A new treatise on the theory and practice of dental surgery / by J. Lefoulon ; translated from the French, for the American library of dental science, by Thomas E. Bond, jr.

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A

NEW TREATISE

ON THE

THEORY AND PRACTICE

OF

DENTAL SURGERY.

BY J. LEFOULON,

SURGEON DENTIST, PARIS.

Translated from the French, for the American Library of Dental Science,

BY THOMAS E. BOND, JR., M. D., A. M.

PROFESSOR OF SPECIAL PATHOLOGY AND THERAPEUTICS IN THE BALTIMORE COLLEGE OF DENTAL SURGERY.

To extract is not to cure, but to destroy.

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A

PRACTICAL TREATISE ON THE DENTAL ART.

PART I.

ANATOMY, PHYSIOLOGY AND HYGIENE.

CHAPTER I.

Sec. 1. *Description of the Mouth.*

The nature of our work will not permit us to enter upon long details in describing the mouth and the bones that compose it: there are special treatises upon this subject, which will afford full information to any of our readers who may desire more complete knowledge upon this point. As we address ourselves to practical men, whom we do not wish to embarrass by the niceties of microscopical anatomy, we will content ourselves with describing the principal organs which enter into the construction of the buccal apparatus, and which have direct relation to the physiological or pathological state of the dental system. The mouth is an irregularly ovoid cavity, bounded anteriorly by the jaws, behind by the velam of the palate and opening of the gullet, above by the vault of the palate, and below by the tongue and buccal membranes. This cavity communicates with the exterior by an opening comprised between the two lips, which are two membranous folds, whose organization, which is very complete, is made up of beard, muscles, sebacious glands, vessels, nerves and mucous membranes. Their arteries are chiefly derived from the external carotids; their veins communicate with the jugulars, and their nerves emanate from the sub-orbital, the mental, and the facial branches. The lymphatic vessels, which are very abundant, open into the submental trunks.

On the side opposite to the lips, we discover the velum of the palate, a sort of movable partition, terminating below in two prolongations called pillars, which are separated by a mass of sebacious follicules, the tonsils or amygdalæ.

The lateral walls are formed by the two cheeks, which consist of three distinct tissues—the skin, muscles, and mucous membrane. This last, which interests us more than the rest, presents behind, between the buccinator and masseter muscles, an agglomeration of follicules of a sub-mucous character, which are called molar glands. The excretory duct of these glands opens opposite to the last molar tooth. Their nerves come from the sub-orbital, facial, buccal, masseteric, and from the cervical plexus.

The palate is the vault of the buccal cavity. Its mucous membrane which presents transverse rugosities, has less thickness and redness than the other parts of the mouth. Containing a multitude of follicular orifices it is continuous anteriorly and laterally with the gums. These last are formed of three distinct membranes, laid upon one another, and compose that red, firm and solid tissue which these organs present in the healthy state. These three tissues are 1st, the mucous membrane; 2d, a species of pulpy tissue; 3d, a fibrous membrane which is prolonged into the alveoli and forms the sacks or matrices of the teeth.

The lower part of the mouth, exhibits, under the tongue, a fold, called the frenum. The buccal cavity, when the jaws are closed, is filled by the tongue, a symmetrical organ, which, being endowed with powerful muscles, in certain cases, as in the frequent pronunciation of dental sounds, presses upon the incisors and ultimately pushes them forward.

Sec. 2. *Of the Bones of the Jaws.*

We will now say a word about the maxillary bones. It is important to trace through them the canals through which pass the nerves and blood-vessels of the teeth. The superior and inferior maxillary bones have been described by a sufficient number of anatomists to render it unnecessary for us to perform that task for the hundred-thousandth time. We will only describe such parts of their structure as are most interesting to us. These are, the dental canals and the alveolar processes. In the

upper maxillaries, we see, towards their smaller and external part, a groove, which soon changes to a canal. This canal lodges the sub-orbital vessels and nerves, and divides itself anteriorly into two channels, one of which, the superior, is the sub-orbital hole, properly so called, and the other, the inferior, is buried in the thickness of the smaller and anterior wall of the maxillary sinus, where its passage is marked by a furrow more or less distinct. It is this lower canal which anatomists have called the superior and inferior dental canal; it is this which protects the vessels and nerves, which supply the roots of the superior incisor and canine teeth. Finally, the sub-orbital canal, continuing its primitive course, terminates by a large opening, called the inferior orbital foramen, by which the vessels and nerves are conducted to expand themselves over a large portion of the face. At the lower part of the external face of the superior maxillary bones, we see the external side of the superior alveolar arch; that portion of the arch is thin before, thick behind, and bent inwards. Its external side is convex, exhibiting projections which correspond to the alveoli, and depressions which correspond to their partitions.

It is well also to mention, in passing, the maxillary sinus, a sort of three-sided pyramid, in which caries of the first molar teeth sometimes causes abscesses, calling for extraction.

The inferior maxillary bone, situated in the anterior and inferior part of the face, is symmetrical, flattened from before backward, and of a parabolic form, but the extremities of the curve are bent more or less at right angles, according to their thickness. On the external face of this bone, we remark a line, which bears the name of the "oblique line." At the smaller part of this line, below the root of the first or second small molar, we perceive the external orifice of the inferior dental canal, or the mental hole which gives passage to nerves and vessels of the same name. On the internal face we remark, the entrance of the maxillary or inferior dental canal which protects the inferior dental vessels and nerves. These sub-divide and introduce themselves by small particular canals, which pass from the bottom of the alveolar cavity to the roots of the teeth above. Finally, this canal, before ending, doubles on itself and bifur-

cates into two conduits, of which the largest constitutes the mental hole, and the other directs itself towards the first small molar or canine tooth; then it again subdivides to go by yet other channels to the roots of the incisors, whose nerves and vessels it encloses.

Before concluding what we have to say about the maxillary bones, it will be useful to say a little about the changes which they present at different periods of life, this point being important to the surgeon dentist.

In the fœtus the maxillary bones are extremely small. As the child grows, they augment their volume in every sense; that is, by the development of the teeth and the enlargement of the sinus.

At the age of two years, the size of the maxillaries augments considerably by the appearance of the milk teeth to the number of ten. At four years the triangular form of the sinus begins to manifest itself, the orbitary apophyses are very acute and do not connect to the adjacent bone. After the complete evolution of the first dentition, the inferior border of the two superior maxillary bones presents only ten alveoli, while later in life it contains sixteen, for the lodgment of an equal number of permanent teeth. When the work of the second dentition is entirely accomplished, the development of the superior maxillaries is finished in a remarkable manner—but that of the sinus always proceeds slowly. At the approach of adult age, the tuberosities of the maxillary are thrown out by the evolution of the wisdom teeth, and this is so true, that after their appearance these tuberosities flatten, and in old men disappear altogether. At advanced age the canine and myrtiform fossæ are very well marked,—the sinus enlarges, the teeth fall out, the alveoli disappear, the alveolar border is thinned, the gums consolidate and finally become hard. In infancy the rami of the inferior maxillary bones, far from having a perpendicular direction, are thrown backward and form a very obtuse angle with the body of the bone.

The more nearly the child approaches adolescence, the more do the rami become erect; and in adult age they are almost perpendicular. In old men, the teeth and alveoli of the lower jaw undergo similar changes with those in the upper. The

symphysis of the chin becomes salient and forms the peculiar chin of the aged.

As to the rami, they incline a little backward, as in infancy. The posterior angles presenting remarkable prominences under the skin. Happily for men at this age, the gums become hard and callous, and thus very much facilitate mastication.

Sec. 3. *The Dental Vessels.*

Three orders of vessels are distributed to the jaws, these are the arteries, veins and lymphatics.

1st. *The Arteries.* Those which supply the jaws and teeth, come off from the internal maxillary. The divisions of this artery are, for the upper jaw, the sub-orbital and superior alveolar branches; for the lower, the inferior maxillary or alveolar.

The sub-orbital artery enters the canal of the same name, but before penetrating it, gives off the superior incisor, which is distributed to the maxillary sinus; introduces itself into the superior dental canal, and divides to the roots of the incisor and canine teeth. After giving off this branch, the sub-orbital artery emerges from its canal and spreads itself over the anterior part of the face. The superior posterior alveolar artery, coming from the internal maxillary, divides itself in the superior posterior dental canals, furrowed in the thickness of the bone, and when in the alveoli it is conveyed to the roots of the molar teeth.

The maxillary or inferior dental artery arises from the internal maxillary; after having thrown off many important branches it penetrates the dental canal and runs along to the mental foramen. In its course, it furnishes branches to the molar teeth. Arrived at the mental hole, it gives a branch which is distributed to the incisor and canine teeth, and then it sallies from the mental hole to lose itself in the lower lip. The veins, which bear the same name with the arteries, follow the same course.

The extreme tenuity of the lymphatic vessels when they arrive at the jaws, forbids us to demonstrate their existence, nevertheless we do not doubt their presence, as we cannot admit the existence of vitality without them.

Sec. 4. *Dental Nerves.*

We have spoken of the organs which nourish the teeth. Let us now consider their sensitive organs, the nerves.

The nerves which are distributed to the teeth and jaws are furnished by the fifth pair. There are three principal branches, viz.

1. *The superior anterior dental or incisor nerve, from the sub-orbital.* It penetrates by a canal in the thickness of the anterior wall of the maxillary sinus, gains the alveoli and distributes itself to the roots of the incisors, canines and small molars.

2. *The superior posterior dental nerve.* A branch of the superior maxillary. It descends along the posterior wall of the maxillary sinus, to penetrate the posterior dental canals and supply the great molars.

3. *The inferior dental nerve.* A continuation of the inferior maxillary; after having furnished many important branches, among others, one to the maxillary gland, it engages itself in the dental canal, which it traverses as far as the mental hole, where it gives a branch which continues in the dental canal and distributes itself to the incisors, canines and molars. Finally, it escapes through the mental foramen and expands in numerous filaments on the face.

Sec. 5. *Secreting Organs of the Mouth.*

If the vessels which nourish the teeth, and the nerves which animate them, are important to the dentist, the humors which lubricate the mouth, and consequently the organs which secrete them, cannot interest him less. These organs are the mucous crypts and the salivary glands. To these alone, however, is not committed the lubrification of the mouth. Besides the fluids supplied by them, there is arterial transudation, by which a fluid formed in the blood exudes through the open orifices of the capillaries.

The mucous fluid is a secretion from the follicules contained in the buccal membrane. It is an animal fluid entirely soluble in water. Resembling the white of an egg, when mingled with water, it appears viscous, and gluey, and when agitated it be-

comes mossy. When dry it is as transparent as horn, and dissolves with difficulty. As to the rest, it does not differ from vegetable mucilage, except by the ammonia which it gives off in distillation.

Saliva is a frothy liquor, of a white color. It contains a mucilage sparingly soluble in water, a small quantity of albumen, hydrochlorate of soda, phosphates of soda, ammonia and lime. Agitated in the open air, it absorbs some of it, becomes frothy and finally sheds forth an ammoniacal odor.

This fluid is poured into the mouth by the excretory ducts of three glands, which we are about to describe.

The largest is the parotid gland, which is situated in a deep excavation on the sides of the face, between the posterior border of the lower jaw, the external auditory canal, and the mastoid apophysis of the temporal bone. Resembling a very irregular pyramid whose base is turned outwards, it is composed of granulations, whence arise the radicles of the duct of Steno, which opens into the mouth opposite to the interval between the second and third superior molar teeth.

At the internal side of the ramus and body of the lower maxillary bone, between the two bellies of the digastric muscle, we find the maxillary gland, the volume of which is less than that of the gland just described. Irregularly ovoid, it is flattened on three faces and bifurcated forward. Its excretory duct, the canal of Wharton, opens at the side of the frenum of the tongue.

Finally, after these two glands comes the sublingual. Amygdaloid, a little elongated from before backward, and slightly flattened transversely, it is lodged in the thickness of the lower floor of the mouth, below the anterior part of the tongue. The excretory ducts, which have no particular name, open in great number near the frenum, and some even connect with the canal of Wharton.

Besides these we have described, M. Serre has discovered a fourth order of secreting glands. These are called dental, and are lodged in the cartilaginous substance which forms the gums of the fœtus. They are disposed in groups, and bear a great resemblance to the Meibomian glands. They are cysts which suffer a whitish matter to exude through their walls, to lubricate

the gengival cartilage in the fœtus, and which, after the eruption of the teeth, forms the calcareous matter called tartar; at least this is the opinion of the author from whom we borrow this description.

If we have been a little particular in our description of the salivary organs and the follicles that serve to lubricate the mouth, and to facilitate mastication by mingling their fluids with the aliment, it is because these fluids exert great influence upon the health of the teeth, especially when some alteration in the nature of these secretions imparts to them more or less acidity.

CHAPTER II.

Sec. 1. *Of the Teeth in general.*

M. Blandin in his excellent treatise on the Anatomy of the Dental System, defines the teeth to be "resisting bodies, placed at the entrance of the digestive canal, or in a position but little removed from that entrance, destined to seize and divide aliments, and sometimes employed as means of attack and defence."

The teeth, planted in the double range of alveoli pierced in the two jaws, form the masticatory apparatus. They are harder and more compact than the bones of the skeleton with which they were for a long time confounded, and form by their uninterrupted series, on the alveolar arches, two curved parabolic lines, the dental arches. These are so arranged that the superior and inferior teeth encounter exactly in the posterior of the mouth, while in front the upper arch laps over the lower. The free border of both dental arches is thin and simple before, thick and double on the sides, where the teeth are larger and furnished with two ranges of tubercles. In general the teeth present the figure of a very irregular cone, the base of which is turned towards the cavity of the mouth, and the summit, simple or multiplicate, and always pierced, is buried in the alveoli. Each tooth presents a free surface on which a vitreous substance called enamel, takes the place of the periosteum. The lower part, projecting equally or nearly so, in the case of each tooth, is called

the crown; between this and the root is the point of junction, a sort of contraction, called the neck, which is grasped by the terminal edge of the gum. Beyond the neck, is the root, which is single, double, triple, quadruple, and sometimes, though rarely, quintuple. Covered by a membrane of which we shall speak hereafter, and which serves it for periosteum; by the aid of this same membrane it is fastened to the alveolus, by a species of union, called gomphosis, that is to say, a mode of union which resembles that of a nail fastened in wood.

Long previous to Bichat, skilful observers had doubted the identity of the organization of the teeth with that of bone. These doubts were soon verified, and we should not think it at all necessary to dwell upon this subject if M. Duval, had not endeavored, in an article which appeared last year in the columns of the Gazette des Hopitaux, to revive the opinion of the old anatomists. According to him, ivory is nothing more than a bony structure where the calcareous matter is deposited in greater quantity. In support of this opinion he adduces the ivory exostoses, which in certain pathological cases, develope themselves upon the bones and very much resemble the structure of the elephant's tusk.

We think that M. Duval has been deceived by appearances, and that, although the grain of the dental substance—the manner in which its tissue is arranged, bears some analogy to the exostosis alluded to, yet this resemblance is not sufficient to justify his opinion. Skilful analyzers have, it seems to me, settled the question, by demonstrating the different properties of teeth and bone.

