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THE TEETH

HOW TO PRESERVE THEM & PREVENT THEIR DECAY.

S.H. LINN, M.D.

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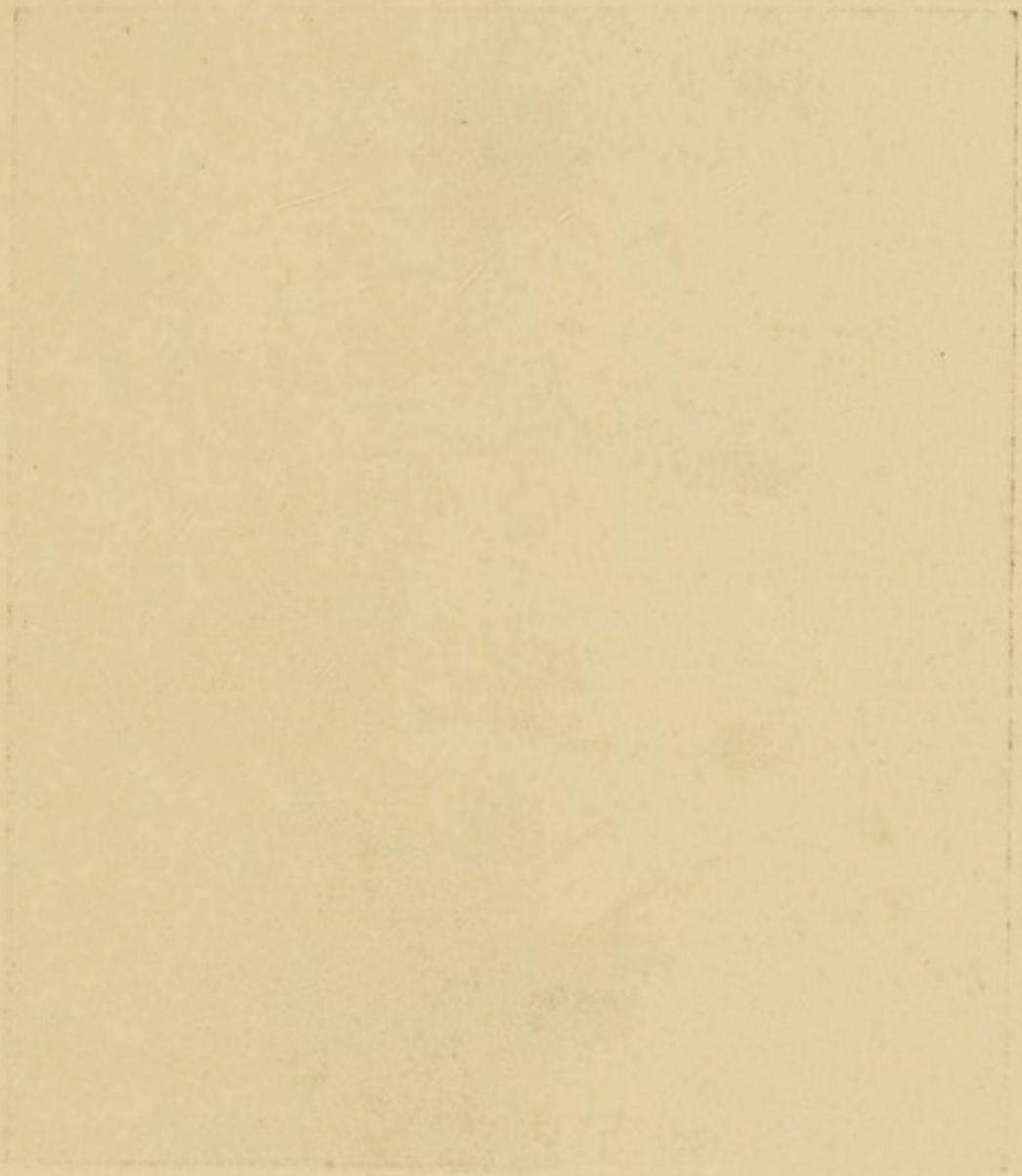

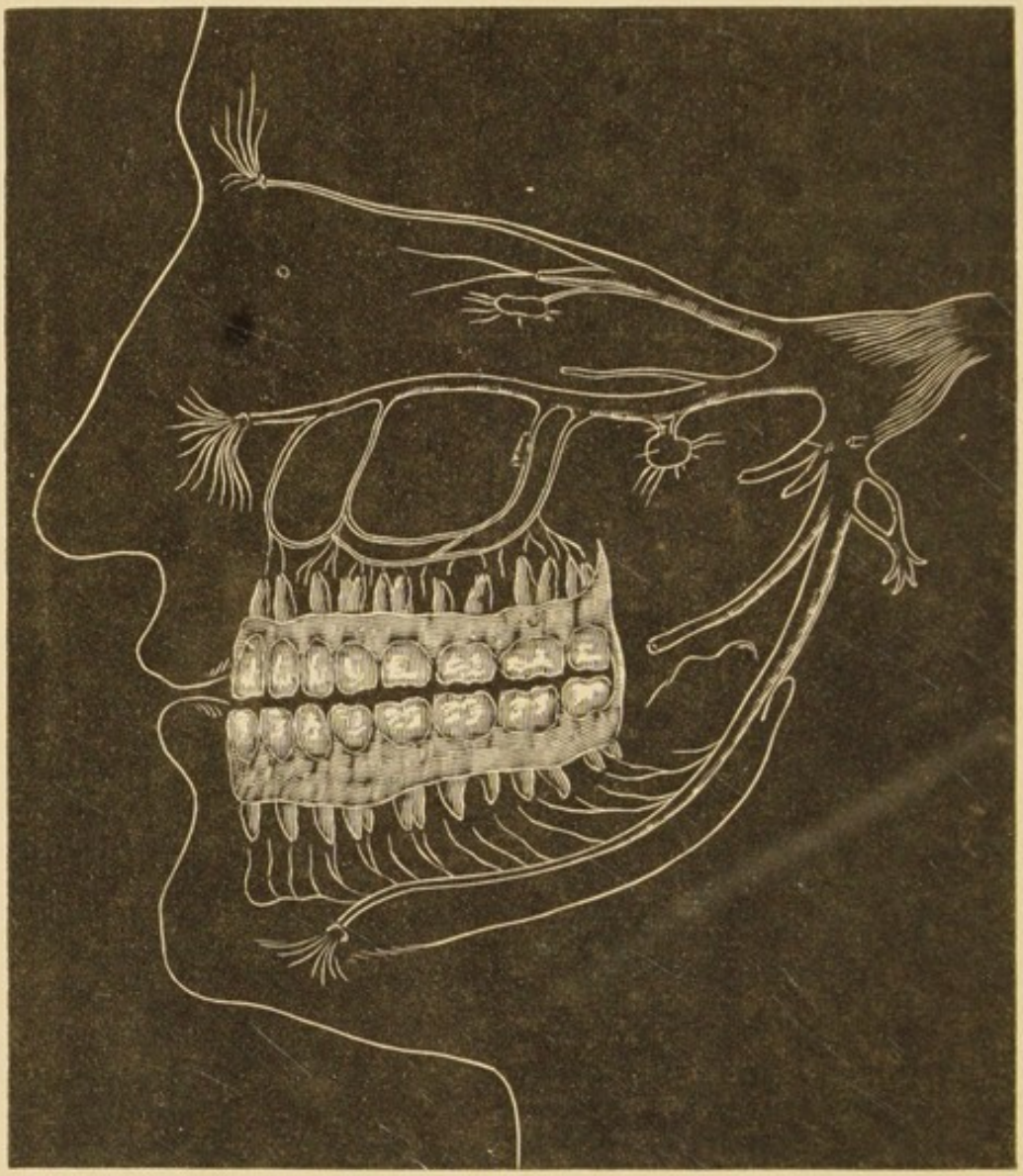

NERVOUS RELATIONS OF THE TEETH.

THE TEETH:

HOW TO PRESERVE THEM AND PREVENT THEIR DECAY.

A Popular Treatise

ON THE

DISEASES AND CARE OF THE TEETH.

BY

S. H. LINN, M.D., D.D.S.,

DOCTOR OF MEDICINE AND OF DENTAL SURGERY, PHILADELPHIA, U.S.; DENTIST TO THE IMPERIAL MEDICO-CHIRURGICAL ACADEMY OF ST. PETERSBURG, ETC., ETC.

With Plates and Diagrams.

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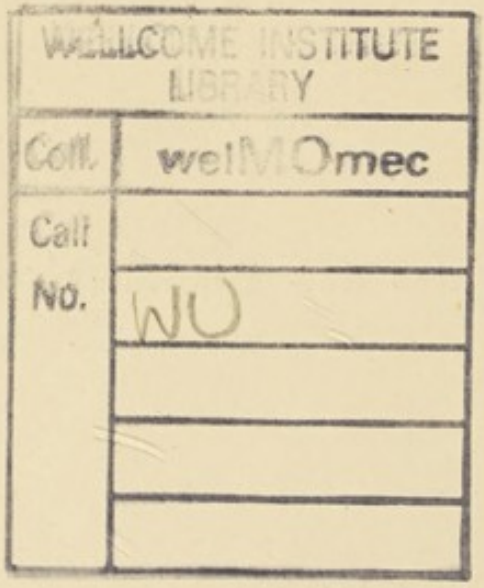
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PREFACE.

THE object of the following pages is to give to my own patients, and to the public in general, a brief but precise idea of the Dental Art; to endeavour to answer the questions so frequently asked of myself, as of other dentists, and which take up so considerable a portion of our time; and, in short, to afford a useful Manual of Reference for all interested in the treatment and preservation of the teeth, and especially those to whom is entrusted the care of the young.

Very little is generally known on the subject. Many people are entirely ignorant of it; and others, having but a vague idea of the extent to which the dental organs are in sympathy with and related to the various parts of the body, suffer from ill-health, the causes of which they seek everywhere rather than in the right place, viz.—the mouth and the condition of the teeth.

Although the art of Dentistry may be traced back to a very remote period, it has only quite recently obtained the rank to which its importance as a special branch of Medicine entitles it. Till within a few years, there existed in Europe a deplorable want of all systematic means of instruction for those destined to the career of the dentist. Now, however, England and the leading Continental nations have happily followed, with the most beneficial results, the example long ago set by the United States.

In that country there have been, for many years, most efficient Colleges for Dentists, based on the model of the Medical Schools, where the Students undergo a thorough

training in Dentistry, Theoretical and Practical, with the collateral branches. The course of study embraces the following subjects :—

PHYSIOLOGY AND DENTAL SURGERY.
GENERAL ANATOMY.
CHEMISTRY AND METALLURGY.
DENTAL MECHANISM (TWO COURSES).
DISSECTION.
DESCRIPTIVE ANATOMY.
SPECIAL HYGIÈNE AND THERAPEUTICS.
DENTAL PATHOLOGY.

—a curriculum which is certainly fitted to render the Student master of his art, and to give him that thorough acquaintance with it which can alone inspire his patients with confidence.

To America belongs the credit of being the first to recognise the great importance of the Dental Art. This much I may, perhaps, be allowed to say of my country without suspicion of boastfulness. The structure, functions, diseases, and treatment of organs which play so important a part in the human economy as the teeth, require a study quite as serious as any other special branch of Medicine.

The Dental Art has been defined as a "Medical Science, able to prevent, modify, or destroy the causes of disease in the dental organs." In this science, however, recourse must be had to scientific mechanism; and, further, no small artistic knowledge is required—talent in constructing and discernment in applying; so that no one can be considered a competent Dentist who is not in his own person at once doctor and surgeon, artist and mechanician as well.

St. Petersburg,
16*th August*, 1882.

CONTENTS.

THE TEETH:

THEIR DISEASES AND THEIR PRESERVATION.

CHAPTER I.

ANATOMY AND PHYSIOLOGY OF THE TEETH.

THE teeth, thirty-two in number in the adult, sixteen in each jaw, form one of the hardest parts of the human body, and have for their principal function the mastication of food, thereby facilitating the work of digestion. Those in the upper jaw are called *superior* teeth, those in the lower, *inferior*. They are divided into four classes, viz.—incisors, cuspids, bi-cuspids, and molars.

The incisors, four in each jaw, are so called from the Latin word *incidere* (to cut). The second class comprises four teeth—two in each jaw—called cuspids, from the Latin word *cuspis* (a spear), because they are pointed. The bi-cuspids, from the Latin *bis* (twice) and *cuspis*, consist of eight teeth, four in each jaw. The teeth in the last class are twelve in number, six to each jaw; they take their name molars from the Latin word *molere* (to grind); they are subdivided into first, second, and third molars. The first are called sixth-year molars, because they appear about that age; for the same reason the second are known as twelfth-year molars; while the third are called "wisdom" teeth,

because they only appear after the individual has reached maturity.

The following figure represents the permanent teeth of the left side :—

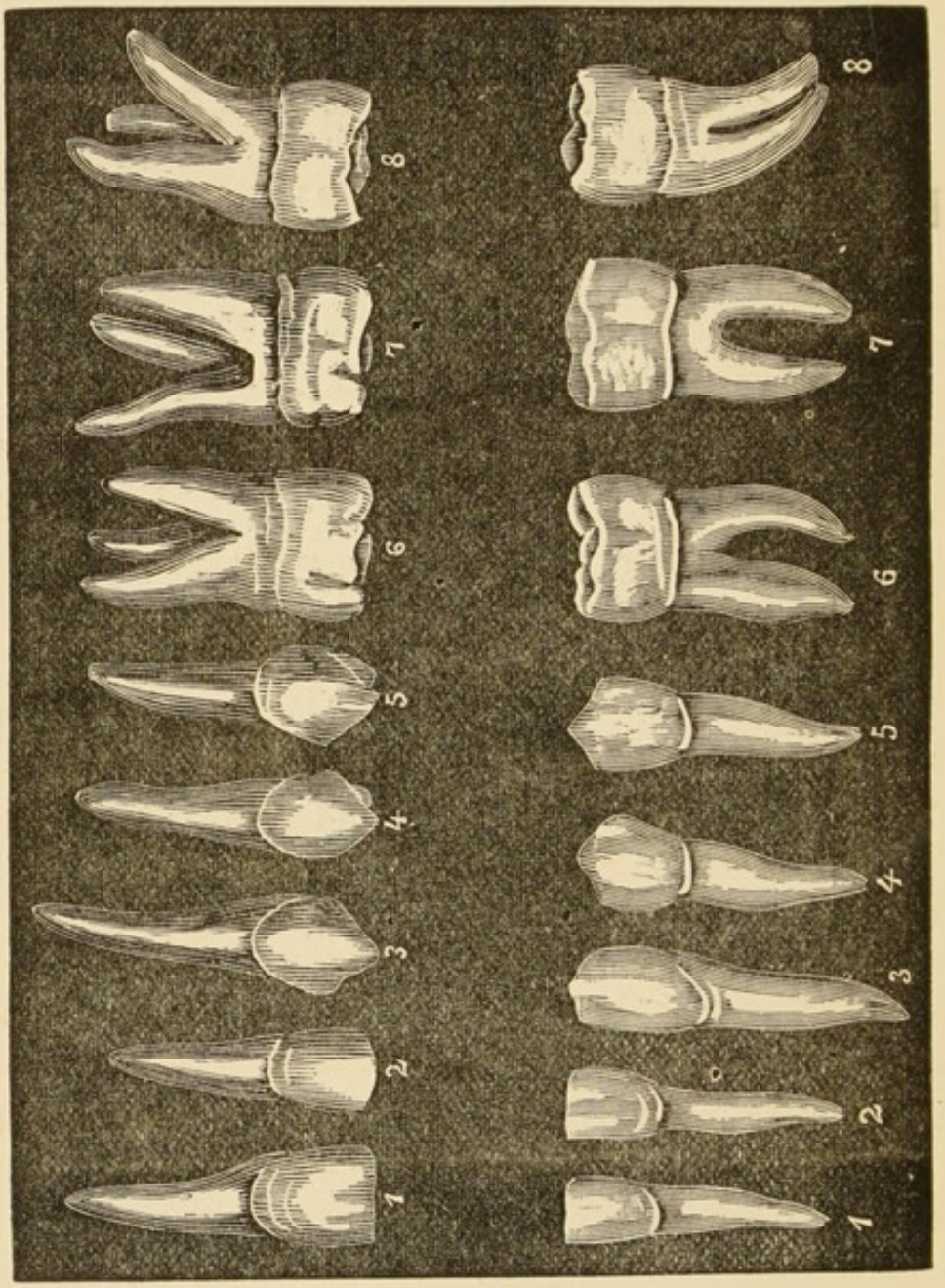

Fig. 1.

The teeth consist of enamel, cementum, dentine, and dental pulp.

The part projecting from the gum is called the crown; that held in the socket, the root; and the part between the crown and root, the neck.

Fig. 2 represents an incisor and molar split so as to show their various parts. A is the grinding surface; B, the cementum; C, the dentine; D, the dental pulp.

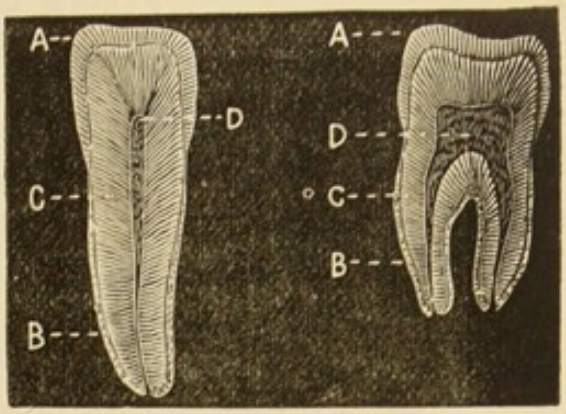

Fig. 2.

