamp immediately in the centre of the boiler. The following represents the frame-work and lamp.

A quart or more of water is poured into the boiler, with as much wax as may be required for taking the

tooth, or of a complete set. Having chosen the proper size, and taken a quantity of the softened wax sufficient to fill the tray, the patient should now be desired to wash his mouth with cold spring water. This precaution against an imperfect impression is absolutely essential, particularly in cases where the natural teeth in the mouth have lost the support of their neighbours, and with it their perpendicular position, and incline obliquely towards the centre. After this preliminary, at once insert the frame cautiously into the mouth, and press the wax perpendicularly and firmly against the cutting edges of the teeth in the part that you wish to fill with an artificial substitute; continue the pressure steadily, until the teeth and gums are completely embedded in the wax. When the required depth has been obtained, carefully press the wax against the inside gum and the fronts of the teeth. The frame must now be slightly tilted from behind, so as to loosen the wax from the back teeth; a similar movement is required to disengage the wax from the fore-part of the mouth; then gently withdraw the tray, taking care not to disturb or drag the wax, otherwise the impression will be imperfect, and the operation will require to be repeated. The following represents a perfect impression.



When the wax has cooled, insert into each impression of the patient's own teeth in the wax (as represented) small pieces of thin iron wire of the following shape, to prevent the plaster cast receiving injury in

removing it from the wax, or in the course of trying on the plates, fitting teeth, &c., on the model, during the process of manufacturing.

For fastening particular kinds of artificial teeth to the plate, such as the American and French mineral, two, and sometimes three, wax impressions are required, the plaster casts from which are used in the process of soldering, and of which we shall speak more particularly when we come to describe the various kinds of teeth that are employed as artificial substitutes.

Casting the Model in Plaster of Paris.—Having the impression in wax, the next process will be to obtain a fac-simile of the deficiency in plaster of Paris. To accomplish this, mix the *finest* plaster of Paris or gypsum in a sufficient quantity of water, in a common basin, with an iron spoon, until it acquires the consistence of cream; then gently pour a little of it on one end of the wax impression, holding it somewhat obliquely, so as to allow the liquid plaster to run into each hollow made by the natural teeth in the wax, at the same time gently tapping the under surface of the frame; the object of which is to prevent air-bubbles in the plaster cast, which would occur should these precautions be neglected, particularly if too great a quantity of plaster were placed in the mould at the commencement. When the impression has been filled to a level with its edges, continue to add more plaster until a sufficient size and thickness is attained, to withstand any pressure that may be necessary in taking a metallic cast.

In ten minutes, if the *finest* plaster of Paris has been used, it will be sufficiently set to allow of the separation of the wax from the plaster. This is done by immersing the lower part of the model containing the wax impression in hot water, and allowing it to remain until the wax is again softened: by gently raising the edges of the wax it will then be found to separate from the plaster with ease and safety.

The plaster cast must now be trimmed, by means of a knife, to a proper shape and form, that it may be readily withdrawn from the model sand when taking the metallic cast. The form it should now assume is the following.

After trimming the cast to the above shape, and cutting off level with the plaster the ends of the iron wire that project beyond the edges of the teeth, it should be thoroughly dried either in an oven or before a fire, and while warm, immersed for two or three minutes in a composition, previously melted, of equal parts of white wax and resin; this will give it a surface, and materially guard against a wearing of the model in trying on the plate; it will also facilitate its removal from the casting sand.

CASTING METALLIC MODELS.—From the plaster model it is necessary to obtain a fac-simile in some kind of hard metal that will fuse at a low temperature, and upon which ultimately a gold plate can be formed. For this purpose a compound metal is prepared, which is kept at most of the dental repertories, under the name of *spelter;* it consists of zinc, bismuth and tin; but some mechanical dentists use zinc or tin alone.

The method of taking a metallic cast for dental work is very similar to the one employed by brass and iron founders, and is generally adopted now by dentists, as being both economical and expeditious. It consists in filling an iron ring, 4½ inches in depth, and 6 inches wide, with modelling sand, which has been previously moistened with water to a consistence that will allow it to cohere readily when pressed. The plaster cast is now pressed gently and firmly into the sand, and cautiously withdrawn in a perpendicular direction. This must be repeated until a clear and distinct impression is observed. Practice alone will soon teach the operator how to shape his plaster cast so as to facilitate its withdrawal. In each impression of the teeth insert a thick iron wire, about an inch in length, to prevent the teeth from breaking off or receiving injury during the process of striking up the plate.

The mould now in the sand must be filled with the spelter or zinc, which has been previously melted in a common ladle. When the spelter cast is cold, any slight inequalities in it around the inner necks of the teeth may be removed by a file or sculper, and made to represent the plaster cast.

The operator being now provided with what is termed his *working cast* in spelter, it is necessary that he should have a similar one in *lead,* which is obtained in precisely the same manner as the last. This being made, melt in a ladle capable of holding a pint and a half of fluid, as much lead as will fill it; into this molten lead immerse the lead cast (previously smeared with fluid plaster of Paris) half way up from the edges of the teeth to the broad part of the cast; immediately place the ladle on a vessel filled with either wet sand or water, up to about two inches from the edge, as follows. This will prevent the re-fusion of the leaden cast. Care should be taken not to insert the lead cast into the body of melted lead when too hot, which would produce a

fusion of the former, and render a repetition of the operation unavoidable. When cold, the cast is to be separated by striking the outer edges of the body of lead with a heavy hammer.

When the gold to be employed is large and thick, it becomes necessary to have two metallic castings in spelter, as the sharpness of the first is generally destroyed in the working; but in ordinary cases the operator will find he is provided with a sufficient number of metallic castings, between which the gold plates can be fashioned.

Whether a single tooth or a complete set be required, the same process and mechanical manipulations are to be observed.

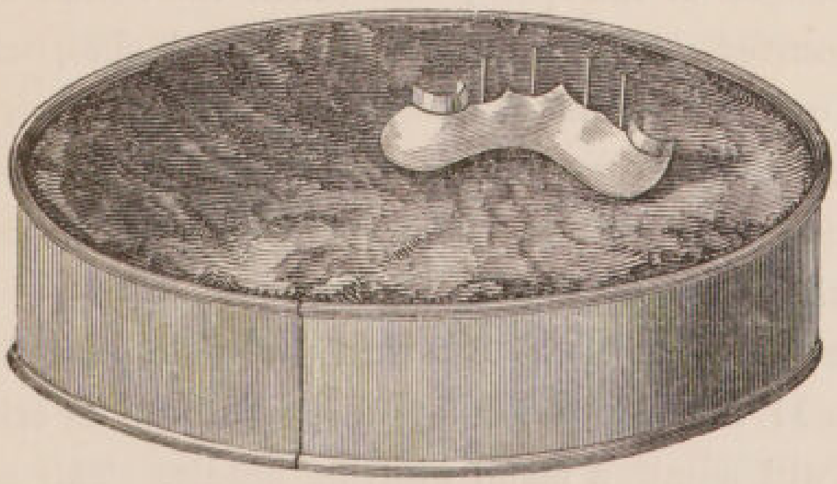
To alloy Gold for Plates.—Gold plates, solder, wire, &c., are generally procured from the dental repositories, where they are kept of all sizes and qualities; but as some students may be desirous of knowing how themselves to prepare them in cases of emergency, we shall here, for their guidance, describe the process. As a rolling mill and other expensive implements are necessary for the purpose, it is best to purchase the above materials ready prepared.

The gold plate employed for artificial work, never ought to be less than 18 carats, nor higher than 20, and the alloy should be *silver;* for if copper be used, the patient, when the work is inserted in the mouth, is seldom, if ever, free from a metallic taste, the result of the chemical action of the salts of the saliva upon the alloy. The 18 or 20 carat gold, which is mostly used by respectable dentists, is prepared as follows:—Take twenty parts of fine gold, and alloy it with four parts of pure silver; melt the two metals with a lump of borax in a crucible, well secured at the bottom with fire clay, in a charcoal fire; when in a state of fusion, run the mass into an ingot of convenient size and shape; after which hammer it, and pass it through a rolling mill, until it be reduced to the required thickness. The plate should then be annealed by heating it to redness, and afterwards cleaned by boiling it for a few minutes, in either muriatic or sulphuric acid, diluted in the proportion of one ounce of acid to fifteen of water.

Wire Making.—When the plate has been reduced to the thickness of half-a-crown by the rolling mill, cut it into narrow slips; file the point and draw it through the largest hole in a draw-plate fixed in a large vice; pass it through the next hole, and so on until it be reduced to the required size.

MAKING SOLDER.—The solder employed for plates of 18 carats, may be prepared in the following manner:—To 2 pennyweights 22 grains of fine gold add 16 grains of pure silver, and 12 of roset copper; melt in a crucible with borax. It is necessary, for convenience in working, that the solder should be rolled into very thin plates, and well cleaned previous to its being used for work.

ESSENTIALS.—During the process of making the plate, it is necessary that the operator should be provided with a piece of charcoal or pumice-stone, for the purpose of annealing, and soldering on springs, rivets, &c., as also to sustain the work, and confine the heat while under the blast of the blow-pipe. For

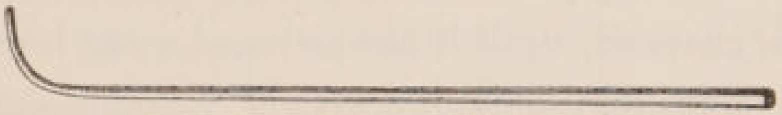


small pieces of work, pumice-stone is preferable; but for sets and large pieces, a round block of charcoal will be requisite, 5 inches in diameter and 8 in length, hollowed in the form of a mortar, the outer surface being either covered with plaster of Paris, or encased in a moderately thick iron plate, as above represented.

Soldering Lamp.—A soldering lamp, similar to the annexed representation, may be procured. It

should be capable of holding a pint and a half of oil; the length of the spout, into which the cotton wick is inserted, being from three to four inches, while the orifice is about three quarters of an inch in calibre. The common gas however is far preferable to the lamp, as all the smell, dirt and trouble attending the latter are thereby avoided.

Blow-pipe.—This instrument should vary from 15 to 17 inches in length, and should have an orifice that will admit a small knitting-needle. The eyes are liable to be seriously injured by the use of the short blow-pipe, and therefore the long one should be preferred: and those who feel incommoded by the light in the use of either, should wear a pair of common green spectacles.



A Blow-pipe with Bellows attached.—In some constitutions the habit of using the blow-pipe is exceedingly injurious to the lungs. Where this is the case, the operator may substitute the following method. In the centre of a frame made of stout wood or iron, support a pair of moderate-size furnace-bellows by means of a swivel screwed to each side of the frame. To the nozle firmly secure an elastic tube of sufficient length, at the end of which fasten the common blow-pipe. Upon the top of the bellows place a weight corresponding to the strength of the frame-work and the size of the bellows. To the back part of the latter attach a treadle of convenient length and breadth, by means of which the apparatus may be worked like a lathe, and the blow-pipe applied with the greatest facility either to the flame of gas or of the common oil lamp. The student should however be extremely cautious in this use of the blow-pipe while soldering, and should closely watch the colour of his metal; otherwise by the intense heat a large piece of work may in a few minutes be melted away.

ANNEALING.—For this purpose a constant blast from the blow-pipe should be given to the metal placed on the charcoal, until it has assumed a *red* heat.

SOLDERING.—This process is accomplished by steadily directing on that part of the work intended to be soldered, a constant blast from the blow-pipe, and gradually bringing the flame to a focus until the solder fuses. If the student use the common in preference to the bellows blow-pipe, he must learn the habit of breathing through the nostrils, so as constantly to expel a current of air through the blow-pipe by the action of the muscles of the cheek.

Simple as this may appear to the casual observer, it will be found upon trial, that to become an adept in soldering, and to use the blow-pipe without distressing the lungs, requires considerable patience and perseverance; and we would strongly recommend the student, instead of trying his skill upon gold, to experimentalize upon some other metal, such as silver or pinchbeck, before he attempts a piece intended for the mouth of a patient.

The surface of the gold plate to which a spring, rivet, or tooth is about to be attached by means of the solder, should be perfectly clean, and should be slightly touched with an aqueous solution of *borax*, laid on with a camel's-hair brush, on the edges of those parts where it is desired that the solder should take effect. The surface best adapted for rubbing the borax upon, is a common piece of slate, cut to a convenient shape, and embedded in plaster of Paris like the charcoal before figured and alluded to.

The solder, having previously been cut in small bits, is placed in contact with the two pieces to be soldered, which are kept in the proper position either by twisting a piece of binding wire around them, or by means of an iron cramp similar to this, which is

made by flattening the two ends of a piece of wire, and by means of pliers turning it into the above shape.

Another method is frequently adopted, viz., that of soldering upon the extra plaster cast, and which we shall more particularly allude to when we treat of soldering teeth to a plate.

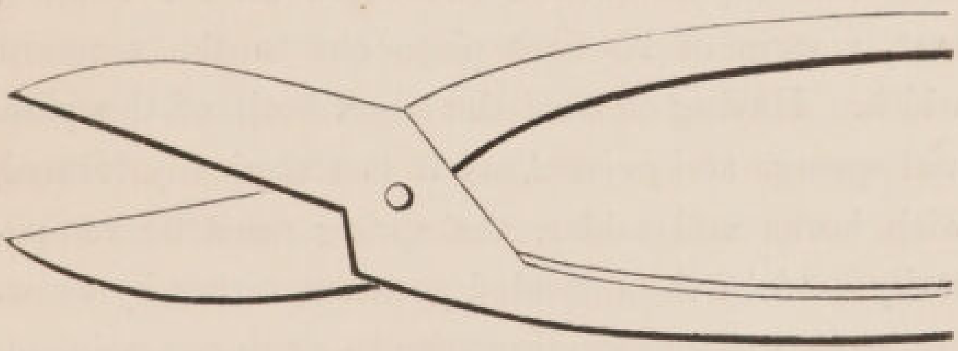
When the spring or rivet has been properly adjusted, the flame is to be brought very gradually upon the parts intended to be united, until they are nearly white hot; but the very instant the solder is fused and runs over those parts, the jet of flame must be withdrawn, otherwise the larger portion of the metal will be liable to be melted.

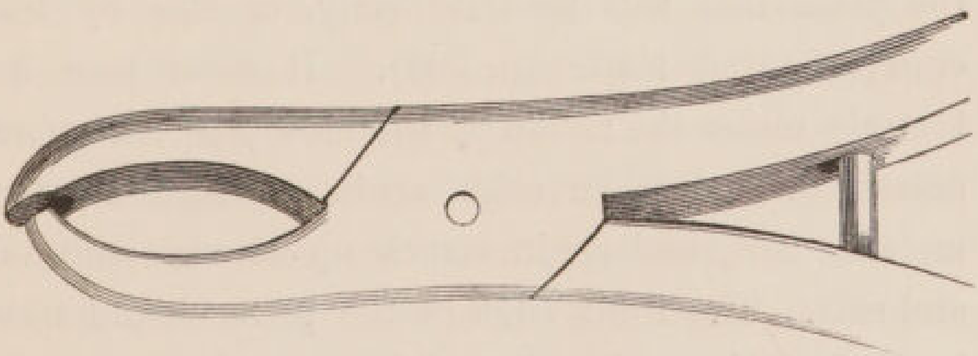
The great art of soldering consists in knowing just the volume of flame proper to be used in a given case, and the exact point (indicated by the colour of the metal) when the flame should be withdrawn: but practice alone can give this knowledge.

Cleaning Gold Plates.—The surface of a gold plate, after being submitted to the flame of a blow-pipe, becomes black from oxydation. This is removed by boiling the plate in diluted muriatic acid, in a copper vessel: to accelerate the process, the copper vessel may be held over the flame of the soldering lamp or gas-light. Nitric and muriatic acids should never be employed conjointly in cleaning, for the compound of these two acids forms that solvent of gold termed *aqua regia.* Where the operator has occasion to employ silver, he should use the dilute *sulphuric acid* for cleaning his work.

We shall now presume the operator to be in full possession of the above details, and to be competent to follow us when in future we allude to the construction of plates, soldering, &c.