M. Serres says, 1st, The development of bones is preceded by a cartilaginous state; the teeth are exuded from the surface of the pulp, and have no intermediate condition. 2d, Bones are enveloped in periosteum which forms a kind of sheath, teeth have none of this, but are covered on the exposed parts by enamel. 3d, Diseases which affect the osseous system in general, such as rickets, which soften and destroy it, do not affect the teeth: this structure remains untouched in the midst of the general dissolution of the osseous system. 4th, If we plunge the proper tissue of a tooth and a portion of bone into

concentrated nitric acid, and leave them for a few hours, the first will not be affected, while the latter will be destroyed. 5th, After calcination, bone leaves a white residuum, of which, the calcareous phosphate appears to be the base: teeth leave a bluish residuum at a higher degree of heat, and its base apparently contains more of the carbonate of lime. 6th, Bones are penetrated by a multitude of vessels, the teeth by none. 7th, The diseases of the teeth and bones are not alike.

We cannot regard as similar, two tissues so unlike in physical and chemical properties. Certainly there are differences between them which avail far more to separate, than the superficial resemblance of external aspect and molicular texture can, to confound them.

We must, as all other writers on the teeth have done, say a word upon their chemical composition.

According to Berzelius, the osseous substance of the teeth is constituted as follows:

Of 100 parts, there are of,

Phosphate of lime,	61 95
Fluate of lime,	2 10
Phosphate of magnesia,	1 05
Carbonate of magnesia,	5 30
Soda and chloride of sodium,	1 40
Animal matter and water.	28 00*

According to Pepys, the roots of the teeth are constituted as follows:

Of 100 parts, there are of,

Phosphate of lime,	58 00
Carbonate of lime,	4 00
Animal matter,	28 00
Water and loss,	10 00

According to Berzelius the enamel of the teeth is composed as follows:

Of 100 parts, there are of,

Phosphate of lime,	85 30
Carbonate of lime,	8 00
Phosphate of magnesia,	1 50
Animal matter and water,	20 00†

*This is obviously incorrect. Berzelius' analysis, as given in Meckel's Anatomy, is as follows:—To 100 parts: 51.04 of phosphate of lime, 2.00 of fluate, 11.30 of carb., 1.16 of phosphate of magnesia, 1.20 of soda, and an indeterminate quantity of hydrochlorate of soda.

†This, also, is incorrect, it should be 85.30 of phosphate, 3.30 of fluate, 8.00 of carb., 1.50 phosphate of magnesia, and 2.00 of animal substance and water.—*Meckel.*—TRANS.

Pepys has found it formed of

Phosphate of lime, . .	78 00
Carbonate of lime, . . .	6 00
Water and loss, . . .	16 00

The enamel, therefore, differs much from ivory. It is nearly altogether calcareous, while enamel contains some little animal matter analogous to that of bone, as may be seen in many preparations deposited in the collection of the faculty, by M. Cloquet.

Among all the authors who have written upon the teeth, M. Blandin, seems to us to be, beyond all contradiction, the most philosophical.

He considers the teeth a production of the internal tegumentary system, as true appendages of the digestive membrane, in a depression of which they are fixed by their adherent extremity.

Further, these organs are essentially composed of two elements; the part secreting and the part secreted. The secreting part, matrix, follicle, bulb, germ—is an immediate dependance of the tegumentary system. A small sack, much like the sebacious follicles, it differs from them in a single point, in that it presents towards the bottom a projection called papilla or stony pulp. This pouch is tied to the neighboring parts by a bundle of vessels and nerves, while at the other extremity it presents a sort of narrow canal, which has received different names, as *iter dentis*, *gubernaculum*, and according to M. Blandin, from whom we borrow the most of our ideas on this matter, the *throat* of the follicle.

The part secreted, or the product, is the tooth properly so called; its very variable form reduces itself to three principal parts, which, as we have before said, are the crown, the neck and the root.

The matrix of the tooth partakes of the membranous organization of the teguments in general, with this difference, that the papillary body presents a considerable addition. The tooth, on the contrary, is an osteoid substance composed of calcareous layers impacted in one another, and without vessels or nerves—or, according to others, vessels and nerves have much to do with these organs, especially with a certain grey line, discovered by Cuvier, between the vitreous and ivory parts—a sort

of membrane, which that celebrated naturalist believed to be formed by the prolongation of the internal layer of the follicle, and in which there remains some of the nerves which that layer possessed before it was caught between the two substances of the tooth at the moment of their formation.

In its development, the follicle, of course, precedes the tooth with whose production it is charged. This developes itself upon the papilla by thin layers, exactly moulded on it, and simply laid upon each other. As the tooth grows by a true intus susception, the papilla contracts and finally diminishes very much. The calcareous layers last formed are added to the internal face of those already concreted.

When, by the force of development, the tooth seeks to issue, it dilates the throat of its follicule, which has hence been called *iter dentis.* But before discussing this important part of the history of dentition, let us examine, cursorily, the intimate texture of the teeth in general.

Sec. 2. *Anatomy of the Teeth.*

The dental structure consists of three distinct parts: the enamel which covers the crown, the ossiform part which clothes the base, and the follicle of which we have already spoken, which throws out a papillary elongation into the interior of the tooth.

Only the crown presents that brilliant, pearly layer which we call the enamel. It is entirely different from the subjacent tissue. It dissolves readily in nitric acid, even upon three or four hours' immersion.

The enamel is thinner in the infant than in the adult. It is thinner upon the incisors than the canines, and, in the majority of cases, though this rule has exceptions, it is more abundant upon the first great molar than upon any other tooth.

The enamel is formed in the following way: the point where the organization of the tooth begins, manifests no trace of this vitreous matter. As the organ developes, the protecting layer increases in thickness. But we do not observe its polish, hardness and lustre, except when it is in contact with the air. While in the follicle it is of a dead white.

What is the secreting organ for the enamel? An important question, not yet answered. Herissant thought that this substance, secreted by the external layer of the membranous sack, deposited itself, drop by drop, upon the tooth as it was formed. Cuvier partakes of this opinion. He thinks that the enamel deposits itself, at first, upon the first layers of ivory, afterwards upon those plates which are laid upon the first—that it is deposited in drops, which hardening and pressing upon each other, form the perpendicular striæ of which the enamel is composed.

It is evident that all that can be said upon this subject is hypothetical; let us, therefore, turn our attention to the physical properties of the enamel, a cortical substance which covers the tooth no farther than the neck, milky white, extremely hard, giving sparks in collision with steel, and running its perpendicular fibres upon the crown like threads of velvet.

The ivory forms nearly all the tooth. It constitutes, exclusively, the root and the central part of the crown—in it we discover neither fibres nor cells, but many plates impacted in one another and parallel to the external surface of the tooth.

If we macerate a tooth in nitric acid, as we have already said, the enamel will disappear entirely in a few hours. If care be taken to increase the acid, the tooth softens and permits us to take away layer after layer until we reach the walls of the interior cavity of the tooth, where we find a small and harder layer which seems to protect the soft part.

We have now said nearly all that relates to the part produced, and after our description, it will necessarily be granted, that so far as structure is concerned, there is the greatest analogy between the substance of the hair and the ivory of the teeth, which like it, is formed of laminæ impacted in one another.

It now remains for us to describe the secreting part, the membranous sack, and the pulpous part adhering to the bottom of it, considered by some to be a sort of ganglion, and by others a papilla. Which ever opinion we may adopt, and we incline to the last, we see that the nerves and vessels which penetrate by the roots of the teeth, when arrived at the neck, swell and form a tubercle, where the tooth has a single protuberance, and two, three, or even four, when the tooth has more, as is observed in

the great molars. As to the organization of the pulp itself, it is most certain that the nervous and vascular elements meet there in a proportion obviously equal.

We will not engage in the interminable discussions which have been agitated as to whether the vessels and nerves go thence from the follicle, or if they expand themselves in the ossiform part of the organ. Let us leave these speculations, which have but a secondary interest for the practical man, but, which, nevertheless, it is necessary not to be ignorant of.

Sec. 3. *Classification of the Teeth.*

It would, perhaps, have been more natural, to have delayed describing the permanent teeth until we had described the temporary ones, but when this shall be done, we will have sufficient occupation in enumerating the different peculiarities of their development and eruption, without having to describe them. We, therefore, proceed to do this at once.

The permanent teeth differ very much from the temporary ones, in length, form and number. They may be divided into two classes. 1. Those which succeed the deciduous teeth. 2. Those which are added to them. The teeth which succeed to the infantile incisors and cuspidati bear the same name, and have the same form, except that they are larger. Those which replace the temporary molars, are, on the contrary, smaller, and as at their summits they are divided into two roots, they are called bicuspids. The adult molars are added to the decidui, and appear one after the other as the jaw elongates.

We distinguish four classes of permanent teeth: The incisors, the cuspidati, bicuspid and molar. There are characteristic differences in their figure, and in the number and form of their roots. We observe in their configuration almost the same insensible progression by which the vertebræ accomplish their transition. Thus the cuspidati hold a middle place between the incisors and bicuspids, and these last between the molars and cuspidati.

The incisors or cutting teeth are placed in the middle and front of the mouth. Each jaw has four of them disposed in such a way that the central ones project rather more than the

next. They are convex on their external face and concave behind. Their edge is cutting and parallel to the summit of the root. They augment in breadth and diminish in thickness from the neck to the edge; being of a wedge-like form, the best possible for the division of food.

Their roots are conical and shorter than those of the cuspidati. In the upper jaw the central incisors are larger and broader than the lateral ones. In the lower jaw they are nearly of equal size.

There are four cuspidati or canine teeth, two in each jaw, placed at the side and a little behind the incisors. The crown of the cuspidati resembles that of the incisors, but it is pointed and angular, instead of having a broad cutting margin. The roots of these teeth are the longest, and penetrate the most deeply in the jaws. In the adult they terminate in a sort of tubercle, easily felt by the tongue, but which insensibly disappears in age. Their use is not to cut the food but to tear it, as the carnivori do. An irrefragable argument against the Utopians, who would confine men to vegetable diet.

The bicuspids are placed immediately behind and in contact with the cuspidati. They have sometimes been called canine teeth, sometimes small molars, but they have not the form either of the one or the other. They constitute a class intermediate between these two, approaching more nearly the cuspid than the molars. Their crown offers to the upper jaw two points, the one internal the other external. Their roots are flattened on their sides and resemble two branches with an intermediate depression. Ordinarily they have two roots, often, however, the two first have but one. The bicuspids of the lower jaw are smaller than the others, their points less salient, and as they are not hung from above downward, nature, which acts reasonably in all it does, has given them but a single root.

The molars are twelve in number. There are three of them in each side of the jaw, and as they occupy the two extremities of the arch formed by the maxillaries, they are the nearest of all to the bottom of the mouth. The first two being absolutely alike, it is unnecessary to describe separately any but the third, the dens sapientiæ, or adult tooth. These teeth are generally larger than the

others, hence the name, great molars. They are large, and fortified with many tubercles, which correspond with depressions in the opposite jaw, an arrangement which renders them very effective in grinding the food. They all have multiplied roots. The teeth of the inferior jaw are inclined inwards, while those of the upper are nearly perpendicular. For the reason noticed above, the molars in the upper jaw have three roots, one internal, the others external, while in the lower jaw we generally find but two, placed side by side. The third molar, or wisdom tooth, is smaller, and its axis is directed more inwardly than is the case with the others. Its rounded crown is furnished with three or four tubercles; its root is generally single, furrowed longitudinally, short, conoid. Sometimes it presents two, three and even four divisions, confounded in part or entirely. Their form is to the utmost extent irregular. It would seem that the exhausted organism was no longer capable of producing a perfect product. Their volume hardly equals that of a small molar.

Sec. 4. *Development of the Teeth in general.*

A month after conception, the gums are not yet membranous. The pulp, enclosed in the follicle, is not well developed until towards the second month. From the third to the fourth, the pulpy part is completely developed. It exhibits a structure similar to that of certain ganglions. The pulp in the bosom of the follicle, floats in the midst of a sero-mucilaginous liquid, like the fœtus in the waters of the amnios. It is at the end, and even at the beginning of the fourth month, that the dental papilla sets itself to secrete the ivory which is to form the crown of the tooth. This latter presents itself first under the aspect of a little cap which covers the papilla. In receiving layers more and more extensive, it is raised up and increased in volume by the inferior layers which embrace the papillary body in its whole circumference. Then it is completely formed, and the ivory is deposited in it as before stated. At the end of this period of evolution, the papilla raises itself from the bottom of the alveolus. New plates of ivory embrace it inferiorly, forming capitals less and less widely separated, and descending to the extremity of the papilla, finish the formation of the root.

When the tooth is multicuspid, there are some differences to note. The formation of ivory commences by separate points and represents as many little capitals as the tooth ought to have tubercles, and the papilla presents prolongations. Soon, by the progression of bony formation, the capitals in question reunite, and the roots are formed, as we have described for the bicuspid, with this single difference, that instead of one single tubular circumference, there are two, three or four connecting at the same time around the pedicules of the papilla. When the latter, straitly confined in the bony prison itself has built, finds itself restrained in further acts of secretion, then the tooth ceases to grow.

To recapitulate in a few words: the teeth grow from the summit of the crown towards the point of the root, and from the exterior towards the interior. They thicken and elongate at once in embracing the papilla, at all points, more or less closely.

Sec. 5. *Mechanism of the Eruption of the Teeth in general.*

The mode of the eruption of the teeth has very much embarrassed anatomists at all times. At first, not willing to give themselves the trouble to observe the actual working of nature by examining the jaws of young subjects, they found it more convenient to throw themselves into the deceitful regions of hypothesis: for the most part they gave very satisfactory explanations, but in reality they were in palpable contradiction to the truth.

They have called in the aid of gravity, the pulsations of the arterial trunks, a struggle between the tooth and the gum, in which the former came off victorious, &c.

One point which has tried the sagacity of odontologists, is the shedding of the deciduous teeth. A very simple explanation presented itself to their mind. The permanent tooth developes itself, its crown begins to push, rub and compress the infantile tooth and determine its decay. Others did not look so far. Seeing that the teeth dropped out without roots, they concluded that they had none—others supposed that the crown separated from the fangs, as the horns of certain animals are shed, and that the roots of the first teeth served to groove the crown of the

permanent teeth. Of all these magnificent theories, not one remained after the scalpel was made to exhibit nature as she is. We know that the temporary teeth have roots, that the permanent teeth do not chafe upon them, and further, that this hypothesis, of all others the most plausible, and sustained by the greatest names, is completely overthrown by the fact, that the crown of the permanent tooth has constantly interposed between it and the root of its predecessor, a reddish vascular tubercle, which, as M. Delabarre thinks, subserves an important part, and which acts as a cushion between the two.

This is the place to explain the theory of that skilful anatomist. During dentition, he says, the alveoli of the permanent teeth assume the form of almond shells, of which the extremity, looking towards the gum, offers the orifice of a little bony canal, directing itself obliquely from behind forward, and opening by an oval hole behind the primary teeth. This is the throat of the follicle of M. Blandin, the *gubernaculum* of M. Serres, the *iter dentis* of M. Delabarre.

During the slow progression of the tooth towards its orifice, the *iter dentis* acquires considerable capacity by absorption, while the deep walls of the alveolus contract and apply themselves to the root.