A tooth may be divided into two parts, one soft, the other hard. The hard part is composed of enamel, dentine, or ivory, and cementum. The soft part consists of dental pulp.

The crown is composed of ivory covered with enamel; the root is also composed of ivory covered with cementum, which in its turn is covered by the periosteum, a membrane enveloping all bones.

ENAMEL.

The enamel is the exterior part of the tooth. It is a brilliant substance of a bluish-white colour, covering the crown and gradually becoming thinner towards the neck, where it ends; it is a very hard tissue, and at the same time very brittle. It is covered by a delicate calcified membrane, called the cuticle of the enamel. This membrane offers great resistance to chemical reagents, thus forming a particularly appropriate defence for the crown of the tooth.

The chemical composition of enamel, according to Berzelius, is—

Phosphate of lime,	85·3
Fluate of lime,	3·2
Carbonate of lime,	8·0
Phosphate of magnesia,	1·5
Soda and muriate of soda,	1·0
Animal matter and water,	1·0
	100·0

Ivory or Dentine.

Ivory or dentine is a very hard substance, constituting the inner and larger portion of the crown, and nearly the whole of the root of the tooth; though less hard than enamel, it is much stronger than bone or cementum. It is made up of granular layers, together with innumerable little tubes or fibres radiating from the pulp cavity. Until quite recently, dentine was generally supposed to be entirely destitute of nerves and vascular canals; however, late minute microscopic observations have led many eminent practitioners to express their decided opinion as to its possessing both the one and the other.

Berzelius gives the following as the chemical composition of dentine:—

Phosphate of lime,	62·0
Fluate of lime,	2·0
Carbonate of lime,	5·5
Phosphate of magnesia,	1·0
Soda and muriate of soda,	1·5
Gelatine and water,	28·0
	100·0

Cementum.

Cementum is a substance corresponding in structure to osseous tissue, and covering the exterior surface of the roots.

Lassaigne gives the following as its composition:—

Phosphate of lime,	53·84
Carbonate of lime,	3·98
Animal matter,	42·18
	100·00

The Alveolo-dental Periosteum.

This is the name given to a membrane which lines the alveolar cavities or sockets of the teeth, covering their roots,

to which it is attached, as well as to the gums at their necks.

Dental Pulp.

The pulp is an exquisitely sensitive substance, of a reddish-grey colour; it is liberally supplied with blood-vessels, and enveloped in an exceedingly delicate membrane continuous with the alveolo-dental periosteum.

According to the microscopic observations of Mr. Nasmyth, it "is principally composed of minute vascular cells, varying in size from one ten-thousandth to one-eighth of an inch in diameter, disposed in concentric layers; these, when macerated, have an irregular reticulated appearance, and are found to be interspersed with granules, the parenchyma being traversed by vessels having a vertical direction."

Mr. Tomes describes it as "consisting from its earliest appearance of a series of nucleated cells, united and supported by plasma; also, prior to the commencement of the formation of the dentine, of delicate areolar tissue, occupied by a thick, clear, homogeneous fluid or plasma."

Again, Kölliker describes the pulp as "consisting of an indistinctly fibrous connective tissue, containing many dispersed, rounded, and elongated nuclei, with occasionally narrow bundles, somewhat like imperfect fœtal connective tissue, filled with a fluid substance."

It is impossible to fix an exact period for the eruption of the teeth. The following table will serve to show the approximate order of their appearance:—

First molars,	from 5 to 6 years.
Central incisors,	,, 6 ,, 8 ,,
,, laterals,	,, 7 ,, 9 ,,
First bicuspids,	,, 9 ,, 10 ,,
Second ,,	,, 10 ,, 11 ,,
Cuspids,	,, 11 ,, 12 ,,
Molars,	,, 12 ,, 14 ,,
Wisdom-teeth,	,, 17 ,, 21 ,,

We will now pass to temporary (commonly called "milk") teeth. These number twenty, ten to each jaw, consisting of two central incisors and two laterals, two cuspids (commonly called canines or eye-teeth), and four molars or double teeth. It is also impossible to fix the time of their eruption, some children being born with teeth, while others only cut them at a comparatively late age.

Fig. 3 represents the left side of a set of temporary teeth.

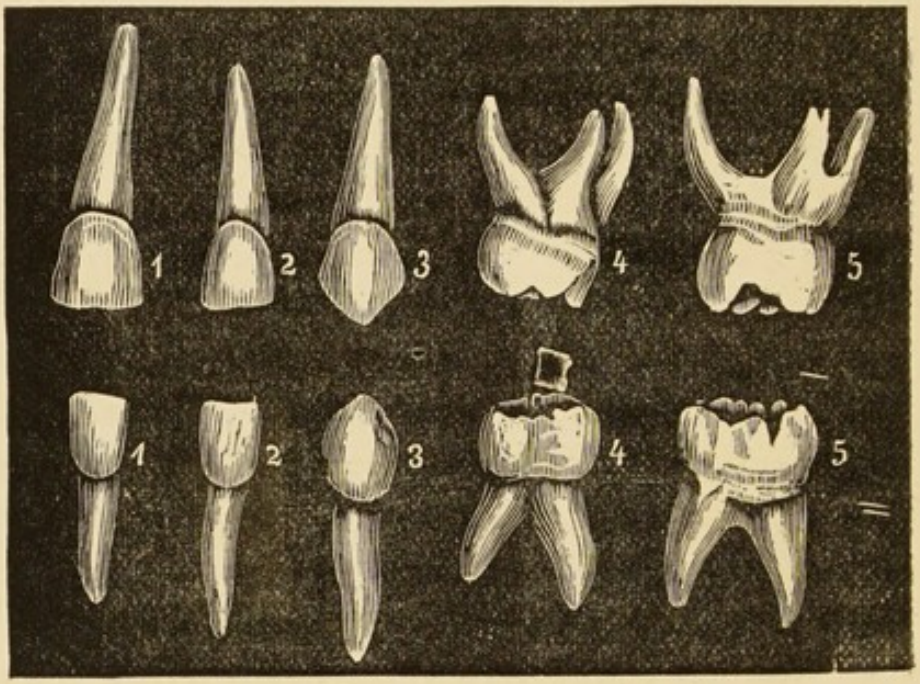

Fig. 3.

CHAPTER II.

TEMPORARY OR MILK TEETH.

TOWARDS the fifth month after the birth of a child, the process of dentition begins—a double process, consisting of the gradual elongation and eruption of teeth, and a simultaneous destruction of the tissues, both hard and soft, which cover them. The alveolar borders show the first signs of the work,

as they cause the adjacent edges to contract, and so leave room for the coming teeth.

These teeth growing in their sockets—while the roots elongate—press on the gums overlying them, which, becoming thinner and thinner, at length yield to the imprisoned teeth. There is no definite rule either as to the time or the order of eruption. Generally, however, the lower or inferior teeth appear two or three months before the corresponding upper ones; but it sometimes happens that the superior precede the inferior in the same proportion of time. As a general rule, also, the teeth erupt in pairs, on either side of the same jaw; though it not unfrequently occurs that a single tooth will appear before its corresponding one. Sometimes two or three pairs erupt together.

Fig. 4 shows a set of superior temporary teeth, numbering five on each side.

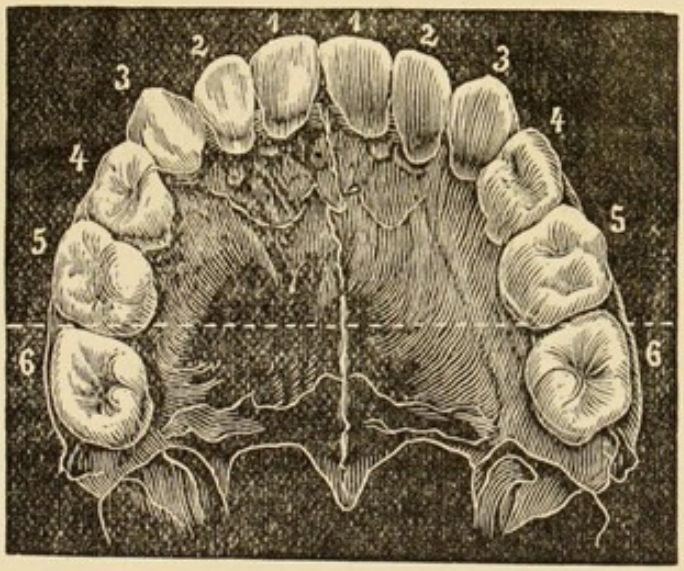

Fig. 4.

The customary order of their appearance is the following—

The two central incisors		(No. 1)	from the	5th	to the 8th	month.
,,	lateral ,,	(No. 2)	,,	7th	,, 10th	,,
,,	canines ,,	(No. 3)	,,	12th	,, 16th	,,
,,	first molars	(No. 4)	,,	14th	,, 20th	,,
,,	second molars	(No. 5)	,,	20th	,, 36th	,,

The inferior set are of equal number, and have the same names. They generally appear in the same order as the superior teeth, but a few weeks before.

Fig. 5 gives a side view of a child's jaw.

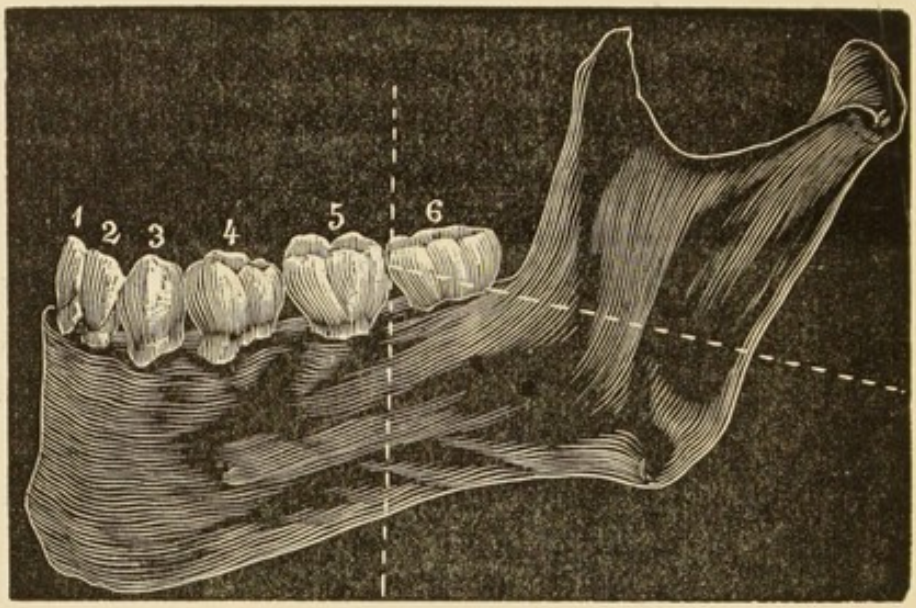

Fig. 5.

The teeth marked 6 in Figs. 4 and 5 do not belong to the temporary set of teeth; they will be spoken of in the chapter devoted to sixth-year molars.

CHAPTER III.

SIXTH-YEAR MOLARS.

It must not be forgotten that the eruption of the second set of teeth begins before the fall of one of the first set. Thus the first permanent molars, numbering four—one on either side of each jaw—appear between the ages of $5\frac{1}{2}$ and $6\frac{1}{2}$. Parents generally suppose that these teeth belong to the first set, so that if they decay soon after their growth, not

much importance is attached to the fact, as it is thought that they will soon give place to new ones, and before the error is discovered irreparable harm is done.

Although the crowns of the teeth are entirely formed before their issue from the gums, their structure has not yet acquired the solidity and durability which afterwards characterise it; indeed, it is only after months, or even years, that they attain their maximum density. Consequently, decay does more damage, in a given time, during infancy, than at a more advanced age.

For other reasons, till now but insufficiently explained, the sixth-year molars are liable to deep fissures, with imperfect union of the enamel edges. The result of this, together with other causes, is that they are specially subject to caries or decay. It even frequently happens that decay begins before they are entirely erupted. This fact shows how important it is to pay the greatest attention to them in time, for if the teeth can be preserved until thoroughly solidified, the tendency to decay is considerably diminished, whilst the chance of preserving them for life is proportionately increased.

The sixth-year molars are the largest teeth. In Figs. 4 and 5 may be seen the relation which they bear to the temporary set of a child of six years.* They are important teeth in many respects, and ought never to be allowed to decay, when it can possibly be avoided. Even when it is impossible to save them permanently, yet, for the sake of the dental arch, there are good reasons why they should be preserved till the age of ten or twelve, the epoch when the twelfth-year molars appear. For equally good reasons, if there is no prospect of permanently saving them, they should be extracted at this time.

Another fact which ought to draw the attention of parents to these teeth is, that in the opinion of many experienced practitioners, the loss of one of them often necessitates the

* In Figs. 6 and 7 the relation which they bear to permanent teeth is shown.

removal of the three others, in order to preserve the harmony of articulation. The teeth are a mutual support to each other, and are adapted one for the other, so that the rising and falling of their surfaces correspond in a way to produce the result most favourable to mastication.

After the extraction of a tooth, the adjacent ones generally change their position a little, thereby interfering with the natural occlusion, and more or less impairing it. Much harm may result from a tooth not being taken out at an opportune moment. If extracted too soon, the adjacent teeth are contracted, thus causing irregularity in the growth of the others. If extracted too late, the space will never be properly filled up, and the teeth on each side, not finding their natural support, will lean towards this space in such a way that they will always be pushed out of their natural position by the occlusion during mastication. Under these conditions the gums contract over the spaces, the alveolar tissues are absorbed, the teeth, being left without support, become sensitive, painful, and loose, and in the end are lost; those in contact with them are also affected and lost in their turn; and in consequence of the extraction of a sixth-year molar, after the eruption of the bicuspids and twelfth-year molars, the side of the mouth from which it has been taken is ruined quite early in life.

Then, if the opposite side is in the same condition, the functions of mastication are necessarily destroyed. Are not these reasons sufficient to prove to parents the necessity for paying continual attention to the sixth-year molars?

It is prudent frequently to count a child's teeth after it has attained its fifth year, and when more than five on each side are found, the last may be known to belong to the second or permanent set, and this, if it disappear, will never be replaced. Should extraction be necessary, yet the tooth not taken out at a propitious moment, the whole denture may be impaired, for there is then a complete disorganisation of the health. Then, also, mastication being interfered with,

gives rise to dyspepsia, accompanied with intestinal disorders tending to shorten life.

One of the chief causes of defect in the mastication of many people arises from the fact, that the necessity for a careful treatment of the sixth-year molars has not been duly appreciated.

CHAPTER IV.

SHEDDING OF THE TEMPORARY AND ERUPTION OF THE PERMANENT TEETH.

WHEN the small size and delicate structure of a child's jaw are considered, together with the fact that the teeth are proportional in size, it is evident that the second or permanent set must also be proportional in size and strength to the development of the adult jaw. Almost simultaneously, therefore, with the development of the germ of each temporary tooth, and in the appendage to the sac in which it is enclosed, the germ of the permanent tooth appears. The germ of the sixth-year molar is formed independently, like those of the temporary teeth, but it furnishes an appendage enclosing the germs of the twelfth-year molars, which in their turn supply appendages for the production of the germs of the wisdom-teeth.

Thus, while the development of the temporary teeth advances, that of the permanent set is also in progress. When the former erupt, the latter are in different stages of development.

Fig. 6 is an illustration of the jaw of a child about six years old, in which the relation is shown between the two sets; the temporary teeth being still in their sockets, while the molars are about to erupt. The inferior permanent

incisors which, after the sixth-year molars, are the next to erupt, are most advanced both in form and position. The canines, which only appear between the ages of eleven and thirteen, are neither so complete in form nor so far advanced towards eruption.

As soon as the permanent teeth are entirely developed, a process called "absorption" begins, by means of which the temporary set gradually disappears. Little by little the

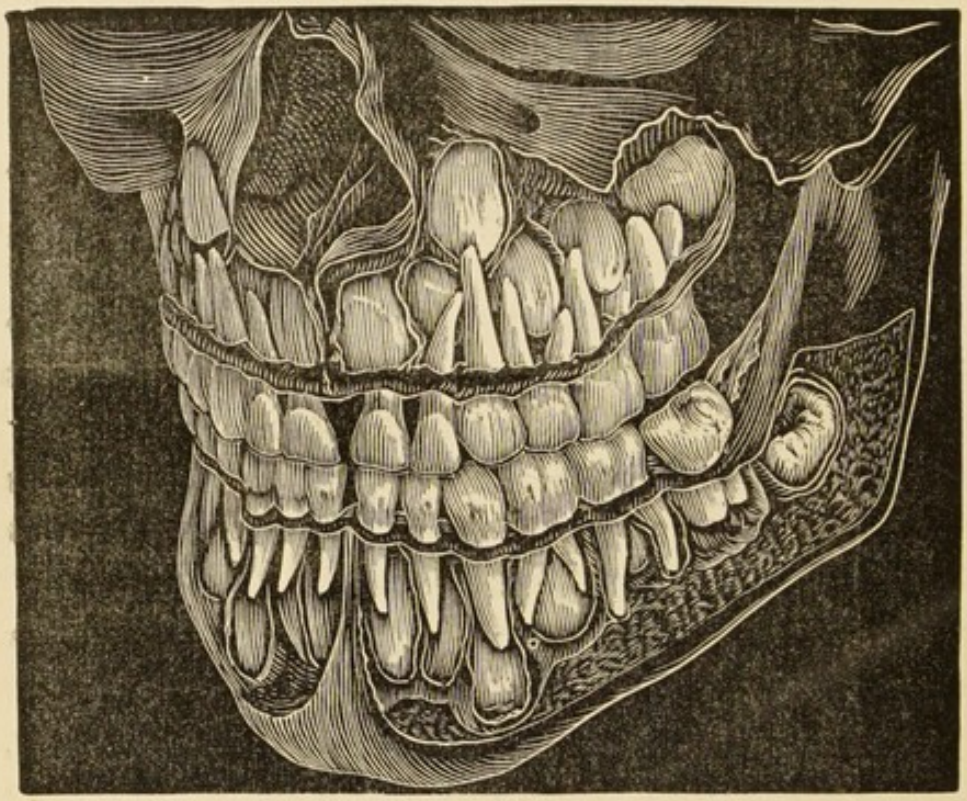

Fig. 6.

roots are absorbed, and the particles composing them carried away, until only the crowns remain. All the roots do not undergo this absorptive process at once, but it is regulated by the order of their development and eruption.