Making the Plates.—Being now provided with metallic casts, proceed to cut a piece of sheet lead to the *spelter* model, of the exact shape and size that the gold plate is intended to be: this lay on the sheet gold, and with a point trace its pattern. Then with either of the subjoined instruments cut the plate to the outline indicated by the point. Anneal



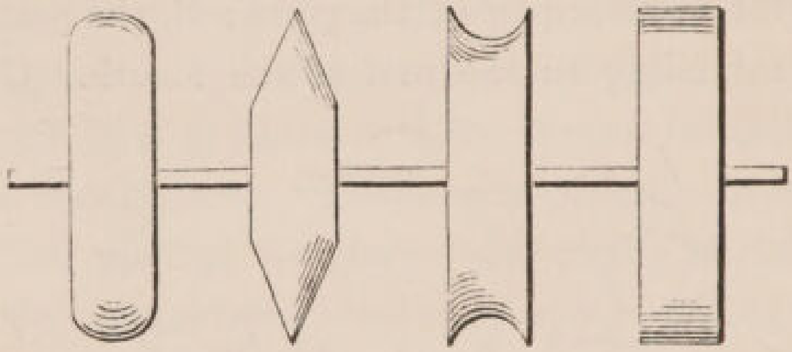


the gold, and place it on the metallic cast. By means of pliers and a hammer made of *cow-horn,* adjust the plate as nearly as possible to its intended position. After this is accomplished, place the cast with the gold plate in the lead die, and with a wooden mallet, and heavy blows on the cast, strike up the plate. This must be repeated several times, until the gold is forced into the various inequalities of the metallic cast. File away a sufficient quantity from that part of the plate which comes in contact with the natural teeth remaining in the mouth, so as to allow for the additional thickness of the spring; and then adjust around the tooth on the metallic cast, a strip of 16-carat plate cut to the requisite width. Having cleaned the edges both of the plate and spring, and *primed,* as it is technically termed, with borax and solder, the spring must be temporarily held in the intended position, either by twisting a piece of fine binding wire to some one point on the plate that will hold it firmly, or else by the cramp figured above (p. 207). It must now be brought under the action of the blow-pipe, as before described, and when cold, again replaced on the metallic cast, and again struck up between the die and cast. The front edge of the plate should now be filed nearly to the edge of the gum, and to within four or five lines of the front surface of the remaining natural teeth in the mouth: and the intervening spaces that are to be occupied by the artificial teeth on the plate should also be filed away. The plate will then present the following appearance. A, represents the anterior part of the plate ; B, the posterior part, extending to the roof of the mouth. C and

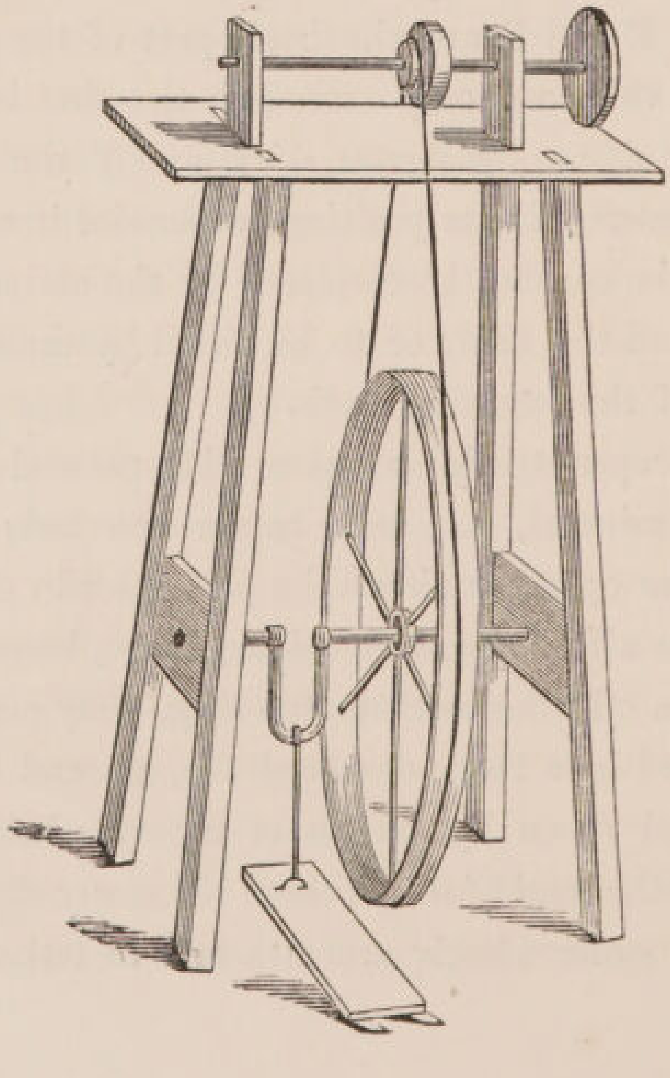
D are the front springs, which will require to be reduced if too conspicuous when inserted in the mouth. E and F are the back part of the springs, which in this case only extend to the first bicuspids on either side. By means of E and F the plate is firmly secured in its position, otherwise it would be liable to be constantly displaced by the action of the tongue and the food, or to be tilted by the approximation of the opposing teeth.

The proper teeth, whether the natural or the English mineral, are now to be selected; if the latter, the operator should be particular in choosing specimens all of the same colour, shape, breadth and thickness. If the teeth be too long, they can either be chipped by a three-cornered file, ground smooth, or ground down by means of emery wheels fixed upon a lathe, and of which there are many shapes.

These stone wheels are attached to lathes of va-



rious sizes for the workshop: the most simple and economical lathe is represented in the following figure; and when enclosed in a case of polished ma-



hogany, it becomes a respectable piece of furniture for the operating room.

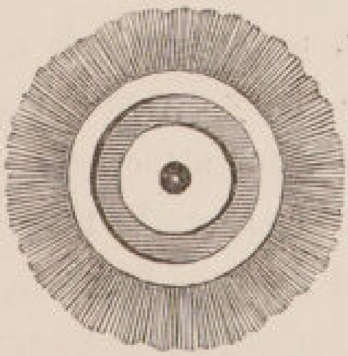
Choice of Teeth.—It is here necessary to observe, that when we speak of the teeth to be mounted on the plate, we refer for the present only to the natural, or else to the English mineral teeth; for in the former of these, the natural canal remains; and in the latter, the hole for the pivot necessary to fix them to the plate, is manufactured with the teeth, and corresponds in position with the natural orifice.

Fitting the Teeth to the Plate.—The plate being placed upon the cast, and the teeth selected, the next process is to rough-fit them to the plate. This is done by repeatedly applying the base of the tooth to that part of the plate to which it is to be fixed; the plate having previously been painted with vermillion and oil; and by cutting away, with the emery wheel, that portion of the tooth that is marked by the color.

The exact point where the rivet is to be inserted, so as to correspond in position to the natural teeth in the mouth, must now be ascertained. This is done by temporarily fixing the teeth in their intended places on the plate by means of a piece of warm bees-wax; on the removal of which, a raised point will be observed, corresponding to the openings in

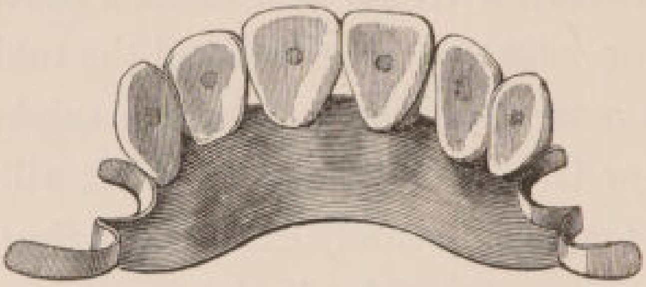
the common flowers of sulphur may be used for these teeth, with the utmost success; as follows:—Place the teeth on their rivets, and insert a small quantity of sulphur between the rivets and the tubing; hold the plate over a spirit lamp until the sulphur melts; then allow it to cool gradually, and it will be found that the teeth are securely fixed to the rivets. Some dentists use pewter solder in the same manner; it is objectionable, inasmuch as it yields a constant metallic taste in the mouth.

Finishing and Polishing the Plate.—When the teeth have all been fixed, the edges of the plate must be rendered perfectly smooth and even by a fine gold file and burnisher; and the whole must be highly polished with a soft brush similar to the next figure, and attached to a lathe. Finely levigated



pumice, emery, crocus, or whitening and water may be employed for this purpose.

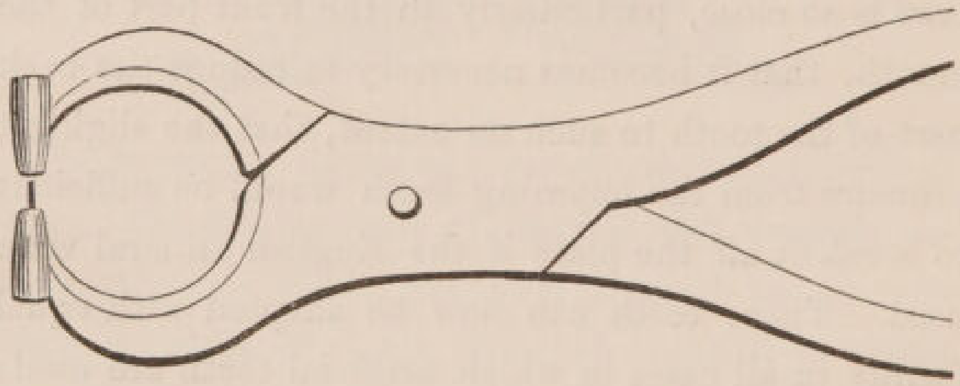
A plate or piece of the kind we have been describing, containing English mineral teeth, would present the following appearance when finished.



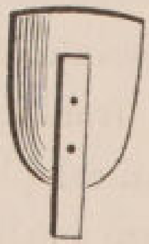
The foregoing observations apply, as we said before, only to the employment of natural and English mineral artificial teeth: we now proceed to describe other varieties of teeth, and the method of fixing them to the plate.

Stockton's American Mineral.—Teeth of this description are manufactured on a large scale in America by the gentleman whose name they bear: they beautifully resemble the natural teeth both in shape and colour, and when it is necessary to supply an artificial gum, they are manufactured with a facsimile of this substance attached: a device which has not at present been brought to perfection anywhere but in the United States. The use, however, of these teeth is chiefly confined to that country; owing probably to a bad imitation having some two years since been manufactured in England, where it was hawked about by a pretended agent from the manufacturer.

description, of the proper shape, colour and size; by means of the emery wheels, oil and rouge, rough-fit them to the plate; cut a piece of gold plate nearly as large as the back surface of the tooth, and by means of a punch of this description, pierce holes



in the plate and insert the pivots: as thus.



After priming the plate, solder it to the tooth in the usual way, taking care not to raise the heat too suddenly, lest the enamel of the teeth should crack. Be cautious also not to cool the tooth too suddenly, after it has been soldered to the plate. The surface over which the solder has taken effect, may be smoothed with a gold file and polishing brush.

Place the plate on a *second* plaster cast which has been taken for the purpose of soldering upon. By the aid of a file and the emery wheels, *fine*-fit the teeth to the plate, taking care that the gold plate at the back of the tooth fits closely to the plate on the model; and observe particularly that the front edges of the teeth come well over the edge of the plate, in the same manner as the natural and English mineral before referred to. Now arrange the teeth on the plate in the exact position they are to occupy in the mouth, as regards the adjacent teeth on the model, and those in the opposing jaw. Support the teeth temporarily in their places by a piece of bees'-wax laid behind the back of the teeth, and coming in contact with the plate; the wax being made to adhere by gently warming the work over a spirit lamp. Replace the piece on the cast, and cover the enamel surfaces of the teeth with plaster of Paris. When this sets, remove the wax from behind with a point. The piece is now ready for soldering, which must be done neatly but strongly. After applying the borax to the edges of the two plates, put a sufficient quantity of solder on the part, and round it, in a semi-circular form, apply a thin coating of plaster or whitening, to prevent the solder from diffusing itself over any other part of the work.

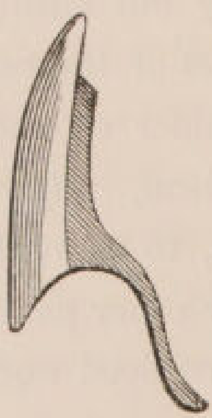
With respect to artificial work in which the teeth are *backed* with gold, or where much solder has been employed, it is necessary, previous to its being finished and inserted in the mouth, that it should be submitted to a chemical mixture, to decompose the copper in the solder. For this purpose boil the work for half an hour in a porcelain vessel containing the following; a quantity of which should be always kept ready:

Muriate of Soda,	½ ounce,
Nitrate of Potass,	8 ounces,
Alum,	2 ounces,
Water,	24 ounces;

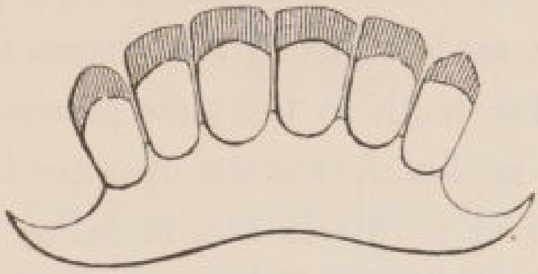
Mix.

Next boil in a solution of bicarbonate of soda or potass, and lastly in water.

If the work has been properly executed, a single tooth of the kind we are describing, when viewed laterally in connexion with a section of the plate, will agree with the following representation.

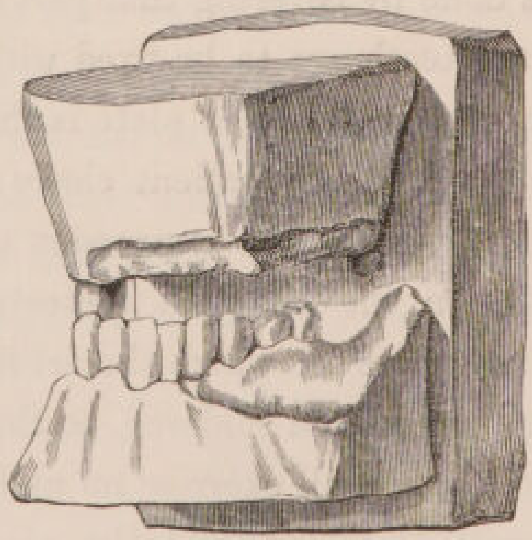


Again, a piece for the front of the mouth, when the same teeth are used, and properly finished, if viewed from behind, will resemble the annexed.



Taking the Bite.—In large pieces of artificial work, previous to finishing and before the teeth are soldered to the plate, it is essential to try the plate in the patient's mouth for the purpose of *taking the bite*. This is done by covering that part of the plate upon which the teeth are to be fixed with bees'-wax made to adhere by heat. The plate is then inserted into the mouth, and the patient closes the jaws in his usual manner: when the impression of the antagonizing teeth on the wax will indicate the exact position on the plate in which the artificial substitutes are to be placed and soldered, so that the teeth in the opposite jaw shall exercise no undue pressure when the mouth is closed and the piece finished. After this, the plate with the wax is replaced on the plaster cast, and the fac-simile model of the opposing teeth, (which was taken when the patient was first seen,) is placed in the impressions in the wax above mentioned. Next oil the back surface of the two models, and run plaster of Paris over them when set; separate the back from the plaster casts, and remove the wax from the plate. On placing the back to the models during the process of adjusting and fixing the teeth to the plate previous to soldering, it will be found that the operator has obtained an exact guide to direct him in fixing the teeth in their proper locations. If this part of the process be managed correctly, little or no alteration will be necessary when the piece is inserted in the mouth.

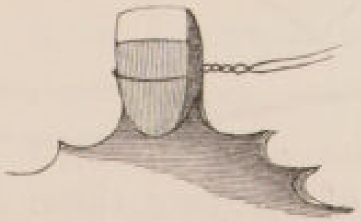
The subjoined cut represents the two models with the back as above described.



French Mineral Teeth.—These teeth are fitted to the plate in the same manner as the American Mineral, and are soldered to a rivet previously inserted in it in the way adopted in fixing the natural and English Mineral. The following gives the back view of a French Mineral Tooth.

To obtain the exact point where the rivet should be soldered into the plate, place each tooth in its intended position, and support it behind with a piece of bees'-wax. Then carefully remove the tooth, and a raised impression on the wax will be observed corresponding with the groove and platina at the back of the tooth. Now by means of a sharp point mark the corresponding depression on the plate, and there insert and solder the rivets in the usual way.

Backing the Teeth.—The process of backing these teeth with gold is by cutting a piece of metal of the size of the back part of the tooth, and neatly adjusting it to the plate and back. This piece is supported in its place by a piece of binding wire twisted round the tooth and plate as here represented.

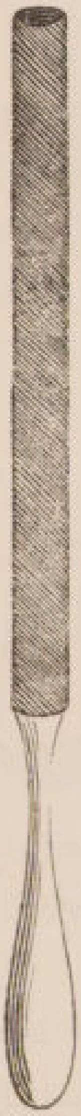


The two edges are soldered in the same manner as for fixing the American Mineral Teeth to the plate. A piece of French Mineral work when finished resembles the following.

Pivoting Teeth.—When the greater part of the crown of a natural tooth has been destroyed either by caries or accident, an artificial one should be engrafted upon the stump. If any portions of the tooth project beyond the gum, a pair of excising forceps are used for their removal. These should be so constructed as to give a sense of solidity and firmness when grasped in the hand of the operator; and their cutting edges should be an eighth of an inch wide, as the following.

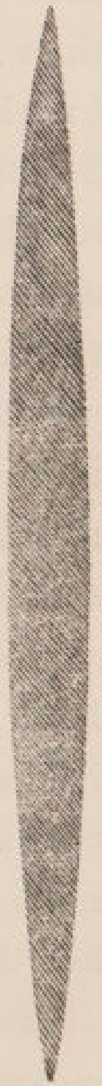
The manner of applying these is to embrace the stump of the tooth as high up as the gum, and gently but firmly closing the handles, to bring the two cutting edges together. In using this instrument the operator should be exceedingly careful not to jar or shake the fang.