The learned dentist whom we now quote, has given to the eruption of the tooth the name of "odontocie" or accouchement of that organ, because he finds great resemblance between the escape of the tooth and the delivery of the fœtus. He supposes that the follicle, the vascularity of which is at that moment augmented, retracts upon the neck, and raises it by a mechanical act similar to that which a fisherman employs to seize a fish which he has taken in his net. He draws together the meshes in such a manner as to fold them together, and in the same way that his prey is elevated towards him, the teeth, drawn by the contractility of the fibres, is pressed against the gum.

But it is not this part of the theory which is most ingenious or most satisfactory to us. We are more interested in the vascular button, which we have before mentioned, and which, according to him, is employed in effecting the absorption of the temporary teeth.

We have already exposed some of the theories which have been given in explanation of the remarkable phenomenon of the dissolution of these teeth. There are many more, but we beg leave to consider that which appears the most plausible in the present state of science.

The dental matrix, after having been dilated to serve as a protecting envelope to the tooth, contracts to form not only this little vascular body which we find immediately above the milk teeth, at the moment when they fall out, the volume of which necessarily augments as the dentition advances; but also a fleshy mass, by which the whole crown is covered, and the thickness of which is in proportion to the advance of the tooth from its orifice. It is this apparatus which undermines, corrodes, and absorbs the root of the temporary tooth, and often even the inside of the crown, which thence resembles a capsule.

We shall not examine all the evidence that M. Delabarre adduces in corroboration of his views. They are, for the most part, plausible, and may be summed up, as follows: The crown of the permanent tooth never touches the root of the temporary one, hence it cannot destroy it. The absorption of the root sometimes takes place when the permanent tooth is quite distant. This seems to us an argument hard to answer.

In that excellent chapter in which M. Delabarre developes his ideas about the absorbent apparatus, he explains, in a most satisfactory manner, the phenomena and even anomalies of dentition. If the absorbent tubercle approaches the root of a permanent tooth, it is destroyed like the others. If a permanent tooth, deviating from its natural route, progresses in a line perpendicular to the axis of the alveoli, the bony plate of the latter will be destroyed by this destructive tubercle, to which nature has given such power, that it eats its way through all obstacles.

Sec. 6. *Varieties in Number, Form, Position, Structure and Consistence.*

Varieties depending on age.—The temporary teeth are plainly distinguished from the permanent ones. They are twenty in number. The four teeth which appear towards the fifth year, are permanent. The incisors and canines are rather smaller,

the molars much larger than those of the second dentition, which will be bicuspid, while the temporary teeth which they succeed, have the properties of great molars.

The roots of the temporary teeth are generally shorter and more slender than those of the permanent teeth. The substance of the first is a little softer than that of the second, which shine readily upon rubbing.

Varieties depending on race.—Difference of race impresses but slight difference on the teeth. Negroes have theirs a little larger, a little longer, and a little more obliquely directed than ours.

Varieties in individuals.—We may consider these under five principal classes—as varieties in number, figure, direction, position and structure.

Varieties in number.—Some have more teeth than ordinary, some less, and some none. Baumes and Berelli, each, cite an example of this last kind. In other cases, only a few teeth have appeared. Finally, there are families in which an incisor, canine or molar is uniformly wanting.

Teeth have been observed cemented together, sometimes by an intimate fusion of two teeth, the ivory being common, sometimes by the intervention of the alveolar dental periosteum. In the first instance the crowns are united, in the second, the roots.

Excess in number, generally, depends upon the continuance of the milk teeth, hence the supernumeraries usually appear behind the others. Among the cases of this kind the following are the most remarkable. Bourdet has seen the two last upper molars double. Planquet, Camper and Scemering have observed five molars well ranged in the inferior jaw, the first in his own case, the second in that of an inhabitant of Java, and the last in a European.

Varieties of figure.—Those which do not depend upon disease are very rare, and depend, generally, upon the continuance of the milk teeth. One of my friends has, in his upper jaw, the two lateral incisors of the first dentition, which is the more readily detected, because each of his permanent teeth is marked by an eroded groove which cuts them transversely. The only teeth perfectly smooth are the two upper lateral incisors.

Varieties in direction.—These anomalies, which are not commonly observed, sometimes present a simple obliquity of the teeth, sometimes they are placed in a horizontal position, and very rarely they are completely inverted. According to Scemering, there may be such irregularity of the teeth as to give the appearance of a double rank. In the case of complete inversion, the tooth does not emerge from the alveolus, and some day its crown pushes into the maxillary sinus or nostril, the root being downward.

Varieties in position.—As we have just said, the teeth may change their direction towards the palate or maxillary sinus, or elsewhere. Under these circumstances tumors are developed in the vicinity of the dental arches, which are often puzzling to the surgeon. Teeth have even been found in parts of the body far from the mouth. Almost always they have been found enclosed in a fibrous cyst with hair and fatty matter. At other times they have been found implanted on portions of bone in true alveoli. A case of this kind, related by M. Blandin, is too remarkable to be passed over in silence. It occurred in a Polish woman, who was afflicted with a fluor albus, against which all remedies, local and general, were ineffectual. In her fifth confinement, the child presented an excoriation on the left cheek, evidently recent. After an attentive examination, M. Jousinski perceived a hard body between the rectum and vagina. After vain efforts to remove this body with the ordinary polypus forceps, he made use of stronger ones, with which he extracted a well formed molar tooth with three roots. Three other incisors and molars were then extracted without much suffering to the patient. This case might well appear fabulous to persons unacquainted with medicine, but a physician can readily explain it by considering these teeth as the detritus of an extra uterine fœtus. It is strange, however, that the teeth thus engrafted upon the mother should continue to grow after the atrophy and death of the child.

Varieties in structure.—Most of these depend upon morbid causes; Hunter, however, records the following: A young subject presented two anterior incisors of the upper jaw which did not traverse the gum, and whose roots were barely long

enough to be embedded in the gum by their upper extremity. They were not at all of the nature of those whose roots fall out in infancy, for they did not penetrate the gum—certainly, they never had any roots. The place where these should have been, exhibited small, round, smooth eminences, having each a small channel of communication with the body of the tooth, which was well formed. This is not the only case of this kind. Miel relates many of a similar sort.

Sec. 7. *Of the Mechanism of Mastication.*

This mechanism consists in the motion of the jaws, and the division of the substances placed between the dental arches, by the action of the muscles.

When we open the mouth, the jaws are separated from one another, leaving an interval more or less great, as the branches of the lower maxillary are arranged more or less at right angles, a relation which varies with age. At birth, as we have seen, the condyles of the jaw are almost on a level with the body of the bone, and describe an angle of nearly one hundred and eighty degrees. As the child advances in life, the condyles approach towards a right angle, which is only ninety degrees. The more obtuse the angles of the jaw, the smaller is the opening of the mouth. Infants cannot open the mouth as wide as adults, which is a happy provision of nature, as otherwise their cries would constantly expose them to the risk of dislocating the jaw. The centre of movement of this bone is located in the tempero maxillary articulation. The movement is thus made: the condyles turning from above downward, and from behind forward upon the transverse zygomatic apophysis, as upon an axis, the body of the bone describes an arc of a circle which determines the opening of the mouth. This opening is from fifteen to sixteen lines at its anterior part, while posteriorly it is only six or seven lines. It is by a movement of elevation opposed to that of depression, that the jaw is brought back to its natural position.

Allowing for its small degree of solidity, the superior jaw may be compared to an anvil, upon which the inferior strikes in crushing the food.

The tempero-maxillary articulations permit the utmost latitude of motion, downwards, upwards, backwards, forwards and laterally.

When the lower jaw is depressed, the elevator muscles are, by degrees, relaxed, and it tends to separate from the upper jaw by its weight. In this movement it falls downwards and backwards, and describes an arc of a circle. The condyles rotate forwards and downwards and glide below the transverse zygomatic apophyses, from which they even escape sometimes, creating the tempero-maxillary luxation.

When the inferior jaw is elevated, it necessarily describes an arc of a circle opposite to that described in its descent. The condyles fall back into the glenoid cavity, gliding under the apophyses from before backwards.

The lower jaw cannot be brought forward without some little depression, and without the condyles partly leaving the glenoid cavities. It has no motion backward except after having moved forward.

The lateral motions are made when the jaw is a little depressed, and when the chin looks to the left, the condyle of the same side is buried in the glenoid cavity. As to the right condyle, it glides from behind forward, and from without inward, the jaw turning on the left condyle as on its axis. An opposite movement is made when the chin is directed to the right. As to the upper jaw it is only concerned in mastication by passive support. Its movement is merely that of the head pulled backward by its extensor muscles, which in the carnivori are powerful auxiliaries to mastication.

CHAPTER III.

FIRST DENTITION.

Dentition is that process of nature by which the teeth are developed and extruded from their alveoli upon the free border of the jaws.

There are two acts of dentition—the first of the temporary teeth, twenty in number, ten in each jaw. The second of the

permanent teeth, thirty-two in number, sixteen in each jaw. The first is embraced in the period intervening between the formation of the jaws and the sixth or seventh year; the second takes place between this latter period and adult age. It is of the first dentition that we shall speak particularly in this chapter.

Sec. 1. *Of the First Teeth, from the conception to the birth of the Fœtus.*

The teeth, like other parts of the body, cannot be discerned at the moment of conception. It is towards the fourth or fifth month of fœtal life that the jaws commence to attain sufficient size to enable us to distinguish the dental germs.

As to the dental follicles they are observable from the second month. If we carefully examine the alveolar arches, we find there a great number of follicles shut up in the thickness of the membranous fold which forms the gum. They are very small, of globular shape, placed in the furrow which marks the alveoli at that age, and covered by the deepest layer of the gingival tissue.

When we open the dental follicle in a young fœtus, we find it filled by a yellowish and viscous fluid, which diminishes in quantity from the time of its first appearance until the eruption of the tooth, when it disappears entirely.

Above the dental germs, the gum appears more resisting and somewhat cartilaginous, which has caused it to be called the dental cartilage. This can be isolated perfectly by ebullition. It appears under the form of a sharp and slightly indented crest, which has caused it to be compared justly enough, to the beak of a bird.

It is remarkable that the ossification of the first teeth proceeds in the same order as their ulterior eruption. The central inferior incisor commences first, then the upper central incisor, then the lateral incisor, the first molar, the canine and second molar. In a fœtus of eight months, each small superior incisor is already three lines broad and two lines long.

Sec. 2. *After Birth.*

After birth the crowns of the milk teeth are ossified, but they are still shut up in the jaw. Their capsule envelopes them on all sides. Until the fourth month the jaws and the cartilaginous tissue which covers them do not undergo any change, but with the progress of organization the jaws become more apparent, the alveolar cavity enlarges, the bony borders of which they are formed stretch and elevate themselves in proportion, the tooth developes, and soon, being no longer capable of being contained in the capsule, it elevates and distends it even to the gum, which it finally pierces. But this is not done without difficulty, owing to the resistance which these tissues offer. After the perforation, the neck of the capsule adheres to the neck of the tooth and forms that little cushion which we observe marked on the gums, and which ensures the firmness of the organs of mastication.

The time of the first dentition is very variable. Sometimes it is precocious, sometimes tardy. Every surgeon dentist, as well as ourselves, may have noticed cases of children born with one or more teeth. Polydorus Virgilius, mentions one born with six: Louis XIV had four. In other cases the contrary prevails. We have seen a young girl of seven years of age, whose two lower incisors had not been cut; we have even observed canines effect their eruption at the age of fifteen or eighteen years.

Nevertheless, all these cases, are but exceptions; ordinarily the eruption of the temporary teeth is graduated and effected as follows:

Between the tenth and fourteenth month, the two lower incisors appear. Two months after, the upper great incisors, the lower lateral incisors, and at a time equally distant, the superior lateral ones. Some months afterward the lower canines, and then the upper appear. Nevertheless, it is not uncommon to see the canines delayed until after the appearance of the first molars. At other times they appear together, but always from the fourteenth month till the completion of the second year, all the teeth we have mentioned are cut. From two years and a half

till four years the first molars appear, then the second, which comprise the first dentition, of twenty teeth.

A fact worthy of remark, and which shows the constant order in which nature performs her acts, is that the appearance of the teeth commences always in the lower jaw, the corresponding teeth then appear above, and the dentition proceeds by this alternate method.

To resume, we will say that the first dentition may be divided into two well marked periods. The first extends from the sixth or seventh month after birth until eighteen months or two years. The second from the age of two to that of four years. During the first of these periods the eight incisors and the four canines are cut. During the second the eight molars.

TABLE OF FIRST DENTITION.

First Period.

From 6 to 8 months—the 4 smaller incisors.
" 8 " 10 months—the 4 lateral incisors.
" 10 " 12 months—the 4 canines.

Second Period.

From 15 to 20 months—the first 4 molars.
" 20 " 36 months—the second 4 molars.

SEC. 3. *Disorders produced by the First Dentition.*

The period when the first dentition is begun, is dangerous and often fatal to the infant. In view of the alarming disorders which attend the accomplishment of this painful process, physicians have been led to regard dentition itself as a disease. This is surely wrong. There are many physiological functions attended with pain, and which are nevertheless perfectly healthy; labor and menstruation are examples of this. Nevertheless, we freely admit that in these critical moments the organization is on the very verge of diseased action, and it is this which has deceived the physicians of whom we just spake.

The accidents which may attend dentition are many and demand details which would be two large for a work like this. And indeed, to tell the truth, it is rare, exceedingly rare, for

men of our profession to be called to treat dental affections at this period of life. This is generally the province of midwives and accoucheurs. We will, therefore, content ourselves with a rapid glance at this part of the subject, leaving ourselves room for more thorough discussion of these matters, which are specially important to the surgeon dentist.

All physicians who have directed their attention to the study of the diseases of infants, have laid down the following principles: 1st, Children of robust and vigorous frame, born of healthy parents, pass the period of dentition without danger and almost without pain. 2d, Those that are feeble, languid and unhealthy, the issue of invalid or unsound parents, or trusted to bad nurses, are almost always condemned to painful and difficult dentition.

The diseases which attack children at the time of dentition, are divisible into two classes. To the first, belong the accidents which attend the local distress of dentition; to the second, those sympathetic affections which accompany the local irritation, or result from it.

Sec. 4. *Local Accidents.*

Ptyalism.—By ptyalism, we understand an augmentation of the salivary secretion, which, far from being dangerous, is a very salutary occurrence, inasmuch as it favors the softening and dilatation of the gum, and moreover prevents sensibility and inflammation. But when the progress of teething is delayed by some obstacle, the excitation which augments the vitality of the salivary glands and increases their activity, becomes an irritation sufficiently great to inflame them. Then the mouth becomes hot and dry, thirst becomes considerable, the throat and the brain sympathize, the countenance becomes red and swollen, in a word, we observe all the symptoms of decided fever. A day or more after the occurrence of this condition, the mouth is inundated by a salivary secretion, abundant in proportion to the intensity of the previous inflammation. Ordinarily, this abnormal salivation checks itself after a few days, or at most a week or two; but sometimes it gives rise to lymphatic salivary engorgements and is protracted indefinitely. The first case is not

serious, but the second calls for the most prompt attention of the physician, for, it induces rapid marasms.

Treatment.—As a slight salivation is very favorable, it is well to provoke it when tardy, and to excite it when it is unduly checked. For this purpose, it will be sufficient to anoint the sides of the jaws and neck with warm oil of almonds or olive oil, and to moisten the mouth frequently either with breast milk or warm emollient drinks.