The inferior central incisors are the first to become loose and fall out, then the superior central incisors, then the laterals, and so on, according to the order of their eruption. Deprived of support, and being but loosely fastened to the gums, the crowns are expelled by the movements of the

tongue, cheeks, or lips, during mastication, or they are taken out with the fingers.

The second or permanent teeth number thirty-two, including the twelve which do not exist in the deciduous set, viz.—eight bicuspids and four wisdom-teeth; the sixth-year molars form a part of this set.

In the second chapter a table has been given showing the approximate time and order for the eruption of permanent teeth, both subject, as has before been said, to considerable variation in particular cases.

Fig. 7 shows a set of superior permanent teeth, in which 1 are the central incisors; 2, the lateral incisors; 3, the canines; 4, the first bicuspids; 5, the second bicuspids; 6, the sixth-year molars; 7, the twelfth-year molars; and 8, the wisdom-teeth.

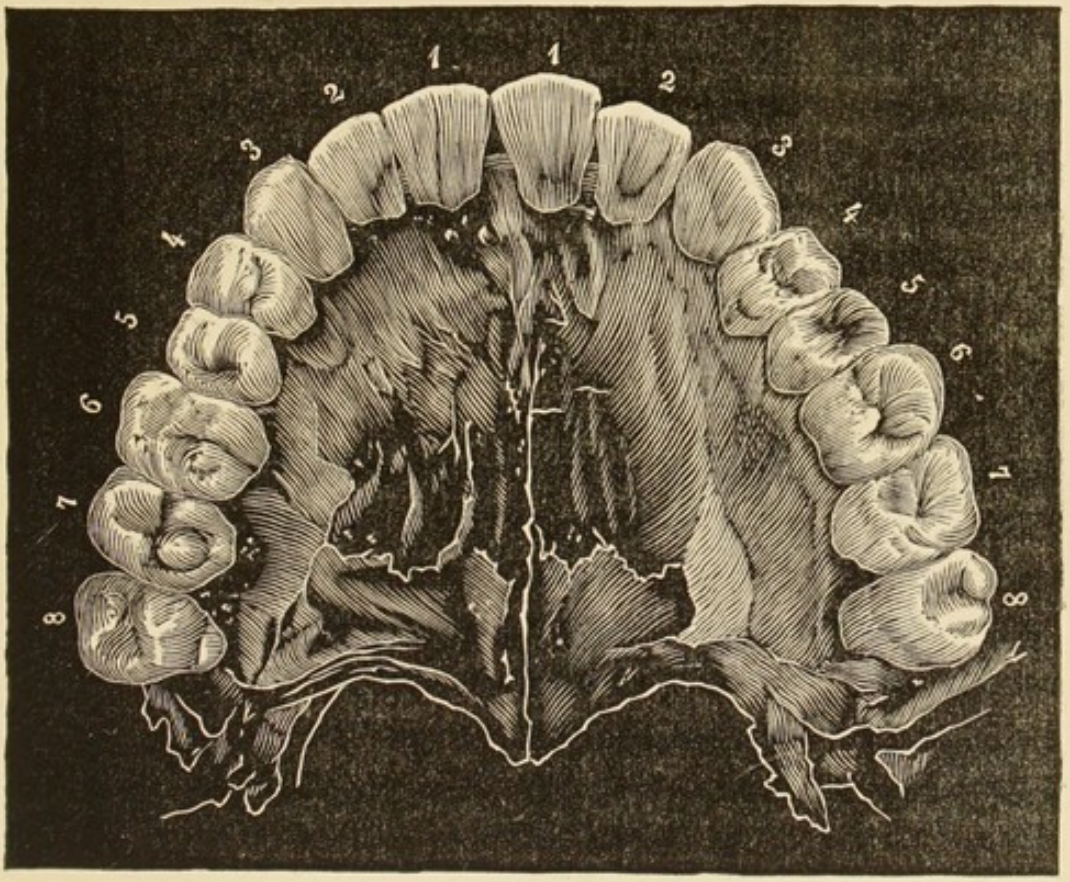

Fig. 7.

Fig. 8 gives a side view of a set of inferior permanent teeth.

The cutting edges of the incisors are, at the time of their eruption, divided into little points (evidently intended to facilitate the eruption), which give them the appearance of a saw. These points are after a time quite worn down, only leaving the regular smooth edges.

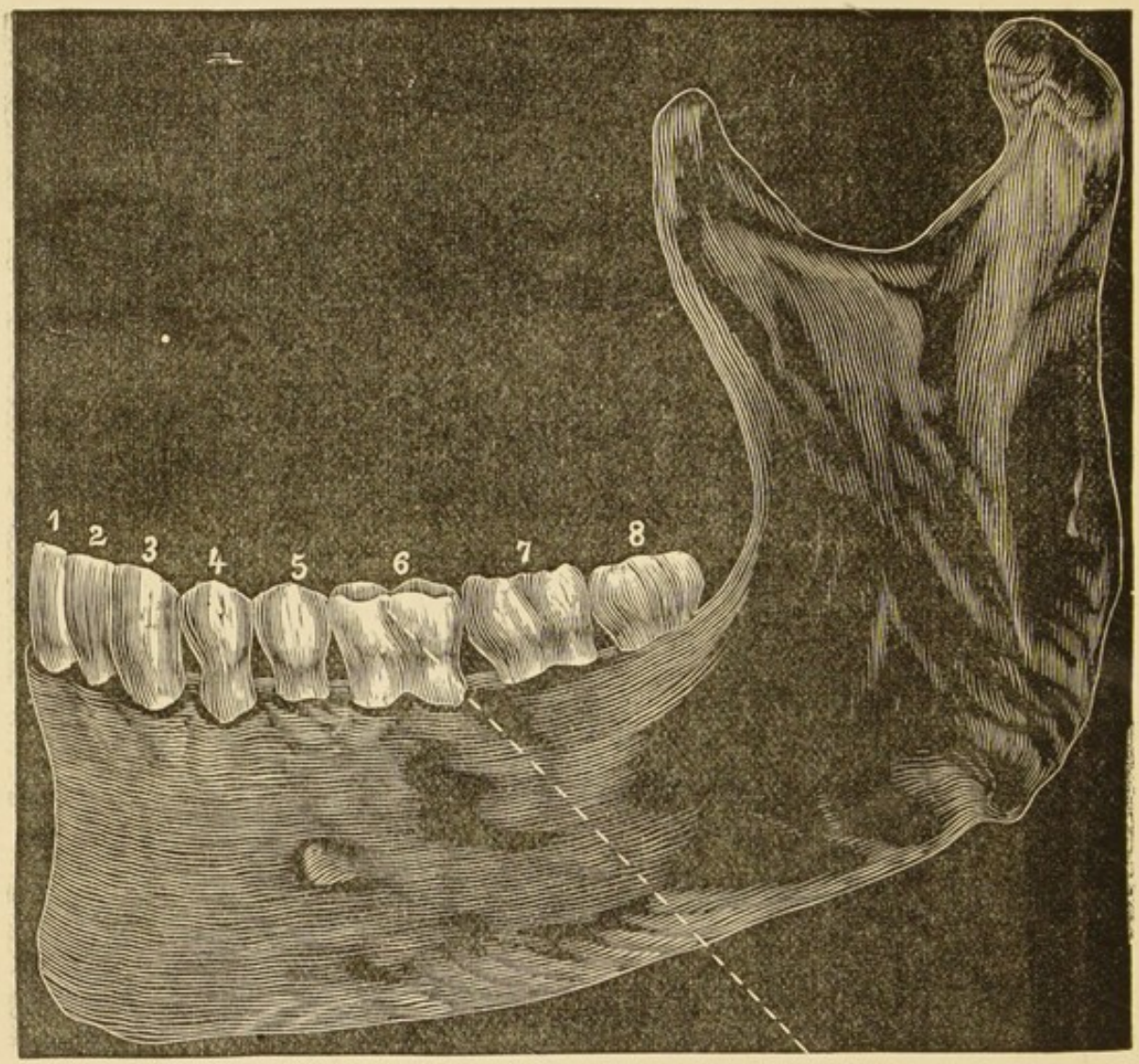

Fig. 8.

The life of a child between the ages of six and twelve or fourteen, is especially important with regard to the care necessary for the teeth, the future condition of which greatly depends on the treatment they undergo at that period, as to whether they will be afterwards useful and an ornament—or

the reverse. Proper attention paid to the teeth at this period will, in all probability, prevent the necessity for treatment in after life. Parents or guardians should endeavour to advise and arrange for daily cleansings of the teeth, and should moreover supervise these cleansings, so that there may be no omission as to time or manner. In addition, a systematic examination of the mouth should also frequently be made by an experienced dentist. It does not do to wait till a child complains of toothache, or until decay manifests itself; long before this, irreparable harm may be done.

As a general rule, there is very little trouble with the second dentition; occasionally, however, it is attended with pain, swellings, sore throat, difficulty in swallowing, ear-ache, and even an entire constitutional disorder. Nervous affections have been known to follow the eruption of a sixth- or twelfth-year molar. The third molars, or wisdom-teeth, of the superior jaw generally erupt without any special derangements, except when, taking a wrong direction, they come in contact with the cheeks, which causes ulceration.

The eruption of the inferior wisdom teeth generally causes considerable pain and trouble, owing to their being crowded between the second molar and the ramus (the upright portion) of the jaw. As there is insufficient space, the gum is pressed between the outside surface of the tooth and the ramus; the irritation produces swelling, which is itself aggravated by contact with the gums during mastication, or by the teeth of the superior jaw. This gives rise to inflammation, which spreads to the soft tissues of the adjacent parts, rendering swallowing painful and difficult, and mastication impossible.

Sometimes the inflammation ends in suppuration, and the pus is ejected at points more or less distant, internal or external. In these cases the trouble does not last long, and ceases with the complete eruption of the tooth. Some cases require lancing of the gum, or the removal of those parts of it covering the tooth; sometimes the extraction of the

tooth, or of the one in front of it. There is no absolute rule for the treatment of these cases: all depends on the place which the tooth occupies in the jaw, the form of deviation, the eruption (whether natural or otherwise), and, finally, on the nervous constitution of the individual.

The statistics of troubles caused by wisdom-teeth in a crowded arch, furnish cases of ulceration and inflammation of the neighbouring tissues, affections of the eyes, ear-ache, deafness, headache, neuralgia, hysteria, St. Vitus's dance, epilepsy, lock-jaw, and a great many other complaints; a few rare cases have even ended in death.

At six, at twelve, and at seventeen, or until all the teeth have erupted, it would be well for patients suffering from affections of the eyes, ears, or other disorders of doubtful origin, to consult a competent dentist, in order to find out whether the cause of their sufferings is not to be found in the mouth.

CHAPTER V.

IRREGULARITIES OF CHILDREN'S TEETH.

AN irregular and crowded set of teeth is not only a great deformity, but is also extremely liable to decay. Teeth in this condition are generally loose in their sockets, and, from crowding one upon another, their surfaces are worn down or break off, leaving hollow places, which form receptacles for remnants of food, inaccessible to the lips, tongue, and even to the ordinary use of the brush, so that they are more liable to decay than when they occupy the space assigned them by nature.

The worst cases of irregularity can generally be cured. It is difficult for people not thoroughly understanding the subject

to believe in the change which it is possible to make in the position of organs so firmly fixed as the human teeth; but when they consider the fact that all the bones of the body, till the age of from twelve to sixteen, are only imperfectly calcified, or are in a semi-plastic state; that even at an advanced age they yield to a constant, gradual pressure, it is easy to understand that they *can* be moved, and that by the application of gentle force the teeth can be deplaced without suffering or danger to the neighbouring parts.

There is no operation in dental surgery more important than the adjustment of irregular teeth, no one which is so reassuring for parents, or for which they express more gratitude.

A few words must be said on the causes of irregularity of the teeth. The first great cause is the want of development of the jaws during that of the teeth; then come the shocks received by the teeth, either by blows or incurred in falling; the presence of supernumerary teeth; the premature extraction of temporary teeth or their roots; and the habit which some children acquire of constantly pressing on their teeth while sucking their thumb, tongue, or under lip. The causes and forms of irregularity are, however, so numerous and varied, that it is impossible to establish rules for their treatment which shall be applicable to all cases.

The natural development of the gum during a certain period, the progress of the irregularity, the character of the teeth, the age of the patient, and various other considerations, will determine the opinion of the dentist.

Under the direction of a competent specialist, the prevention or the adjustment of many forms of irregularity is neither difficult nor problematic, if only undertaken at an opportune moment.

In a paper on this subject, read in 1864 before the Odontological Society of London, Mr. Cartwright says—"Want of space in the bones of the jaws may be defined as the true cause of irregularity in the position of the teeth in

the majority of instances;" and follows this statement immediately with an inquiry as "to a satisfactory explanation of this want of capacity in the jaws of people of certain communities." He further says—"Irregularity is uncommon among many if not most aboriginal peoples and tribes, and also the inhabitants of particular districts and locations. Irregularity is common in most highly civilised communities, and especially so among the upper and middle classes; and it is more constant among the inhabitants of towns than it is among the inhabitants of agricultural districts."

Mr. Cartwright then offers the hypothesis that this abnormity is due to a process of breeding, and brings forward Mr. Darwin's statements that the bones and plumage of birds become altered by such a process. He further supports his position by the results of high breeding among animals, such as possess peculiar points and characteristics. For instance, he says—"Take the horse and the ox, and consider the points which make up a thoroughbred animal —the small head and ears, the thin legs, small fetlocks and feet, the neck and body finely and symmetrically proportioned, and then the narrowness and comparative smallness of the maxillæ. From the results obtained by high breeding in animals they might reasonably argue that small jaws might be a characteristic of breed in certain conditions of life. If they compared two types of human beings, represented by the upper class in one case, and in the other case by a large class, of which the prize-fighter furnished an apt example, they would find as a rule in the first—well-shaped lips, a small oval orifice, high and capacious forehead, well-pronounced chin, ears small and neck long, the ankles, wrists, feet, and hands small, with an expression in which the intellectual predominated over the animal; while the other class, represented by the prize-fighter, would present exactly the opposite characteristics."

Kingsley says—"A perfect dental development is the result of well-balanced physical and nervous systems, without

hereditary taint;" and he classes the causes of irregularity as "developmental and accidental; the developmental operating prior to the eruption of the teeth, and the accidental subsequently.

"Abnormities of development, having their origin in the same individual, are due to a disturbance of the trigeminal nerve during the period in which the crowns of the permanent teeth are forming and arranging themselves in the jaw prior to eruption; or, when arising from causes antedating the life of the individual, are traceable to an inherited tendency, which tendency had its origin in a like disturbance in one of the progenitors, and was subsequently transmitted; or, they are the result of mixing different and distinctly-marked types of jaws and teeth by the progenitors."

This proposition may be stated in another form as follows:—The cause of irregularities of the teeth, other than accidental, lies in a want of development of the jaws commensurate with the size of the teeth; and this want of relation is sometimes due to a retarded growth of the jaw, while the development and eruption of the teeth are not retarded, and sometimes due to the inheritance of large teeth out of all proportion to the size of the inherited jaw.

In our view we do not call a feeble mind, a sluggish brain, or a dull intellect a nerve lesion or a brain disturbance; for it is abundantly proved that when this condition is associated with an average physique, the development of the dental organs is tardy, but in regular order.

We have before us, then, both the solution of the problem and the evidence of most alarming symptoms in the physical and mental condition of the inhabitants of the centres of civilisation.

There can be no question that the Creator intended that there should be perfect harmony in the development of the physical and nervous systems, and that where such harmony exists we come nearest to the standard of a perfect organisation. This harmony of organisation, or true balance of the

two systems, demands that in the earlier years of life the brain and the nervous system be held in abeyance to the physical.

The healthy mental organisation is of slow growth. If, therefore, we find that a certain mode of life destroys this harmony, breaks up this balance, there will follow necessarily deterioration and destruction of the race, and this is based on a well-recognised physiological law. If the brain and the nervous system are in an undue state of activity, the drain upon the sources of nutrition will be at the expense of the physique.