It is also advisable in those cases where decay has not extended to the neck of the tooth, to divide it partially by means of a file or a fine watch-spring saw fixed in a frame, before the forceps are applied.

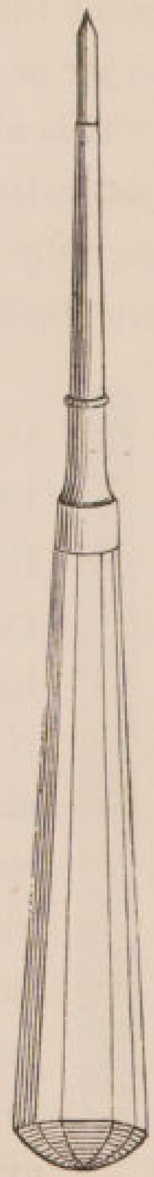


Those portions of the crown of the tooth that projected beyond the gum having been removed, the surface of the fang must now be filed to the required form by means of an oval or half-round file similar to the following.

The file should be used with care and gentleness, and the root supported by placing the finger and thumb behind, which will leave the sides of the root higher than the centre, and prevent the artificial crown that is about to be fixed from turning round upon its axis, and will also materially assist in retaining it in its position in front; otherwise the friction and continual jarring of the file may occasion inflammatory action of the investing membrane and surrounding parts, and en-



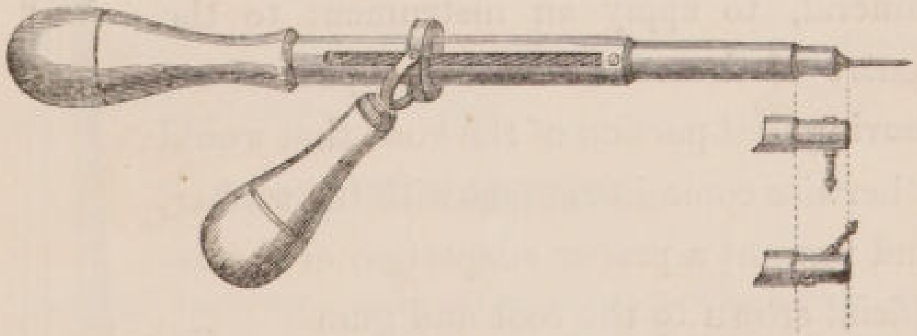
tirely preclude the success of the operation. The fang having been reduced to a level with the edge of the gum, the nerve, if still alive, should now be immediately destroyed by introducing the point of a square drill fixed in a handle of this description; force the drill firmly and steadly up the fang, and instantly give it a rotatory motion; withdraw the instrument, and permit the patient to wash his mouth with warm water, to which has been added a few drops of laudanum; after which proceed gradually to enlarge the natural orifice to the required size and depth by means of drills similar to the annexed. The operator should be provided with a number of these varying in size from that of a common pin to a middling-sized knitting needle. The drills should be exceedingly soft, otherwise by any sudden movement of the patient's head during their application, they are liable to be broken in the fang. The depth to which the drill is carried must depend entirely upon the length of the fang, but should never be less than a quarter of an inch.



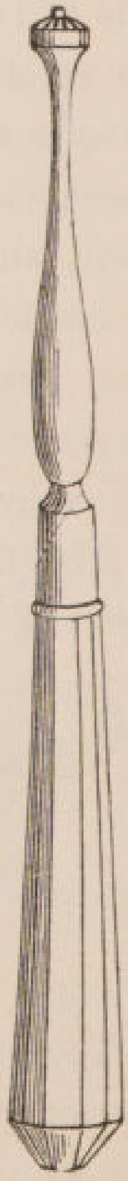
The above method of destroying the nerve and enlarging the natural orifice in the tooth, generally occupies a considerable time; but as it is invariably attended with pain, it is a great point to perform it as expeditiously as possible.

For this purpose Mr. McDowall, of Lincoln's-Inn-Fields, has invented a very ingenious and simple instrument upon the principle of the helix-lever. At the end of the screw is inserted a drill which is made to revolve with the greatest rapidity by means of a female screw attached and fixed in a handle. The mechanical parts of the instrument are enclosed in a tube, and so arranged that it can be made equally available for excavating caries at almost any angle that may be required, by merely unscrewing the upper end of the tube and substituting the additional heads, in which the action is reversed.

The following engraving represents the different parts of this instrument.



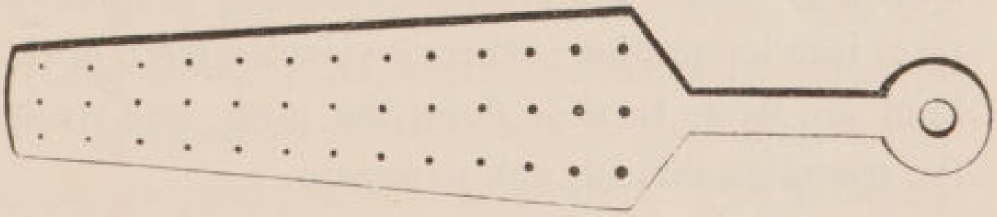
The root of the tooth having been thus prepared, the operator must now select an artificial crown of the same colour, shape and size as the natural teeth remaining in the mouth, and as nearly of the same length as possible; then fit the artificial substitute, by means of rouge and oil, carefully and accurately to the natural stump; observing that it is in an exact line with the anterior surfaces of the other teeth, and fits closely to the posterior part of the root. When this has been done, temporarily, fix the new crown in its intended position by means of a piece of dog-wood or birch.



The patient must now bring together the opposing teeth, and provided the artificial crown does not strike its antagonist, or in any way press against the adjoining teeth, it may be permanently fixed. It is however necessary in those cases when a washer is employed, as in the English mineral, to apply an instrument to the centre of the root, for the purpose of removing that portion of the bone that would otherwise come in contact with the washer, and prevent a proper adaptation of the artificial crown to the root and gum.

In such cases, the following rose-top drill fixed in a handle may be used. By applying it to the orifice and giving it a slight rotatory motion, it will be found on applying the artificial crown that the joint is quite perfect.*

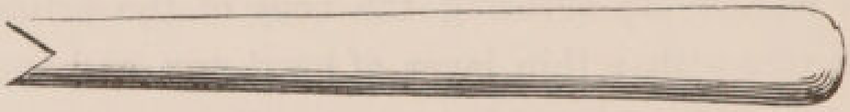
Pivoting Natural Teeth.—If the crown to be pivoted be natural, it will be necessary to ascertain the position of the hole in the root, so as to make the opening in the crown correspond exactly with it. This is done by covering the body of the artificial substitute with a thin layer of bees'-wax, and applying it to the surface of the root. On removing the former, a raised point will be observed corresponding with that in the fang: a hole must now be drilled at that point, and a screw formed by gently turning a piece of gold wire of the proper size in several holes



of the above screw-plate. After which the screw will be of the following shape.

* Two very ingenious instruments have recently been invented for this purpose by Dr. E. Townsend, of Philadelphia. They consist of an oval and a hollow file; the former fitting exactly into the latter. Dr. T. makes use of the oval instrument for filing the root; of the hollow one, for filing the artificial crown.

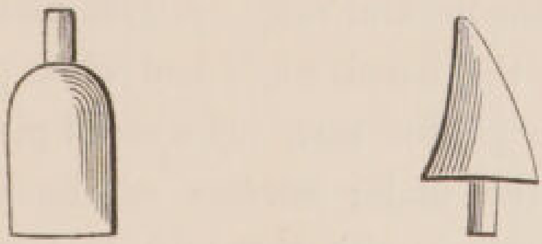
The screw end must now be inserted into the artificial crown, and the other into the natural stump. If the power of the hand be found insufficient to force it into its place, the object may be effected by the aid of a wooden instrument constructed like the following.



Pivoting English Mineral Teeth.—Should one of these teeth be used, it will be necessary to have soldered to the gold pin, close to the basis of the crown, a washer, so that when inserted into the stump, it resists the pressure necessary to force the pivot into its position; otherwise pivoted teeth of this kind are liable to slide down the pivot, and render the operation difficult and uncertain.

The tooth in short cases is fastened to the pivot by sulphur, or in long cases by flos silk in the usual way. A pivoted tooth of this kind, when ready for insertion, resembles the following.

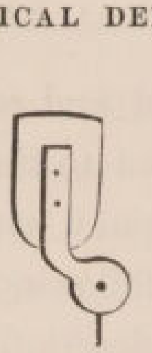
Pivoting American Mineral Teeth.—These teeth are adjusted to the stump in the same manner as the last, but the method of fixing them permanently is materially different, inasmuch as a pivot of hickory is substituted for the gold, the holes of these artificial crowns not going through the teeth. A piece of this wood is rounded and smoothed to the size of the hole by means of a file and sand-paper, and firmly pushed into the artificial crown; the remaining part of the pivot that projects from the crown is cut to the length required, and reduced by the file to the size of the orifice in the fang. To insert the pivot into the natural root, the pressure need not be great, since the temperature of the body, and the swelling of the wood, when the latter is saturated with the moisture of the mouth, will be sufficient to secure the pivot firmly in its position. The following present a front and lateral view of an American pivoted mineral crown prepared for insertion.



Pivoted Teeth on a Gold Plate.—Occasionally the natural fang in the mouth is situated behind the circle of the other teeth, in which position it will not admit of either of the before-mentioned methods being adopted; and when a tooth of either of the above kinds is inserted, it will be found either to be too far back or too far forward, or to have too great a lateral inclination to the right or the left side. In these cases an entirely different course of procedure must be pursued; as follows. After preparing the root as before mentioned, insert a small piece of dog-wood cut to the size of the natural hole in the fang. An impression in wax of the deficiency must now be taken in the usual way; when by carefully withdrawing the wax the wooden pivot will adhere to the wax. Run plaster of Paris into the impression containing the pivot; when set, separate the plaster from the wax; dry the model, and immerse it in bees'-wax and resin for a few minutes; then remove the pivot from the cast, when it will be seen that the position it occupied corresponds with the hole in the natural root. A gold plate must now be made in the usual way; and when properly adjusted to the plaster cast, lay a small piece of bees'-wax upon the under surface of the plate, which comes in contact with the root in the jaw; then replace it upon the model, and on removal, a raised point will be seen on the wax, in which place the pivot is to be inserted and soldered. The artificial crown may now be fixed to the plate at any required point, so as to correspond with the teeth remaining in the mouth. The following represents a pivoted tooth on plate of this description.

American and French Mineral Teeth pivoted on Plate.—The same mechanical manipulations and nicety must be observed in fixing these teeth to the plate for pivoting, as we have already detailed for the guidance of the student in the foregoing observations. These teeth, when thus constructed, on a lateral view, and from behind, present the following appearance.

Observations.—A pivot may occasionally require to be placed on one side of the centre of the fang, in which case it may be thus represented.

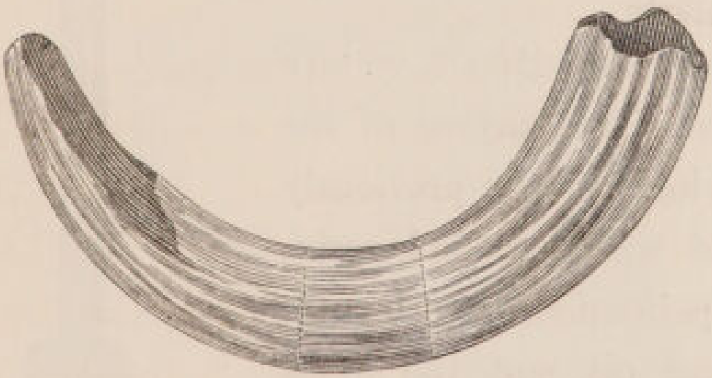


When the size of the orifice in the root is large, a piece of hickory may be inserted first, and the metallic pivot inserted into the wood.

Metallic pivots, when placed in contact with the bone of the fang, occasionally loosen by abrasion. To prevent this result, the pivot should be either *roughed* with a file, and covered with flos silk, slightly moistened with a solution of mastic; or be encased with a thin layer of well-seasoned hickory.

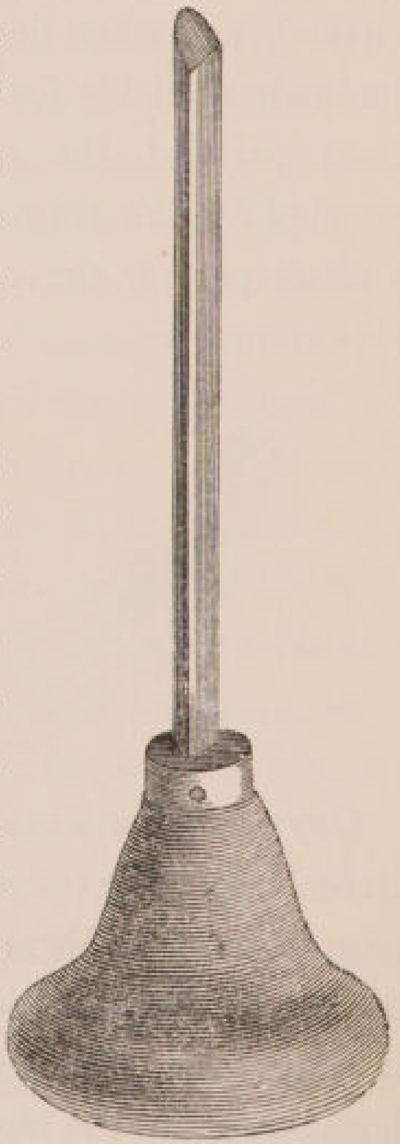
In conducting the operation for the insertion of a pivoted tooth, the student should bear in mind the necessity of so placing it in the mouth, that the opposing tooth does not come in contact with it: otherwise the continual pressure is not only liable to produce inflammation in the socket of the fang, but renders the artificial crown liable to fracture, which may subject the patient to great inconvenience.

ARTIFICIAL TEETH SET IN BONE, OR SUCTION PIECES.—Another method of supplying artificial teeth, is that of inserting either mineral or natural teeth in sockets of dentine, or occasionally, for economy's sake, in sockets of elephant and walrus tusks. Both the latter, however, are far inferior in durability and colour to dentine, and always occasion unpleasant effluvia from the mouth. The hippopotamus or *dentine* is far preferable to them, as possessing a much closer texture of fibre, a whiter colour, and greater durability: another important advantage it possesses is, that the greater part of its surface is covered with enamel, and when desired, this natural covering can be made available for forming artificial teeth for the front part of the mouth. It is however better adapted for the sides; because, after being worn for a short period, the enamel assumes a bluish-white appearance.



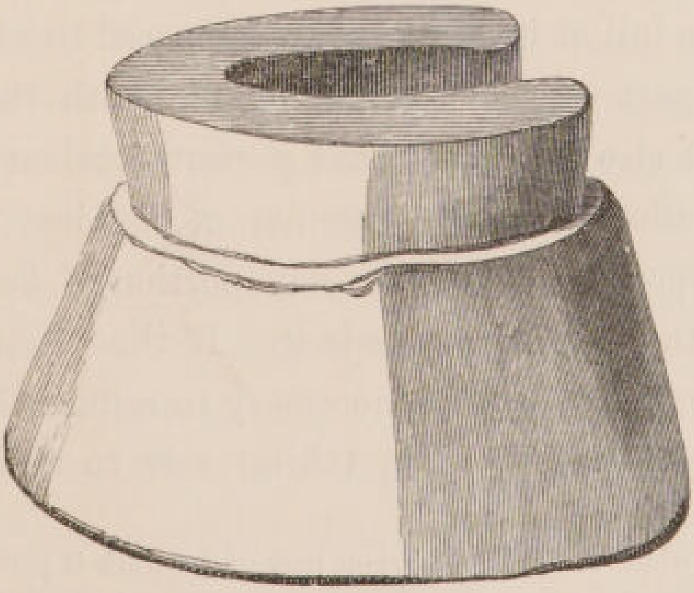
Cutting the Tusk of the Hippopotamus into Blocks.—If the operator wishes to insert mineral or natural teeth in his artificial socket, or only intends carving a representation of them in the plain bone, it is necessary that the fibres of the tusk be applied horizontally to the plaster model. For either of the above purposes, a piece should be cut transversely (as shewn by the dotted lines in the above diagram), and the block formed out of it by again dividing it down the centre lengthwise.

If we intend that the artificial teeth shall have the enamel on their anterior surfaces, the tusk must be divided in a transverse direction: previous to which, however, the student should ascertain by means of his compass that a sufficient thickness of bone is left for the depth of socket. In this instance, when the bone is applied to the model, it will be found that the fibres run perpendicularly.