If very abundant ptyalism is the result of inflammation of the gums, we may check it by antiphlogistics, two leeches at the angle of the jaws, for example: and, if the child be at the breast, by putting the nurse upon a soothing diet.

Pruritus.—Dentition produces in children an itching of the gums more or less intense. When this is not great, it is not morbid, but when the resistance of the gums increases the intensity of the sensation to an extreme degree, the children are restless, sleepless, and plagued with immoderate salivation. We have seen this state of erythism even produce convulsions tetanus, and obstruction to the digestive functions.

Treatment.—We may prevent itching by mucilaginous and soothing drinks, pediluvia, and emollient lotions to the gums. If it should, nevertheless, occur, we must use the same means, abstract all excitants, and give the infant a stick of mallows or liquorice to chew.

Inflammatory and painful swelling of the gums.—Inflammatory swelling is one of the most frequent accidents attending dentition. The causes are, the natural thickness of the gums, and their hardening by the inconsiderate use of corals, which, far from aiding the tooth to pierce the gum, as is vulgarly supposed, only converts the latter into a sort of callous substance, which becomes one of the greatest obstacles to dentition.

The symptoms of this affection are as follows: the gum is stretched, of a lively red color, sometimes approaching to violet, and above all, so painful as to cause the child to scream in a most distressing manner. All the surrounding parts partake of the inflammation. It terminates by resolution, suppuration, or gangrene, and if the inflammatien be not combatted by proper

means, it may give rise to the most alarming symptoms, such as convulsions and inflammation of the digestive or respiratory organs.

Treatment.—This consists in counteracting the leading causes, in administering emollient and soothing drinks, and in the use of emollient applications to the mouth by a pencil. In order to oppose the cerebral congestion, it is well to apply one or two leeches behind the ears, and to use simple or slightly stimulating pediluvia. If the gums show any symptom of gangrene, we must lose no time in touching them with a pencil dipped in honey, acidulated with hydrochloric acid.

Periodontitis.—In this affection, the alveoli dental membrane, and the little blood-vessels contained in it, are inflamed. The causes are the unnatural flow of blood to the head, the irregular relation between a tooth and the alveolar opening, and the impossibility which sometimes occurs for a tooth to pass between two others, cut before it. The symptoms are a deep obscure pain, a sense of pricking, and the swelling and redness of the gum.

Treatment.—Emollient drinks, one or two leeches to the mastoid apophyses, warm lotions, pediluvia and mild purgatives. In case the affection is obstinate, a flying blister may be put behind the ear, and where there is a mechanical opposition to the escape of the tooth, the alveolar opening may be enlarged. If the cause be the too near approach of two teeth, one may be extracted, but only as a last resort.

Odontitis.—Inflammation of the dental pulp. This is very rare in infants. Authors who have written upon the diseases or accidents of first dentition do not mention it, evidently, because it never exists alone. Its diagnosis is difficult; but this is no reason why we should not examine it. It exists in two degrees, differing according as the inflammation is subacute or acute.

In the first instance, the patient feels, when exposed to cold, a sense of pricking and pulsation which is insufferable. In the second, the pain is very severe, the slightest cause excites and aggravates it, the whole mouth inflames, and sometimes even the neck, face, ears, even to the top of the head. The pain is so terrible that the patient is sometimes almost mad.

Treatment.—When odontitis is slight, separation from the exciting cause, a soothing regimen, and some local fomentation will almost always relieve it in a few days; but if it is very acute, we must combat it by the most energetic antiphlogistic and counter-irritant means, such as leeches to the angle of the jaws and gums, emollient mouth-washes, sinapisms upon the bowels, and pediluvia, frequently repeated.

As the malady declines, never at its onset, little blisters may be put behind the ears, and laxatives employed to act upon the intestines. If the inflammation does not yield, we may try narcotics, applying them to the tooth itself, as with cotton steeped in laudanum.

Obstacles at the entrance of the alveolus.—Is the orifice of the alveolus merely closed by the gum, or occupied by a tissue of another kind? This is a question upon which anatomists differ. Whatever may be the nature of this covering, if it has been hardened by the use of corals so as to prevent the egress of the tooth, the reaction of the latter upon the walls and bottom of the alveolus, will give rise to nervous and inflammatory accidents. Under these circumstances it is well to divide the gum, and permit the tooth to escape.

At other times the difficulty is caused by the approximation of the walls of the dental canal, the result of rickets. In this case, a more serious operation is required in order to release the tooth. It is then necessary, after having freely incised the gum, to cut away a part of the alveolus with strong scissors or little cutting forceps.

Obstacles to the issue of the tooth from the too near approach of two neighboring teeth.—If the time which separates the appearance of one of the canine teeth from that of the molars, be too long, the place that it ought to occupy will be renewed, because the teeth in growing, will lean to that side when nothing opposes their growth. In this case, or in case the alveolar border offers sufficient resistance to prevent the impeded tooth from pushing forward or backward, (when it pushes forward, as it generally does, it only induces a deformity, which inflicts no injury upon the health) or in case it should press upon the neck of its neighbors and produce inflammatory and nervous

disorder—then we have no other resource than to extract the first infantile molar, the loss of which will do less harm to the arrangement of the permanent teeth, than would ensue from that of a lateral incisor. We must not forget, however, that we are to be very cautious in the use of this means of relief. It rarely needs to be resorted to. The same accidents sometimes occur when the second temporary molars escape after the first multicuspids. We may employ the same means, always bearing in mind, that the multicuspid which impedes the escape of the second molar is a permanent tooth, and, consequently, must be respected.

Having thus reviewed the local disorders of the first dentition, it now becomes proper to treat of the sympathetic disturbances which attend it.

Sec. 5. *Sympathetic Disorders.*

The sympathetic consequences of dentition may be very numerous, but I am inclined to think that physicians have attributed more diseases to this source than in reality spring from it. It is a point in pathology, about which there is yet much uncertainty—nevertheless, the affections which appear properly to be chargeable to the labor of dentition, when there is no other apparent cause for them, are the following: cerebral congestion, convulsions, tetanus, epilepsy, dental neuralgia, nervous vomiting, modification of the secretion, and inflammation of the digestive organs, inflammation of the respiratory apparatus; modification of the secretion and inflammation of the genito urinary organs, ophthalmia, otitis, cutaneous eruptions and lymphatic engorgements.

We remind the reader that the treatment of these diseases belongs to general medicine. We will pass them rapidly in review, and there are more which we omit altogether.

Cerebral congestion.—In plethoric children, habitually costive, dentition determines a flow of blood to the brain, which congests that organ. This condition ceases with the cause of it, and when prolonged, it requires a resort to antiphlogistic means, especially to leeching behind the ears.

Convulsions.—This disease is well worthy our attention, and demands that we dwell upon it more at large, than upon all the rest. The convulsions which occur at the time of dentition do not altogether depend upon that cause. This is a prejudice which ignorance has imprinted upon the vulgar mind. Scientific men have discovered that many of the convulsions observed in children are symptomatic of disorders especially of inflammation, in the gastro-intestinal system. Yet we must not adopt the narrow views of the gentlemen who first avowed this opinion, for it is evident, that convulsions may be induced by cerebral congestion, or by the erythism which attends difficult dentition.

A nervous temperament, robust constitution, and great nervous irritability, may be considered the predisposing causes of this affection. Children who are most liable to it, are the feeble, pale, meagre ones, who are subject to frequent diarrhœa—together with those that are fat, fresh colored, strong and plethoric—which almost amounts to saying that all children are exposed to it.

The precursory phenomena are generally the ordinary symptoms of painful dentition, restlessness, tossing and watchfulness.

The convulsive movements appear in a part of the system, more or less limited. Sometimes they are only visible in the muscles of the eyes, or eye-lids, or mouth, or alæ nasi. At other times they agitate the whole muscular structure of the face—sometimes they exhibit themselves in the upper limbs, sometimes, but less frequently, in the lower extremities. As to their duration, it varies exceedingly.

Although very alarming in themselves, convulsions do not compromise the life of the child as often as is supposed. Yet, though only a symptom of disease, they require great attention, for if often repeated, they terminate by inducing imbecility, epilepsy and palsy.

Prophylactic treatment.—We must appease the local disorders of dentition, abate in every possible way nervous excitement and cerebral congestion—advise soothing and slightly laxative drinks, frequent pediluvia, and warm cataplasms to the lower limbs. If the children are plethoric, one or two leeches may be

put behind each ear; if they are of a nervous temperament, they should be frequently bathed in warm water.

Curative treatment.—If you are called to see a child in convulsions, take care not to be in haste to administer antispasmodics, for they are more likely to increase cerebral congestion than relieve it.

During the fit, employ all the means which can create prompt derivation, such as warm pediluvia, and manuluvia, irritating cataplasms upon the abdominal regions, sprinkling cold water upon the face, cold applications to the forehead, and warm baths. You will notice, with regard to this last means, that at the moment of immersion, the convulsions may increase, but very soon the good effect of the bath will be manifest. If the child be so feeble as to forbid sanguineous evacuation, we should administer an antispasmodic potion, or what is better, some camphorated injections.

An excellent expedient also, when the convulsions are obstinate, is to cut the gum, which is not attended with the inconvenience that timorous persons have supposed. When incision of the gum is necessary, some matrons and nurses tear it with the nail; a barbarous custom, which ought to be suppressed. Some physicians content themselves with making a simple longitudinal incision upon the part of the gum which seems to resist the tooth. This mode of operation is useless, because cicatrization takes place with great rapidity, and because but little blood escapes. To avoid these difficulties, others have tried crucial incisions, which, although better, are attended with nearly the same disadvantages. Boyer advises to make a crucial incision, and to dissect off the flaps. Is this practicable in the case of a young child, while screaming and struggling? The best way we think, is to employ a small curved blade, or rather, arched upon its side. This instrument is carried upon the swollen gum, and plunged horizontally into the side of it nearest the extremity of the alveolar arch. Then, by making the instrument describe a semi-circle, we cut off the entire plate of gum which opposes the exit of the tooth.

After having combatted the local symptoms, we use local bleeding, we administer relaxing drinks and injections; we may,

also, have recourse to frequent pediluvia, warm baths and flying blisters upon the inferior extremities. If, in spite of this treatment, the convulsions recur, we must use antispasmodics, but never opium, which greatly irritates the brain, and arrests the alvine discharges. A very successful remedy, in such cases, is camphor, given in injection, in a dose of from 7 to 9 decigrammes, (13 to 17 grains,) dissolved in alcohol, or better, mixed with the yolk of an egg. Some also speak highly of a few drops of ether in a sedative potion.

Epilepsy.—A disorder characterized by continuance of convulsive movements, either partial or general, with loss of intelligence; and tetanus, that is to say, rigid convulsion or tension of a great number of muscles, which supervenes upon very intense local suffering in dentition, are but varieties of convulsion. We will not devote any special paragraph to them, the treatment, with slight variation, being the same as we have just described.

Dental neuralgia.—Though this disorder is rare in young subjects, yet it does sometimes occur in them. It is a disease of the teeth, and their constituent parts, which is characterized by a vivid, acute pain, which suddenly reaches its acme of intensity, and may fasten upon one or more teeth without local alteration. Among its causes are the erythism which attends dentition, and the compression which the dental nerve undergoes, when the tooth cannot escape from the alveolus.

This affection cannot readily be distinguished in children under four or five years old, because of the want of observable change in structure.

Treatment.—We must alleviate the local difficulties of dentition, and calm the nervous erythism by fomentations, antiphlogistics and derivatives. If the neuralgia does not yield, do not trust to antispasmodics and antiphlogistics, which always fail. Apply little blisters behind the ears and on the temples; in most cases they will succeed. If the neuralgia present a decided intermittent type, we must have recourse to quinine, pediluvia and gentle purging.

Nervous vomiting.—This symptom is by no means rare, at the time of dentition, and ordinarily attends swelling and itching of the gums. It is attended with this peculiarity, that the little pa-

tients often reject liquids and retain solids. It is a disorder which is never serious, and requires little but nursing. It is necessary to diminish the quantity of aliment, and to avoid all excitants. If the vomiting should be attended with pain in the head and redness of the face, we must have recourse to leeches behind the mastoid processes, and camphorated and opiate embrocations upon the epigastrium. Baumes advises two or three grains of musk in a little sugar and mint water.

Modification of secretion in the digestive organs.—During dentition, it is common to see the saliva and mucus thrown in greater quantities upon the alimentary tube and creating fluid and abundant dejections and vomitings. While these symptoms are restrained within proper bounds, they are propitious, as they set up a salutary derivation in the intestinal canal, but when prolonged, the secretion increases, day by day, and marasmus supervenes.

It is well to remember, that a number of causes, growing out of the improper management of children, may occasion similar changes in the dejections to those legitimately due to dentition. It is important to observe this distinction, as the treatment is not the same in the two cases. If a serous diarrhœa sets in, really caused by painful dentition, it is favorable. At most, we should only recommend mucilaginous drinks, emollient injections, and good alimentary regimen, that is to say, food soothing and easily digested. If the infant be not weaned, it should have the breast less frequently than before.

If after the teeth appear, the purging continues, and no inflammatory symptom supervenes, we may seek to check it by the use of gummed rice water, and by tonic diet and drinks. Some practiciens recommend colombo, in the dose of from four to six grains, in some tincture of rhubarb, or made into pills with conserve of roses.

Finally, the other sympathetic disorders of dentition are inflammation of the digestive organs. The different forms of stomatitis, angina pharyngea, gastro-intestinal inflammations, inflammatory conditions of the air passages, coryza, laryngeo tracheal angina, pulmonary catarrh, the modification of the secretions, and inflammation of the genito urinary organs, ophthalmia, otitis, cutaneous eruptions, lymphatic engorgements, &c.

The reader will readily perceive that it would be to travel entirely out of our province to describe all these phlegmasia. Those who desire more ample knowledge on these subjects, may consult the Thesis of M. Charles Bouchard de Conliége, whose remarkable work has been of great service to us: the Treatise of M. Baumes on First Dentition, and, finally, an excellent little work, by M. Taveau, upon the Hygiene of the Mouth.

As in our general considerations of the teeth, we exhibited, at length, M. Delabarre's theory on the shedding of the first teeth, it will not be necessary to revert to that matter here. We will, therefore, pass on to consider "second dentition," which must be the subject of a fourth chapter.

CHAPTER IV.

SECOND DENTITION.

We have now arrived at the point when the temporary teeth successively fall out to give place to the teeth called permanent, because they may remain until advanced life. This second process of teething has been called second dentition. Although it involves far less accidents than the former, it is nevertheless, well worthy of study, inasmuch as the definite arrangement of the denture depends upon it. It is also important that mothers should not apply for aid under these circumstances to ignorant practiciens, lest instead of improving they should hinder the process in question. These considerations are but a prelude to the numerous observations we have made in the course of daily practice, and which we propose to lay before our readers in a special paragraph, in which this subject shall be treated at length. But previously, it is well to say a few words concerning the dental follicles of the second dentition, of their relations to those of the first, and finally of the order in which the eruption of the teeth takes place when their organization has been completed.