No force operating on the brain can interrupt or alter the type or inherited model of the dental arch after the first decade of life. All cerebral disturbances occurring during that period showing mental aberration we should class under the head of idiocy—imbecility. After that period such manifestations come more properly under the head of lunacy —insanity, which might degenerate into imbecility or idiocy. Consequently, neither lunacy nor insanity, in the ordinary acceptation of the terms, can have any direct bearing upon the development of the dental organs; but such a condition would be more potent of evil if transmitted to offspring.

I do not hesitate to place it upon record that the next generation will see more of abnormity in dental development, and an increase of nervous and cerebral diseases, and that the two are correlated and spring from the same cause. It is too late to stop it in those who have passed infancy, but it is not too late to modify and partially remedy the evil in those now being born, and those who may be begotten hereafter.

To fathers and mothers surrounded by luxury and flattered with the precocity of their infants, which they are stimulating to the last degree, we would say—"Do not, under peril, encourage this brilliancy, which is now so charming; rather let the mind stagnate. For the first seven years of life give concern only to the morals and to the physique of

your child. Nourish him as you would nourish an animal from which you desire the finest development, stimulating only his moral nature, and his intellect will take care of itself. Thus, if he have no hereditary taint, will be laid the foundation of a splendid specimen of his race."

CHAPTER VI.

PRESERVATION OF THE TEETH.

It is impossible to insist too strongly on the importance of keeping the teeth in a perfect state of cleanliness: even the pains taken by those who pride themselves on the care which they bestow upon their teeth, does not nearly equal their value.

As a preventative against diseases of the teeth and gums, cleanliness holds the first place; by means of it, not only is the formation of tartar avoided, but the particles of food and other injurious substances (which, by remaining in the mouth, tend to vitiate the secretions and bring on inflammation of the gums), are carried away. The deposit called tartar, which accumulates more or less round every tooth, varies very much in appearance, quantity, and character. It is black, brown, grey, yellow, or nearly white; and its presence is more or less deleterious, according to its quality and quantity.

In some cases its influence is extremely pernicious, for it tumefies and inflames the gums, causing suppuration of their borders, accompanied by the retraction of the necks of the teeth, and absorption of the alveoli. The gums become so tender that the use of the tooth-brush is very painful, causing many people to refrain from efforts to keep the mouth clean. Tartar accumulates rapidly, resulting in as

rapid a destruction of the alveoli, which loosens the teeth and causes them to fall out. These are not the only results: the breath becomes fœtid, the secretions of the mouth are vitiated, involving indigestion, loss of appetite, affections of the eyes, ear-ache, headache, and neuralgia, followed by a general derangement of the health. That this derangement of the digestive organs and of the health, can result from an unwholesome state of the mouth, is a fact too well known for it to be necessary to insist upon it. The presence of decayed teeth and roots, ulcerated gums, the accumulation of tartar, &c., must necessarily vitiate the secretions of the mouth, causing a more or less serious inflammation of the mucous membrane of the stomach. When the mouth is in such an unhealthy state, the breath must exercise a bad influence over the bronchial tubes and lungs, and is even capable of causing consumption.

To ensure the cleanliness of the teeth, they should be brushed on rising, after each meal, and before going to bed; the latter is the most important time of all, because while the tongue and muscles of the mouth are in repose during sleep, the substances or deposits on the teeth have time to exercise their pernicious action.

A good powder should be employed at least once a day—the morning is the better time, and a detersive lotion should be made use of before going to bed. Much-advertised powders and washes should be avoided, and it is better to use only such as are recommended by an experienced dentist.

Any wash that is recommended for whitening the teeth is either incapable of obtaining the desired result, or does so at the expense of the integrity of the enamel.

The powders should contain no hard substance, such as charcoal, silex, or pumice-stone. These substances are used to polish iron and steel; their ingredients are insoluble and of so hard a texture that, however finely they may be powdered, they will insinuate themselves between the gums

and the necks of the teeth, causing local irritation, and consequently, by destroying the membrane surrounding the tooth, injure the enamel.

By the daily use of a good powder, the teeth may be kept clean and the gums healthy.

The brush should not be too hard, for fear of hurting the gums, and all accessible parts of the teeth must be carefully cleansed; the upper teeth should be brushed downward, and the lower upward, so as to avoid crowding the gums from off the necks of the teeth.

With sufficient attention and care to have the mouth examined by a competent dentist every six months, in order that the slightest sign of disease may be detected and removed, there is no reason why the majority of persons should not preserve their teeth to an advanced age.

CHAPTER VII.

TOOTHACHE.

THE causes of toothache are almost as numerous as are the varieties of character which it exhibits. Irritation or inflammation of the nerve or the pulp, and inflammation of the surrounding membrane, are the most common causes.

Toothache does not always originate, as many people suppose, in the exposure of the nerve. It is a known fact that the majority of teeth extracted because they gave pain have no nerve at all, it having been dead some time. In this case the suffering is caused by the inflammation of the membrane surrounding the tooth and alveole.

Toothache caused by the exposure of the nerve is a shooting pain, commonly known as sudden or "jumping toothache," and the pain is caused by the nerve coming in

contact with some foreign substance; the atmospheric air, or food taken into the mouth, either very hot or very cold, may also bring on the pain.

This kind of toothache, for the most part, disappears with the cause which produced it.

On the other hand, in cases of toothache caused by inflammation, an acute pain is felt over the whole of one side of the face, and it even extends to the neck and shoulders.

People are often at a loss to account for this last kind of pain (inflammation of the surrounding membrane), and wonder how a tooth can hurt after the nerve is dead. The reason of it is, that, in many cases, the dead nerve decomposes, and a gas is formed, which, escaping through the little opening at the end of the root, produces inflammation of the surrounding membrane. In this case, all substances placed in the tooth only increase the pain.

People little suspect that by far the greater number of swollen faces are caused by the inexperience of the dentists themselves. Many of them, taking no notice of the prescriptions which advise that a tooth should never be filled until the destroyed nerve has been taken away, shut up the wolf in the fold. Too much attention cannot be paid to the fact that the nerve, imprisoned by fillings, produces, by its decomposition, a gas which, finding no vent on the outside, escapes from the ends of the roots into the sockets, and occasions irritation of the periosteum, an irritation which is not long in showing itself in the form of an abscess more or less serious.

The teeth should, therefore, never be filled before the dead nerve has been taken away—it is a painless operation—and the cavity thoroughly purified.

Is it not evident that much trouble may be avoided if only care is taken not to postpone the filling of a tooth until the nerve is exposed? The dental art has made such progress, that the integrity of a nerve may nearly always be preserved, if it be numbed before being filled.

The accumulation of tartar, the irritation caused by badly fixed hooks, loose roots, irregular and crowded teeth, inflammation of the living pulp and of the dental canals, are also causes of toothache. There exists yet another which must not be passed over in silence—exostosis. But owing to the uncertainty of the diagnosis, the existence of this affection can, as a rule, only be certified after the extraction of the tooth. Lastly, the idiosyncrasies of some teeth cause them to be peculiarly liable to odontalgy. It sometimes happens that all the teeth have decayed without giving the least uneasiness; while, on the other hand, teeth, to all appearance perfectly sound, cause acute pain.

Treatment of Toothache.

The first thing to be attended to in the treatment of toothache is the removal of the causes which have given rise to it. This can only be done by carrying out the curative and remedial indications of the morbid conditions and functional disturbances with which it is connected. While these continue it will be impossible to obtain permanent relief. The sensibility of the nerves supplying a tooth may be often numbed, and the pain palliated by the application of stimulating and anodyne agents to the exposed pulp; but the relief thus procured is seldom of long duration. When their effect subsides, the pain usually returns with increased severity. When the pain arises from chronic inflammation and irritation, produced by external agents on an exposed portion of the lining membrane, such applications may often be employed with great advantage. Among those which are used for this purpose are chloroform, oil of cloves, cinnamon, laudanum, alcohol, camphor, &c. The author has found the following remedy to be the most efficacious in relieving pain:—

Sulphuric æther, ...	30	℥
Pulverised camphor, ...	8	,,
Pulverised alum, ...	8	,,
Sulphate of morphia, ...	0·12	,,

The alum must be very finely powdered, and all the ingredients well mixed before using. After having removed all foreign substances, and carefully cleansed the cavity of the tooth, take a small piece of cotton wool, dip it in the above mixture, and apply it to the tooth, repeating the process two or three times a day, if necessary. The same directions will serve for the other remedies. The following is another very advantageous family prescription :—

Oil of cloves, ...	30	℥
Sweet spirits of nitre, ...	30	,,
Acetate of morphia, ...	0·76	,,

The removal of decomposed and irritating matter, the cleansing of the cavity and filling it with wadding or wax, often relieves toothache. When the irritation is caused by the presence of acids in the cavity, the application of a little bicarbonate of soda, or any other alkali, is often all that is necessary to stop the pain.

The patient should make use of no other than the simplest remedies; for, in order to obtain good results, the cavity must be well dried, and the tongue and cheeks separated from the tooth. The remedy must also be kept from contact with the saliva by some impermeable substance.

It is painful to witness the harm which patients sometimes inflict upon themselves by an injudicious use of creosote, often burning their lips, cheeks, and tongue. When such accidents occur, a little sweet oil should immediately be applied to the injured parts. One drop of creosote, or even less, is quite sufficient for any tooth whatever; but it must be placed exactly in the cavity itself, the form of which is often such that it is difficult to apply the remedy.

The usual remedies, however, only afford temporary relief, and it is not at all rare for a patient to prefer to suffer for several weeks rather than go to a dentist at once, trying every possible remedy, and passing sleepless nights, till at length he ends by ardently wishing for the extraction of the tooth. He is often in such a state of excitement that he refuses to listen when told that the tooth may be saved; indeed, his wrath is such that nothing but the blood of the offender will appease it! Let such patients reflect that the best and wisest thing to do is to go to a dentist *at first;* the pulp may then be covered, and the tooth stopped.

The simplicity of the treatment greatly depends on the time that has elapsed since the pain began, whether the periosteum is affected or not, and the general state of the health. It is a positive fact that the pulp may often be preserved even, after it has been exposed, and that, in the majority of cases, extraction of the tooth may be avoided through the skill of the dentist, by means of the destruction of the pulp and the filling of the tooth. In fact, it is possible to take away the vitality of the pulp, or destroy the nerve, as it is commonly called.

CHAPTER VIII.

NERVOUS RELATIONS OF THE TEETH.

It is very difficult to understand the causes which produce suffering by reflex action, and the sympathetic relation that exists between the mouth and other parts of the human body, if the distribution of the nerves, and the relation they bear to each other, be not first thoroughly understood. The limits of this work, however, only allow of a brief account of the subject.

The nerves are tubular cords of the same structure as

the two great nervous centres—the brain and the spinal marrow—in one of which they all originate.

They extend to every part of the human body, often communicating with each other; at the points of contact they form ganglia, in which the nerves from the brain and the spinal marrow unite to form the "nervous centres," which exercise an influence over all the parts they supply with nerves.

In addition to the brain and the spinal marrow, there exists another nervous system, known as the "great sympathetic," and which, though communicating with both the nervous centres, is not under the influence of either. Its functions are limited to the muscles of involuntary motion, such as the heart, lungs, stomach, &c.

Impressions are conveyed from the brain and spinal marrow to different parts of the body, as well as from these parts to the nervous centres.

The different nerves have various functions; thus, there are nerves of special senses, as those connected with hearing, seeing, smelling, and tasting. There are nerves of sensation; nerves of motion; nerves combining both sensation and motion; and nerves belonging to the so-called involuntary muscles.

The irritation of a nerve of sensation causes pain; that of a nerve of motion, muscular contraction; that of a nerve of the retina, the sensation of light; of the auditory nerve, the sensation of sound.

"Sympathy" depends on the connection which exists between two organs; if one is affected, it can transfer the impression received to another.

The "sympathy" may be that of contiguity or continuity. The former is represented by earache, which is frequently associated with an aching tooth; continuity by the extension of an irritation or inflammation of a membrane of which it is a continuation, as a sore mouth may be the result of a disordered stomach.

By "reflex action" is meant the peculiar phenomenon of an impression, which, originating in one point, is transmitted to the nervous centres, and then reflected to another point more or less distant from the source of irritation.

Billiard-players are well aware of this phenomenon; they know that when a ball strikes another, it will go off in an opposite direction, forming with the line which it followed before touching the ball, an angle called the "angle of reflexion."

A striking example of this is often seen, when, the tooth

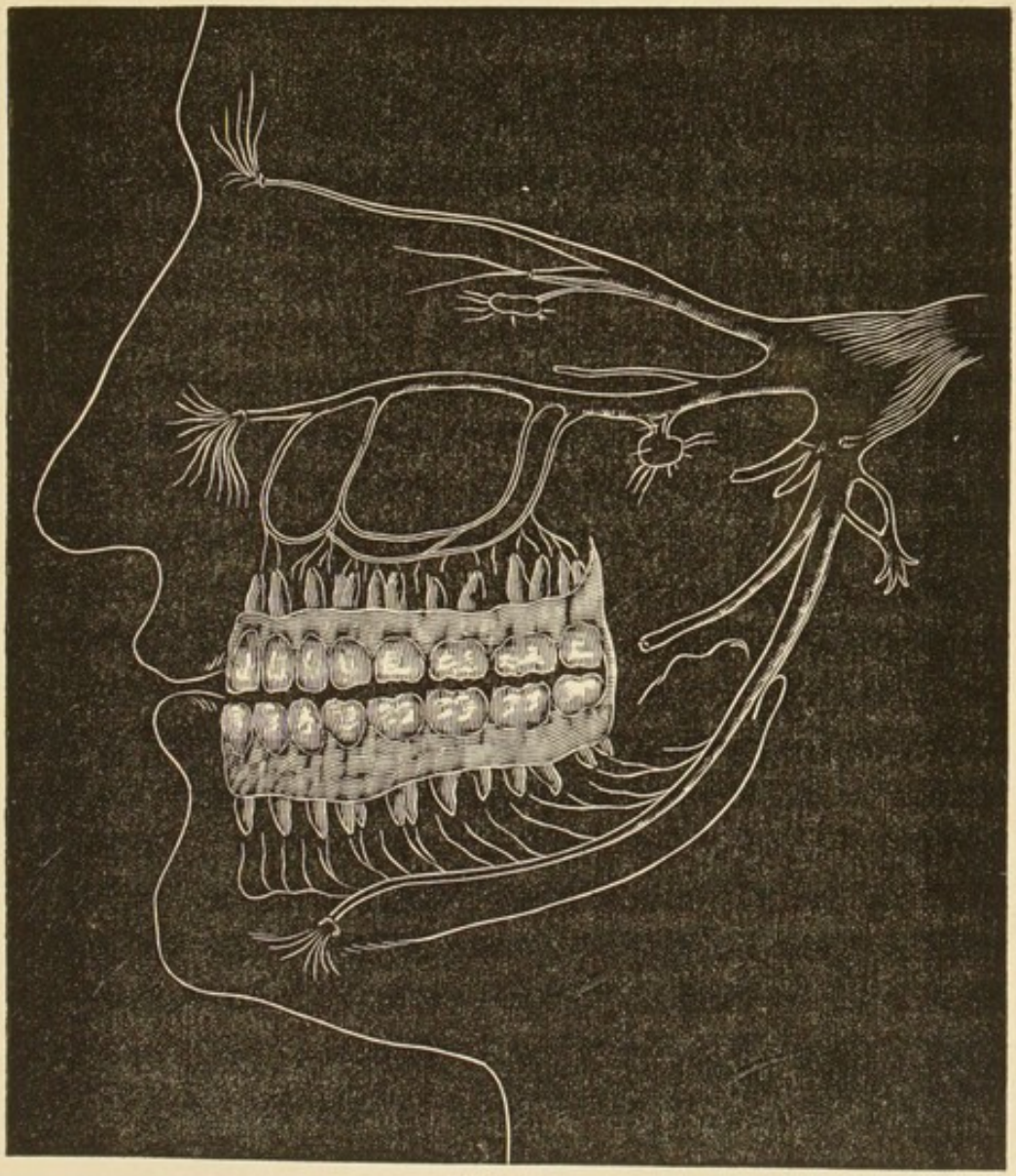

Fig. 9.

of one jaw causing suffering, the pain is felt in the other jaw also, by reflex action.

The brain furnishes twelve pairs of nerves, and the spinal marrow thirty-one. The fifth nerve, represented in Fig. 9, originates in the brain.

It is the largest of the cranial nerves, and has various functions. It is the great sensitive nerve of the head and face; the nerve of the special sense of taste, the nutrient nerve of the teeth, and the motor nerve of the muscles of mastication. It is called *trifacial*, because it is divided into three main branches, known as the "ophthalmic," the "superior maxillary," and the "inferior maxillary." These in their turn are subdivided, giving off branches to the eyes, the eyelids, the nose, the ears, the forehead, the scalp, the lips, the chin, the gums, the tongue, and to the teeth of each jaw.

Filaments of the maxillary branches again join the ophthalmic and the seventh nerve—the nerve influencing the muscles of the face.

The fifth nerve is remarkable for its numerous communications with the "great sympathetic" system, and for its ganglia and various functions. It is the fifth nerve that is specially affected during the eruption of teeth, whether temporary or permanent. It is the irritation of this nerve during dentition that causes convulsions in children. It is this nerve which is the seat of facial neuralgia. It is the relation which this nerve bears to the head and face, which causes the different "sympathetic" affections of the eyes and ears, so frequently associated with dental disorders. The painful sensations resulting from the irritation of one of the branches of this nerve in the mouth, are reflected not only on the adjacent parts, but to remote organs.