Fitting the Block to the Models.—The surface of the model, having been previously prepared with wax and resin, is now painted over with rose-pink and oil, and the block being applied horizontally, a portion of the colouring matter adheres to the bone, at the points of apposition, and thus indicates the parts to be removed by sculpers; with a variety of which, of different sizes, the operator should be provided. The process of removal or excavation must be continued after each application of the bone to the model, until a sufficient depth of socket is formed, and the bone comes in close contact with every point and inequality on the surface. A similar adaptation must also be made on a second model reserved for the purpose, the first having lost its sharpness from the repeated applications of the bone.

The piece must now be reduced by files and rasps to nearly the size and shape it is ultimately intended to assume, which will be nearly as follows.*



* An ingenious machine to supersede manual labour in the above process, has been invented by Mr. Tomes; but from the imperfect

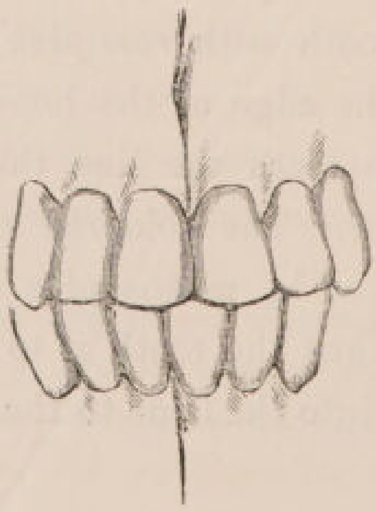
Fitting the Piece in the Mouth.—At this stage of the work it is necessary that the piece should be fitted to the mouth. For this purpose, first paint with rose-pink and oil the surface of the gum over which the piece is to extend, in precisely the same manner as was previously done with the plaster model; adapting the opposing teeth in the other jaw to the bite, by applying the colouring matter also to their cutting edges or grinding surfaces, and removing those marks on the bone which result from the teeth, thus coloured, coming in contact with it. If the piece be intended for the upper jaw, the operator must reduce the external surface of the bone to the shape and size of the mouth, leaving the piece full at its lower edge compared to what it is at that part which comes in contact with the gum. He must also take care that perfect freedom of motion is allowed to the frænum of the lip; and for this purpose must remove any portion of bone that may in the least incommode it. If the piece be for the lower jaw, it will be necessary to reduce the bone in the opposite direction, taking care to allow suffi-

manner in which the most important part of the work is performed by it, where under-cutting (a necessary operation in bone-fitting) is required, it is not, in its present state, available generally in mechanical dentistry.

cient space for the free movement of the tongue, and also bearing in mind the position occupied by the sublingual gland.

Fitting in the Teeth. — Having accurately adapted the bone to the gum, lip, &c., a line must be made in the piece opposite the frænum, so as to indicate the centre of the jaw, after which the process of *fitting in* may be commenced. This is done by grinding down the mineral teeth to a semi-elliptical form; or occasionally cutting them in an oblique direction, so as to leave the posterior surface shorter than the anterior. This latter mode is more particularly necessary when a thin socket is wanted. After having thus prepared the requisite number of teeth, which for a top set averages *eight* in front, (the posterior being formed out of the back part of the socket,) the two central incisors must first be fitted into the bone separately, colouring the fitting surface of the tooth with *rose-pink and water*, and applying it to the edge of the bone, so as to leave between the two teeth the line that indicates the centre of the jaw. The coloured points of contact are to be removed by means of a round file rather coarsely cut. Thus the tooth is to be carefully and accurately fitted into the bone to the required length, and temporarily fixed in its position with resin and wax; in each case being let down separately, and temporarily fixed in the above manner.

In adjusting the two central teeth in partial sets on their artificial basis, it is common so to arrange them, that during the bite the interstice between the upper centrals shall exactly correspond with that between the lower. This practice will in a great measure account for the formal character and unnatural appearance that artificial teeth often present. It arises from the dentist not observing the actual position of the teeth during approximation of the jaws. For in most cases where there is a good denture, the above interstices do not coincide, but were they prolonged, would run nearly parallel to each other, at a distance of from three to six lines apart; as here represented. Of course the student should



be particular to arrange his teeth so as to present a similar appearance.*

* This hitherto neglected fact is of singular interest not less to the practical dentist than to the philosophical physiologist. It forms one of a group of observations that tend to illustrate the mechanical laws of the human system. As an old writer has observed:—"The viscera, cavities and septa of the organic frame are not precisely equilibrated and sustained by each other in the manner of the well-poised scales of a balance; that is to say, they are not symmetrical, nor of equal force and weight, on the right and left sides of the body. Thus the right lobe of the lungs is larger and more capacious than the left; likewise the right cavity of the breast or pleura that encloses the right lung. The mediastinum behind the sternum is on this account inflected considerably towards the left. The right half of the plane of the diaphragm surpasses the left half in size and strength; so also the right half of the inferior muscle, with its crura and pedicles. Again, the heart does not lie exactly in the middle between the lungs, or upon the aponeurotic centre, but pulsates at the left side of the chest, in the opposite direction to the greatest force of the lungs. The stomach does not occupy the middle of the abdomen; nor is its cavity constructed on both sides with an equal arch: nor are its two orifices, the cardia and pylorus, found in the course of the same diameter. The spleen on the left side does not equal, although with the pancreas it sustains, the weight of the liver on the right side. The vena cava and the aorta, . . . do not lie close to each other in their passage through the diaphragm. The one intercostal nerve does not run forth in the chest in the same manner as the other; still less in the abdomen, and in the mesaraic plexuses. As it is in the whole body, so it is in every viscus of the body." The same remarks may be applied to the exteriors of the frame, to the two sides of the head, the two eyes and eye-

Fixing the Teeth.—After filing and polishing the socket with sand-paper, finely-powdered pumice-stone, and whitening, the teeth should be permanently fixed in it; first by ascertaining the exact point where the hole in the bone is to be drilled, corresponding with that in the mineral tooth; this is done in precisely the same manner as described for the insertion of pivots in a gold plate. For fixing all English mineral teeth to bone sockets in the manner

brows, also the arms, testes, legs, &c., &c.: in all which the structure as well as the energy of the function is manifestly unequal. Thus the perfection of the human body is not mere symmetry, but a profound harmony; not the dead level of equality, but a living equilibrium between dissimilars; an equilibrium constantly lost and restored: in a word, perpetual motion provided by means consummately mechanical. This is finely exemplified in the teeth. When the upper and lower teeth are brought one upon the other, so that the two central interstices precisely correspond, or form one line, we have the ghastly grin of the articulated skeleton: when on the other hand the interstices are parallel but not coincident, the freedom and play of the living mouth are adequately represented. It is curious, however, that in opening the mouth the central teeth and their median interstices come opposite to each other, clearly proving that in this act, as well as in closing the jaws, both of which acts appear to take place in a straight line, a rotatory motion is really performed. The energy of the molar action seems to be proportional to the above inequality. The subject, however, is new, though easily verified. Its practical consequences, we are inclined to suspect, may be very important.

above mentioned, it will be necessary to solder to the rivet a thin washer of gold, to interpose between the tooth and the bone, so as to resist the blows of the hammer; which might otherwise fracture the teeth. It is moreover essential that the rivet should be made of the softest gold wire, and the tooth fastened to it by means of sulphur or flos silk previously to being fixed.

The part of the rivet to be inserted into the bone must be of sufficient length to project just beyond the inside of the socket; the inner edge of the hole having been countersunk with a few turns of the rose-top drill used in pivoting. The cutting edge of the tooth is now laid on a piece of lead of convenient form, and the gold wire is rivetted on the inside.

The head of the rivet must be reduced to a level with the inner surface of the bone by means of a sculper, and rendered smooth with sand-paper, &c.; the posterior parts may be carved either to represent natural teeth, or they may be left plain externally and internally, and merely the crowns carved.

. Natural Teeth inserted in Bone.—The method of fixing these teeth in bone is precisely similar to the above, except that after enlarging and extending the natural opening in the crown of the tooth as far down as the enamel by means of a drill, a screw is inserted instead of a plain rivet, and the teeth are not permanently fixed until the bone socket has been polished and stained to represent the human gum.

Carving Teeth in Bone.—Previous to carving the teeth on the block, it is necessary to pencil an outline of their number, shape, breadth and length, on the surface of the bone, leaving a sufficient depth beyond the upper edge of each tooth to represent the gum. Then by means of engraving tools of various sizes and shapes the outline must be formed, and the character and shape of the teeth by degrees sculptured out. After this the piece must be polished with pumice-stone and chalk in the usual manner.

Carving Teeth with Enamel Fronts.—Previous to attempting to form these teeth, the enamel should be ground perfectly smooth, for from its extreme hardness, it is impossible to act upon it by the usual engraving instruments. This process must therefore be performed with appropriate files, after which the piece must be highly polished, as above.

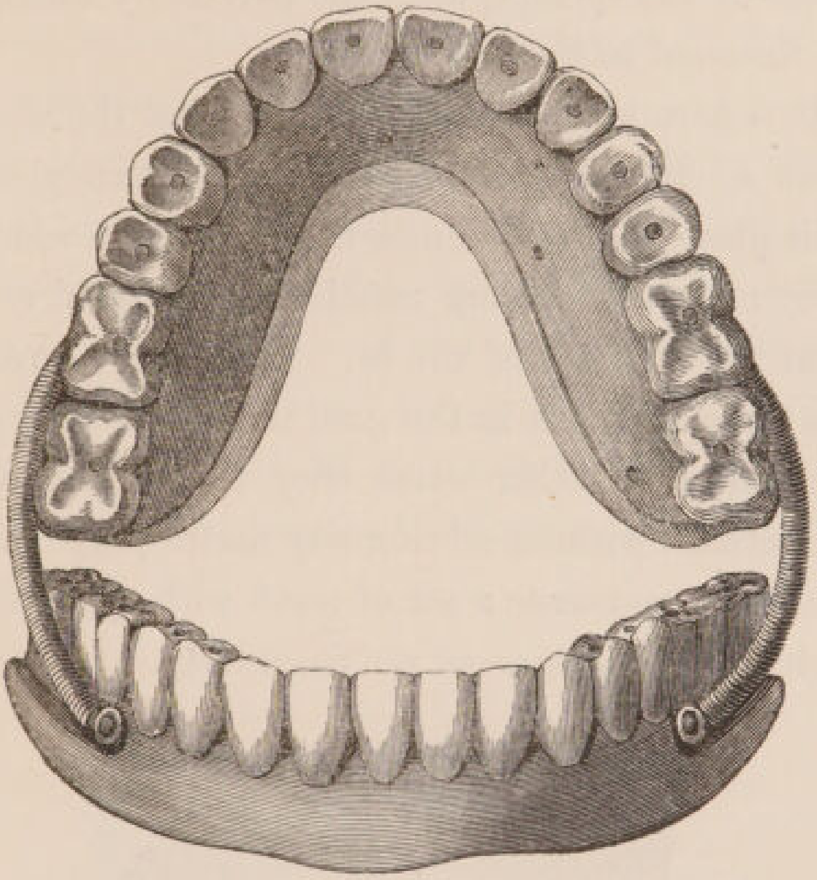
Mounting Gold Plates with Mineral or Natural Teeth on Bone Sockets.—Having fitted the bone to the model, the mineral or natural teeth are cut to their proper length and shape, and fitted into the bone in the manner before described. After the required number has been fitted and adjusted, remove the teeth, and secure the bone socket to the model by running plaster of Paris round its edges, A correct metallic cast and lead die must now be made in the usual way, between which the shape of the gold plate is formed; when this has been done, accurately fit the plate to the bone by means of rose-pink and oil, and with the sculpers, as before mentioned. If the plate be small, and required to carry only one, two, or three teeth, this process will be sufficient. In large pieces of work, where it is necessary to insert eight or ten teeth, the operator must cut out the bone to the required shape and depth that his gold is to have, previous to his taking the metallic castings. It will then be found, if he has modelled correctly, that the plate will fit the bone without much trouble.

The plate then having been accurately fitted to the bone socket, the usual rivets to which the teeth are fixed are soldered to the plate. In large pieces of work it is necessary to drill three or four holes through the bone socket, leaving the gold wire forming the rivets, and corresponding with the hole in the bone, of sufficient length to allow of its being rivetted on the inside of the bone socket; by this means the front part of the plate will be securely fastened to the bone; the back part can be secured by using three or four cone-shaped rivets similar to the following, and rivetting them in the same manner.

The operator should fasten his teeth on the plate (if sulphur be used) in the usual way before he commences the rivetting; otherwise the bone is likely to be injured by the heat employed.

The following engraving represents an entire set of this description ready for insertion; also the plate attached to the bone on the inside of the upper row, with a front view of the lower row.

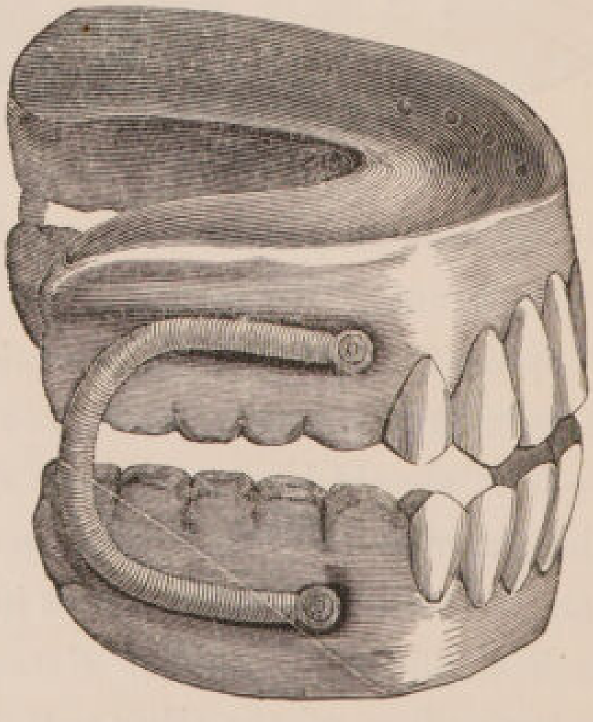
Colouring the Bone.—For this purpose a liquid is used composed of one scruple of cochineal, one drachm of muriatic acid, three grains of alum, and two drachms of water: which ingredients are rubbed together in a glass mortar, and the parts intended to represent the gum are carefully painted over with the compound applied on a camel's-hair brush. After a few minutes the piece is immersed in cold spring water; and on brushing its outer surface, it is found to represent the natural gum. Colouring the bone in this manner is merely a matter of ornament,



which may well be dispensed with, as it lasts but for a few days, and merely serves the purpose of giving an appearance of finish to the work.

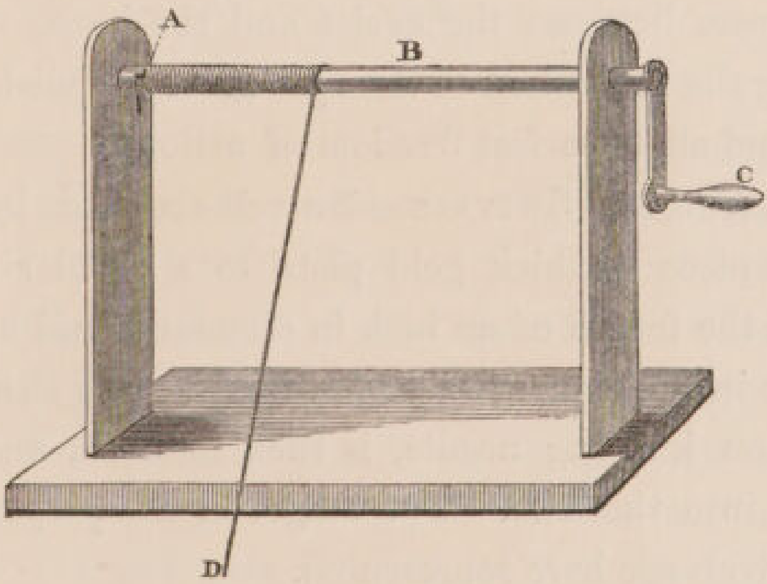
Preparing the Sides of the Pieces for Spiral Springs.—If it should be necessary to attach these springs, the outer sides of the pieces in sets should be plain and smooth, and those spaces in which the springs work should be sunk the sixteenth of an inch below the surface of the other part, which prevents any annoyance to the cheeks from the prominence of the springs, or of the swivels by which they are fastened to the two pieces.

It is here necessary to observe, that the object of these springs is merely to keep the two pieces in their places. The firmness and steadiness which the piece maintains during mastication, depend entirely upon the accuracy of the fit. It is only where there is a want of depth in the gum that these springs are necessary; in other cases they merely incommode the patient, without serving any useful purpose. The following represents a set of teeth with spiral springs made in the manner we are describing.



Making Spiral Springs.—The operator may be so situated, that he cannot procure these springs from the manufacturer; in that case it is well to know how they are fabricated.

Take 16-carat gold wire, rendered elastic by being drawn through a diminishing series of holes in a steel plate until it attains the smallness of a fine sewing needle: insert one end of the wire into the hole, A, of the annexed apparatus, keeping tight hold of the other end, D, with a small hand-vice. By gently turning the handle, C, the wire will coil round the steel rod, B.