SEC. 1. *Dental Follicles of the Second Dentition.*

M. Serres assures us that he has seen the germs of the second dentition, even of the wisdom tooth, as early as the third month

of fœtal life. This distinguished anatomist has traced the progressive development of those organs up to the full term of delivery. We will not go into these details, but commence our description from the time of birth. At that time the germs of the teeth are near the gums, but by the progress of ossification they are thrown further back and ultimately are lodged in the interior of the jaws. Some of these germs or follicles are rounded like pin-heads, others are oval, being connected to the gum by a pedicle more or less elongated. They remain in contact with the follicles of the temporary teeth, and during dentition the alveoli of the permanent teeth assume the appearance of almond shells, whose extremity, ending in a little bony canal, serves as the passage to the dental follicle, which M. Delabarre calls *iter dentis*, and which acquires considerable capacity by absorption.

Sec. 2. *Development of the Permanent Teeth.*

The thirty-two permanent teeth, are of two classes. The first formed entirely by the teeth of replacement—these are the twenty anterior teeth which take the place of the milk teeth. The second, by the twelve teeth primitively permanent, these are the great molars of the adult.

After birth, in the inferior jaw the small incisors bear against the posterior face of the roots of those which they are to replace, and as they are larger than those, they encroach a little on their partition. The lateral incisors being stronger still than the preceding, are placed just in face of the partition that separates the lateral incisors from the canine of the first dentition. The canine is more deeply embedded in the thickness of the jaw than the others, and it escapes under the anterior plate of the alveolar process. The first small molar is placed below and behind the teeth which it is to replace, while the second molar is immediately subjacent to the second molar of the first dentition. From this examination of the relation which the teeth of the second dentition bear to those of the first, it is easy to see why the canine is out of line; the permanent incisors occupying the space of the six first teeth, and the permanent molars coming into nearly the places of the temporary ones, it becomes necessary for the canine to take up an eccentric position, which it occupies more or less during life.

About a year after birth, the germs of the second teeth are separated from the milk teeth and from one another by bony partitions which form special cells for them, which are penetrated by a canal at each extremity; on one side for the vessels and nerves, of which the pedicle of the dental papilla is composed, at the other for the neck or ductus of the dental follicle.

In proportion as the permanent tooth is developed, the milk tooth, as we have before said, is wasted away by an absorbent apparatus which nothing can resist, and the septum which separates the two classes of alveoli, soon disappears also. Sometimes the tooth immediately presses towards the alveolar border without altering the wall of the alveolus of the tooth it is about to replace; but this is not the ordinary process of nature, though Hunter held that opinion.

The following is the order in which the permanent teeth effect their evolution. The first large molar, the central incisor, the lateral incisor, the first small molar, the canine, the second small molar, and the second large molar; the third great molar is the last.

Now we will name the age when these teeth appear. At the fifth or sixth year the first great molar passes from the alveolus; at seven years, when the corresponding temporary tooth has been shed, we may see the lateral incisor, a little after the preceding. The first small molar escapes about the ninth year; the canine from the tenth to the eleventh; the second small molar from the eleventh to thirteenth; the second large molar from twelfth to fourteenth, and the third large molar or wisdom tooth, between the eighteenth and thirtieth year.

All the large molars have an oblique direction at the moment of their appearance; afterwards they straighten themselves, when the alveolar borders are modified to permit it.

As we stated in the sixth section of the second chapter, the permanent teeth occasionally present anomalies. We will not recur to that subject, except to remark, that the teeth do not always issue exactly at the period we have fixed. The second molar is often before the canine, sometimes the exit of that is retarded, sometimes, indeed, it does not appear at all.

There happens among old persons an abortive attempt at

teething, which has been called the third dentition, by some, while others reject such a term and consider the phenomenon to be nothing more than the tardy development of germs whose evolution had been arrested. One thing is certain, that a complete set of new teeth never has yet appeared in the mouth of an aged person, and that the so-called third dentition, as observed by Hunter, so far from being a benefit to the person in whom it occurred, was an inconvenience. For in an old man, who has lost all his other teeth, these imperfectly developed organs stand alone in the dental arch, and finding no antagonists, irritate, inflame and ulcerate the gums, and make it necessary to practice extraction.

Sec. 3. *Accidents which attend Second Dentition.*

The disorders which attend the second dentition are by no means as serious as those which accompany the first. The local symptoms being the same, call for similar treatment. The constitutional affections, are, sanguine congestions, nasal hæmorrhages, mucous and sometimes bloody ptyalism, engorgement of the glands, diseases of the eyes and ears, scaly and hairy eruptions, scurfy tetters on the face, which disappear almost as soon as they show themselves; but we do not see the serous and inflammatory diarrhœa, which attends the first dentition.

If the second dentition of childhood is effected with ease, it is not always so in the adult. The cutting of the third great molars or wisdom teeth, brings with it circumstances the more distressing, as the other teeth are more closely serried, and leave less space between the coronoid apophysis and the second large molar. The great thickness of the bony substance which they have to traverse is also a frequent cause of trouble.

In some individuals severe pain recurs, at little intervals, for several weeks, and, sometimes, even during the two or three years in which the teeth are performing their evolution. Inflammation, with abscesses of the gum, ensues. The contraction is such, that the patient sometimes has great difficulty in using the jaws. Sometimes, also, we observe fever, continued or intermittent, with nervous symptoms in the neigbor-

hood of the chest or head. These fevers, after having obstinately resisted all means of cure, generally subside, together with the greater part of the nervous symptoms, when the teeth come through, an operation which may be very materially facilitated by cutting away or even incising the gum. This assistance, generally, immediately relieves the fearful pains, the cause of which the patient may never have suspected. If the trismus be sufficiently great to hinder the opening of the jaws, some leeches should be put behind the ears; very stimulating baths should be applied to the feet, and then we may have recourse to emollient and narcotic cataplasms.

It sometimes happens that, although the tooth be sufficiently extruded, it must, nevertheless, be extracted, because of its interfering with the movements of the opposite jaw. If this cannot be done, and there be urgent necessity for present relief, we may take out the tooth next before it: the last will naturally fall into the open space.

Sec. 4. *Management of Second Dentition.*

This subject is, unquestionably, one of the most vexed in dental medicine. With regard to it, opinions, directly opposite, are advanced and defended with equal warmth and equal talent, by men the most distinguished in the art. As for ourselves, long experience, corroborated by the most conclusive facts, observed in a large circle of practice, has led us to form those opinions which we expect to establish by the most satisfactory evidence. But, previously, we must consider some generalities.

It is, for the most part, children brought up in large cities in whom the first dentition is effected in a painful and irregular way. Those born in the country, and the children of the poorer classes in towns, are favored with a remarkable dentition, not only on account of the facility with which it is performed, and the beauty of the denture, but for the absence of the pain to which others are so subject. The reason is plain. The habit of exposure to changes of weather, and of exercise in air, frequently renewed, if not always pure, imparts a remarkable strength to the constitution. But, for the children of the rich, circumstances are very different; at a time when every

thing should be directed to the development of their physical powers, their brain is kept in a state of excitement, which causes it to absorb the whole vital energy, and to arrest the development of organs most essential to every part: the result is, a predisposition to numberless disorders, and an exalted sensibility, which quintuples the intensity of the least suffering.

We may then affirm, that one means of preventing the accidents of second dentition, is to procure for children, as early as we can, a sound and vigorous constitution.

But it will not suffice to prevent the disorders which are likely to attend the eruption of the permanent teeth, it is also important to have regard to their symmetrical arrangement. What then are we to do to this end? Are we prematurely to extract the temporary teeth or leave them to the course of nature? And where the negligence of parents has procured for children an irregular denture, must we take away a permanent tooth, to facilitate the restoration of the rest to proper order?

Let us consider the first of these inquiries, must we extract the temporary teeth? When they fall out with difficulty, when their presence becomes a mechanical impediment to the progress of the permanent teeth, and obliges them to take an irregular direction or growth, we must not hesitate to extract them. Unless we do, we expose the children to deformity, which is much easier prevented than cured.

Some dentists are afraid that, in attempting to take away the deciduous tooth, they might also extract the germ of the permanent one. This fear is entirely chimerical. Between the fourth and fifth year the germ is entirely ossified, and does not touch the temporary tooth, whose root is half destroyed by absorption.

Nevertheless, it is wrong to remove the milk teeth prematurely, and without good reason, for if we remove more teeth than can be readily replaced, those of the second dentition, finding more room than belongs to them, may encroach upon the proper space of those that are to come after, and thus induces irregularity, more or less deforming. If, on the contrary, we take care not to remove them faster than they can be supplied with exact regard to the space proper to each succeeding tooth, the denture will be of that symmetrical character which so singularly beautifies the mouth.

There are some dentists, however, who, urged with a desire to operate, make no scruple to extract the first teeth without regard to necessity. What is the consequence? From a child of seven years, for instance, you take away the four incisors; they are replaced. But those which come after them being larger than the first, force the temporary canines to give way before their time. You then remove these canines. Those which are to replace them, finding no longer the resistance which ought to restrain them, shoot up in such a way as to arrange themselves, either within or without the dental circle, forming overlapping teeth; a deformity caused by this meddlesome management, which is but too frequent. Another reason why the temporary teeth should not be unnecessarily extracted is, that their presence contributes no little to the spread of the jaw, or of the alveolar circle which has not yet attained its full dimensions.

Every day's experience shows us that teeth, which are at first, to a trifling extent, irregular, will straighten themselves as the circle of the jaw expands. We would urge upon our brethren to take a lesson from nature, who thus re-establishes the harmony for a moment disturbed.

As M. Miel has well observed in a treatise, the entire doctrines of which we are far from endorsing, two things may powerfully contribute to irregularity of the teeth. 1st. A fœtus feebly organized, may be born puny and slender: every thing being in accordance with this imperfect state, the germs of the teeth are small. When the time of dentition arrives, it is possible that the constition of the child may have become much more vigorous: the pulps and teeth of the second formation, will thence be relatively larger than those of the first dentition.

Again, the child may have been originally well formed, and its milk teeth have received their full development, but disease, scrofula for example, occurs, which gives to the second teeth unnatural size; these will, of course, be out of proportion to the first. In these two cases, it is impossible that the dentition should be regularly performed. The teeth press upon one another and necessarily assume irregular positions. When thus situated, they are not only disagreeable to the sight, and in each other's way, but being difficult to clean, they decay with great rapidity.

Pressed with the serious nature of these consequences, dentists have not failed to suggest and to try means, more or less rational, as they were or were not in accordance with nature. Some viewing the anterior arch of the alveolar border, which contains the twenty temporary teeth, as being entirely immovable, stationary and fixed, in the midst of the general growth, can think of no expedient but the extraction of one or two molars, in order to give the other teeth room to arrange themselves. Others, among whom we confess ourselves to be, affirming that the alveolar arch, like all other parts of our bodies, is capable of extension, oppose, strenuously, such a mutilation as the sacrifice of permanent teeth for the better arrangement of the denture.

Before announcing our views upon this subject, we think proper to prove one thing, in contradiction of M. Miel, that is, that the anterior part of the maxillaries is susceptible of development, and that when nature fails to effect it, art may succeed. Here we are compelled to anticipate some things which concern dental pathology in general. For a long time, it has been our habit, when consulted by patients troubled with prominence of the dental arch, growing out of a too near approach of its lateral extremities, to overcome this deformity by applying eccentric force upon the molars of each jaw. But under these circumstances we do not use so complicated an apparatus as when we have to do with extreme narrowness of the jaws. Again, if we observe nothing but too close an arrangement of the teeth, which forces them from their symmetrical relation, we are contented, when the subject is a child, to introduce the thumbs upon the upper jaw, and by frequent and well managed traction, to force the alveolar arches apart. We perform this operation before the parents, and prevail on them, or on the child itself, to repeat it every morning, and even during the day.

For the inferior jaw we use the two index fingers instead of the thumbs. Constantly this practice succeeds, and we see the teeth, which were throwing themselves upon one another, straighten and assume their proper places without pain or deformity. Sometimes we have even gained space enough to permit the canine tooth to return to the common range, in a case where premature extraction would have caused them to overlap.

It is then only in extraordinary cases that we advise the extraction of an adult tooth, and the traction of others into the open space by a silken thread. We only mention this method in order to show our systematic rejection of it.

When the vicious arrangement has long existed, there are many means of remedying it, but as these belong to dental pathology, we will not mention them now, but adhere to our plan.

To recapitulate our views—we repeat, that it is most important in the management of second dentition, to remove the milk teeth already decayed, only to extract them one at a time, and when the neighboring permanent teeth are already half extruded. There are two extremes to shun. The premature extraction which permits the new teeth to encroach upon the places of others, and the permitting a decayed tooth to remain so long as to occasion its successor to deviate from its proper course.

CHAPTER V.

DENTAL HYGIENE.

Many excellent authors, who have written upon surgical dentistry, have placed hygiene after dental pathology. We, who have directed all our efforts to postpone, as long as possible, the time when organs so precious as the teeth being lost, the appearance and the health are impaired, we will give hygiene the precedence. It is far more important to learn to preserve than to learn to cure.

This branch of our art is more extensive than might be supposed, and its importance requires that we should direct to it our closest attention. How many mutilated persons there are, who are afraid to smile lest they should display the disagreeable void by which their mouths are deformed, and who might have escaped the ugliness which troubles them in all the circumstances of life, if they had but taken a little care—so little, that the re-

collection of the trifling amount of carefulness required, adds bitterness to a loss, which, under the best circumstances, is sufficiently distressing.

Hygiene includes several subjects for consideration, viz.

Articles of food which are injurious.

The influence of clothing and atmospheric vicissitudes.

What is injurious to the teeth, and what preserves them.

Cleanliness of the mouth, and all the means useful thereto.

Without dwelling further on general matters, we will proceed to consider each of these subjects particularly.

Sec. 1. *Articles of Food which are injurious.*

Although the greater number of patients are heedless of advice on this point, it is our duty to point out such aliments as are likely to engender or to prolong diseases of the teeth, and such as are by no means hurtful. It may happen, that a nervous lady, subject to one of those neuralgias, which involves the whole denture, may apply to you for advice, by following which she may hope to escape perpetual suffering. Regimen is one of the most efficacious means to check this disorder. In general, animal substances are not as favorable to the preservation of the teeth as vegetables are. The difficulty which is found to attend the removal of the fibrous residuum of roast meat, from between the teeth, or to take away the glutinous plastering left by those which have been boiled, will sufficiently justify this saying. We must also dread the prolonged use of smoked and salted meats, the very unfavorable action of which is the cause of that terrible disorder, the scurvy, which consists in continual bleeding of the gums, and the loosening and pain of the teeth.

We are accustomed to regard sugar, and all substances that contain it, as very injurious to the teeth. This is, nevertheless, doubtful. The negroes, who, during a certain season of the year, eat almost nothing else, do not manifest any loss of the remarkable whiteness of their beautiful teeth, while, at the same time, they fatten on this diet. We have, at hand, other examples of those who have long preserved their teeth, while they have made immoderate use of sugar. Persons, who mer-

cilessly proscribe this luxury of childhood and old age, will tell us that the chrystalized sugar, like other hard bodies, scratches the enamel, and, ultimately, corrodes it; and that even syrup, or gelatinous vegetable matter containing sugar, agglutinates upon the teeth, subjects them continually to the action of the air, and makes them a habitual focus of an inflammatory fluxion which often induces caries.