Attention is naturally called to the teeth in those cases when pain is felt in one or more of them; but it frequently happens that dental affections have subsequently been proved to be the exciting causes of pain in the other organs; a state of matters which was not at first discovered, as there was an entire absence of all local irritation.

In these cases the patient smiles incredulously when told that the pain, not felt in the mouth, originates in the dental apparatus. However, numerous observations call to witness the fact, that many illnesses are misunderstood, and wrongly treated, because doctors neglect to seek their origin in the teeth.

The general systematic disturbances resulting from diseases of the dental organs might be considered as impossible, were it not for the cases with which every dentist is familiar, such as debility, insomnia, nervous disorders, intellectual depression, palpitation, &c., which, having resisted a constitutional treatment, disappear immediately after the mouth has been well attended to. Since it has certainly often been found that a nervous, irritable, or melancholy state of mind was caused by derangement of the dental organs, it follows that it should be considered a duty to have the mouth examined by an experienced dentist, when the cause of pain and suffering is not to be found elsewhere.

The disorders which are "reflected" on other organs, or which depend upon a constitutional cause, brought on by dental irritation, are too numerous to be recounted here.

Many cases of painful affections of the fifth nerve furnish well-known examples of reflected sensations having their origin in the stomach or intestinal canal.

It often happens that the pain above the eyes, so frequently the accompaniment of digestive disorders, can be cured immediately by neutralising the acidity of the stomach.

The illness commonly known as a "bilious attack" is often experienced at the same time as a peculiar discomfort in the teeth, which, described in various ways, may be called "exalted sensibility."

To conclude this part of our subject, we will only add that neuralgia originating in the teeth may be reflected to the face, the scalp, the eyes, the ears, or even remote parts of the body.

It is a positive fact that there are many "sympathetic"

illnesses which depend upon the teeth; doctors, dentists, and patients are therefore quite wrong in thinking that the teeth are only mechanical organs, requiring merely mechanical treatment, and in ignoring that they are in nervous communication with the entire organism.

CHAPTER IX.

DECAY OF THE TEETH, OR CARIES.

THE tendency of the teeth to decay varies with individuals. Some people are so susceptible to the action of corruptive agents, that their teeth begin to decay before their issue from the gums; whilst those of others, again, remain uninjured, although subjected to the action of like agents. Teeth in the same mouth are sometimes unequally attacked by caries. This anomaly has its origin in the constitutional state of the individual at the time of the formation of the teeth, which causes different degrees of perfection in their texture, and a tendency, more or less powerful, to resist the action of destructive agents.

As a general rule, the teeth of people enjoying good health, and of regular habits, are exempt from caries; but there are many exceptions to this rule. Consumptive and scrofulous persons, and those of delicate constitutions, have bad teeth.

Many people consider that the action of certain medicines causes decay. In many cases it is so. Sometimes in serious illnesses, when the life of the patient is at stake, and must be considered before his teeth, as in the desperate cases requiring energetic remedies, there is no hesitation about giving them, although they will have a deleterious effect on the teeth.

Much harm, however, undoubtedly results from an inju-

dicious use of medicine. Patients are often so saturated with mercury, that the quantity of saliva secreted is considerably increased, causing such an absorption of the alveoli that the teeth may be taken out with the fingers. People should never neglect, after taking remedies, such as tincture of iron, &c., which have a direct influence on the enamel, carefully to rinse the mouth, that the action of the medicines may be neutralised as much as possible.

Sugar and acids do not possess, in their original state, destructive properties in the degree popularly attributed to them. A moderate use of these substances will not harm the teeth.

Irregular teeth are very liable to decay. This is due to their agglomeration, which hinders them from being kept clean. In many cases, chemical action resulting from the decomposition of the remnants of food lodged in the interstices or depressions of the teeth, is much to be feared. These depressions are formed by the juxtaposition of the borders of the enamel during the formation of the teeth.

People should not wait to take precautions against caries until it manifests itself. In our opinion, the surest means of preventing decay is to keep the teeth perfectly clean. If due attention be paid to the directions already given, in all probability this disagreeable affection will never be known.

As to the curative treatment, we will now briefly state in what this consists. People are wrong in thinking that, when once decay has shown itself, it will continue to make more or less rapid progress, in spite of everything, for it can be arrested by continual care. In fact, we do not hesitate to say that in all but exceptional cases, due to constitutional causes, decay is very easily stopped. It is better, however, that it be treated before the dental pulp is exposed.

Our greatest enemy is neglect. How many people may constantly be met with who, either because their teeth are not painful, or because the decay has been long slowly pro-

gressing, put off going to see a dentist, till the chances of a definite cure are much diminished. It does not require a great stretch of imagination to understand that the best time for treating a carious tooth is when it is not painful, for then there is nothing to hinder its being filled. People waiting till they suffer, expose themselves to being deprived of their teeth, while they may not have felt the least pain; it is even affirmed that silent caries is the most difficult form of all to cure. It is well known that the presence of one spoiled fruit is enough to contaminate a whole basketful of sound ones. So it is with caries—when a tooth is attacked by it, if a remedy be not promptly applied, the decay may spread to all the others.

We are often asked, as though it were the most natural thing in the world to do, to cure a tooth which breaks off in pieces directly it is touched! Our skill and patience are put to a severe proof by these requests.

In caries there are many degrees which must be considered; if only superficial, the part attacked is taken away, and the empty space filled with gold or some other special substance. In this case, the result is always satisfactory.

If caries have exposed the pulp to such a degree that it can no longer be capped or covered, the patient must apply to a skilful dentist, who may yet save the tooth by destroying and removing the pulp, taking care to clear out the dental canals well. If decay has given rise to suppuration followed by a swelling, or has occasioned periodontitis, or exostosis, the case is more serious, especially with regard to large molars, from which it is impossible to remove the abscesses that have formed, though it can be done for the other teeth.

Do not believe dentists who tell you that it is never necessary to extract a tooth, or remove the nerve. According to them, the mode of treatment is, first, to calm the pain, then put in an infallible filling; but the almost certain result will be, the decomposition of the nerve, which will produce abscesses, followed by swellings and violent pain,

and, after all, the patient will be obliged to have recourse to extraction.

Taking for granted that decay can nearly always be stopped when noticed at the beginning (and then a dentist only can recognise its existence), it would be well to follow the example of the Americans, who, however good their teeth may be, have them examined twice a year by a specialist, thus guarding against subsequent long, painful, and expensive operations.

Gold-filling is a very delicate operation, but the best for stopping the development of decay. It consists in introducing leaves of beaten gold into the diseased tooth, and making them take the form of the cavity. When this operation is well done, the most fragile teeth acquire an astonishing solidity.

In America, certain dentists undertake this branch of the profession only, and it is thanks to this specializing, that some of them have acquired considerable and well-deserved celebrity. It was also from the United States that all nations first procured their gold foil. Mr. White of Philadelphia annually prepares gold to the value of some millions. Before filling a tooth with gold, a suitable cavity must be prepared, that the filling may not fall out.

Decay is not the only enemy of the teeth; many people lose theirs through the absorption of the gums and alveoli, an absorption caused by the presence of tartar. This result threatens all teeth that are not kept in a perfect state of cleanliness. It can be avoided in most cases by constant and intelligent care. It is rare that recession of the gums, or absorption of the alveoli, occurs in mouths always kept clean.

CHAPTER X.

DECAY OF TEMPORARY TEETH.

UNDER ordinary circumstances the first teeth ought not to decay; their fastenings ought to be loosened by the absorption of their roots, and they should then fall out as white and clean as when they erupted.

Temporary teeth are smaller than permanent, and less solid, consequently, when decay does attack them, it makes greater progress than on the latter. For this reason still more attention, if possible, should be paid to them than to permanent teeth.

It is an error to think that, because they are temporary, they need not be attended to, and that if any trouble is apprehended from them, they should no longer be left in the mouth, for fear of their hindering the eruption of the permanent set. In fact, the regularity of the latter depends largely upon the presence in the sockets of the temporary teeth till they are ready to erupt.

The best means to guard against the pain caused by the decay of children's teeth, and the consequent trouble to parents, is to attend to them constantly after their appearance. Besides, the general health of the child will be ameliorated, if the care given to the teeth facilitates mastication. Without this care, the child will early learn to avoid what gives trouble, and will swallow his food without masticating it, which will cause indigestion. During infancy every mother should make it a rule thoroughly to cleanse her child's teeth. When the child is old enough to use a brush for himself, being accustomed to having it done, it will be impossible for him to feel comfortable after a meal till his teeth have been as carefully brushed as his face and hands have been washed.

Small soft brushes, and agreeable dentrifices, are now manufactured for the purpose. Their use, if the habit be early acquired, will soon become a necessity; moreover, it is certain that the habit will have been contracted for life. In cases where, in spite of all the pains taken, the teeth continue to decay, or where the issue of the permanent set takes place before the fall of the temporary, by the absorption of the roots of the latter, the child should be taken to an experienced dentist, capable of pointing out the treatment to be followed. But if this be not done, nature should be allowed to remedy the evil, rather than that parents should take it upon themselves to decide which teeth to pull out; for, as has been said, a premature extraction of the temporary, is a certain cause of irregularity in the permanent set.

If decay attacks the temporary teeth, the same precautions should be taken as with the permanent. All the cavities should be filled with some one of the numerous preparations used by members of the profession. The premature loss of the temporary teeth is the cause of many irregularities, and the deformation of a great number of mouths. When the multitudes of people suffering from this loss, either with regard to articulation, pronunciation, or the contortion of the face for life, be considered, it is impossible not to appreciate the importance of taking precautions in time. It would be well, after a child has reached his fifth or sixth year, to have his mouth examined at least every six months.

CHAPTER XI.

CAUSES OF DECAY.

DECAY may be defined as a "disintegration of the tooth-structure, affecting the enamel, the dentine, and sometimes,

though rarely, the cementum." It always commences on the exterior of a tooth, being the result of external influences. Some investigators suppose it to commence internally also. It is true that the place of its apparition may be modified by constitutional conditions. The predisposing causes of decay are, imperfect structure of the teeth, irregularity, &c. They depend upon the health of the mother during the ultra-uterine formation of the tooth, and the health of the child during its development. In these cases the dentine is soft, the enamel semi-crystallised, and deficient in quantity or quality, forming a heterogeneous mixture of animal and mineral substances. The imperfect teeth resulting from these causes are incapable of resisting the action of destructive agents. Irregularity of the teeth, produced by any cause whatever, renders them susceptible to caries, so that when they lap over one another, or meet in abnormal points, the result it nearly always rapid decay, especially as it is so difficult to keep them clean in this condition.

Blows, falls, the habit of cracking nuts, &c., with the teeth, and thus destroying the continuity of the enamel, also predispose to decay.

The exciting causes are, chiefly, different forms of chemical action following the use of acids either as medicines, or in food, tooth-powders, and mouth-washes.

Other causes of decay result from a vitiation of the secretions of the mouth, either from a constitutional derangement or a local cause, such as, mumps, sore throat, the presence of tartar round the necks of the teeth, which produces an irritation of the gums followed by an acid secretion; lastly, the fermentation and decomposition of particles of food left between the teeth. This last cause is beyond question the most dangerous, for it has been proved that the decomposition of animal or vegetable matter generates acids produced by fermentation, and it is these acids which attack and destroy the structure of the teeth in various places.

If an egg be submersed in vinegar, in a few days the

shell, which, like the teeth, is composed almost entirely of lime, will be completely dissolved. This simple experiment will serve to show the action which acids have upon the teeth.

The acids produced by the fermentation of food, uniting with the secretions of the mouth, attack, disintegrate, and dissolve the lime of the teeth.

Decay never begins on the smooth surfaces of the teeth, but always shows itself in interstices visible in the fissures of molars, bicuspids, and on their neighbouring surfaces. It is these fissures which retain the particles of food and mucus.

Decay proceeds slowly with regard to the enamel, but when it reaches the ivory or dentine, its progress is very rapid, and it soon reaches the pulp. It advances still more rapidly when there is a cavity in the tooth, for then the destructive substance is in contact with the tooth-structure, and not, as is often supposed, because the dentine is more susceptible than the enamel. If well polished, the dentine becomes quite as capable of resistance as the enamel itself.

Caries differs with individuals. It is dark, light, dry, soft, chalky, cartilaginous, &c. The slight irritation produced by the tartar accumulated round the teeth, is sufficient to produce an acid secretion ; a derangement of the alimentary canal renders the saliva acid. The latter peculiarity is also noticeable during pregnancy, and it is for this reason that decay makes such rapid progress at this period. In all inflammatory diseases, and in all chronic affections of the digestive tract, there is an increased viscidity of the mucous secretions, and a diminution of the saliva tending to produce decay. In dyspepsia there is an acid condition of the digestive fluids, which are regurgitated from the stomach to the mouth, and all of which act upon the lime of the teeth.

Besides the acidity resulting from gastric disorders, and the fermentation of the particles of food, there is another

agent which plays an active part in the propagation of caries; this agent is a vegetable parasite found in the interstices of neglected teeth, but oftenest in the decayed cavities. It has not been proved that this fungus, the *Leptothrix buccalis*, is the cause of caries, but it is assuredly an active agent of destruction when once decay has begun. Its development seems to be favoured by the acidity of the mouth, so that by counteracting this acidity, the danger may be lessened.

Sugar can have no direct influence on the teeth, but when taken in excess, and remnants are left in the interstices, it generates an acid; and it has been proved that much sugar taken before going to bed will work considerable harm in the twelve hours.

The vinegar used in cooking is not always pure; it often happens that sulphuric acid is substituted for acetic. As the former, by reason of its strength, has a tendency to mix with the lime of which the tooth-structure is largely composed, it is not astonishing that it acts upon it as a disintegrating substance, and partly destroys the dental tissue.

Besides sulphuric acid there are citric and malic, which also exercise a deleterious effect on the teeth; but the acids most to be feared are sulphuric, azotic, and muriatic. Medicines containing them are generally taken through a straw, in order that they may be swallowed without touching the teeth. This precaution is fundamentally useless, for when once the acids are in the stomach, they return involuntarily to the mouth, and their action is exercised. The only means of preventing it is to have a bottle containing a solution of bicarbonate of soda (a teaspoonful of soda to a pint of water), and to rinse the mouth thoroughly with it several times after having taken medicines containing acids; in this way their action is neutralised.

To return to the *Leptothrix buccalis*, we will add that this parasite plays an important part in dental decay.

Many people who find "*omne ignotum pro mirifico,*" pretend that this fungus is to be met with in all animal matters, an assumption which is not based on any serious observations. It is true that it is constantly met with in the mouth, if care be not taken to rinse it regularly. Mr. Bowditch, after examining forty persons of different social positions, proved the absence of the parasite only in people cleaning their teeth three times a day. All the others possessed it in a degree proportional to the neglect of cleanliness.

Mr. Kölliker, out of from twenty to thirty young persons in good health, found hardly one the papillæ of whose tongue were free from a greyish and granular coating; he more rarely met with filaments of the fungus. It is true that regard must be had to the hour of the day at which the examinations were made; it is natural that all these matters should always be more abundant when the individual is fasting.

As before stated, an acid condition of the mouth favours the development of this fungus, while, according to Mr. Bowditch, it cannot exist in an alkaline liquid. There is always, on the surface of the tongue, and in the interstices of the teeth, a whitish cheesy substance, formed in great part by the *Leptothrix buccalis.* Under the microscope this substance appears to be a grey, finely-granular mass, with delicate and stiff filaments of various lengths. If care be not taken, the leptothrix attains its greatest size in the interstices of the teeth. The filaments composing it are sometimes parallel or undulating, and at others firmly interlaced.

In conclusion, to destroy the leptothrix, counteract the acidity of the mouth, and prevent the development of its parasite, we recommend the use of special lotions prescribed by a skilful, and, at the same time, conscientious dentist. As to those people who, for some cause or other, cannot avail themselves of the advice of a practitioner, we would

recommend the use of permanganate of potassia dissolved in water, as a useful mouth-wash, inasmuch as this remedy is a very excellent antiseptic, and at the same time the best means of preventing fermentation; this water exercises a beneficial action upon the mucous membrane of the mouth.

We here give two plates (after Dr. Leder), which show the disorder occasioned by the *Leptothrix buccalis* on the dental organism.

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1 (magnified three times).

A longitudinal section of a decayed bicuspid. The section is slightly oblique across a large decayed cavity; on the left side of the crown, a cone may be seen, of a dark colour, in the dentine, altered by caries; this cone extends in the direction of the dental canals, from the surface to the pulp, and represents radiated striæ, corresponding to these canals. On the surface of the section, the loss of substance only extends to the enamel; while, on the neighbouring parts, it penetrates deeply into the interior of the dentine. Two fissures may be seen on the smooth surface of the enamel.

Fig. 2 (magnified three times).