A few trials will soon teach the operator how much force to exert with the hand in holding the end, D, in order to bring the coils closely together. It must be remembered that the important properties of the spiral spring depend upon its elasticity; therefore, annealing the wire in the process of drawing it down, would render it perfectly useless for these purposes.

The length of the springs will depend upon the mouth of the patient, but generally it averages from an inch and a quarter to two inches.

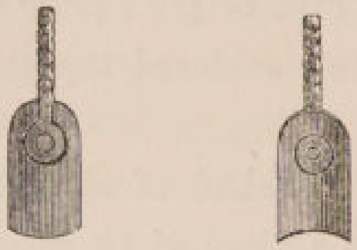
Fixing the Springs.—The spiral springs are fastened to the sides of the pieces by means of swivels or eyelets, which are rivetted to the piece; a small portion of gold plate termed a *washer*, being soldered to the pin and countersunk into the bone, interposes between the eyelet and the bone, so as, during the movement of the spring, to diminish friction and allow perfect freedom of action.

Making the Swivels.—Swivels are made by cutting a piece of thick gold plate to a circular form, about the fourth of an inch in diameter, and having a hole in the centre; a gold wire pin, the size of a common knitting needle, is then inserted, and soldered into the hole. The stages in the preparation of swivels are here represented.

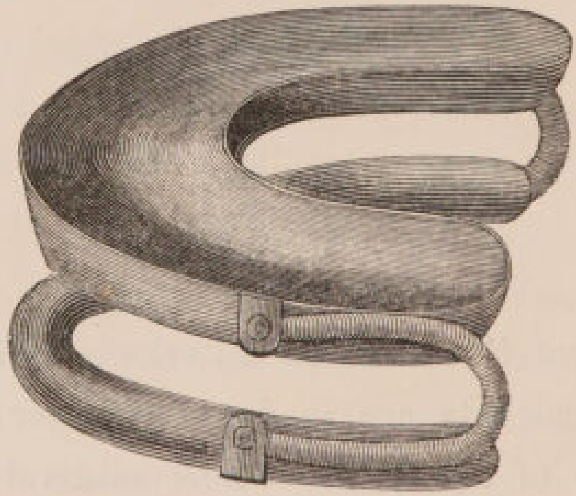
A is a circular disk of gold plate; B, the pin; C, both the preceding soldered together; D, the rivet when finished.

The eyelet, to the shaft of which the spring is fastened, is made of a piece of 18-carat plate, rounded, with hole in centre, to which a piece of wire, constituting the shaft, is soldered. When finished and ready for use it represents the following.

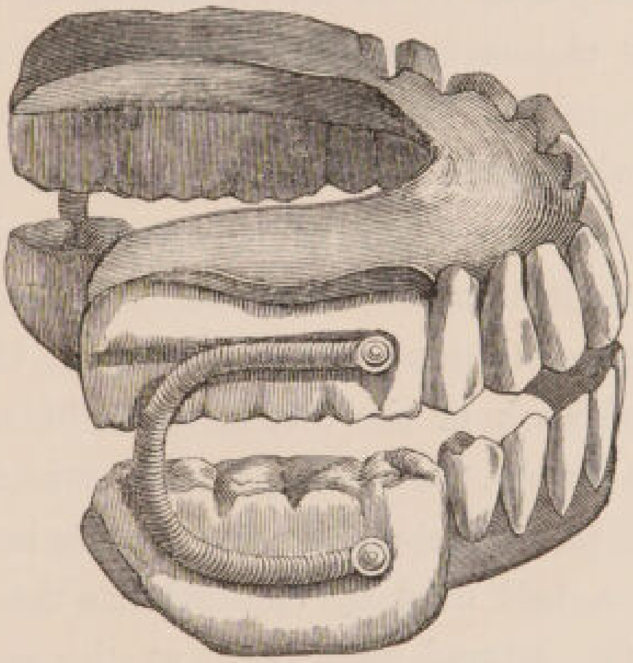
FASTENING SWIVELS TO PLATES.—In some cases where the sockets are made of gold for entire and partial sets of teeth, and where mineral teeth are used for the back of the mouth, or where the block for the back grinders must be so shallow as to preclude the possibility of rivets being passed through it for fastening the swivel, it becomes necessary to solder the swivel to the sockets that the teeth rest upon. For this purpose a standard is required, made of strong gold plate, and of the following form, which represents both the front and back view of it.



This is firmly soldered first to the pins and afterwards to the gold sockets, as figured below.



Position for Fixing the Springs.—The swivels upon which the spiral springs act should be placed at an equal distance from the central teeth, generally opposite the first or second bicuspids, or between the two. If the greatest exactness is not attended to in fixing the swivels opposite to each other, when the set is placed in the mouth, they will be found to shift their position, and by the slightest effort the patient makes to open his mouth, the teeth will twist round. The following cut represents a set of English mineral teeth set on gold with bone blocks, ready for insertion in the mouth.



Artificial Teeth upon Engraved Suction Plates.—A very important improvement in the manufacture of suction plates has recently been made by Mr. Harnett, of New York, who in a communication to the *American Journal of Dental Science,* gives the following directions for their fabrication :—

"After striking up the plate in the usual manner,

Before, however, the above process is commenced, the plate should be so far advanced towards completion as to have the requisite number of rivets inserted, upon which the artificial teeth are to be fixed.

It is also important that the operator should support his plate on the reverse side, so as to counteract the necessary pressure employed in using his tools; otherwise the plate would be liable to serious injury.

For this purpose, melt in a common ladle a sufficient quantity of jeweller's cement, which pour into a ring of iron of convenient size and depth; when the cement has cooled to the consistence of thick cream, immerse the outer side of the plate in it up to its extreme edges, in which state it can be worked without the possibility of injury. When the process of engraving and friezing is finished, the operator has only to warm the surface of his plate and separate it from the cement; after which the teeth, &c., can be fixed to the rivets in the usual manner.

THE SURGICAL TREATMENT OF THE MOUTH PREPARATORY TO THE INSERTION OF ARTIFICIAL TEETH.

Previous to the adaptation of artificial teeth, either upon a gold or bone socket, it is of the greatest importance to the ultimate success of the operation, that the mouth should be in a perfectly healthy condition; for otherwise, however beautiful and correct our artificial apparatus may be, it will be impossible for the patient to wear it with any degree of comfort.

It is, therefore, necessary in all cases requiring artificial teeth, for the operator, before he proceeds to take his impression in wax, to examine thoroughly the condition of the gums, and of any natural teeth remaining in the mouth, and if he finds any loose roots or diseased teeth, to remove them immediately, and defer taking the impression for a period varying from two to six months, so as to allow the subsequent absorption of the alveoli to be complete. This may be materially assisted by the patient frequently washing his mouth and brushing his gums with the following astringent lotion:

℞	Tinct. of Rhatany,	2 ounces,
	——— Pellitory,	1 ounce,
	Terchlorid. Carbon,	3 drachms,
	Alum,	1 drachm,
	Water,	12 ounces.

Mix.

In some healthy constitutions the absorption is rapid, while in debilitated subjects it may occupy a longer period than the longest above mentioned.

In cases requiring full sets, and where many diseased teeth or stumps have been removed, it will be found, when we come to fabricate our artificial substitutes, that the maxillary arch, after absorption has taken place, is considerably contracted, so that it is impossible to insert the usual number of teeth of the same size as natural on the socket. Again, in cases for partial sets it will also be found, under the same circumstances, that the space has become so narrow, that the loss of room will frequently exceed the breadth of one tooth. In both these cases, the operator should use smaller teeth, commencing from the centre with teeth of the original size, and reducing the size as he approaches the back of the mouth, so as not to be perceptible to the casual observer.

It must be evident, from the above observations, that when artificial teeth are inserted in the mouth too soon after the extraction of stumps or diseased teeth, and before a reasonable time has been allowed to elapse for the absorption of the alveoli or natural sockets, the base on which they are fixed, from the continual pressure exerted in mastication, will invariably render the apparatus liable to lose its perfect adaptation to the gum. Hence it is that a vacancy so frequently occurs between the gum and the plate; a vacancy in which particles of food are deposited, where they not only become a source of pain and annoyance to the patient himself in consequence of their chemical decomposition, but from the same ground, render the breath extremely offensive to others.

suddenly quenched in water; it is then broken into small pieces, and ground as fine as possible in a mortar.

Kaolin.—This substance, called by the Chinese, kaolin, or China clay, is the result of the decomposition of feldspar by the united action of air and water. Feldspar is composed of equal quantities of silicate of alumina and silicate of potash. When the decomposition of the spar commences, it loses the silicate of potash by degrees, and when the process is complete, nothing but silicate of alumina remains. As the term kaolin is applied before the decomposition is perfected, it necessarily follows that this substance differs very much in its chemical characters in different specimens, being, as before stated, sometimes silicate of alumina in a pure state, at other times mixed with a variable quantity of silicate of potash. In France, when pure, it is called kaolin; when not so much decomposed, *sable argileux;* and when but little altered from the state of feldspar, *sable cailloteux*. This *sable cailloteux* is used in some of the formulæ that follow, but it is there called by its proper name, *disintegrated feldspar*. This condition of the spar is marked by a loss of its translucency, and a readiness to crumble, which is not perceptible in the uninjured spar.

Chemical composition.—Kaolin, when fully decomposed, contains forty-eight parts of silex and fifty-two of alumina. Thus feldspar in decomposing loses two-thirds of its weight. Decomposed pumice-stone furnishes a very white kaolin, which has been used with success in the manufacture of mineral teeth.

Preparation.—Kaolin is prepared by levigating in water. To do this, it is necessary to provide two tubs, one of which should have several holes bored in the side at different distances from the bottom, about three, five, and seven inches. These are to be closed by wooden plugs. This may be called tub No. 2. Take tub No. 1, and having nearly filled it with clean water, put kaolin into it, and stir it well: then suffer it to stand for ten or fifteen seconds. During this time the coarser particles will have fallen to the bottom by their gravity. Now pour off the upper portion of the fluid containing the finer particles in a state of suspension, into tub No. 2; cover it, and allow it to stand until the whole of the kaolin has subsided. When this has taken place, draw off the supernatant water by means of the holes in the side, withdrawing the plugs for the purpose. After this, the mass must be dried in the sun, and preserved for use in well-closed vessels.

Clay.—Certain very pure and light-coloured clays are used for teeth: but as all kinds of clay will not answer, trial must be made of any peculiar kind to ascertain whether it contracts too much in the burning, or not. Pipe-clay cannot be used on this account.

Silex or Silicic Acid.—This substance, which is known in mineralogy by the generic name of quartz, is widely diffused in nature. It exists more or less pure in the form of flint, white sand, and granular quartz, and is found in a state of absolute purity in rock crystal. Quartz should always be selected in the crystalline form, as it is the purest and most easy to prepare for use.

Preparation.—Silex is prepared by heating it red hot, and quenching it in cold water. It is then easily pulverized, and should afterwards be levigated.

All the above substances should be carefully dried, and preserved until wanted for use.

Substances for colouring Mineral Teeth.—These substances are either metals in a state of minute division, or metallic oxides. They are used by mixing them in certain proportions with either the body of the teeth, or the enamel, or both. The most common mode of applying them to the colouring of teeth, is to mix them with both the enamel and the body. The result is not absolutely certain, as the colour is deeper or paler according to the degree of heat employed, and the thickness of the enamel. A method has been tried which affords a fair prospect of success; namely, to colour teeth and gums in the same manner as flowers, &c., are painted upon porcelain. The process is as follows. The oxides are formed into an enamel by being fused with some flux, of which one of the best is formed in the following way :—Flint glass, 12 parts; red lead, 16 ditto; calcined borax, 3 ditto; powdered flint, 4 ditto. This produces an enamel the colour of which is derived from the metallic oxide. The enamel is to be powdered and mixed with oil of lavender, when it may be painted upon the teeth with a brush. When dry, the teeth are placed for the third time in the furnace, and the enamel fused. The only objection to this plan is, that the coat is very thin, and apt to lose its colour in the subsequent process of soldering. It would be well to try this mode of applying colour, by putting it on the body and covering it with an enamel, which should be transparent enough to shew the colour through.

The following are the substances most usually employed in the colouring of mineral teeth :—

Substances used.	Colours given.
1. Chloro-platinate of Ammonia	Blue.
2. Platina in filings or the spongy state	Blue grey.
3. Gold in filings or ground from the leaves	Rosy red.
4. Per-oxide of Gold	Bright rosy red.
5. Purple Powder of Cassius	Rosy purple.
6. Oxide of Titanium	Bright yellow.
7. —— of Uranium	Orange yellow.
8. —— of Zinc	Yellow.
9. —— of Manganese	Purple.
10. —— of Cobalt	Blue.
11. —— of Silver	Lemon yellow.

Should the operator be desirous of making the above preparations himself, the following formulas will be sufficient.

Chloro-platinate of Ammonia.—Prepare some nitro-muriatic acid *(aqua regia)* by adding one part of nitric acid to two of muriatic or chloro-hydric acid. Put this into a common oil flask, and place it in a sand-bath; drop in small pieces of platina, and allow it to remain until it has dissolved as much of the metal as it can. Then pour off the solution, which contains chloride of platina, into a larger vessel; dilute it with water to a certain extent, and precipitate it with a strong solution of muriate of ammonia. Separate the precipitate by means of a filter; then wash and dry it for use.

METALLIC PLATINUM.—This is used either in the form of filings, or of spongy platinum. The last is the best, and is prepared by compressing into a ball some of the precipitate obtained by the last process, and heating it to redness.

METALLIC GOLD.—This is used either in filings, or in the fine powder which is precipitated from a solution of chloride of gold by means of proto-sulphate of iron. It may also be made by grinding gold-leaf with honey, and then washing away the honey with water.

PEROXIDE OF GOLD.—Prepare a saturated solution of chloride of gold, by digesting metallic gold in nitro-muriatic acid. Dilute the solution, and precipitate it with aqua ammoniæ. In doing this, great care must be taken not to add an excess of ammonia, as this would re-dissolve the precipitate, and give rise to a powerful fulminating compound. The peroxide of gold, when properly prepared, is of a brownish yellow colour, and detonates feebly when heated, losing its oxygen, and becoming converted into metallic gold.

PURPLE POWDER OF CASSIUS.—This is a peculiar compound of gold and tin, in which the tin seems to play the part of an acid. Under this view, the tin may be called stannic acid, and the purple powder, a stannate of gold. It has been found by Berzelius to be constituted as follows :—

Gold	28	35
Binoxide of Tin	64	00
Water	7	65
	100	00

In the preparation of this article, great care is necessary to obtain it always of the same quality. The following are the rules adopted by Thénard :— Prepare an *aqua regia* of one part of muriatic acid and two parts of nitric, to dissolve the gold. When dissolved, dilute it with distilled water, and filter; then add a much larger quantity of water. Also prepare, to dissolve the tin, an *aqua regia*, consisting of one part nitric acid and two parts distilled water, to which is to be added common salt, in the proportion of 130 grains to each pint of the diluted acid. The tin should be quite pure, and must be added to the acid by degrees: when the first portion is dissolved, add a second, and so on until the acid is saturated.

The solution should be of a yellow colour, and the operation carried on very slowly in a cool place. When it is finished, filter the liquid, and dilute it with a hundred times its weight of distilled water.

Then place the dilute solution of gold in a glass vessel, and add the solution of tin by degrees, incessantly agitating the mixture with a glass rod, until the liquid partakes of the colour of port-wine. Allow it to stand, when large flakes of the purple will be deposited at the bottom of the vessel. Decant the solution; wash and dry the precipitate on bibulous paper.

Oxide of Titanium.—This oxide, which is called titanic acid, is found in a natural state, combined sometimes with the oxide of iron, and occasionally with pure oxide of uranium. This oxide is also found in a pure state, in which condition it is generally employed. Its composition is—

Oxide of Uranium	72	15
Water	15	70
Lime	6	87
Oxide of Tin and Manganese	1	55
Gangue	2	50

It may be pulverized and levigated in water; then dried and preserved for use.

Oxide of Zinc.—This is prepared by precipitating a solution of sulphate of zinc with carbonate of soda, washing the precipitate, which is a carbonate of zinc, and heating it to redness to drive off the carbonic acid; after which it occurs in the form of a white powder.

Oxide of Manganese.—This is found in a natural and pure state.

Oxide of Cobalt.—This is made by precipitating a solution of either the nitrate, sulphate, or muriate of cobalt, by carbonate of soda; drying it, and calcining to a red heat, taking care to exclude the atmosphere. It is in the form of a grey powder, and is composed of 100 parts of cobalt and 27·097 of oxygen. Its colouring power is so great, that one part will colour *three hundred* of borax almost black.

Oxide of Silver.—This oxide or protoxide is of a deep olive colour. It is prepared by dissolving pure silver in nitric acid, and precipitating it with potash or soda, then washing it with a large quantity of water, and drying it in the usual manner. It consists of 100 parts of silver and 7·6 of oxygen.