Although chemical analysis does not detect in sugar any acid quality, it is certain that every body, who, about the time of new year, eats largely of confectionary, must experience sensations about the teeth by no means favorable to perseverance in the indulgence. Besides, some debris of sugar will remain between the teeth, and undergoing fermentation will have a strong tendency to become acid. Then their presence will unquestionably be injurious.

It is hard to get over the fact, that workmen in sugar refineries generally have very bad teeth, and that many girls who are employed in confectionary shops, display teeth so ravaged with caries as to furnish sufficient evidence of their habit of partaking largely of the sweets they are employed to sell.

Young girls of that age in which they are so often afflicted with chlorosis or hysteria, often have an invincible propensity to devour acid substances, such as green fruits, pickles, salad, &c. We cannot too frequently set before them the danger to their health, which such indulgence involves, and the destruction of their teeth, to them a priceless ornament, which must result if they should not repress this depraved appetite.

The use of alcoholic drinks is not less dangerous to the teeth. Supposing that their chemical action is not hurtful, they keep the mouth and gums in a state of irritation which must affect the teeth.

It is also well established, that well water contributes effectively to alter the enamel. Two things confirm this remark: the chemical analysis of these waters, and the bad state of the mouth of those who use them. It is certain that in towns, where no river water can be got, the inhabitants are toothless at their fortieth year.

SEC. 2. *Influence of Clothing and Atmospheric Vicissitudes.*

If the great part of mankind will listen to no counsel about their food, they are yet more deaf to all argument in the matter of clothing; especially ladies, who do not fear to bare their necks, and wear the lightest stuffs in the middle of winter. Nevertheless, we must do our duty, and point out the fearful consequences incident upon atmospheric changes. Next to the lungs, the teeth are most exposed to suffer from the daily imprudences committed in this respect. They may be affected, directly or indirectly. Directly, by the sharp stimulation which the cold imparts to the blood vessels and nerves enclosed in the membrane in the dental canal. Indirectly, by the sudden suppression of transpiration from some part of the body, which is thrown upon the mucous membrane of the mouth, and thence upon the teeth themselves, inflaming the parts, and inducing buccal abscesses. Women, especially, on account of their nervous and delicate organization, are most sensible to slight changes of temperature. The best means of protecting themselves, is to contract, early, the habit of not clothing the person too heavily, and to take exercise in the open air. This, while it favors the harmonious development of all parts of the body, gives to each part the power to resist morbid influences.

As soon as there is a change of temperature, females should take care to clothe themselves suitably. Especially when passing from crowded rooms, where the exhiliration of pleasure, and the high temperature has excited them to the utmost, they must be very careful lest they forget a caution most essential to health. Many, for the pleasure of a ball, happening at an unfortunate time, plunge their feet in cold water, and thus suppress an evacuation, which causes the destruction of the teeth, if the damage be not greater, even, indeed, if it be not fatal.

Sometimes, the too free use of a fan, by constantly arresting transpiration, developes most actively the disorders which prey upon the teeth.

This is all we have to say about clothing and atmospheric change. Let us now consider the things, other than aliment, which may injure the teeth.

Sec. 3. *Things hurtful to the Teeth.*

Among the things which are most injurious to the teeth, we may rank, first, the wretched habit of using them for purposes for which they were never made. Persons, who, with their teeth, crack nuts, bite thread, draw corks, and even nails, lift tables and other heavy burdens, expose to premature destruction, organs indispensable to nutrition. In the same category we may class smokers, in whose mouths the lateral incisor and the canine teeth are not only corroded by the stem of their pipe, but whose entire gums are kept in a state of perpetual irritation by the empyreumatic oil and acetic acid, which is disengaged with the smoke.

Frigidum inimicum dentibus.—Cold is an enemy to teeth, said Hippocrates. It is, therefore, a bad habit to drink "goute doctorale," after soup. This not only does harm to the doctor but to the patient, who, in consequence, must oftener see the dentist. What shall we say of ices in the heated ball-room? Men seem to have a fatal instinct, which impels them to do every thing most likely to injure their health.

We must not forget to mention those, whose unpardonable negligence prevents their attention to a carious tooth, or whose cowardice is so great as to forbid them to permit extraction, when the decay is so extensive, that our etherial albuminous paste, of which we shall speak presently, cannot save them. Here is the consequence. As the pressure of food gives great pain, the patient gets into the habit of eating on one side only, and the inactive teeth become encased in tartar. This, sometimes, so irritates the gum, as to induce gouty or rheumatic disorder in them, and cause the loss of the teeth.

Unfortunate, indeed, are they, whom syphilis condemns to use mercury! Their mouth is heated and inflamed by salivation; their gums become fungous, and their loosened teeth fall out, one by one, at the slightest touch!

In our day, ladies of fashion no longer employ, at the toilet, paints, lotions, and a multitude of cosmetics containing mineral substances, which, in truth, are poisons. To prevent such use at any future time, it may be well to apprise them, that these

paints, ordinarily contain antimony, bismuth and oxide of lead, and the "Water of Ninon," "Sultana," "Dutchess" and "Marchioness" waters contain either corrosive sublimate or hydrochlorate of lead. Therefore, some of these substances act directly upon the teeth in the most deleterious way, while others are injurious indirectly by their astringent action, forcing the blood to the neighboring parts.

But there is a bad habit which, among ladies, still survives, that is, the putting pins in their mouths while dressing. This is no little matter. It is evident that the often repeated contact with these hard bodies, pressed as they are with more or less force, will wear away the enamel, and, sometimes, induce caries of the whole tooth.

Those who have bad health, ought, more than others, to be careful of their teeth. How often have we seen young people, apparently in good health, take pains to remove from their faces little pimples, and scurfy eruptions, and be totally unaware of the inconvenience, until caries has appeared. And others, troubled with immoderate perspiration of the feet, have sometimes plunged them into cold water in order to suppress it; and thus made themselves liable to the disorders we have been considering.

Again, it is not a matter of indifference as regards the teeth, that the head be subjected to the caprices of fashion, and, although tooth-ache may have been cured by cutting the hair, it does not follow that this can always be done with impunity.

The hair is a transpiratory apparatus, whose widely extended surface exudes an unctious liquid, which mixes with that which escapes through the pores of the scalp. Between the teeth and hair there is such a sympathy, that one of these organs is useful to the other. The unctious exhalation which unites the mass of hair together, makes of it a sort of protecting covering which preserves the brain from the dangerous influence of atmospheric changes. We may, then, readily perceive, that by cutting it too short we destroy not only a protecting covering, but also a necessary emunctory, we need not then wonder at the head-aches, feebleness of sight, engorgement of the glands, and, above all, the dental caries, with which those are assailed who inconsiderately despoil themselves of their hair.

A bad practice, against which dentists cannot protest too earnestly, is that of putting children's heads under the cock of a hydrant. This, certainly, is a very expeditious mode of washing their hair and scalp, but to how many dangers does it expose them? How many young infants, from this cause only, are prematurely subjected to the destructive key?

I believe we have enumerated all that militates against the preservation and health of the teeth. Let us pass now to the general precepts which must be observed in order to their well being.

Sec. 4. *Cleanness of the Mouth.*

One of the simplest and most efficacious means of preserving the teeth, consists in the local attention which we call cleanliness of the mouth.

As this part of dental hygiene is imprudently neglected by some, and very badly understood by others, we think proper to omit none of the details, not even the most minute which belong to it.

After rising from bed, the first thing should be to rinse the mouth with fresh water of the temperature of 8° or 10°,* and for this reason—if we first use a brush, we rub upon the teeth and gums the mucosities which the mouth has gathered during the night, and this is not our object.

Pure water, generally, answers the purpose, but people who have bad breath, or whose gums are spongy and soft, may add a few drops of good brandy, or what is better, of a dentifrice elixir, of which we will give the composition at the proper time and place.

After this, it is well to use some dentifrice powder, with which the teeth and gums should be well rubbed by a hard brush. Every time the brush is used it should be carefully washed, until it will no longer stain clear water. It should be replaced as soon as it begins to wear. There are some countries, as America, where it is thought improper to use a brush more than once, and hence it is always broken after use.† This, perhaps, is carrying

* Reaumur's thermometer.

† This will be news to our countrymen.—Trans.

the matter a little too far, nevertheless, we can readily perceive that the bristles will corrupt by maceration in saliva and water.

Some persons rub their gums and teeth with a rag merely, without washing the mouth. Instead of being favorable to the cleanliness and preservation of the teeth, this practice is injurious, because the pressure exercised upon these organs must harden and accumulate the tartar, in the places where it inclines to gather, that is, between the intervals of the teeth and at the neck.

Before it was the custom in France, for guests at the dinner table, to rinse their mouths in warm aromatic water after eating, as is the fashion in England, some dentists were loud in their praises of this practice—now, that it is generally adopted here, there are others who no less vehemently deplore the mouth-washing and spitting which now takes place after dessert. There are some unhappy people who think that nothing can be well, except what does not now exist. As for ourselves, we think that when the custom has once been generally adopted, people will become more and more familiar with it, and though it be not the most pleasant thing to succeed the dessert, yet the consequence will be, that we shall more frequently see the female mouth have sound and beautiful teeth, which will abundantly compensate for so trifling an inconvenience. It is also well to remember, that this precaution not only tends to keep the teeth clean, but also to clear the voice of those who may be about to sing or converse.

We must now enter upon some detailed description of the instruments, dentifrices, washes and elixirs, in daily use for cleaning the teeth.

Sec. 5. *Instruments and Preparations in use for Cleansing the Teeth.*

Brushes.—These are in universal use. Each hair which composes them may be regarded as a little tooth-pick, used to remove the slime deposited on the teeth; they serve to keep the mouth perfectly clean, and to preserve the teeth and gums of those who use them from the various diseases to which these organs are subject.

Brushes are of various forms, and the bristles are of various kinds. Some are very soft—these are made of horse-hair or that of the badger. Others are very hard—these are made of the bristles of swine. Others, again, are between the two. These have the two smaller rows of bristles, and the two outer of white hair. Among all these varieties we prefer those which are made of the bristles of a young hog, wide enough apart from one another. Their handle is slightly bent, and they have only three rows, and what is of the most consequence, they are narrow at their extremity, so as easily to penetrate even to the last molars without wounding the cheeks. In using them, we strenuously advise our patients to make them traverse upon the teeth, the bristles a little inclined towards the gums, and to have no fears about rubbing the latter. If they be made to bleed, the depletion strengthens them, and they are the better of it.

What we say is the result of many years' experience in our profession.

In order to brush the teeth well on their anterior face, we should carefully perform movements of semi-rotation from below, upwards, for the lower teeth; and from above, downwards, for the upper. The slime is much more readily removed in this way than by the ordinary rubbing from right to left, and from left to right.

Sponges.—Fouchard very much vaunts the advantages of this means; but independently of the fact, that sponges produce a very disagreeable sensation in passing over the teeth, especially to persons who, after an operation, have teeth partly deprived of enamel, being fixed upon a resisting body, they only rub the middle of the teeth, and do not reach at all the points at which they touch; which places should by all means be cleaned. To be sure, they may be used without being fixed on a staff, but then, as the fingers cannot reach the bottom of the mouth perfectly, they only cleanse the anterior teeth, and, consequently, only fulfil one-half the indication for which they are employed.

Of different roots.—To make brushes of these, they are cut into slits at one end. Ordinarily, they are the roots of liquorice or mallow, or Spanish trefoil, boiled several times; and colored and

flavored for use. Besides, that roots thus prepared, are too sweet, they are also hard to preserve. If placed in a dry situation they get too hard and become brittle, if in a moist place they become mouldy. We have only spoke of them as things that have been.

We rank in the same category the coral sticks composed of different calcareous powders, colored, and rendered partly soluble by the addition of a sufficient quantity of gum-arabic. These were of the size of a duck quill, and were used as brushes to clean the teeth, but they have justly gone out of use, because they required strong pressure to make them act upon the teeth, which they only partially cleansed. Besides, they excoriate the gums.

Of tooth-picks.—These are made of quills, horn, shell, very flexible wood, ivory, bone, gold or silver. The best are made of quills not boiled, that is to say, such as have not been deprived of the oily matter which gives them their transparency. These are only used to remove fragments of food lodged in the interstices of the teeth, when they cannot be dislodged by the point of the tongue.

We cannot too strongly reprehend the bad habit of those, who, after meals, causelessly torment their teeth and gums, for hours together, and very often with metallic tooth-picks. We condemn these last entirely, and without exception, and most strongly the point of a knife, which we have seen made use of by some old men as a lever to loosen their teeth, and precipitate their fall.

Sec. 6. *Dentifrices in general.*

As water has not the property to restore to the teeth the brilliant hue which the slime deprives them of, industry must supply the defects, and science seeks to perfect the means of satisfying the proper wish of all who desire to have fine teeth. Hence we have an incalculable number of recipes, which are by no means equally innocent. That which has most contributed to their multiplication is the desire which every dentist has of having a dentifrice of his own composition. Many of these powders contain substances, which, placed upon the enamel, exert their action there, even before the taste of the noxious ingredient is perceived. Some only whiten the enamel by destroying its pol-

ish, and others, as tannin and alum, affect the gums by constringing their tissue. Cremor tartar, too, whitens the teeth, but it sets them on edge, and makes mastication painful. Charcoal, which is in such universal use, is, nevertheless, a detestable dentifrice. Its little black grains remain between the neck of the tooth and gum, and, besides, it scratches the enamel; this will seem plain enough when we remember that it is with charcoal that men polish steel. In general, all acids only whiten the teeth by destroying their texture—vinegar, only, does not do this—sorrel, lemon-juice, cremor tartar, and all the mineral acids, under whatever form they may be used, and under whatever Greek name they are disguised. In the long run they corrode the teeth, and give them a permanent yellow hue.

Among the dentifrices, some are solid and pulvurulent, others soft, and others liquid. They are called powders, dentifrices, opiates, elixirs or liqueurs.

Powders.—At the beginning of this paragraph we have condemned many of them. Perhaps, we might have included Peruvian bark, as its astringent principle gives a yellow tinge to the teeth. We would have done so, but for the fact, that in spongy gums it is very useful. It strengthens them, and imparts tone.

The dentifrice which we recommend to our patients is a vegetable powder, made as follows:

Cochleria, (scurvy-grass,)
Horse-radish,
Guiacum,
Peruvian bark,
Mint,
Pellitory,
Calamus,
Ratany-root.

These substances are reduced to an impalpable powder, and passed through the finest hair-sifter. When our patients are liable to gastralgia, we add a little magnesia.

Besides, that this powder contains no ingredient that can act chemically upon the teeth, its extreme softness, and the tenuity of the particles which compose it, prevent it from scratching. Hence we prefer it to others. Respectable authors, guided only by a desire to do good, and not by blameable speculation, have

proposed various preparations, the value of which we are about to discuss.

Mr. Alibert's Powder.

Magnesia,	192	grammes.
Red-shell,	32	do.
Florence Iris,	160	do.
Sup. tart. pot.	64	do.

We find little here to disapprove, except the sup. tart. pot. which may ultimately set the teeth on edge, especially in people whose enamel has been softened by other causes.

Maury's Powder—Rubbed with water.

Charcoal of white wood,	256	grammes.
Peruv. bark,	128	do.
White sugar,	236	do.
Oil of mint,	16	do.
Essence of cinnamon,	8	do.
Muscated spirit of amber,	2	do.