This figure represents a longitudinal section of a canine tooth just attacked by decay. In the centre of the crown, a small spot of caries may be seen in a depression of the enamel. A similar spot exists on the left side of the crown, also without loss of the substance; and it is from this spot that decay has spread across the extent of the dentine to the pulp cavity. The layers farthest off from the centre of the

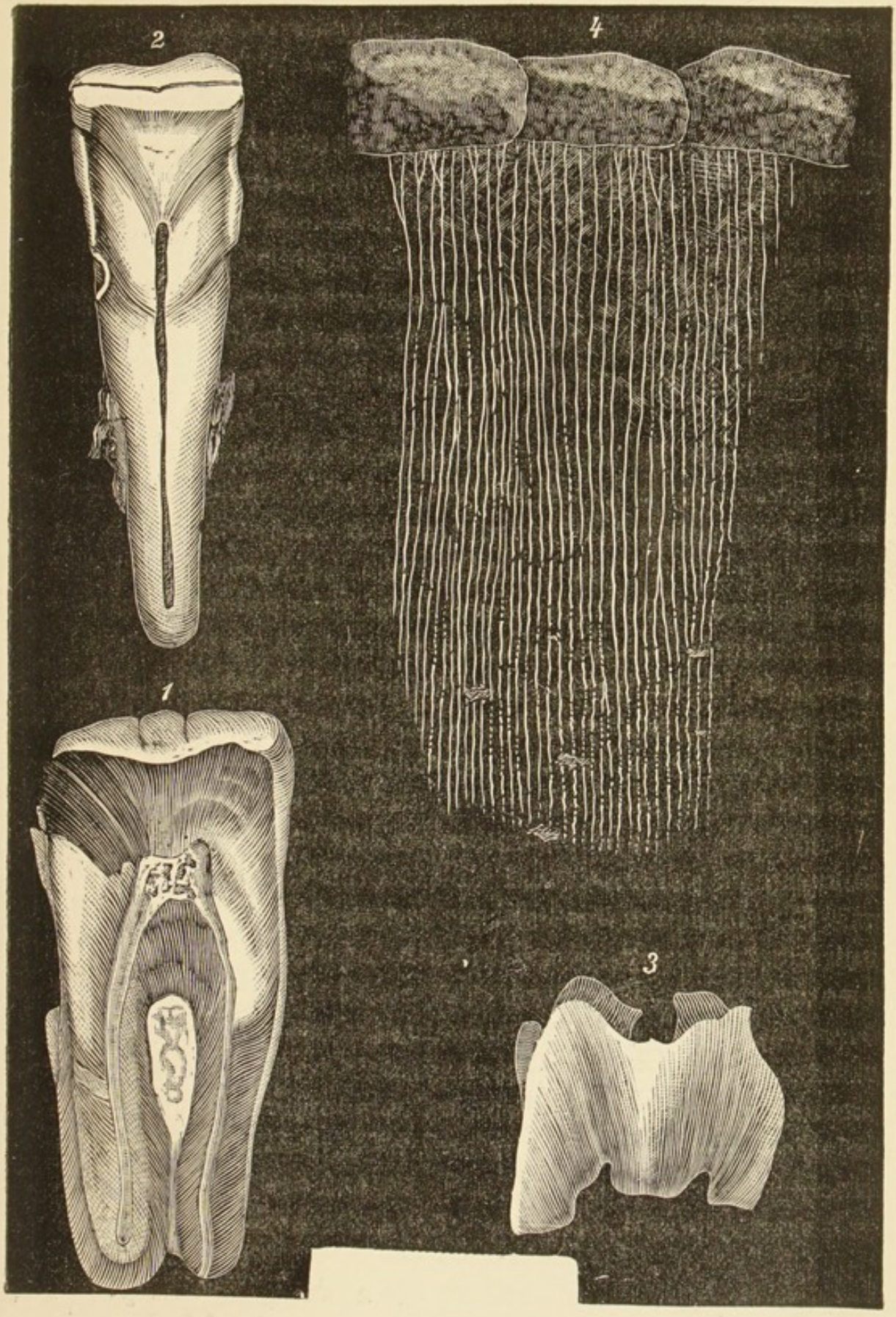

Plate 1.

dentine, are of a darker colour than the lowest layers of the enamel, the colour diminishing in both from their internal surfaces. Three little decayed cavities also exist on the surface of the dentine, and cones of decayed dentine are visible, going from the cavities and spots to the pulp; one of these cavities is on the right side of the crown, the two others on the neck of the tooth.

Fig. 3 (magnified three times).

A section of a human molar beginning to decay. In the centre of the crown, there is a loss of substance of the enamel (it has been taken away from the side in preparation); in the dentine a light cone, attacked by caries, is seen; this light colour is due to the transparency of the tissue; the brown colour cannot be seen, on account of the thinness of the module.

Fig. 4 (is a fragment of the same section, magnified 100 times).

A very thin layer of enamel is seen on the same line as the loss of substance; the most superficial layers are very transparent, on account of the disappearance of the calcareous salts. It may be also seen that the surface is irregular and covered with fissures. The layer of the *Leptothrix buccalis* is not confined to the surface, but at this point granulous masses of leptothrix exist, which have penetrated to the dentine through a fissure in the enamel. The outside layers of dentine are dark, and the canals more difficult to distinguish. In the canals of the deep layers little deposits of calcareous salts are to be found.

Plate II.

Fig. 1 (magnified 100 times).

A section of the surface of a decayed cavity. The dentine is reduced to fragments covered with leptothrix.

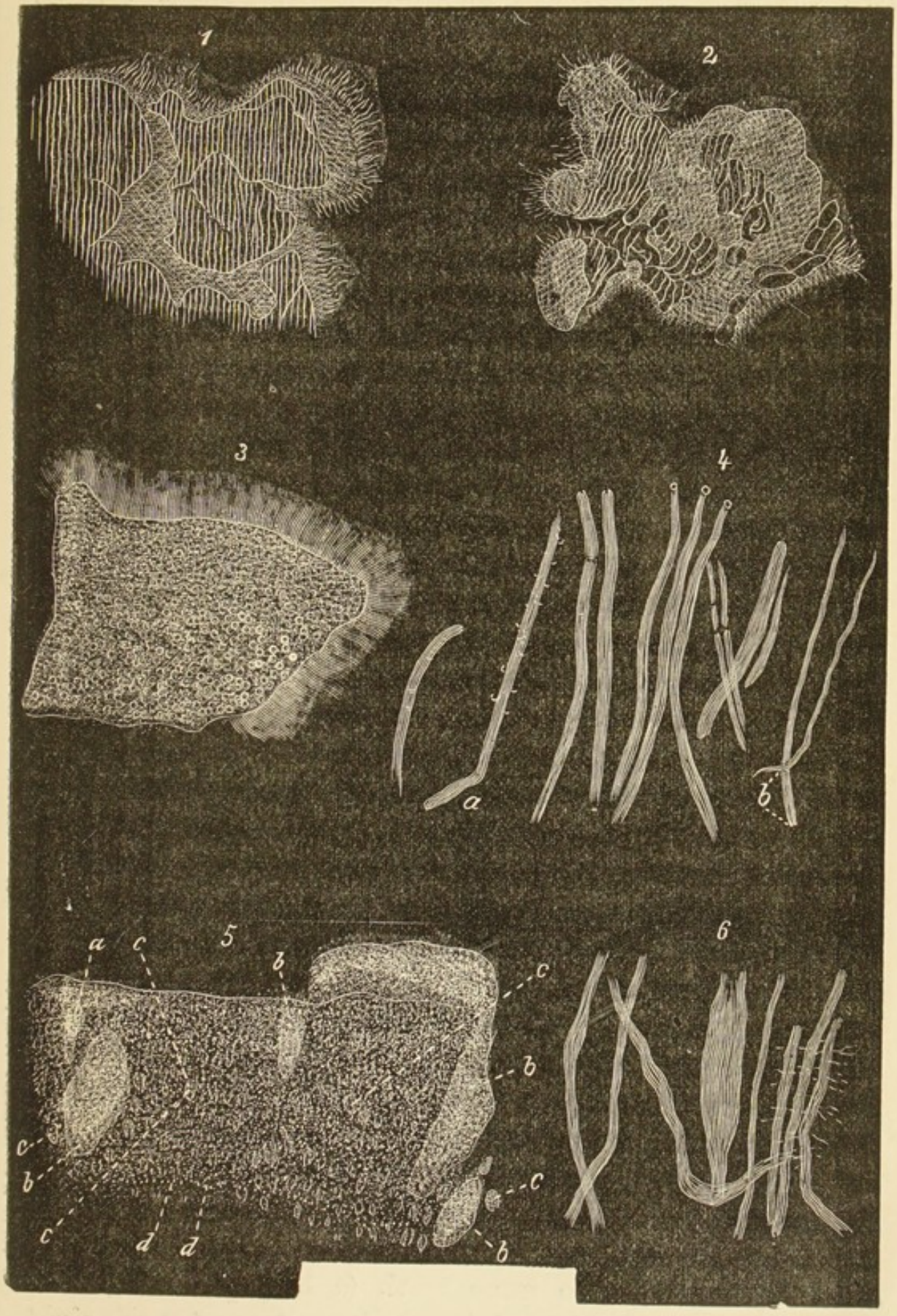

Plate 2.

On the free surface are hung filaments of the fungus, crossing the granulous masses.

Fig. 2 (magnified 100 times).

The decomposition of the dentine has made still greater progress. The particles are smaller and less voluminous than the surrounding layers of leptothrix.

Fig. 3 (magnified 100 times).

A transverse section of the surface of a cavity across the decayed dentine. The dental canals are considerably thickened (which is difficult to see in the longitudinal section of Figs. 1 and 2); on the surface there is a thick layer of very fine filaments of leptothrix.

Fig. 4 (magnified 250 times).

Canals isolated by chlorohydric acid, and coming from the decayed dentine. These canals have different degrees of thickness; their contents are divided into little packets—*a* is a much dilated canal, sending out narrow ramifications, detached from their original points by preparation; *b* shows two small tubes slightly dilated, one of which gradually becomes thicker.

Fig. 5 (magnified 200 times).

Transverse section of a decayed tooth of a hippopotamus. There is a layer of leptothrix on the surface; masses of leptothrix penetrate at *a*, going from the surface to the interior of the tissue, at the point *b*; they appear to be separate from the surface, because they have been obliquely crushed by the section. The dental canals are for the most part dilated (*c*); some still present their normal state (*d*).

Fig. 6 (magnified 250 times).

The canals of the same tooth (a hippopotamus), much dilated and presenting different sinuosities. On the right,

some are still united by fine fibres, which appear to be the remains of the dentine.

CHAPTER XII.

RECESSION OF THE GUMS AND LOOSENING OF THE TEETH.

RECESSION of the gums, and the loosening and fall of the teeth, generally result from inflammation of the gums, or of the alveolo-dental periosteum.

Among the causes of chronic dental periodontitis may be mentioned mercurial stomatitis, "saturnine" intoxication, scurvy, &c.; but it is the accumulation of tartar which seems to be the most active agent in the production of this serious affection.

Inflammation of the gums results sometimes from periodontitis, and also from other numerous causes; it brings on an obstruction, followed by redness and tumefaction. The gum soon ulcerates, ceases to adhere to the tooth, and causes abundant suppuration round the alveoli. Being thus deprived of its natural support, the tooth becomes loose, and it is not long before it falls out.

The gum does not always ulcerate round the tooth, but as it is loosened, the result is the same.

Generally speaking, inflammation of the gums begins with a slight irritation, produced by the presence of tartar. At first it is supposed that some particles of food have remained between the teeth, but the irritation soon spreads to the alveolo-dental periosteum, and the tooth ceases to adhere to the socket. If treated at the outset, the gum may be cured when it is only obstructed; but if the inflammation is allowed to go on, the gum festers, the tooth is laid bare, and soon falls out.

The recession of the gums, causing the loss of many teeth, is very frequent among the inhabitants of large towns. Those whose gums are softened, inflamed, and bleeding, are often foolish enough to ignore that they are seriously affected.

There are intermediate degrees between the simple inflammation of the gums and the loosening and fall of the teeth. In simple cases, the gum only presents a slight tumefaction, accompanied by a disagreeable odour of the breath. This form is most common, and is the result of a too substantial diet, the want of cleanliness of the mouth, and certain individual dispositions. This kind of affection can be easily cured.

However, if care be not taken, the malady does not remain stationary, and can become dangerous: for when neglected it develops considerably. It sometimes happens that a single gum is attacked, but more often all are diseased, and inflammation is spread to the alveolo-dental periosteum. From this time the tooth becomes loose.

At the same time that the gums tumefy they recede from the teeth, and it often happens that this recession is only noticed when too far advanced, and the tooth is no longer firm.

Inflammation of the gums often causes their ulceration; when it reaches the periosteum, the latter is entirely destroyed.

With a little experience the loosening of the teeth may at once be recognised; but if it have made considerable progress, the patient himself will notice that they are loose by the movements of his tongue. By this time it is almost impossible to save them.

As already stated, it is the accumulation of tartar round the teeth which most frequently causes them to become loose. Since it is so, the best thing to be done is first to remove the tartar, and then to prevent its return, which is easily effected by the daily use of a good astringent lotion.

CHAPTER XIII.

TOBACCO AND ITS ACTION ON THE DENTAL ORGANS.

We are constantly asked by habitual smokers, whether the action of tobacco is injurious to the teeth or not. Unfortunately they do not ask the question with a view to reform, but simply to find out to what extent their suffering is due to their insatiable love for tobacco.

People are not agreed as to the extent of the influence of this "weed" on the dental organs. In our opinion, they are wrong to suppose that tobacco exercises a *direct* influence on the teeth, but we quite admit that a daily use of it may *indirectly* injure them. It must not be forgotten that the principles it contains act on the organs which are in communication with the teeth. Again, as Professor Sklifasovski has shown, in an article published in a medical journal of St. Petersburg, the habit of smoking in the open air, in a rigorous climate subject to sudden changes of temperature, cannot fail to injure the enamel of the teeth.

Dr. Sklifasovski does not consider the nicotine and the disinfectant properties of tobacco-smoke capable of stopping the progress of caries; indeed, he declares that it often produces digestive troubles, troubles which, in their turn, have a deleterious influence on the dental system, and which principally manifest themselves by an irritation of the mucous membrane of the mouth and gums, thus exposing them to chronic inflammation.

The use of tobacco certainly increases the acidity of the stomach, and as it causes regurgitations from this organ, the teeth are often brought in contact with acids whose disastrous effects are well known.

Among the European nations, those of Sclavonic origin

are noted as the greatest smokers. It is also known that their teeth are in the worst state, which might naturally be attributed to the use of tobacco; but it must not be forgotten that they lose their teeth from other and no less serious causes connected with their social conditions.

However this may be, we will give our readers an extract from a statistic made by Dr. Sklifasovski. This professor, after having examined at St. Petersburg several persons of about the same age and of the same social position, who had come to this city from the different towns of Russia, arrived at the following conclusions:—

First.—That up to the age of twenty-six, it is rare to find people at St. Petersburg having all their teeth;

Second.—Molars are the teeth most often attacked by caries, which begins from the eighth year;

Third.—Among the molars, it is generally the wisdom-teeth which decay.

Carrying his inquiries still further, the learned professor discovered that 80 per cent. of the inhabitants of St. Petersburg have bad teeth; in the northern provinces, 65 per cent.; in the southern, 64 per cent.; and in the western, 58 per cent.

To return to the influence of tobacco, we do not hesitate to affirm that alveolo-dental periodontitis, many abscesses, and the loss of the teeth, are due to the extent to which some people indulge in smoking.

As we are quite aware that no advice will hinder smokers from pursuing their favourite habit, we content ourselves with recommending them to take more care of their teeth than people generally do; they may thus modify, in a great measure, the pernicious effects of tobacco on the dental organs.

CHAPTER XIV.

THE STOPPING OR FILLING OF TEETH.

THE filling of teeth is the most important, as well as the most useful, operation a dentist is called upon to perform. It is, unfortunately, but too little practised, and is a point of contention, which may be briefly stated thus:—Can a decayed tooth be so filled as to preserve it and render it still useful? Yes; it can—for a certain number of years, if not for life, provided a sufficient quantity remain undecayed. The result obtained with regard to the duration of the filling generally depends on the care taken afterwards. A filling made with a suitable material, and at an opportune moment, will almost invariably save the tooth, when the dentist can rely on the co-operation of the patient, who must take great care of his teeth when once the operation has been performed.

The remark is often made: "It is of no use stopping my tooth, the filling does not remain in it." If this be the case, it is generally the result of an imperfect operation; it is true that those connected with this branch of the profession are more seldom successful than others. Some dentists fill teeth with a substance in a half-consolidated state, or without having first well-prepared the cavity. All operations made under these circumstances are useless. To obtain a good result, and to be of some use, they must be irreproachably executed.

If only mechanical treatment be employed for the teeth, if their primitive organism, special condition, the age and temperament of the patient be ignored, it is useless to expect to succeed. All these things must be considered in connection with the treatment pursued. Nothing is so ridiculous

as to wish to establish absolute rules for these operations. A skilful dentist will always know what measures to take, and patients should submit to his judgment, which is certain to be better than their own.

It is not our intention to discuss here the relative merits of different materials. In our opinion, the duty of a conscientious dentist lies—not in removing the teeth to substitute others, but rather in treating and preserving them.

Various substances are used for filling; each has its advantages.

Up to the present, gold is the best material which has ever been used; at the same time, it is the most difficult to manipulate. Some dentists are more skilful than others in the use of gold; it offers great resistance to the force of mastication, and is not injurious to the teeth or other parts. Contact with destructive agents does not change it; this is more than can be said for any other material. Its colour gives rise to objections with regard to the front teeth, many people preferring to have a substance used of the same colour as the teeth, at the risk of having it often renewed, or even to have artificial teeth, rather than that gold should be seen every time they open the mouth. Its power of conducting sensations of heat and cold to the sensitive pulp is sometimes a great disadvantage, as it produces a continual irritation, loss of vitality, and suppuration; but a suitable treatment, and the interposition of a non-conducting substance between the filling and the sensitive part, will generally prevent these disagreeable occurrences.