Preparing and Mixing the Body and Enamel.—The proper proportions of the various ingredients for the body having been accurately weighed, they are moistened by adding by degrees distilled water, and thoroughly amalgamated by means of a pestle in a Wedgwood mortar. The mass is now placed upon a slab of the same substance, as glass is so soft that it contaminates the materials. It should then be reduced to an impalpable paste by means of a Wedgwood muller.

When the paste is perfectly ground, it must be allowed to dry to the consistence of a stiff dough, and then beaten with a wooden mallet, or thrown repeatedly upon the slab with some force and for a considerable time. This process renders it solid, and prevents it from contracting so much in the baking as it otherwise would do.

When the paste has been fully prepared, it may be kept for any length of time without injury, if it be prevented from drying ; nay, it improves by keeping, provided it be always moist.

The preparation of the enamel differs but little from that of the body, except that the whole process requires, if possible, more care. Every particle of dust or metallic contamination must be carefully excluded, and an ivory spatula used to handle the body and enamel in the mortar or on the slab. The enamel must be ground as fine as possible, and kept of the consistence of cream.

In the following recipes for mineral teeth, the colours will be found to differ from those of most others, in consequence of the high temperature required, and which contributes to render these teeth so beautifully translucent, and to make them resemble the natural ones with great accuracy.

INGREDIENTS FOR MINERAL BLOCKS.

No. 1.

Feldspar	3 parts.
Clay	1 part.

No. 2.

Feldspar	4 parts.
Kaolin	1 part.

No. 3.

Feldspar	24 parts.
Silex	12 parts.
Clay	6 parts.

No. 4.

Feldspar	24 parts.
Silex	12 parts.
Kaolin	6 parts.

Starch (amidine) may be added to the body for making single teeth, in the proportion of two parts of starch to one hundred parts of dry material; the starch being boiled to a jelly before mixing it with the body: but it will not answer to put starch in the body for carving blocks, as it renders them difficult to cut when dry.

INGREDIENTS FOR MORE TRANSPARENT SINGLE TEETH.

No. 5.

Feldspar	18 parts.
Disintegrated ditto	6 parts.
Kaolin	2 parts.
Flint	12 parts.

No. 6.

Feldspar	36 parts.
Kaolin	3 parts.
Silex	2 parts.

No. 7.

Feldspar	24 pennyweights.
Silex	12 pennyweights.
Kaolin	36 grains.

No. 8.

Feldspar	48 parts.
Silex	32 parts.
Clay	3 parts.

No. 9.

Feldspar	60 parts.
Silex	32 parts.
Kaolin	3 parts.

No. 10.

Feldspar	60 parts.
Disintegrated ditto	40 parts.
Silex	20 parts.

No. 11.

Feldspar	72 parts.
Disintegrated ditto	48 parts.
Silex	24 parts.
Kaolin	6 parts.

No. 12.

Feldspar	100 parts.
Disintegrated ditto	50 parts.
Silex	24 parts.
Kaolin	12 parts

ENAMELS FOR THE PREVIOUS INGREDIENTS.

No. 1.

Disintegrated Feldspar	24 parts.
Flint Glass	12 parts.
Feldspar	6 parts.

No. 2.

Disintegrated Feldspar	24 parts.
Powdered Blue Canton Porcelain	10 parts.
Flint Glass	3 parts.
Borax	4 parts.

This enamel is very fusible, and is used on bodies which are the same.

No. 3.

Disintegrated Feldspar	24 parts.
Blue Canton Porcelain	12 parts.
Flint Glass	6 parts.

After fusing the above in well-luted crucibles in a furnace for about three hours, and allowing it to cool, the enamel must be removed from the crucibles by breaking them; it is then to be finely powdered, after which add half a part of Canton porcelain and half a part of feldspar. Mix, and grind the whole firmly together.

Gum Enamel.—Gum enamel may be made from any of the recipes given, except those which have clay in them. One grain of peroxide of gold will be sufficient to colour fourteen pennyweights of enamel. If the gold gives too bright a colour, a very small proportion of the oxide of titanium must be added.

GRADES OF COLOUR FOR THE INGREDIENTS OF MINERAL TEETH,

To thirty-seven pennyweights of dry material.

The degree of colour is designated by the capital letter, and the colour by the small letter. If A = the pure uncoloured enamel, then B = the lightest tint, and I = the deepest.

Yellow.

B. *y.*	Oxide Titanium	2 grains.
C. *y.*	Ditto	3 grains.
D. *y.*	Ditto	5 grains.
E. *y.*	Ditto	6 grains.
F. *y.*	Ditto	8 grains.

Blue Tints.

B. *b*.	Spongy Platina	1½ grains.
C. *b*.	Ditto	2 grains.
D. *b*.	Ditto	2½ grains.
E. *b*.	Ditto	3 grains.
F. *b*.	Ditto	4 grains.

Greenish Tints.

B. *g*.	Oxide Titanium	3 grains;	and Spongy Platina	1 grain.
C. *g*.	Ditto	4 grains;	and ditto	1½ grains.
D. *g*.	Ditto	5 grains;	and ditto	2 grains.
E. *g*.	Ditto	6 grains;	and ditto	2½ grains.
F. *g*.	Ditto	7 grains;	and ditto	3 grains.
G. *g*.	Ditto	8 grains;	and ditto	4 grains.

GRADES OF COLOUR FOR ENAMELS.

To four and a half pennyweights of dry material.

Yellow Tints.

B. *y*.	Oxide Titanium	¼ grain.
C. *y*.	Ditto	½ grain.
D. *y*.	Ditto	¾ grain.
E. *y*.	Ditto	1 grain.

Blue Tints.

B. *b*.	Spongy Platina	¼ grain.
C. *b*.	Ditto	½ grain.
D. *b*.	Ditto	¾ grain.
E. *b*.	Ditto	1 grain.

Greenish Tints.

B. *g*.	Oxide Titanium	¼ grain;	and Spongy Platina	½ grain.
C. *g*.	Ditto	½ grain;	and ditto	¾ grain.

D. *g*. Ditto..........	$\frac{3}{4}$ grain;	and ditto .... $\frac{3}{4}$ grain.
E. *g*. Ditto..........	1 grain;	and ditto .... $\frac{3}{4}$ grain.
F. *g*. Ditto..........	$1\frac{1}{4}$ grain;	and ditto .... 1 grain.
G. *g*. Ditto..........	$1\frac{1}{2}$ grain;	and ditto .... $1\frac{1}{4}$ grain.
H. *g*. Ditto..........	$1\frac{3}{4}$ grain;	and ditto .... $1\frac{1}{2}$ grain.
I. *g*. Ditto..........	$1\frac{3}{4}$ grain;	and ditto .... $1\frac{3}{4}$ grain.

MOULDING MINERAL TEETH.—The moulds for this purpose may be either made in plaster of Paris, or in brass or steel; those made in the latter are more durable, and if properly carved out, are more uniform as well as better. The cavities in which the teeth are to be moulded, must be one-fifth larger than the tooth required, as the body contracts in that proportion in baking. If plaster moulds are used, they should be perfectly dried, and immersed in equal parts of melted wax and resin to render them durable. Having well oiled the moulds with a brush and fine oil, the prepared paste for the body is to be worked or pressed into them. The cavities are not only to be filled, but a redundant portion must be left projecting, which is to be squeezed out by putting the back of the mould in a vice.

If the teeth are plate teeth (American), and the platina pins have been previously cut from a wire of the proper size, they should have one end either flattened with a hammer, or a small head made on them, after which they may be inserted into the paste through the hole at the back of the mould. If they are to be pivot teeth, they require no pins, but a hole is made up the centre of the paste, by pushing a round piece of wire into the hole made for its reception on the top of the mould; previous to which a little instrument of the shape of a gouge is introduced, to scoop out a small quantity of the body where the platina tubes are to be inserted. The teeth are then to be dried, which is done by placing the moulds on a stove, or in a warm place. When they are perfectly dry, the moulds may be separated, and the teeth will drop out. If they are then found to have any improper mark, it may be removed by cutting or scraping, and, if requisite, their shape may be slightly altered in the same manner.

Moulding Mineral Blocks.—It is better to make a block containing several teeth at once, and their appropriate gums. Having made the gold plate upon which the artificial teeth are to be fixed, it is to be the base upon which the block is moulded. The body is first rudely modelled in the plastic state to a proper form, taking care to make every part a little too large. The platina pins or tubes are now inserted opposite the centre of each tooth, and the model thoroughly dried. When dry, it must be carefully carved into a proper shape, imitating the natural teeth as nearly as possible, and making them about one-fifth too large. This part of the process requires skill and care; skill to form the teeth of a proper shape, and care in not injuring the body; for in this state it is exceedingly frail.

A full set of artificial teeth is usually made in three blocks, the front one containing the incisors and cuspidates, which must be carved and baked first, so that it may contract as much as possible; the side blocks may then be modelled to it, without leaving any appreciable opening between the front and side blocks when they are all finished.

Baking and Enamelling.—The teeth being moulded or carved in the manner described, should now be placed in a crucible having a little dry kaolin at the bottom, and subjected to a bright red heat in a charcoal fire. This degree of heat will not vitrify them, but agglutinates and renders them hard enough to receive enamel. The body in this state is termed *biscuit*, and the process, *biscuiting porcelain*.

When the biscuit is cool the enamel must be applied; a process which requires much care. Having a quantity of the enamel prepared of the consistence of cream, and in several parcels of different tints of colour, it is to be applied to the face of the tooth, previously well cleaned, with a camel's-hair pencil, in a regular uniform coat, which should extend beyond the cutting edge of the tooth, so as to give that part the required transparency. If the tooth is of a uniform colour, it is only necessary, after it has dried, to make it regular and even, by means of a needle set in a handle.

Generally the operator wishes to colour the tooth of three different tints, and, in the case of mineral blocks, to colour the artificial gums. To do this, several parcels of enamel of the proper tints must be mixed, (see Grades of Colour for Enamel, p. 275,) and each put on in its appropriate place. Great care must be taken not to let the rosy gum enamel touch the teeth, for if it does, a well-shaped edge will be formed around each drop. The tints on the crown of the tooth must be incorporated carefully, so as to blend or shade off into the other enamel, whilst the gum forms a sharp well-defined edge. To do this well, the coloured enamels should be placed on the tooth, and covered by a thin layer of enamel mixed with an increased quantity of water to render it fluid.

It is usual to colour the part of the crown next to the neck of the tooth, yellow, and the tip, blue. If the predominant colour of the teeth to be imitated is yellow, the thin coat may be of yellow enamel, and on the contrary, if blue, this layer may be put on with blue enamel.

The body of the tooth should always be coloured to harmonize with the enamel, or the effect is not good. When perfectly dry the teeth are ready to go into the furnace.

The furnace is of the kind called a *muffle furnace,* containing a slide upon which the teeth are to be placed, and which is made of strong, fire-proof clay, with small grooves for the accommodation of the platina pins (if making flat teeth), which enables them to be laid in such a way that their cutting edges may be free, and not come in contact with anything capable of altering their shape. Before putting the teeth on the slide, it must be rather thickly covered with kaolin mixed with water, or with a layer of dry powdered silex, to prevent the teeth from adhering. Perhaps the best means, is a layer of dry kaolin. When pivot teeth are baked, they should be so placed in one of the grooves on the slide, that their edge may project and not become deformed. For this purpose the grooves should be made transverse, which is usually done on a separate slide, with a collar fitted with a stovepipe, which should be introduced into a chimney to produce a draught.

Firing.—The fire must be kindled with small pieces of charcoal, as it produces but little ashes. Over this must be placed a quantity of anthracite (of a kind that is hard and produces white ashes) broken into pieces about the size of a walnut. To prevent chilling the muffle, the anthracite must be added in small quantities until the furnace is full; when this is fully kindled, and the charcoal wholly burned away, the furnace is to be filled up until it is two inches deep over the top of the muffle with anthracite, and the stopper put into the upper opening, and well luted. The coal should, before this last filling, be well shook down under the muffle, as the greatest heat is required at that point.

The teeth having been biscuited, and the enamel put on them, are to be laid as directed upon the slide. The muffle being in its place, the slide is to be carefully placed in it, and the door luted into the end of the muffle with fire clay. Care must be taken not to shake or stir the fire after this.

The test-piece, which consists of a platina wire projecting from the end of a plug made to fit the hole in the cover last mentioned, is now to have one of the teeth of the same batch attached to the end of it, to enable the operator to judge of the progress of the baking; and is to be introduced into its place.

The second cover is then imposed, and tightly luted.

Some prefer a door with three holes, in each of which a test-piece is introduced. The advantage of this is, that the operator can withdraw one test, and if it indicates an insufficient baking, he can go on, knowing that the remaining tests have not been exposed to the cooling process whilst being examined. This plan is very advantageous to beginners, but after some practice, the state of the baking can be judged of without cooling the test-piece. Some use no test-piece, but open the muffle and withdraw the slide partially, when they think that the teeth are sufficiently baked. If they are not finished, the slide is quickly returned, and allowed to remain some time longer, when it may be again examined. As soon as the test-piece on examination has indicated that the teeth are sufficiently baked, which is known by the enamel being perfectly fused and polished over the whole surface: the plug must be removed from the upper door, and the stopper put into the lower and luted tight. The furnace must then stand until the combustion has ceased and the whole has become cool. By this means the teeth will be very gradually brought down from an intense heat to the ordinary temperature. And the particles or molecules of which they are composed, will have had time to arrange themselves in the most compact manner. This is usually termed the *annealing* process, and the teeth are said to be either *well* or *badly annealed.* When they are well annealed they will stand sudden changes of temperature without injury, whereas, on the contrary, if badly annealed, the plate teeth will certainly crack under the blow-pipe, and thus be rendered useless.

TO SEPARATE SILVER, GOLD, AND PLATINUM FROM FOREIGN BODIES.

However cautious the operator may be in working, a certain quantity of the metallic material employed by him, is sure to collect, in the form of dust and filings, upon the bench and floor, and in the leather apron attached to the bench. This is technically termed the *lemel* or *sweep;* and as it generally contains, besides the precious metals, a variety of substances, as iron, zinc, bismuth, tin, &c., &c., it becomes necessary to separate the valuable portion of it from the worthless. We shall now, therefore, describe the methods by which this is effected.

Silver.—For the purpose of separating the charcoal, cinders, and other large foreign substances from the metals, pass the sweepings through a fine wire sieve; reduce the remainder to a fine powder by pounding it in an iron mortar, and sift again; after which, submit the whole to repeated washings by immersing it in water, and agitating it by means of the hand or a stick. In the course of this process, the earthy matters, which are lighter than the metals contained in the dust, float through the water, which is then poured off, and the metals are left at the bottom.

Having collected the residue, submit it in a glass vessel to the action of dilute nitric acid in the proportion of four parts of acid to two of distilled water; facilitate the action of the acid by the heat of a sand-bath. If bismuth, copper, silver or iron be present, the acid will dissolve these metals, and any portion of iron or tin not dissolved, will remain in a state of oxide, leaving a residue composed of gold and platinum.

The liquor is now decanted, and the residue repeatedly washed with water, and added to the mother liquor. Filter this liquor through white bibulous paper, and treat the fluid with hydrochloric acid, until no more precipitate falls. The precipitate is the chloride of silver, 1000 parts of which should contain 753 of silver, which may be reduced as follows:—After washing the precipitate, and collecting and drying it upon a filter, mix it with small portions of chalk and charcoal; put the mixture in a crucible, and submit it to the action of the furnace for half an hour. When cool, break the crucible, and the silver will be found at the bottom in the shape of a button, mixed with one or two per cent. of gold.

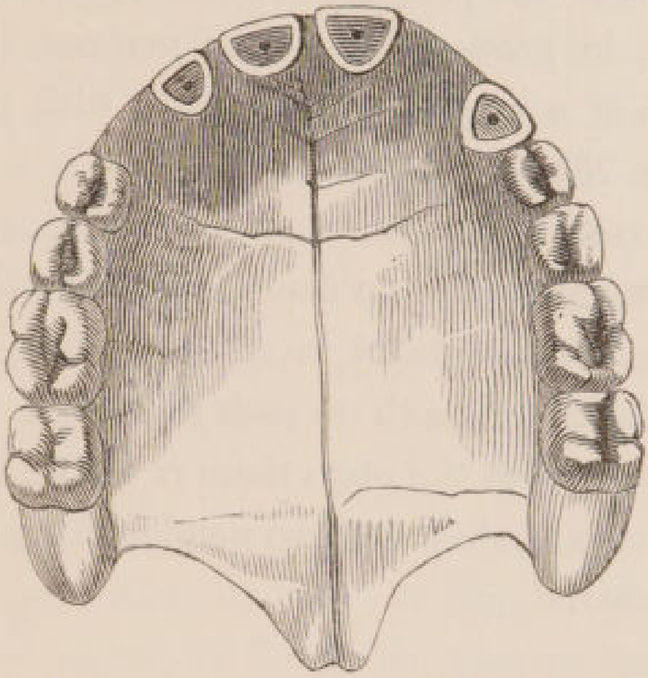
borax and nitre placed in a crucible, and then submitted to the furnace in the manner before described.