We disapprove of two ingredients, the charcoal and the bark, and that for reasons above given. The oil of mint seems, also, to be too stimulating; so, also, is the oil of cinnamon, and the muscated spirit of amber, which makes this prescription an inflammatory paste.

Jamet's Powder.

Florence Iris, cleansed with spirits of wine,	500	grammes.
Magnesia,	128	do.
Pumice stone,	256	do.
Bones of cuttle-fish,	256	do.
Sul. quinine,	128	do.
Cascarilla,	32	do.
Sugar of milk,	300	do.

Reduce these substances to powder, pass them through a fine hair-sifter, and mingle them together; take the pumice stone separately, and put in it, of

Essence of mint,	32	grammes.
Essence of cinnamon,	8	do.
Essence of orange-flowers,	4	do.
Muscated and rosated spt. amber,	4	do.

Mix them, and when the pumice stone is dry, add them to the other powders, and again pass through a sieve.

We object to this formula even more than to the first. It contains substances (pumice stone, &c.) which may scratch the enamel, and, moreover, has ingredients of the most stimulating quality. These would do very well where the gums were soft and spongy, but are far from being suitable when they are rather inclined to sanguineous congestions, as is the case with persons, the mucous membrane of whose mouth is always of a lively red, almost inflammatory in its appearance.

Powders have also been recommended for imparting to the gums and lips a good rose color, which might continue for a part of the day. It would be degrading to our art to prostitute it to the purposes of coquetry—these belong rather to the perfumers.

Opiates and mixtures.—These only differ from powders in this, that in order to make them soft, they contain a little syrup or good honey. This addition gives them a sweetish taste which is far from being pleasant to every body.

Liqueurs and elixirs.—These preparations are, for the most part, emulsive, that is to say, they whiten water. Those, whose base is acid, redden the syrup of violets and the tincture of sunflower. They serve to substitute the powders, especially, when there are carious teeth, which the brush cannot reach, and where the gums are extremely sensitive. As these preparations are generally highly concentrated, it is sufficient to drop a very little into water enough to cleanse the mouth.

We do not speak of these elixirs which contain acids. As to those whose base is essential oil, inasmuch as the quantity used in a glass of water is very small, they are not so hurtful as powders of similar composition. Besides, they who use them can dilute them according to the greater or less susceptibility of the mucous membrane of the mouth.

Elixir, with a base of Essential Oil.

Tincture of vanilla,	15	grammes.
Tincture of pellitory,	128	do.
Spirit of mint,	32	do.
Spirit of rosemary,	32	do.
Spirit of rose,	64	do.

mingle them together.

Of all elixirs, the Bottot water has enjoyed, and does still enjoy, the greatest reputation. It consists of

Spirit of wine, at 33,	2 litres.
Pounded cloves, Cinnamon, Green anis,	each 32 grammes.
Powdered cochineal, Essence of peppermint,	each 16 grammes.

There are other elixirs more or less anti-odontalgic, anti-neuralgic, and anti-scorbutic, a further description of which we spare the reader.

As for ourselves, sustained by the good results which we have obtained from our vegetable dentifrice, and persuaded that elixirs are, for the most part, only aromatic liqueurs, which serve to mask fetid breath, and impart moderate tone to the gums, we have composed our elixir of the same substances of which we have compounded our dentifrice. In order to preserve their virtues we immerse them for three months in very good brandy.

This elixir may be used, like the others, by dropping a few drops in a glass of water.

Sec. 7. *General Precepts for the Preservation of the Teeth.*

We cannot conclude our remarks on dental hygiene better than by giving some general directions for the preservation of these precious organs, which are the pride of beauty and the delight of the epicure.

The whole secret is to avoid every thing likely to injure them, and to obtain this end, it is necessary, first, to guard against the use of cold lotions for the head—to employ nothing to repel little eruptions from the face, nor any pomatum to color the hair.

2d. Not to crack hard bodies with the teeth: not to make a cork-screw, or vice of the jaws.

3d. Not to bite thread or any thing of the kind. This may be injurious to the teeth even if it does not induce caries.

4th. Not to allow food to remain in carious cavities, and above all to use no improper dentifrices, such as corals, pumice stone and acid waters, elixirs and tinctures.

5th. Not to take cold food or drink immediately after partaking of warm food. Not to expose one's-self to cold air soon after smoking, for it is not merely the smoke of the tobacco which induces caries, but also, and perhaps more frequently, the cold air, which penetrating the mouth contrasts with the general heat which the smoke has begotten there. Inflammations of the dental pulp may arise, and caries in those teeth liable to it.

6th. It is necessary, also to shun residence in low and humid situations, by the side of lakes and rivers, and in all locations subject to frequent variations of temperature.

7th. It is well not to drink mineral waters in very large quantity. Their daily use sets the teeth on edge, renders them painful, and covers them with a blackish coat. To abstain from eating much confectionary, and from such employments as require the frequent handling of mercury and other metallic substances, which, reduced to vapor, may alter the teeth in a remarkable and serious manner.

There are certainly other causes which can engender caries, but as they for the most part affect the whole constitution, it would be an intrusion into the domain of general pathology to consider them here. We will, therefore, proceed no farther.

PART II.

PATHOLOGY AND THERAPEUTICS.

PATHOLOGY.

In this second part of our treatise we are about to express our opinions upon dental pathology and therapeutics. So far, we have been combatting doctrines advanced in the works of respectable authors upon the subject of dental physiology. Only under the head of hygiene we have exhibited our own views upon some controverted points touching dentifrices, and other means in daily use for preserving the masticating apparatus in good order.

Now our task will be far lighter and much more pleasant. Forsaking the ungrateful labor of a compiler, we enter upon a branch of the dental art to which we have directed our assiduous attention, and upon which we flatter ourselves that we have some new ideas to advance.

One point, upon which we propose to dwell at length is orthodontosy, vulgarly (and incorrectly) called dental orthopedy. This branch of the dental art has been the subject of our very special thoughts, and the successful results we have often obtained in our practice, we hope will permit us to enrich the book of science with means entirely new, and in our experience sanctioned by incontestible efficacy.

Nevertheless, lest we should be understood to claim too much, we will observe, that we have appropriated to ourselves, so to speak, many instruments and processes long known, by the im-

portant modifications which we have made upon them, as the result of long and careful practice.

Before entering upon the matter, before setting forth at length, the little suggestions, the numberless precautions, the operations, either painful or uncomfortable to which those must submit who are so unfortunate as to have their teeth threatened with caries, or irregular in their arrangement, or shaken in their connexions, it is well to show the importance of these organs, not only to personal beauty, but for the preservation of the health.

We have thought these remarks necessary, in order to overcome the lethargy, the culpable negligence of many, who, shutting their eyes to the importance of dentition, persuade themselves, that it is not worth while to pay any attention to it.

We may consider the influence of the teeth upon the system, in two respects—with regard to the changes which their loss works in the inferior part of the face, and with regard to the functions in which they are concerned.

Upon the first point we shall have least to say. Indeed, it is not necessary to dwell long upon the deformities of countenance which result from loss of teeth. As soon as the alveoli are empty, their walls tend to approach one another. The alveolar border contracts, and as there is no longer a double row of teeth to sustain the cheeks, the face, near the commissure of the lips, exhibits depressions on each side. The prominent bones, immovable in the midst of the sinking soft parts, appear conspicuously beneath the skin. The sinking not only takes place laterally, but from above downwards. The loss of the teeth, and the retraction of the alveolar border, combine to shorten the face remarkably, and give to the visage the appearance so characteristic of old men. The cheek projects, the lips, now too long, wrinkle and fold inwards, and the nose seems to fall towards the chin. From all these changes, evidently, results deformity of the countenance.

In a functional point of view the teeth are of the utmost importance. They help to form a barrier which retains the saliva in the mouth: they aid in prehension and mastication, and in pronunciation they play a part so important, as to render their preservation of great consequence.

The incisors, of all others, are most useful in the prehension of solid matters. Having cutting extremities they act like scissors. This is not the place to say much about the physiological uses of the several kinds of teeth; let us, therefore, content ourselves with regarding their influence upon gastric digestion. Being essential to mastication, when the teeth are for the most part lost, chymification is performed with difficulty; the stomach, fretted with ill-prepared aliment, is irritated and inflamed. From this condition arises acidity of the gastric fluids, which hastens the destruction of such teeth as may, hitherto, have escaped caries.

The teeth, especially the incisors, and next to them the canines, are very necessary to the pure enunciation of certain sounds. But this is by no means their only use in conversation. The anterior teeth hinder the continual expulsion of saliva in the act of speaking: a great misfortune, which, where it exists, can only be remedied by artificial teeth. But to avoid the necessity of a resort to this means, the public should be well convinced of this fact, that the teeth are of the utmost importance to the regular process of nutrition, and to speech.

As soon as any constitutional or local cause whatever, menaces the teeth with danger, either immediate or remote, we cannot have recourse too soon to the advice of men skilled in the dental art.

How many persons, by the most simple and easy precautions, have preserved in their perfection, these organs, so indispensable for the fulfilment of the two capital functions we have named; that which repairs the waste of the system, and that which contributes to the clear articulation of words, and consequently to the freedom of intellectual intercourse.

CHAPTER VI.

Diseases of the teeth are of three principal kinds. 1st, Those proper to their substance. 2d, Those which affect them through their connexions. 3d, Anomalies of arrangement, irregularities of the dental arches.

Each of these classes will furnish matter for a separate chapter. In the third chapter we intend to treat with very particular care, the management of all the anomalies which the teeth present in their arrangement; this branch of the art having been the subject of our long and fruitful research.

First then, we are to examine the diseases proper to the structure of the teeth. These are more numerous than might be supposed, and when we have seen the long list of them, we will not be surprised that so many people lose their teeth prematurely.

The teeth wear away, break and crack, they corrode, their enamel decomposes and is discolored, their whole substance becomes carious, their roots are ruined by consumption; they are subject to exostosis, to spina ventosa, to necrosis, to inflammation of the alveolo-dental membrane and of the pulp, which in some cases ossifies.

After this simple statement, it is easy to perceive that among all these numerous diseases which attack the dental organs, some affect the hard, others the soft parts. Thus in a first series, we have, wearing, cracking, fracture, atrophy, decomposition and discoloration of the enamel, caries of the teeth, consumption, and even exostosis of their roots.

The second series presents us with inflammation of the pulp; its fungosity, its ossification, and the different forms of dental neuralgia. A third includes the diseases of the teeth, relating to their connexions, as loosening, luxation, denuding of the roots and concretions which form upon the teeth.

SEC. 1. *Wearing of the Teeth, Cracking, Fracture, Erosion, Atrophy.*

Wearing.—Although the enamel that covers the teeth renders their structure stronger and more compact than that of the other

bones, a great many causes may wear it away. Among these are the chemical influence of certain aliments, the rubbing of mastication, the employment of dentifrices not well pulverized, especially such as contain acids; the use of tobacco pipes, the habit of chewing on one side only, the practice of biting hard bodies—trismus, which causes the jaws to be rubbed upon one another.

It has also been remarked that the incisors wear away more readily when the molars are lost, and vice-versa.

The parts of the teeth which are worn off are never reproduced; but in proportion as the crown wears off, ossification of the pulp takes place in the cavity of the tooth which serves, so to speak, to repair the breach made by the rubbing, &c. M. Rousseau has given the name of "*osselet*" to that part of the pulp that is converted into bone. This is a substance more yellow than the rest of the teeth, transparent and friable as they are, and assuming no regular structure. It detaches itself from the dental cavity, and the sides which present to the cavity are far more sensitive than its internal surface.

The mode of treatment to pursue to remedy the inconvenience resulting from the wearing of the teeth, depends upon the cause which produces it. If acid or badly levigated dentifrices have injured the surface of the tooth, they must be instantly discontinued. If a tooth, from its irregular position, rubs upon another it must be straightened. If the angles formed by the injured tooth wound the tongue or other neighboring parts we must use the file. When the injury has gone so far as to be painful, we must cauterize the cavity so as to destroy the nervous ganglion, and then fill it so as to prevent the introduction of alimentary matters into the interior of the tooth.

Cracking.—Properly speaking this is but a small fracture. The only difference is, that being superficial it does not involve destruction of the tooth. The causes which produce it are the same as those which produce *wearing*, with this exception, that their action is immediate, as a blow from a hard body, or the grinding of the teeth in convulsions. The only remedy consists in filing the angular and cutting parts which might hurt the tongue or lips and occasion ulcers, (especially if the

subject be old) which may promptly become cancerous. We have seen two terrible cases of this kind. We cannot therefore be too earnest in enforcing the care necessary to prevent an accident which, though apparently trifling, may result so seriously.

Fracture.—This affection differs from the one we have just described, only in this, that the lesion is more considerable. It may affect different parts of the teeth, the crown, neck or root. It may be transverse or oblique. The crown may be fractured partially or completely; finally the tooth may be split longitudinally, or only cracked in that direction. At the moment of injury it may be sound or carious. We may readily see that in the latter case it will require less force, sometimes no more than the effort of mastication, to cause a fracture of the neck or a part of the crown. Rickets, scurvy and syphilis, by rendering the substance more brittle, predispose to this accident.

The traumatic causes are a violent blow, a fall on the face, or the shock of some projectile.

When one or more teeth are fractured, the impression of cold or heat, acids, and the rubbing of hard bodies, occasion severe pain. This painful condition may endure for months or even for many years, according to the extent of the fracture. It generally continues until, by a wise arrangement of nature, a new ossification takes place in the internal cavity of the tooth. These teeth become yellow or dark. They do not decay unless the fracture be so extensive as to expose the cavity, which is rare.

Many inconveniences may result from the fracture of a tooth. The dental pulp may be exposed and its contact with the air may give rise to pain, more or less severe. The best remedy in this case is to cauterize the cavity and nerve, and then to fill the cavity.

Sometimes, as we have said, the fracture extends to the neck of the tooth. In this case we must insert a pivot tooth if it be in front, and content ourselves with plugging the root, if it be one of the great molars.

At other times the fracture is longer, and one of the portions or both of them being movable, an extremely painful inflammation ensues, attacking the pulp and even the alveolus. A cyst forms at the extremity of the roots, or a fistulous abscess, with

the discharge of fetid pus, and finally caries. The only way of preventing these evils is to extract the unsteady fragments. Especially we must not hesitate to do this when it happens in patients from ten to fifteen years old, whose neighboring teeth will approach and fill the void, unless they are naturally wide apart.

Erosion and Atrophy of the Teeth.—M. Delabarre very properly distinguishes erosion from atrophy. He thinks that each of these conditions manifests peculiarities which make it unnecessary to confound them.

Congenital atrophy is observed frequently in a single tooth while the others are sound. Congenital erosion, on the contrary, is always met with upon a row of teeth, and this species of disease frequently occurs. Atrophy, which is less common than erosion, may be the result of a vicious development of the little exhalent vessels which, according to M. Delabarre, secrete the enamel. In order to understand this idea we must know that he considers the enamel an integral part of the tooth and emanating from the dental embryo, differing in this respect from many writers, who regard it as the result of crystallization from matter contained in the fluid of the dental matrix. According to the same author there is another kind of atrophy, which consists in the partial and accidental death of some crystals of enamel which were primitively well organized.