In the filling of very large cavities requiring strong pressure, the periosteum is certainly often seriously affected, especially with people susceptible to irritating influences.

There is still another objection to the use of gold, that is, where the walls of the cavity are too thin, and it is doubtful if they will be able to resist the necessary pressure; for it is useless to be content with an imperfect, half-consolidated filling, merely for the sake of having gold in one's mouth.

There are various preparations of gold, and many more ways of manipulating it than those outside of the profession would imagine.

Among other substances used for the filling of teeth, may be mentioned various amalgams, platina, cement, oxychloride of zinc, a composition of gutta-percha, felspar, and quick-lime, prepared by Hill, Linn, Fletcher, and others.

The other substances used are similar to the preceding, and about equally useful.

CHAPTER XV.

EXTRACTION OF TEETH.

Of all operations that a dentist is called upon to perform, that of extraction is the one which a patient most dreads. The extraction of a tooth is very disagreeable and painful; there are people who are willing to suffer weeks together, rather than have it done; while others prefer to allow their denture partially or wholly to decay, although they are aware that this not only disfigures them, but is injurious to their health, and, by reason of the resulting offensive odour, is very disagreeable for those surrounding them. But when the operation is performed by a skilful dentist, it almost always succeeds.

Broken teeth and roots in an advanced state of decay, call for much tact in their extraction; while for others force is required.

There are cases where, as shown in Fig. 10, the roots are bent as in No. 1; exostosed, as No. 2; convex, as No. 3; or concave, as No. 4.

However, when a tooth in any of the above conditions is confided to a skilful dentist, it is rare that an accident

happens, for he knows how to assure himself beforehand of the direction of the tooth, and of the movements necessary for its extraction.

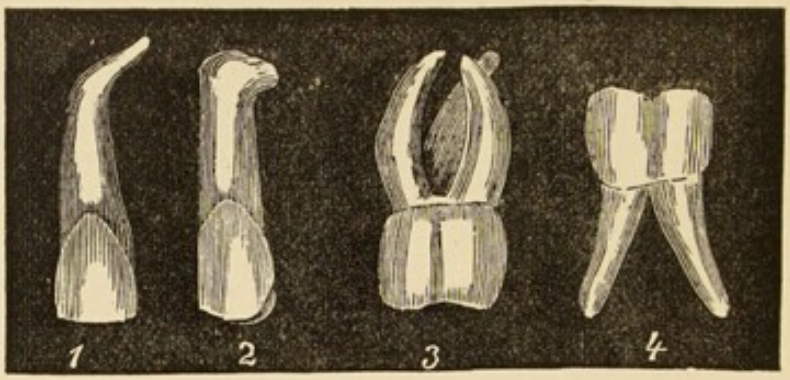

Fig. 10.

Painless Extraction of Teeth.

The means for the painless extraction of teeth are simple and highly recommended by all able dentists under every practicable circumstance. The use of a harmless anæsthetic, such as nitrous oxide or laughing gas, is without danger, and can in no wise have such a powerful influence on the economy as even ordinary extraction would have on the nervous system.

Dental Hæmorrhage.

The hæmorrhage following the extraction of a tooth is generally of short duration.

In exceptional cases, however, it lasts a considerable time, and then it requires treatment. In his desire to have it cease, the patient only prevents the blood congealing, which he ought rather to facilitate. If, however, the hæmorrhage continue, such astringents as alum, persulphate of iron, tannin, krameria, or substances which act mechanically, as burnt linen, powdered resin, &c., must be resorted to. Tannin is, perhaps, the most efficacious of all these astringents; it should be applied on a little cotton wool. Then if, in spite of all this, the bleeding still continue, compression must be

employed; a pledget of cotton wool, saturated with tannin, must be pressed into the socket of the extracted tooth, and held there by a piece of cork, in which a V-shaped groove has been cut to fit on the teeth, thereby better securing its position; it is kept in place, if necessary, by a bandage round the head. A hot foot-bath sometimes effectually diverts the circulation to other parts of the body, and the patient should maintain a vertical rather than recumbent position, as a further help.

CHAPTER XVI.

NITROUS OXIDE GAS.

NITROUS oxide gas was discovered by Priestly in 1776. He procured it by exposing binoxide of nitrogen to the action of iron, which deprived it of a portion of its oxygen, and transformed it into nitrous oxide. Very little was known, however, of its properties, until Sir Humphry Davy, by a series of experiments, discovered its character.

The inhalations made by himself and many others induced him to write the following prophetic paragraph:

"As nitrous oxide in its extensive operations seems capable of destroying physical pain, it may probably be used to advantage during surgical operations in which no great effusion of blood takes place."

After numerous trials, the process now universally employed was devised; it consists in decomposing crystals of ammonia by heat.

Those who inhale the gas experience a pleasant intoxication, which acts on them in such a way as to make them fancy themselves endowed with new organs. Davy was full of hope that nitrous oxide would speedily be adopted in medicine; yet, strange to say, this did not induce him to

extend his researches in this direction, and thus give to the world what has since been considered one of the greatest boons to suffering humanity.

It must be remarked that, at that time, the operations for which it is now used with most success (as the extraction of teeth) were performed with very primitive instruments, which would have prevented its advantages from being recognised. Now, thanks to the superior instruments in use, the influence of nitrous oxide lasts much longer than the time required for minor operations.

It is evident that, in the great chain of discovery in all branches of knowledge, each requires the more perfect complement of the collateral branches, in order to give full effect to its own intrinsic merits.

Davy's prophecy remained unfulfilled for forty-four years. During this long period, everything went on just as though there were no method capable of mitigating the pain in surgical operations.

The honour of the discovery of the anæsthetic properties of nitrous oxide is due to Horace Wells, an American dentist. This discovery gave an impetus to fresh experiments with anæsthetics, which led, finally, to the introduction of æther and chloroform into surgical operations.

Horace Wells first tried the experiment on himself. While under the influence of the gas, he had a tooth extracted and felt no pain. He repeated the experiment before a certain number of persons; then, proud of the result obtained, presented himself before the faculty and students of Hartford (United States), and in their presence extracted a tooth for a person to whom he had previously administered "laughing gas." During the operation this person accidentally struck his foot against a sofa, severely bruised himself, and exclaimed as though conscious of pain, though, on recovering from the effects of the gas, he denied having suffered. The apparent failure was probably due to the celebrated doctor's having used nitrous oxide mixed with a little bin-

oxide of nitrogen, or his not having employed a sufficient quantity of anæsthetic to control completely the boisterous condition of the patient.

However that may be, he did not succeed in convincing those present, who were all ready to treat him as an impostor, and a general laugh was raised among them.

Wells then abandoned his precious discovery for a time, and continued his researches on the properties of æther. Returning, however, to nitrous oxide, he subsequently travelled from place to place, hoping to make his discovery more widely known, but was everywhere repulsed.

Then, mastered by despair, like a second Seneca, he got into a warm bath, opened four veins, and, in order that his discovery might at least be of some use to himself, inhaled a quantity of nitrous oxide, and died thus, disowned by humanity, to whom his bequest has since rendered such great and lasting services.

Preparation of Nitrous Oxide Gas.

The manufacture of nitrous oxide gas may be regarded as easily accomplished by those who often prepare it. But the intricate manipulations which it requires render its preparation difficult for those unaccustomed to it.

The chemical symbol for nitrous oxide is NO; its equivalent number 22, and its density 1·5.

The first and most important point in the manufacture of this gas, is the use of the apparatus shown in Fig. 11.

This form of gasometer is extensively employed at the present time, and always gives satisfaction.

It is not our intention to express an opinion here as to the relative value of different gasometers, neither can we, within the limits of this little treatise, enter into a detailed description of the various apparatus. We merely state that no gasometer should be used that is not in perfect condition.

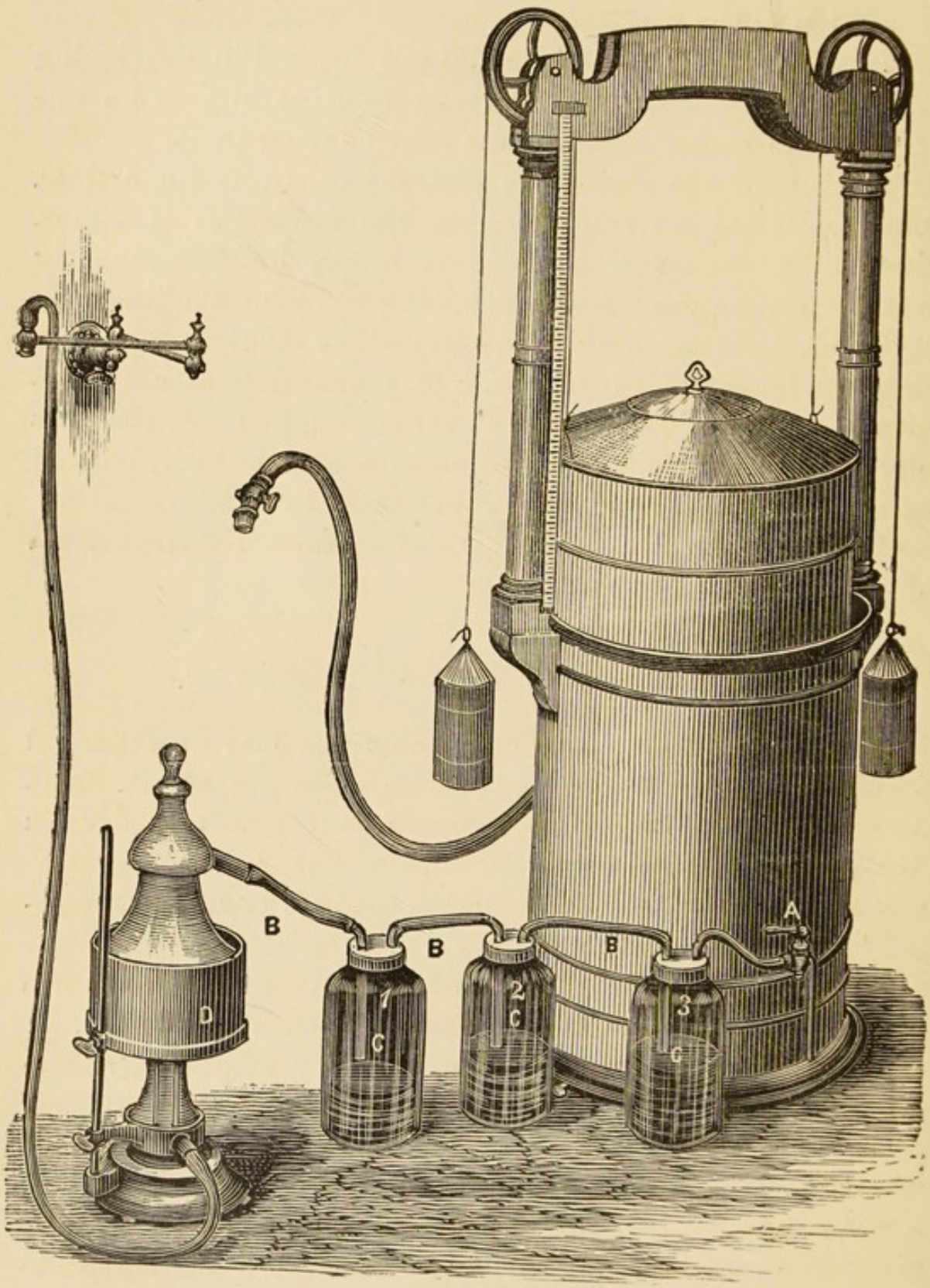

Fig. 11.

Description of the Apparatus, and Mode of Preparation.

No 1 represents a gasometer ready for use. The holder is first filled with water, to within an inch and a half of the top. Then the weights are taken away and the spigots opened, so that the air may pass out, and the receiver remain in position. When the holder is filled, the spigot A is closed, and the weights are replaced. The apparatus is then ready to receive the gas; the wash-bottles are next arranged. They are placed as represented in Nos. 1, 2, 3, and are connected one with the other and with the retort and gasometer by means of the gutta-percha tube B. The first bottle, placed near the retort, is only used to catch the drops of water resulting from condensed vapour.

The long tube No. 1 must not be submerged in water, as it would interrupt the free passage of the gas.

In the second bottle about a quarter of a pound of sulphate of iron is put, to which is added sufficient water to cover the end of tube C, to one and a half or two inches. As a rule nothing but fresh water is put into wash-bottle No 3; some manipulators, however, add caustic potash. There must be sufficient water to allow the tube to sink to about the same depth as it does in No. 2. In arranging the bottles, care must be taken that the dip-pipe be fixed to the tube B, and to the gasometer. If they are properly arranged, a current of air blown into the tube connecting with the retort, will cause the water to bubble into the wash-bottles Nos. 2 and 3. If the spigot A be opened, the receiver will rise.

When the bottles are ready and well connected, the quantity of ammonia intended to be used is placed in the retort. One pound will make about thirty gallons of gas. D is a little stove with a sand-dish for holding and heating

the retort. Enough sand must be put into this dish to protect the retort, or the heat will crack it.

The retort is then placed in it, and connected with the long pipe of the first bottle by the gutta-percha tube, after which the spigot of the gasometer is opened.

Thus obtained, nitrous oxide is a colourless, inodorous gas, of sweetish flavour. In ordinary temperature its density is 1·5; it solidifies at 100° below zero, and becomes liquid at 0° under an atmospheric pressure of 30°. It is almost as vigorous a supporter of combustion as oxygen itself. The reason of this is that nitrous oxide is very rich in oxygen.

Nitrous oxide has considerable advantages over other anæsthetic agents. Used in a pure state, it is perfectly harmless. The Americans utilised it long before it was introduced into Europe, and it is only recently that it has been brought into daily use.

The Physiological Action of Nitrous Oxide Gas.

In order to give our readers an idea of the physiological effects of nitrous oxide, we cannot do better than quote some of the experiments recorded in one of his works, by Sir Humphry Davy, after inhaling this gas.

This is what he says of the first experiment: "With the first inhalation I took in the contents of the vessel. A sweet taste filled my mouth and chest, which dilated under its influence. I breathed again, but at the third inhalation I heard a ringing in my ears, and I dropped the vessel.

"At this moment, although I had not quite lost consciousness, I turned my eyes in a giddy sort of way; then I broke out into a fit of laughing, such as I had never done before. After a few moments, all wish to laugh suddenly ceased, and I felt nothing extraordinary. I repeated the experiment at the same sitting, but the wish to laugh did not occur again."

Some days after a new experiment took place, consisting in the inhalation of about a gallon of nitrous oxide. Davy describes it thus:—"The first inspirations occasioned a slight degree of giddiness, succeeded by a sensation analogous to gentle pressure on all the muscles, attended by a highly pleasurable thrilling, particularly in the chest and the extremities. The objects around me became dazzling, and my hearing more acute. Towards the last inspirations, the thrilling increased, the sense of muscular power became greater, and at last an irresistible propensity to action was indulged in. I recollect but indistinctly what followed; I know that my motions were various and violent.

"By degrees, as the pleasurable sensations increased, I lost all connection with external things; trains of vivid, visible images rapidly passed through my mind, and were connected with words in such a manner, as to produce perceptions perfectly novel. I existed in a world of newly connected and newly modified ideas. I theorised—I imagined that I made discoveries. When I was awakened from this semi-delirious trance by Dr. Kingslake, who took the bag from my mouth, indignation and pride were the first feelings produced by the sight of the persons around me. My emotions were enthusiastic and sublime, and for a minute I walked round the room, perfectly regardless of what was said to me. As I recovered my former state of mind, I felt an inclination to communicate the discoveries I had made during the experiment. I endeavoured to recall the ideas—they were feeble and indistinct; one collection of terms, however, presented itself; and with the most intense belief and prophetic manner, I exclaimed to Dr. Kingslake, 'Nothing exists but thoughts! The universe is composed of impressions, ideas, pleasures, and pains.'"

The following were Davy's impressions after another experiment, at which he had inhaled a considerable quantity of gas after certain mental excitement:—"On May 5th, at

night, after walking for an hour amid the scenery of the Avon, at this period rendered exquisitely beautiful by bright moonshine, my mind being in a state of agreeable feeling, I inspired six quarts of newly-prepared nitrous oxide. The thrilling was very rapidly produced. The pleasurable sensation was at first local, and perceived in the lips and about the cheeks. It gradually, however, diffused itself over the whole body, and in the middle of the experiment was for a moment so intense and pure as to absorb existence. At this moment, and not before, I lost consciousness. The thrilling and the pleasurable feeling continued for many minutes; I felt, two hours afterward, a slight recurrence of them in the intermediate state between sleeping and waking, and I had during the whole of the night vivid and agreeable dreams."

Throughout Europe Davy's experiments excited much interest, and they were repeated on a large scale.

The naturalist Pictet gives the following account of an experiment to which he was invited by Rumford:—"There were five or six of us ready to make the trial, and in my quality of foreigner, I was privileged to begin. At the third or fourth inspiration, I entered into a series of rapid sensations quite new to me, and difficult to describe. The principal effect was felt in the head; I heard a buzzing sound; the surrounding objects became larger, and it seemed to me that my head rapidly increased in size; I only saw indistinctly, as through a mist; I thought I had left this world, and was rising to the empyrean; however, I distinctly remember being very glad to feel that my friends were near me, and particularly Count Rumford, who, as we had agreed, counted the beatings of my pulse, which had become so irregular that it was impossible to follow it. I then left off inhaling the gas, and entered into a calm, languid, but agreeable state. Far from seeking muscular power, I shrank from all movement; I experienced, in an exalted manner, the feeling of simple existence, and wished for

nothing more. In a few minutes, I returned to my normal state.