Platinum.—The remaining part of the solution, which now only contains platinum, is to be thus treated. To separate the platinum, suspend plates of zinc in the solution for two or three days, and by degrees the platinum will be precipitated in the form of a black powder. Wash this with water acidulated with sulphuric acid, in order to remove any zinc that may remain. Again dissolve in *aqua regia*, and evaporate the solution to dryness; dissolve the residue in distilled water, to which add a solution of sal ammoniac, when a yellow precipitate will be the result, compound of hydrochloric acid, platinum, and ammonia. Collect and dry the deposit upon the filter; place it in a crucible, and gradually raise the temperature of the furnace. When the white fumes consequent upon the decomposition of the ammonia have passed off, increase the heat; allow the crucible to cool, and collect the residue, which occurs in the form of a spongy mass, being that substance termed spongy platinum.

CASES THAT OCCUR IN PRACTICE.

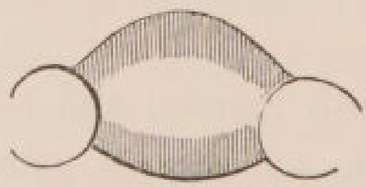
Having, in the foregoing pages, given the student an account of the mechanical manipulations necessary for the construction and adaptation of partial or entire sets of artificial teeth, we shall proceed to enumerate a few of the cases that most frequently occur, that he may not experience difficulty from want of the knowledge necessary to enable him to construct such pieces of artificial work as will in all probability be required of him in private practice. For the purpose of illustration, we will suppose a case in which there is a loss of the six front teeth; *i.e.*, that the crowns of the three incisors and left cuspidate are lost; and that the roots of the remaining left lateral and right canine have been extracted, as represented in the following cut.

It will be obvious, in this supposititious instance, that on the four fangs four artificial crowns could be pivoted in the usual manner, leaving a vacancy on each side, which it is essential both for the comfort and appearance of the patient should be supplied. In the assumed case before us, it may be observed,



that the back teeth remain, and advantage may be taken of them as affording a point of support for fastening a plate with clasps. Some patients, however, have an objection to the use of clasps; and it sometimes does occur that the whole of the back teeth are lost, making it imperative on the operator so to construct his piece, that the whole number of teeth required may be firmly secured upon the four roots as above represented. In either case an impression of the fore part of the mouth must be taken, wooden pivots being previously inserted in the natural openings in the fangs; and a plate must be made extending along the required space; and on the inside of the plate four metallic pivots are to be soldered, in precisely the same manner as for the insertion of a single tooth on plate with pivot: see above, p. 231.

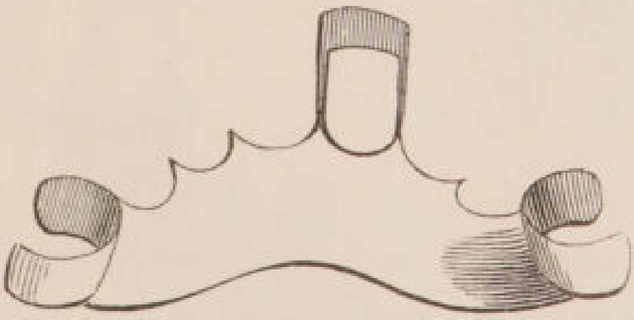
INSERTION OF SINGLE TEETH ON A PLATE.—The method usual with some dentists for the insertion of a single tooth, consists in carrying the gold plate only as far as the tooth on each side of the vacancy; while attached to the plate there is a fine gold *wire* that is made to clasp the two neighbouring teeth; as here figured.



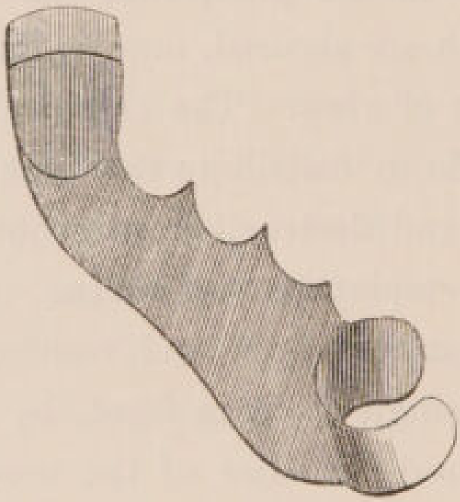
This method of fixing a single tooth, besides being objectionable as shewing the gold in the mouth, is also highly injurious to the adjoining teeth, to which the wires are fastened, insomuch that by the continual friction of the latter upon the teeth, their substance is soon destroyed, the teeth are loosened in consequence of the want of solidity and firmness in the artificial substitute, and are generally lost in the course of a few months.

The important object to be attained, and that the operator should constantly have in view, in constructing artificial teeth, is, to extend his work over such a surface of the gum, that the fastenings by which the teeth are secured, may be far enough back to be quite out of view. The clasps also should be sufficiently wide to distribute the force, and prevent those serious and destructive consequences that result from the employment of wires.

The plan that we adopt and recommend for the insertion of a single tooth in front, is, to extend the gold plate around the sides of the mouth as far as the first molars or bicuspids, and to attach broad clasps to the ends of the plate. In some cases where no natural division exists between the teeth, it will be necessary to separate them by means of a file. A tooth constructed on this plan would be as here figured.

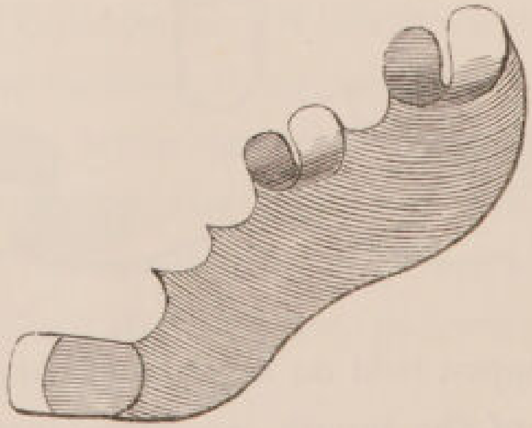


It may happen that on account of the loss of teeth on one side of the mouth, an attachment can only be made to a single tooth, or to those of the same side; in the former case the piece would be as follows.



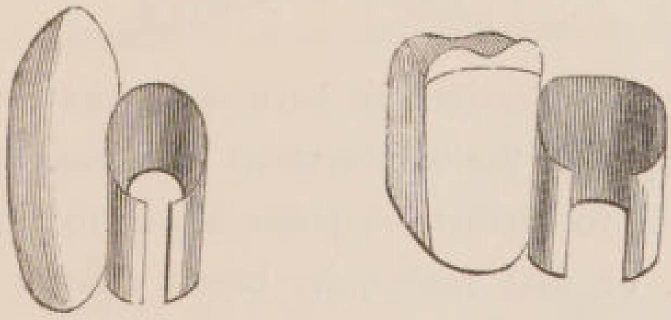
Where the plate and clasp are of sufficient strength, this arrangement will subserve even the purposes of mastication.

In similar cases it is desirable, where practicable, to take two points for the support of the piece, as here shewn.

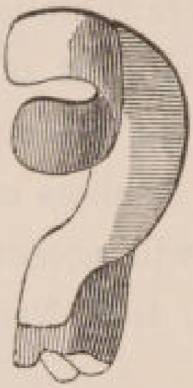


In other cases, where there is only one tooth remaining for the attachment of the artificial tooth, and where that one is a bicuspis or molar, it is obvious that no great firmness can be gained. Some assistance, however, will accrue from the pressure of the opposing tooth, to prevent the new one from rising in its socket.

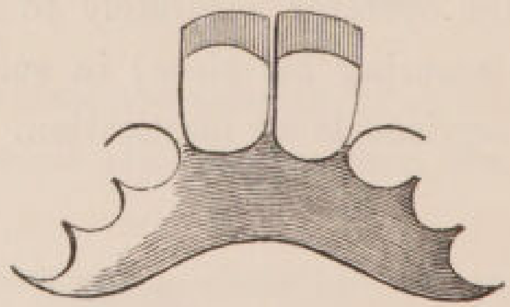
The cases where success may be anticipated, are those in which the tooth remaining in the mouth is firm and healthy, and of a flat or angular shape, so as to enable the operator accurately to adjust to it his clasp for securing his piece; in such cases the work will be serviceable for mastication.



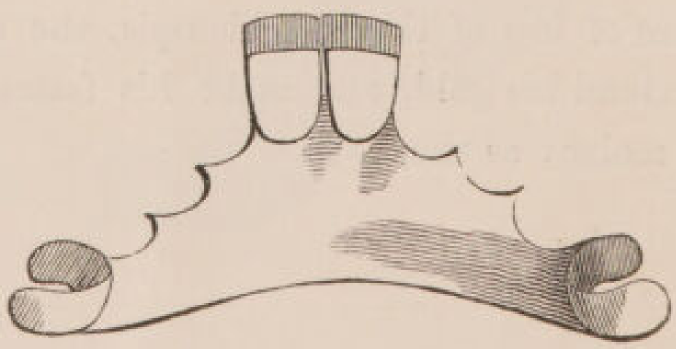
In cases of loss of the first bicuspis, the operator should extend his gold, and make his fastenings to the first molar; as thus:



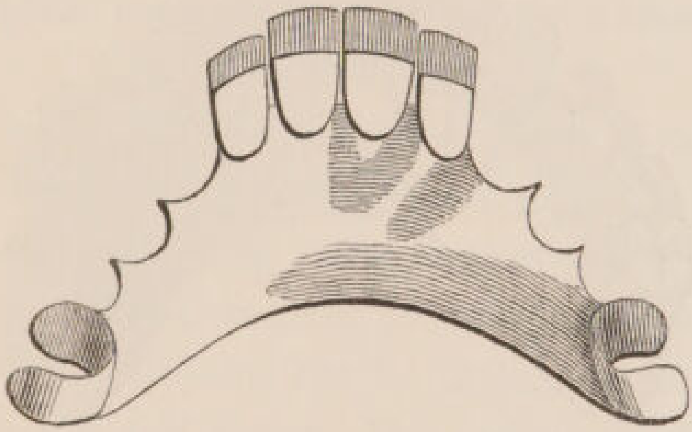
In loss of the two centrals of the upper jaw, the method generally adopted is, to secure the piece by means of wires; thus:



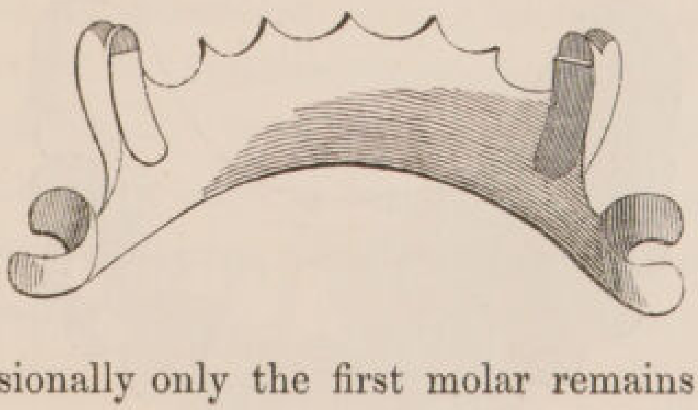
The same objections lie here as in the former instance, against the employment of wires. It is far preferable to secure the piece either to the second bicuspis, or first molar, by broad clasps; as here represented.



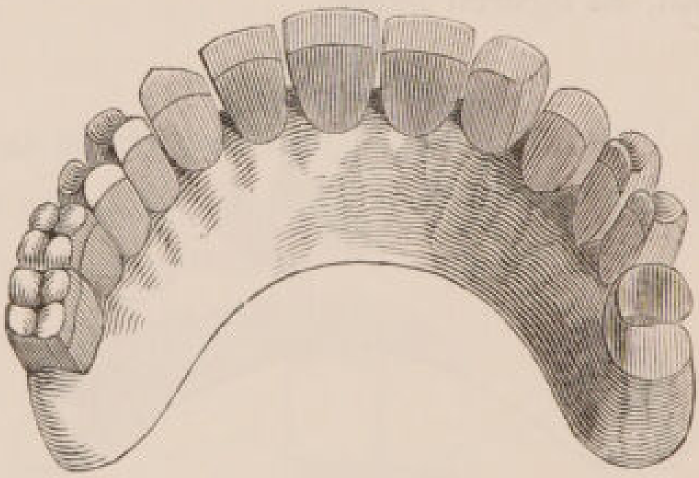
In cases where the four upper centrals are lost, instead of fastening the substitute teeth to the two canines, as is generally done, it is better to extend the gold frame as far as the first molar on each side, so as to embrace the neck of each tooth with a strong wide band, as figured below.



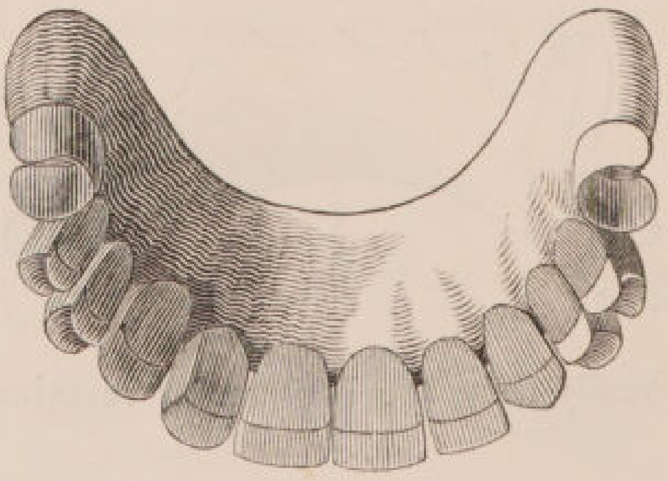
Great inconvenience is frequently experienced by patients from having two or more single teeth inserted separately on gold plates, as for example the two first bicuspids; in those cases, we generally prefer the plan of fixing them on a single plate, as follows.



Occasionally only the first molar remains in the mouth, to support a large piece of artificial work. In these cases the gold plate must be run as high up as possible over the edge of the gum, on the side of the mouth, opposite to where the fastening has been made: as here represented.



Cases also occur in which only two molars remain; the gold in this, and similar instances, should extend as far back in the mouth as possible; inasmuch as it gives steadiness and support to the piece during mastication; as thus.



Where the whole of the upper teeth are lost, the usual method adopted for the support of an artificial piece, is, to fit a plate or bar, to the inner surfaces of the lower teeth, extending the gold over the crowns and outer surfaces of the molars and bicuspids, as far as the edge of the gum, in the form of caps. To the plate covering the latter are soldered the swivels.

This clumsy and inartistic contrivance is unnecessary for the support of an upper set, since if the gold plate be accurately made, friezed and engraved as before described, and carried well over the angles of the jaw; and if the *bite* be accurately adjusted, the plate will not require the assistance of spiral springs for its support. And even should the case not admit of gold, from the shallowness of the gum, the operator can have recourse to dentine.

ARTIFICIAL PALATES.—The dental operator is seldom called upon to furnish these at the present day, when the treatment of syphilis and the administration of its antidote, *mercury*, are so much better understood. Whether palatal deficiencies be congenital, as in cases of hare-lip, or whether they be the result of disease, is matter of little importance to the dentist.

Dr. Brown, of New York, who has written upon this subject, divides the malformation into two kinds, *simple* and *compound;* the former comprising the cases in which the object is merely to supply a deficiency of the arch; the latter, those where the apparatus employed requires to have artificial teeth attached to it.

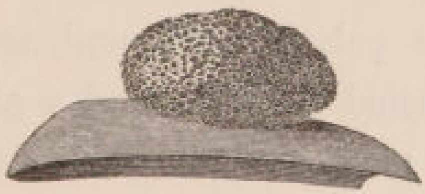
The evils to be remedied by artificial palates are, first, defective enunciation; second, the escape of solids and fluids through the nasal passages; thirdly, difficulty of swallowing.

The *simple* malformation, as we before observed, is a want of palate either congenital or from disease. When arising in the former way, it involves a greater or less declivity in the palatine arch, attended with a perfect denture; and the object is, to attain a proper enunciation, and a prevention of the passage of fluids through the nares.

To effect these ends, a plate must be constructed to fit the upper part of the palate, with a *second* plate soldered to the former, having the proper curve of the palatine arch. This is to be supported by springs or clasps attached to the molar teeth on each side.

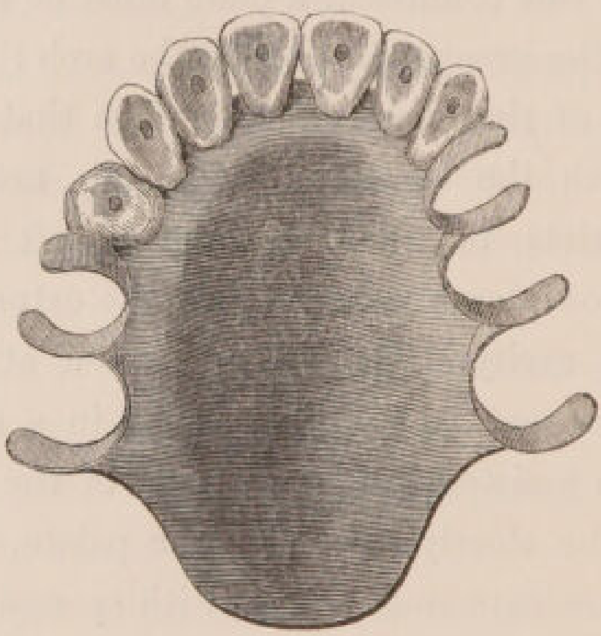
The second cases, or those originating in disease, exhibit an aperture in the palate; the denture being perfect here also.