"Mr. Blackford succeeded me; the effect on him was quite different—an extreme activity, almost approaching convulsions; then noisy mirth, followed by calmer enjoyment; and lastly, the normal state.

"Then came Mr. Eighe. He was not of the languid class, and became so excited after the inhalation, that, when it was necessary to remove the vessel, he held it with all his might, till at last, overcome, he began to laugh and talk with vivacity; he said that he had never experienced anything so agreeable in his life before."

It must be confessed that the researches on the physiological action of nitrous oxide have left the subject in a very obscure state. Certain physiologists think that it acts by asphyxia. We think it best to say with Dr. Evans* that there is no word in the whole modern scientific vocabulary so misapplied as the word asphyxia, when it is used to express that the blood is insufficiently supplied with oxygen, and that it contains too great a proportion of carbonic acid. In fact, there is nothing in the action of nitrous oxide producing a similar result. If there is a slight analogy, there is a much greater difference.

It is not our intention to speak further of the physiological action of nitrous oxide: we will merely add a few words as to its administration.

The Administration of Nitrous Oxide Gas.

The "*modus operandi*," or administration of nitrous oxide, is very important. It is not absolutely necessary that the operator possess extensive scientific acquirements, or be familiar with its medicinal or physiological effects, for all

* "On the Physiological Action of Nitrous Oxide Gas," by T. W. Evans, M.D., D.D.S. Paris.

will prove useless unless he be experienced, and thoroughly conversant with the precautions which it is necessary to take. Those to whom nitrous oxide is administered are nearly always nervous, and ignorant of the action of anæsthetics, or they are children or persons suffering from organic diseases, or, still more frequently, fanciful patients. In all cases, the operator must be self-possessed, and able to meet the inquiries constantly made with practical answers, assuring the patient as to the safety of the anæsthetic.

Many people, outside of our profession, imagine that the extraction of teeth is a very disagreeable branch of dentistry. As we are forced to confess that extraction is sometimes necessary, so we must point out that there are cases when it becomes even agreeable. Consider the immense service expected of us! When we see people enduring torture, ready to bless our intervention, should we not feel a certain satisfaction? Is it not agreeable to the operator who has done his best, to be heartily thanked for the present relief, and the assurance of future tranquillity which he has given?

Local Anæsthesia.

Different means have been employed for effecting local anæsthesia, such as compression, electricity, &c., but the most efficacious method is, undoubtedly, that which occasions insensibility by congelation.

To obtain it, recourse is had to a refrigerating mixture; or the spray-producer, invented by Dr. Richardson, is adopted. This consists of a graduated glass bottle, and tube to insert in the same, with straight, curved, and double jets for various positions in the mouth, a tongue and cheek holder, and an elastic-connecting tube with hand-bellows.

Various substances which are susceptible of rapid volatilization may be used with this instrument, by means of which a refrigerating jet is syringed over the part to be operated

upon. The substances most commonly employed are æther and rigoline; but as the latter is a very volatile product, the effect is only temporary, and repeated applications must be made.

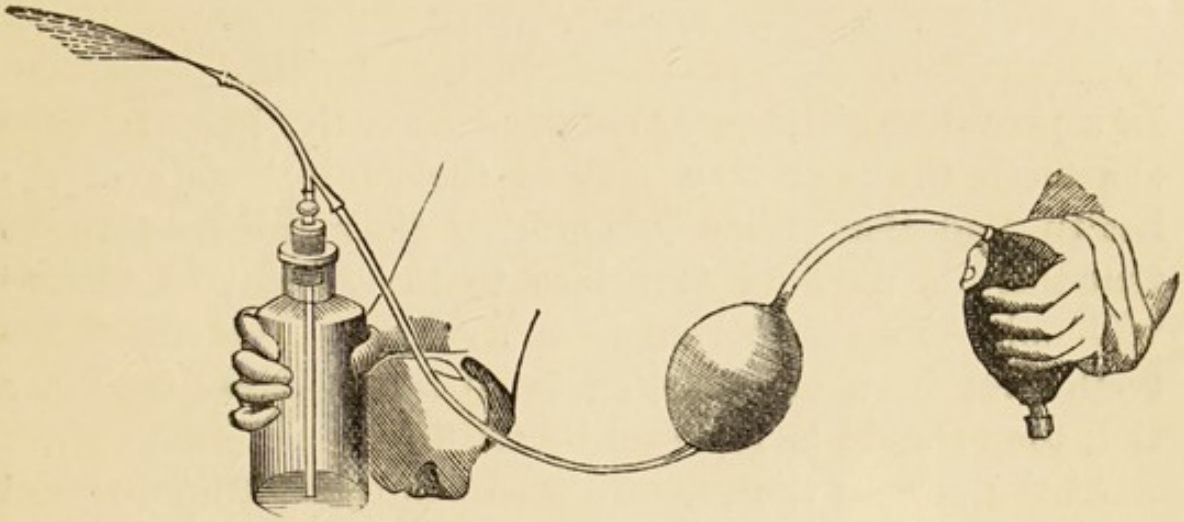

Fig. 12. RICHARDSON'S SPRAY-PRODUCER.

This apparatus allows a great quantity of æther to be injected in a few minutes. On evaporating, these substances produce an almost immediate congealing of the tissues.

But as this congelation only reaches the superficial layers, the spray-producer will be of no use whatever where deep tissues are concerned.

It is, therefore, useless to say that neither this method, nor that of electricity and compression can successfully compete with nitrous oxide.

CHAPTER XVII.

ARTIFICIAL TEETH.

In a preceding chapter we enlarged upon the importance of the teeth, the part they play in the general state of the health, and the utility of ensuring their preservation, so that there is no need to return to the subject here. We will only say that when, from some cause or other, the teeth have been extracted or lost, it is absolutely necessary that they should be replaced by artificial ones.

At the present time, nature is so well copied that artificial teeth can, and do, successfully replace real ones, both as to form and functions. It might be supposed that the ancients ignored this branch of dentistry; but this is not the case. There are to this day undeniable proofs that artificial teeth existed even before the Christian era.

Several kinds of teeth are employed, possessing different qualities and advantages; we will only speak of those most in use—mineral teeth. They have all the advantages of the others without their drawbacks, and were first brought to their actual degree of perfection in America. They are resisting, unchangeable, and susceptible of taking the colour necessary to make them resemble natural teeth.

Various substances are used as bases for artificial dentures; as vulcanite, gold, platinum, celluloid, aluminium, and others which it is unnecessary to mention here.

Vulcanised rubber is used with the greatest success, and in greatest proportion, as a base for artificial teeth; it makes a most perfect "fit," and adjusts itself to the primitive contour of the mouth and cheeks. It forms a very compact light plate, easily kept clean, exempt from cavities which would retain particles of food, and is free from all odour

or unpleasant flavour. It has been called gutta-percha, rose-pearl, amber, &c.

A combination of gold, or of platinum, and vulcanite is likewise used. It consists of a vulcanite base, plated with gold or platinum. By this means a much thinner plate can be obtained than is possible with vulcanite alone, and, at the same time, its power of resistance is increased.

Gold was the most ancient material employed for this purpose; 400 years B.C., it must have been used, since the "Laws of the Twelve Tables" forbade that the dead should be buried with gold, making an exception for that contained in the mouth to support the teeth. Now, it is not so much used as it was formerly, except for partial dentures, and it has been advantageously replaced by other substances. However, where a gold base is preferred, it can be made perfectly well.

Silver is rarely used as a substitute for gold; it corrodes so easily in the mouth that it is unfit for this purpose.

Aluminium is the most recently introduced material as a base for artificial teeth. The plate is made of this metal, and the teeth are fixed to it by vulcanite or some other substance; as it is very light and does not easily corrode in the mouth, it forms a convenient base; in many cases it is even preferable to vulcanite.

Celluloid is also successfully used. Although this substance has only recently been introduced into the manufacture of artificial dentures, many good results are expected from it. It is very light, and in colour much resembles the natural gum.

Artificial teeth, to fulfil all required of them, must possess the following qualities:—they must further mastication; restore the natural contour of the face; their form and position must be in harmony with the complexion, temperament, and expression of the face; they must allow of facility and exactitude in articulation; and, lastly, be convenient and comfortable.

To obtain these results, there must necessarily be a knowledge of the mechanism necessary for adapting hard, inert substances to living parts; the adhesion must be perfect enough to be supported by atmospheric pressure, which is achieved by a mechanical effort. This result is obtained by experience, and by particular attention bestowed upon the workmanship.

The choice of appropriate teeth for each jaw requires a thorough knowledge of anatomy and physiology, and the capacity for recognising the temperaments and peculiarities of the points to which the denture is fixed.

It is ignorance that causes so many errors in the choice and disposition of artificial teeth, and so much unpleasantness to the persons using them, who are frequently tempted to mistrust the utility of such teeth. The same results follow the want of skill in applying acquired knowledge.

For the most part, artificial teeth should, and can, be so arranged as to deceive the most minute observer.

The greater number of teeth now used are chosen from the large stocks kept by many dentists, or they are procured from a dental depôt; occasionally, however, it is necessary to make teeth for special cases.

Sometimes the teeth are dyed or coloured before mounting, that they may be in accordance with the natural ones. Holes have been drilled in artificial teeth and filled with gold, making them look like natural teeth that have been stopped. The great object of the dentist, as regards the appearance of artificial teeth, should be to make his work resemble nature as much as possible. It is well proved that the attempts made to copy natural dentures recompense by the beauty of the result obtained, the application to the work of all the principles of art.

No matter how anatomically correct or how skilfully adapted for speech and mastication, an artificial denture may be, if it does not bear the relation demanded by age,

and is not in harmony with the facial contour, its artificiality will be so prominent as to be easily recognised by everybody.

A distinct articulation of words is very important, and depends on the perfection of the organs producing it. The want of clearness of speech in persons possessing an imperfect palate, is noticed at once.

This is the principal defect in organs used in the production of artificial sounds. The difficulty is heightened when connected with hare-lip, as it often involves the displacing of the front teeth.

These teeth themselves are not only essential for the production of clear sounds, but the slightest deviation from their normal position causes disadvantageous modifications of the voice.

It is evident that the least change in the muscles of the face, caused by the loss of teeth, must modify the voice in proportion to that change. To preserve as much as possible the normal state of all parts, it is necessary to have artificial teeth inserted before the muscles have contracted, or habits, afterwards difficult to break, been acquired. A plate fixed to the gums immediately after the loss of teeth, will keep the lips and cheeks in their natural position, and in a great measure hinder the absorption of the ridges, which would certainly occur without the protection of the plate and teeth.

Different Kinds of Plates.

Suction Plates.—Any one having a slight knowledge of physics will be familiar with the instrument which serves to show the force of atmospheric pressure, and which is known by the name of "The Magdeburg Hemispheres."* This

*So called from the discoverer, Otto Von Guerike, of Magdeburg, the inventor of the air-pump.

instrument is composed of two hollow spherical caps (*a*, *b*), generally made of copper, fitting one into the other, but easily separating when struck. If the air within be exhausted, or, in one word, if the apparatus be emptied, it is impossible to separate the two hemispheres until a quantity of air has been let in (by a tap fixed for the purpose, *c*) sufficient to equal the external atmospheric pressure. This result is owing to the fact that when the hemispheres are in a state of so-called physical emptiness (for it is impossible to arrive at a perfect vacuum), they are subjected to an external pressure equal in weight to a column of air eighty kilometres high, and of equal surface to the hemispheres.

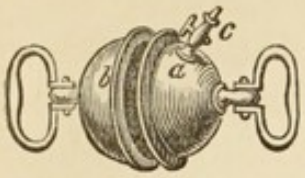

Fig. 13.

The idea of making suction dentures was taken from the old principle—by the way, a false one—that nature abhors a vacuum.

When they are applied to the place reserved for them, and the mass of air contained between them and the surface on which they are fixed is violently expelled, a vacuum is produced, and—thanks to the principle just described—the adhesion is perfect.

Now, one tooth is made and arranged with as much facility as an entire denture.

Pivot Teeth.—These teeth, as their name indicates, are provided with cylindrical or square pivots, which are inserted into solid roots. There is no artificial substitute that imitates nature so completely. However, they can rarely be fitted into small molars, on account of the irregularity of the form of their roots.

Numerous are the systems for inserting pivot teeth, but however great their advantage may be, since they do not require the plate, it is better, when many teeth are missing, to have recourse to a suction or other denture.

When the pivot teeth are carefully inserted, they rarely have to be renewed.

As to suction dentures, they require most care, and present most difficulties for their adaptation, which ought always to be perfect. It but too often happens that the plate has been badly soldered, or the shape altered while the teeth were being fixed, and then the denture is of no use. We therefore quite agree with Professor Harris, when he says that "when the greatest precaution and judicious skill are not brought to bear upon the manufacture of these dentures, they must be expected to fail completely, or at least, if adapted, be of no use or advantage."

Many practitioners have tried to insert teeth in this way, and, failing, have condemned the method, whilst their failure should be attributed to some fault committed in the adaptation of the plate to the gums. A great many failures are due to the pieces being placed too soon. In fact, although the plate on which the teeth are fixed adapts itself to the form of the gum at the moment it is applied, it will soon cease to fit so exactly, if sufficient time has not been allowed for the alveolar borders to change, as they always do after the extraction of natural teeth. When this is the case, the air enters between the plate and the gums, and the apparatus no longer retains its position. If, on the contrary, sufficient time be allowed for these changes to take place, the apparatus will last long and hold well.

It is, then, evident that economy must not be people's first consideration in procuring artificial teeth, for they thus expose themselves to many annoyances, and, after all, badly made dentures are of no use. How many people there are who abuse dentists and the dental art! Yet when the cause of their resentment is known, it always turns out that they have been operated on by an inexperienced manipulator. They wished to practise economy, and rather than confess that they were wrong to do so where their health was concerned, they speak ill of dentists in general.

Pivot teeth should hold firmly from the moment they are

inserted; suction plates, on the contrary, are at first comparatively loose, but they gradually become tighter.

Whatever care be taken with artificial plates, it is rare that they do not require some after-finishing touches.

As a general rule, it can be said that a person using artificial teeth for the first time, or after having long disused them, finds an embarrassment in mastication and enunciation, and even vomiting may occur. But it is well to know that these troubles are of short duration, and sometimes cease after the first hour.

We must add that many patients, when shown the plate destined for them, before they have even tried it, exclaim that they will never be able to accustom themselves to it; they will not be the same; the apparatus is ugly, uncomfortable, &c., &c. However, when they have become more reconciled to the idea, and after the finishing touches, nearly always necessary, have been added, they can judge that it will be easy for them to make use of their apparatus, and that they will soon find it very convenient.

To use a plate to advantage, patience and experience are both assuredly necessary.

In ordinary cases, patients are not inconvenienced by the plates prepared for them, and are satisfied from the beginning. In order to succeed, we only ask of our patients confidence and the time necessary for the treatment of their dentures.* It must not be supposed that artificial teeth are exempt from change. Therefore, the same attention must be paid to them as though they were natural; they must be brushed, washed, and powder must be used.

* The illustrious Washington, who had far more serious occupations than attending to his teeth, nevertheless took great care of them, as the following letter, written to his dentist, Greenwood, will prove. He writes—"My dear friend, for nine months I have been wearing your excellent machine; I am beginning to speak well, and I foresee the day, not far off, when I shall be able to eat; send me several springs, for they wear away quickly, and I am often obliged to replace them." Washington was not discouraged at the end of nine months; could not others follow his example, and wait patiently nine hours?

The artificial pieces should be taken out every evening, so as to give the gums time to repose from their contact (of course, this does not refer to pivot teeth), and allow of their being more thoroughly cleansed. It must not be forgotten that, if artificial teeth remain too long in the mouth, they infallibly cause such accidents as ulceration of the gums.

In cases where, for imperious reasons, the dentures cannot be dispensed with for the night, it would be well to change them on going to bed.

The dentures must always be placed in a certain quantity of cold water for the night to refresh all the parts.

If the molars are lost, they must at once be replaced, for they not only serve for mastication, but are a support for the other teeth, which, being isolated, will not be long in falling out. The habit of masticating with the front teeth must be avoided, for if continued, the upper ones will be pushed out of position or worn away, on account of the action exercised by the lower, resulting in an ugly deformity.

The sole function of the incisors is to cut or separate food, and they should be put to no other use.

In conclusion, we will say that the smallest artificial pieces require very careful work. They can only be made by a very experienced dentist, and a certain length of time is necessary for their perfection. When it is known, for example, that suction dentures are only held by atmospheric pressure, it is easy to understand with what precision they must be adapted, and how perfect their adhesion must be.

In the purchase of dentures, money should always be a secondary consideration. In fact, when a piece is not in good condition, only bad results, or, still oftener, grave accidents, can be expected. It is also well to know that isolated artificial teeth, when they are not irreproachably inserted, are of very doubtful use, and always bring on the decay or fall of their neighbours, instead of lending them the support they need.

L'ENVOI.

One word in conclusion:—In writing this little work, my object has been to render a service not only to my own patients, but to the general public. If I have succeeded in making the importance of the care of the teeth more widely known, and the profession that renders their preservation a speciality better valued, I shall be abundantly rewarded.

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