To meet this condition, a plate must be made that will cover the greater portion of the arch; and upon the centre of that part of its surface that comes in contact with the edges of the spring, are soldered several eyelets, to which a piece of soft sponge is fastened, considerably larger than the external opening of the cavity. The sponge, when attached to the plate, is pressed into the cavity in a dry state. Thus when moistened by the mucus of the nose, the plate will be closely drawn to the palate. The following represents such a plate with sponge attached.



The *compound* description of malformation exists when any or all of the natural teeth have been lost, and artificial substitutes are fixed to the plate: as represented in the following cut.

In all cases of deficiency of palate, the operator must bear in mind, that no mechanical contrivances are to be applied to the mouth, until not only the natural teeth, but the bony, muscular, membranous, and other tissues in the cavity are in a perfectly healthy condition. It is essential also that an im-



pression of the palatal arch and teeth should be taken in the usual manner, and a plate accurately adjusted to a plaster model, and fastened to the molar teeth by means of clasps. The arrangements for cleanliness should be such that the patient can with ease remove the plate; and whenever sponge is attached, it should be renewed daily.

DENTONOMY, AND ITS PRACTICAL IMPORTANCE.

There is one fact connected with all organic beings, and which is of peculiar importance in whatever arts or sciences are founded upon the study and wants of the human frame especially; we mean, the fact, that the body is a whole, and that all the parts represent, involve and characterize the whole, and are in the strictest keeping with it. This fact grows out of the unanimity of use that subsists among the parts, and makes them all minister to the general and precise end of the system to which they belong. Therefore it is that the face, in every instance, is the proper face of the individual who owns it, often reflecting his character with notable and accredited correctness. Hence the science of Physiognomy. And therefore also it is that the parts and members of one person are never exactly similar to those of any other person. Reason and experience alike attest that this is the case with the human teeth. If "quot capita, tot sensus," be valid, so also it is equally veracious to say, "quot capita, tot dentes." Hence there may

brought into exercise in the whole compass of the dental art.

If it were aught so palpable as a new nose, or a new leg, that was to be adapted to the face or the body in place of a natural member unfortunately lost, it would be at once admitted that, as a general rule, the succedaneous nose should resemble its predecessor, and that if a Roman had been destroyed, a snub should not occupy its vacant seat; and in like manner that the wooden or corken leg should have some considerable similarity both to the one lost, and to the one left; so that the stout limb of the porter should not be paired with a fac-simile of the lean and shrunken shank of the clerk; nor the muscular limb of the male, with a resemblance of the rounded and beautiful member of the female. And yet artificial teeth, though comparatively minute, may be as strikingly incongruous with the person of the individual, as even a new nose that subverts the expression of the face, or a new leg that is too long or too short for its unlucky wearer. It is true that in this case the observer may be at a loss to know what feature it is that is so false to the rest of the visage, yet he will certainly have a keen perception that something is very wrong, if he cannot at once determine it. Only let the reader conceive the delicate row of pearls suitable for an aristocratic beauty, inserted into the mouth of an able-bodied, hard-featured labourer, and he will see how widely erroneous a dentist might be, if he did not exercise a discriminating judgment in fitting the teeth to the individual. And we have no hesitation in asserting, that for want of attention to this subject, the dentist often confers upon his patient an idiotic element of expression, which is particularly manifest during laughter, when the artificial denture grins forth horribly,—a huge mass of insignificant formality, making it impossible for the mind to image itself in the countenance. Such cases violate whatever is even mechanical in the dental art, and reduce the practitioner to something lower than a common carpenter. He may still be competent to make *pegs* for mutilated pensioners, but he should at all events cease to profess to *imitate* the natural parts of that system which is alive, and where harmony is essential.

We are ashamed to say, that in treating of this subject, we know not where to look for written information. Unquestionably all good dentists have had a correct, artist-like feeling which has guided them right, to a certain extent, in practice: but the feeling has not been analyzed, or made the germ of a proper science, as we predict that it will be in proportion as our art advances. Those who go blindly right are apt *sometimes* to go blindly wrong. We must no longer be content with a bare instinct in a matter so vitally important, but distinct observation must be cherished, and thought, and ultimately science, and the rules of science, be founded thereupon. The dentist must divide teeth into certain great classes, and in the same manner, faces also; and paralleling the former with the latter, draw up laws that will, in all cases, enable him, with some confidence, to suit the artificial teeth to the features of the face; and thereby, in a certain logical manner, to the teeth that have perished.

It is little that we can yet do to facilitate the science which we have termed Dentonomy, but the following is at any rate a well-meant contribution, or perhaps an attempt only at a contribution.

In Dentonomy then we at present particularize four kinds of teeth corresponding to four kinds of faces.

1. There is the oval face, and answerably thereto the filbert-shaped teeth, having extremely long enamel, great beauty of appearance, and an oval form at the upper part of their front surfaces, near the gum.

2. The round face; the teeth being short and square; their edges thick and broad, and their front surfaces nearly flat; and the jaws approximating for the most part perpendicularly.

3. The third variety occurs in very thin subjects with high cheek bones; the teeth being usually middle-sized, long and narrow; the incisors thin, and the cuspidates rounded and pointed; the bicuspids pointed, and the molars deeply indented.

4. There are other persons with particularly broad faces; the central teeth also being proportionally broad and thin, and their back surfaces deeply indented; the laterals mostly ill-formed and small; and the canines, bicuspids and molars, partaking of the characteristics of the centrals.

The above, however, is a mere sketch, which we invite the profession to correct, fill up and extend, out of the abundant opportunities which are every day presenting themselves: for we are quite sure that there is, at this day, enough of genius among our brethren on both sides of the Atlantic, to place the subject, in a short time, on a satisfactory, *i.e.*, a scientific foundation. Above all, we call upon those dentists who have already entertained the subject in their minds, to record and publish their experience; and especially those who have been employed in the manufacture of artificial teeth, and who must be presumed to have proceeded upon the rules of a true Dentonomy. For we know of no branch of dental study that is more likely than this to reward the attentive observer; of none that will better develop the mind and resources of the noviciate dentist. It is in fact one of those fine points that must make the difference between the man of talent and the man of mere routine; and characterize the prudent adaptations performed by the one, as contrasted with the rude, *malapropos* carpentry attempted by the other.

We may be permitted to observe in conclusion, that we by no means wish it to be understood, that the artificial teeth should always imitate the natural ones, even in their defects (as in class four above specified), but only that general characters should be preserved, and in a word, that *keeping* should be ever maintained: so that the Dentist may be, to the proper extent, an Artist also.

DENTAL EDUCATION.

We have now, to the best of our ability, conducted the reader who has followed us thus far, through the medical and mechanical knowledge, that in its skilful application constitutes the dental art; and as it is our design to recite our own experience, whether negative or positive, wherever it may seem to be useful to others, we shall in conclusion endeavour to draw upon that experience, to give an outline of the education which it is desirable the dentist should possess, and of the etiquette and manners to be observed by him in practice. It is not our aim, however, to set up as a dental Chesterfield, or to put ourselves forth as Master of the Ceremonies to our elder brethren of the profession, (of whom we are a learner, and not a teacher,) but simply to address a few available hints to the younger aspirants after public confidence and dental honours. Let us not, therefore, be misunderstood; nor let it be thought that we wish to imply that we ourselves possess all the endowments and requisites which nevertheless we recommend it to our rising members to acquire, while they yet have time, from the earliest dawn of their studies.

It is obvious that a classical education is of advantage in every profession. To the dentist, however, it not merely confers indirectly the benefit of polishing the mind and speech of its possessor, and of accrediting him at the general court of the sciences, and in the most cultivated classes of society; but it is also directly valuable in enabling him to peruse classical works upon the teeth, and to gather the opinions of those venerable writers, as Aristotle, &c., whose views on some departments of dental physiology have hardly been substantially increased even at this day, when so many branches of knowledge have been aggrandized by new discoveries.

For even wider reasons than these, the student should make himself acquainted with the French and German languages, in which so much is written that is worthy to be read; and which indeed are so often necessary for the common purposes of social intercourse with patients. It is a pitiable sight to see two individuals, for want of a medium of communication, making vague signs, like infants; or with vexation and shame depicted upon their faces, uttering strange vowels, like animals: the unsatisfactory interview being concluded without the one understanding the wants of the other; or if he have guessed them, without his knowing but that something is still unthought of and undone that was included in the purpose of the patient's visit to his dental adviser. Whatever practitioner has been once or twice in this predicament, will heartily wish that it had been his lot to have acquired the modern languages while he was yet a pupil, and before the absorbing occupations and unyielding habits of after life have rendered it difficult or impossible to submit again to the necessary schooling.

There is a similar reason, though of a still more limited kind, why the dentist should have a general knowledge of the anatomy and physiology of the human body, as why the medical and surgical practitioner should possess the same. It is not that *general* anatomy is *all* made use of in either profession, for such is not the fact; yet it is highly educative to the mind, and is the best ground for the acquirement of that *special* anatomy, diverse in each case, that belongs to the medical, surgical, and dental professions respectively. Moreover it is impossible rightly to comprehend a part of the human body without having some knowledge of the whole; so unanimous is the organic system, and so much do the parts depend upon the whole, and *vice versâ*. Therefore here, in the very nature of the body itself, there is a cause why the dentist should be educated in general anatomy and physiology.

Comparative anatomy has also an educative though remote bearing upon dental studies, and it tends in particular, as hitherto received, to shew the importance of the teeth as representative organs; *i.e.*, as means of classification. It may, therefore, where there is opportunity, be justly added to the curriculum of the dental pupil.

That *special*, *human* anatomy that concerns the teeth, and which embraces nearly all the parts and organs of the human mouth, jaws, and face, must be thoroughly mastered by the student. Vague knowledge will not be sufficient here. Precise anatomical views of the form, character, and relative position of all the parts: precise mechanical views of their combined and separate action: precise physiological views of their uses in health: these must be acquired, and through life retained; otherwise the student will never be a truly accomplished dentist; otherwise the practitioner will never deserve, or keep up, his reputation, on the basis of his usefulness. For this is the immediate ground-work which the dental art possesses in the knowledge of the human body.

and surgical mechanics are perhaps nowhere so neatly applicable as to the teeth and mouth. It is wonderful what is done by the scientific dentist in that small space; in the minute fractures and dislocations that there take place; in the application, if we may use the phrase, of permanent splints; in the removal of diseased parts, &c., &c., &c. The dental art, in its perfection, is the very *beau ideal* of a pure mechanical surgery.

The relation of dentistry to mechanics is twofold: there is the mechanics of the art itself, to which we have just alluded: there is also the mechanics preliminary in a manner to the practice of the art, and which forms a main subject in this Second Part of the present Work. The two are both necessary to dentistry; for, as an admirable writer has with great force observed, "*no art is complete, unless another art, that of constructing the tools and fitting them for the purposes of the art, is embodied in it.*" Both of these arts of course flow from the general principles of mechanics, with which, therefore, the student should make himself well acquainted; as well as with all the special principles and applications which are necessary in practice. Upon the mechanical ability and tact of the individual, will greatly depend his success as a dentist. If these conditions are wanting, he may indeed be a physician-dentist, but a surgeon-dentist he never can be. We may add that the grand triumphs of the dental art are nearly all of them mechanical.

We hold that the student ought to give his attention, for a period of from three to five years, to the execution of artificial work of all descriptions; until in fact he has attained to skill and dexterity in the various branches thereof. During the same time he should also take constant opportunities of fitting his work into the mouth, and performing the various dental operations. If he have well availed himself of circumstances to this extent, he will have no lack of confidence and expertness when he comes to practice for himself.

To whatever branch of the dental art we turn ourselves, some knowledge of chemistry is obviously necessary for the student to acquire. In both the first and second Parts of this treatise, particulars occur which demonstrate how closely chemistry is connected with dentism.

A slight consideration of the various subjects which have been successively brought under the reader's view in the foregoing pages, will serve to shew that dentism embraces portions of many sciences, without which it would be empty and ineffective. Thus a whole group of arts is requisite to minister to the human teeth. These, of course, however indispensable, are among the lowest organs of the body; and what a view does this present us with, of the machinery required for the entire system, to maintain it in health, and to cure it when diseased! Nor is such a consideration without its value to the student's mind, inasmuch as by shewing him the wide-spread ramifications of his art, it gives it a broader basis in nature and society, fills up its outlines, and to the utmost utilizes and ennobles it.

But let the student be ever so well informed in his science and accomplished in his art, there are still other qualifications which he must possess, in order to constitute him a successful and useful practitioner.

In the first place, when operating, he must learn to command nerve and firmness, and never to exhibit the slightest alarm under trying circumstances. Without reference to the station of his patient, he must be calm, bold and precise. He must not suffer himself to be influenced in any degree in the execution of his professional duties, against the dictates of his better judgment. He must strenuously cultivate an easy, gentlemanly deportment in the surgery, combining the proper degree of dignity with a becom-

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ing sympathy for his patient; so far as some tenderness is consistent with the offices he is called upon to perform. He must be governed by a high sense of honour, and express it in a friendly politeness that will secure confidence, reassure timidity, and give the public just grounds to form a favourable opinion of his ability and integrity. He must observe the utmost cleanliness in his person, recollecting that it is the patient's *mouth* which he has to treat. His hands, his instruments, and the utensils employed in the surgery, must in this respect be scrupulously attended to. In the course of his manipulations, he must not touch the face further than is requisite to support the part he is about to operate on. Under no circumstances must he make a display of his instruments, nor after one patient has been treated, permit another to enter the apartment before all the instruments, cloths, glasses, &c., previously used, have been removed. He must take no snuff, and eschew tobacco. In short, he must be amiable, agreeable and inoffensive.

It is hardly necessary to say, that a true moral feeling is the safest ground from which nearly all the above qualifications may flow. For they will be more likely to endure, and to brave trial, if they proceed from within, and are the cordial nature of the man, than if they are merely assumed for the occasion. And indeed the moral character is of the highest importance in one who is brought so near to the sacred human person as the dentist often is in the pursuit of his duty. But this is too obvious as well as too serious a subject to require to be dwelt upon here. We will only remark, that the *mens conscia recti,* is the very root of calmness, and of the best kind of courage, as well as of those amenities of manner which are the most certain to be acceptable to others. We commend the acquisition and preservation of it to the rising generation of dentists; and this is the last and best advice that we have to offer.

GLOSSARY

OF SOME TERMS USED IN THE WORK.

Absorbed.—Wasted or removed. In the human body there are an immense number of vessels, called absorbents, whose office it is to remove any foreign or extraneous matter from the system, or from any particular organ. When therefore these vessels are brought into action either by pressure or inflammation, the part where they act is said to be lessened or removed by absorption.

Alkaline.—A term embracing certain chemical agents that neutralize acids; and therefore used as correlative or opposite to *acid*.

Alloy.—A mixture of two metals.

Alveolar Processes.—The sockets that contain the teeth in the jaw-bone.

Amalgam.—The union of a metal with mercury.

Bicuspids.—The two teeth next to the canines are so called, on account of having two points.

Calcareous.—An earth containing lime.

Caries.—Ulceration, decay or mortification in bones.

Chronic.—An adjective applied to diseases of long standing, the term being employed to convey the opposite to *acute*, or sudden diseased action.

Cuspidates.—The canine or eye teeth are so termed from cuspis a point; they are the third from the centre teeth.

Diagnosis.—The art of distinguishing, by symptoms, one disease from another.

FEBRILE.—Feverish.

GELATIN.—A jelly, which forms one of the ingredients in bones of all kinds, and which may be extracted, either by boiling or digesting the bone in caustic potass.

INCISORES OR INCISORS.—The four front teeth in each jaw are so called to express their office, which is to divide or cut the food.

MAXILLARY BONES.—The jaw bones.

MEMBRANE.—A term applied to the thin skin that invests different parts and cavities, &c. of the body.

MOLAR TEETH.—The three back teeth on each side of the jaws, are so called, from *molare* to grind.

MORBID.—Diseased.

MUSCLE.—What is commonly termed flesh: the muscles are the motor powers of the body.

NARCOTIC.—Drugs that induce torpor or drowsiness are narcotics.

OSSEOUS.—Bony.

PATHOLOGY.—The doctrine of disease.

PERIOSTEUM.—The membranous skin that covers the bones, and envelopes the fangs of the teeth.

PHTHISIS.—Consumption.

PHYSIOLOGY.—The doctrine of nature; now generally limited to mean the doctrine of organic bodies.

SUPPURATION.—The process by which *matter* is formed when an organ or part is inflamed.

THE END.

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