Whatever may be the explanation of the thing, dentists observe every day:

1st. Children, in whom the enamel of one or more teeth, though very smooth and polished, is of a brown or dark color, and perfectly insensible to the instrument which cuts it. This is congenital atrophy.

2d. Persons who, having received a blow on a healthy tooth, have perceived that a part of the enamel has consequently changed its color, and presents a white spot of greater or less extent. This is accidental atrophy.

If we compare the relative hardness of enamel thus altered, it is far less in the injured part, being reduced to the state of carbonate of lime by the absorption of the small portion of gelatin which enters into the composition of the enamel.

Erosion, which, as we have said before, should not be confounded with atrophy, results from the death of more or less of the exhalents which furnish the enamel, either before or after birth. The other, on the contrary, is a destruction of the enamel after it is formed. It is the result of a corrosive action of the mucous fluid, in the midst of which the crown of the teeth is developed: the qualities of this fluid vary with the health of the patient.

Upon inspecting the jaws of a number of children, who had died of worms, or of mucous or mesenteric disease, M. Delabarre has noticed that the greater part were affected with atrophy, not only of the enamel but even of a part of the osseous structure.

Erosion is confined to the enamel, and is often met with in those who have been attacked during the formation of the enamel, with small pox, or some other acute disease, which has affected the mucous membranes.

All the teeth which are undergoing ossification, when the causes of erosion occur, are usually affected, but in different parts, according to their degree of elevation in the dental matrix. Thus, if an infant were attacked with a mucous disease sometime before the eighteenth month, the four incisors, the two canines, and the first permanent molars in each jaw would be attacked, either on their edges or grinding surfaces, and even about their crowns if their development be advanced, and if, at this time, any temporary teeth should not have been cut, their crowns might also suffer. If the disease occur at the fourth or fifth year, the bicuspids and the second permanent molars would be affected upon the triturating faces; while the crowns of the six anterior teeth, which at this time would be completely clad in enamel, would not be injured at all, or, at most, very slightly, near the neck; unless, indeed, the violence of the disorder had been such that the liquor contained in the little matrices was rendered very acid, in which case the crown might be almost riddled with erosions. We sometimes see teeth which show even three or four lines of erosion, and we can perceive that the child has been sick as often as there are lines in number. For a long time it was very difficult to remove these erosions. As

local treatment was considered altogether useless, the efforts at cure were entirely directed to constitutional causes, either to prevent or stay their progress. For a long time we were the only one who attempted to cure them, and we succeeded by means of our ethereal albuminous paste, of which we shall speak in the proper place. It must, of course, be understood that the employment of this preparation need not hinder treatment proper to relieve the general disorder which causes the erosions; nevertheless, we may affirm, that our means will second this effort in the most efficacious manner.

Sec. 2. *Decomposition of the Enamel, Discoloration of the Teeth, different kinds of Caries.*

Decomposition of the Enamel.—This affection occurs in three varieties. The first, which is most frequent, consists in brown or blackish spots on the anterior face or sides of the crown. Thence they may extend as far as the internal face of the enamel, which remains smooth and polished, unless it becomes rough by loss of substance. These spots are produced, either by a disease of the dental pulp, or by the too near approach of the teeth, or the contact of a carious tooth.

The file is the great remedy.

The second kind of decomposition of the enamel is known by the loss of polish, by the ease with which parts of it may be removed, and by the extraordinary whiteness which it acquires at first, and loses afterward. Limited at first to the anterior border of the gums, this alteration sometimes extends as far as the bony substance. Then the teeth become extremely sensitive to changes of temperature: they become yellow, and tartar is deposited on them more readily than on those which are sound. In short it is the commencement of a caries, the progress of which it will be difficult to arrest by our ethereal albuminous paste. It is a case which most successfully resists the action of this remedy, so salutary in others.

The third variety is nothing more than the disease which M. Delabarre has described under the name of atrophy. See above.

Discolorations of the teeth.—Generally, the teeth of the first dentition are of a brilliant milk-white. But in the adult their

hue varies according to constitution. They are far from presenting the same appearance and polish in all cases. In young phthisical patients they are of a transparent milk-white, and long and thin in form. In persons who are in good health they are not so long as in the preceding case, and the enamel is of a dull white or grey color; very short teeth are evidence of still better health.

The different diseases to which men are exposed in the course of life may vary the color of the teeth, but return to health restores them to their primitive color. It is probable, however, that after the thirty-fifth year, they lose the power of recovery.

The bad habit of using acid dentifrices, or those containing cremor tartar, tobacco or quinine, always stains the teeth more or less yellow.

Caries of the teeth.—The most common alteration of the teeth is caries. It alone attacks more persons than all the other diseases of the teeth put together. This form of disease is more common in young persons and adults than in the aged, although it is not so rare, as it has been said, to see it after the fiftieth year.

Women are more disposed to it than men. It is very common in lymphatic and scrofulous subjects whose teeth are of a bluish-white, as though they were transparent, and of a texture but slightly solid. In ordinary cases the molars are most commonly the seat of it.

In low, wet, and marshy countries, where the human constitution is usually feeble, caries of the teeth occurs under an endemic form. It is more frequent in cities, and in northern countries, than in the country and in hot climates. We must not attribute this, exclusively, as some do, to the excessive use of hot drinks in cold countries, but to the greater stimulus of the aliment consumed, and to the excessive use of alcoholic drinks; above all, to the violent contrasts between the temperature both of liquids and solids which are so frequently taken into the mouth at extreme and opposite degrees of calorification; a practice which cannot but injure the parts of the tooth in which its sensibility and nutritive vessels reside.

Caries is most frequently noticed upon the surface of the

teeth. The molars, which, as we have said, are most exposed to it, generally exhibit it upon their lateral faces, and, almost, never upon their cutting edges or lingual surfaces. Ordinarily, the seat of the disease is at the bottom of one of the little superficial cavities of their surface. It commences upon the grinding surface or contiguous surfaces, while in the incisors and canines it is only found upon the sides. Caries rarely affects the root of a tooth. It almost always stops at the neck. It is still more rare to find it extending to the end of the root, that part, generally, retains its soundness when all the rest is decayed. But after the crowns have been broken off, or have crumbled away, the roots become foreign bodies, and diminish by daily absorption, until they may even be completely removed. It seems that the insertion of artificial teeth delays the progress of decomposition in the roots, yet sooner or later it will be effected.

The milk-teeth are by no means exempt from caries. They are frequently attacked by it, either in consequence of general disease, or of natural disposition to decay.

The causes of dental caries have been carefully studied by a distinguished dentist, M. Regnart; and long before we read his exposition, we had formed similar opinions with regard to the very important part which acids play in the destruction of the teeth. According to this gentleman, caries is destruction of the teeth by decomposition. He divides the causes of it into *immediate*, *mediate*, and *predisposing*.

Immediate causes.—The prolonged stay of alimentary substances or buccal humors upon the teeth; the predominance of an acid in the fluids of the mouth; the action of acids on the teeth.

The parts of the teeth, upon which caries commences, are precisely these upon which aliments and the fluids of the mouth are most likely to be arrested and retained long enough to undergo decomposition. It is upon the neck of the teeth, and in the interstices of these organs, in the anfractuosities of the great molars, in the little cavities which we sometimes observe upon the external surface upon the first and second great molar of the lower jaw, and upon atrophied teeth, that the disease first manifests itself. We do not hesitate to consider aliments, both solid

and fluid, which are so ready to produce acids, as among the most frequent causes of dental caries.

The presence of an acid in the fluids of the mouth is also a powerful cause of the same affection.

We may recognize the predominance of acid in the saliva by these characteristics. It is, in general, abundant and ropy, and reddens litmus paper.

Under its influence the teeth of some persons are continually on edge. In others, this is only noticed when a tooth is touched, particularly upon the neck. Often the presence of little depressions will indicate that caries has already commenced. Finally, where the acid predominates largely, we find the caries attacking the teeth, simultaneously upon many points, and often not sparing a single one.

Inflammation of the buccal mucous membrane, convalescence from serious diseases, chronic gastritis or enteritis, and, indeed, all chronic disorders, when so far advanced as to impair digestion, are conditions in which the acid is more particularly formed.

Pregnancy, nursing, the habitual use of food which tends to become rapidly acid, such as milk-diet, chocolate, pastry and sweetened things, are also causes of its production.

Another cause, not less destructive, is the internal use of acids, either as drinks, seasoning, medicine or dentifrices.

Drinks.—The cider which is used in Normandy and Picardy. In those countries it is not rare to see the inhabitants, while yet young, deprived of the greatest part of their teeth, which could not resist the corrosive action of the malic acid.

Seasoning.—Aliments, acid of themselves, or seasoned with acids. Lemonade, and sorrel-soup—the one through the citric, and the other by the oxalic acid which it contains, produce sorrowful effects upon the health of the teeth.

Medicines.—Acidulated ptisans; acids applied incautiously in various diseases of the mouth. Nevertheless, the evil effects may be readily prevented, by causing the patient to wash the mouth, either with pure water or a weak alkaline solution, after every use of the acidulated drink.

Dentifrices.—We would, especially, call the attention of the public to a powder called "Charlard's." This powder, which

possesses so great reputation in Paris, is composed of cremor tartar, calcined alum, and something else, which merely serves as a vehicle. The quantity of unfortunate teeth which have suffered by its terrible ravages is incalculable. Caries, from this cause, constantly exhibits itself in the form of little punctured depressions, numerously grouped upon the crown of the teeth, in an arc of a circle, contiguous to that of the border of the gum.

Predisposing causes.—Feeble infancy, constitutional disorders, hereditary disposition, and the pressure of teeth upon one another. This last has been regarded as an immediate cause of caries. The truth, with regard to it, is not very plain, and, indeed, it is not a very constant occurrence. The teeth which are most closely pressed would be the most liable to caries. Now these are the incisors and canines of the lower jaw, and yet these are precisely those which are most rarely attacked by it.

Nevertheless, pressure is sometimes hurtful to the teeth, especially, when the buccal fluids tend to become depraved; and it is so too, *passively*, by permitting alimentary matters, and even the fluids of the mouth, to lodge between the teeth, in the upper jaw, above the point of contact, and below it in the inferior.

The pressure which the teeth exert upon one another is then only a purely accidental cause, although a real one.

Mediate causes.—Long continued acute inflammation of the mucous membrane of the digestive passages, chronic inflammation of the same membrane, and, in general, all the diseases which, by their influence, produce a prolonged alteration of the functions of digestion. We place these causes among those called "mediate," because they do not produce caries by immediate action upon the teeth, but disposing the buccal mucus, and the saliva itself, to undergo the alteration, which, ultimately, induces caries.

Chronic diseases have a powerful influence upon the vitiation of the fluids which lubricate the mouth. The alteration thus induced, developes an acid which does not delay to manifest its deleterious power. The teeth are generally attacked, and often upon many points at once.

This acid is not disseminated equally throughout the mouth. It only exists in small quantity, in the inferior part, especially

in the neighborhood of the incisors and canines, because the saliva, which at its issue, is alkaline, and does not assume an acid quality until it has been in the mouth for a time, longer or shorter, according to the pathological condition of the parts, is frequently renewed at those points; and, hence, does not permit the concentration of acid there. The superior teeth, on the contrary, especially such as are already carious, have no such protection.

This explains why it is that the upper teeth are more often carious than the lower; why the canines and incisors of the inferior jaw, being constantly bathed in fresh saliva, are rarely attacked; why, when a cavity has once been formed, the subsequent destruction is more rapid.

The color of the caries is different, according to the rapidity of its progress. When rapid, it is white; if slower, it is yellow; if very slow, it is brown or black. Caries may even pass from one color to another. The white may become yellow, if the caries be checked; it will become black if the ravage tends to cease, and it may even stop altogether.

All these facts are well sustained by experience.

Formerly the different kinds of dental caries were distinguished as external or internal, dry, moist or prutrescent. It is not necessary to resort to so imperfect a classification. The task of a better arrangement has been performed by M. Duval, with his accustomed talent.

He has established seven varieties of caries, under the names of calcareous, peeling, perforating, carbonated, disruptive, stationary, and that which similates wearing.

First kind—(*Calcareous caries.*)—This presents a slight circular depression about the gum, where we see the enamel whiter than in the natural state, friable, rough like lime, and extremely sensitive. It is very common in youth, or is the result of very serious inflammatory diseases; it ceases with age, and the parts become yellow and sensitive. This caries may result from congenital atrophy, or a blow upon the teeth. Its progress is slow, and art can only remedy it by widening the cavity, so as to prevent viscous humors from lodging in it.

Second kind—(*Peeling caries.*)—The enamel, in this second

variety, which is almost always connected with tettrous affections, assumes a yellow hue near the gums, becomes very brittle, and detaches itself by fragments. The bony substance, at first yellow, then brown, is smooth, and can be cut off by plates. It is very sensitive where the enamel is still adherent.

Third species—(*Perforating caries.*)—This caries, the most frequent of all, shows itself indistinctly upon all parts of the crown of the tooth. The ivory substance, sometimes yellow, sometimes brown, becomes soft, or humid, and fetid. The excavation increases more or less rapidly, and communicates with the exterior by a narrow opening. Sometimes, also, it presents the appearance of a funnel or a canal. The diseased parts are sensitive to the slightest impression, from cold or solid bodies, and when the inflammation has progressed as far as the bulb, when the pulp is uncovered, the pain becomes insupportable. Little by little the ivory is destroyed, the enamel left alone, breaks down by piece-meal, and, finally, there remains only the root, which commonly ceases to give pain. In such a case, if the nerve be not exposed, we fill the cavity with lead or gold, after having isolated the carious part from all contact. But when the nerve is entirely bare, there is no other remedy for the teeth, which have two or three roots, than to extract them, or to cut off the crown with strong cutting forceps.

Fourth species—(*Carbonated caries.*)—This we never observe, until between the ages of fifteen and thirty years, and particularly in individuals disposed to rickets or phthisis pulmonalis. It appears, first, as a blackish spot, the periphery of which may be perceived on one of the sides of the tooth, through the enamel, which here appears bluish, grows black, and is easily destroyed. To this spot succeeds a cavity, whose walls, formed by the bony substance, are dry, friable, black, without odor or sensibility. The disease progresses rapidly, and, ordinarily, stops at the root.

Fifth species—(*Disruptive caries.*)—This most commonly affects the incisors in consumptive persons. It manifests itself by a yellow spot, with loss of substance, near the neck of the tooth, and then propagates itself obliquely and more deeply by the side of the root, forming a brownish semi-circular furrow. The substance of the tooth softens, becomes very sensible to cold and heat, acids and solid bodies.

Sixth species—Stationary caries.—This is less a distinct variety than a condition of all the others, when their progress has has been arrested. The caries called stationary, is that which only attacks the enamel, without injuring the subjacent parts. This caries is developed suddenly, in consequence of serious diseases, the convalescence from which has been very rapid. Under other circumstances they are caused by pressure of the teeth upon one another.

Seventh species—(Caries simulating wearing.)—This last kind, which is not easy to be distinguished at its commencement, because it looks more like a caries spontaneously cured than one about beginning, has its seat upon the grinding surface of the the great molars. It exhibits a depression more or less deep, whose bottom is sometimes on a level with the neck of the tooth. This cavity is smooth and level, generally yellow, sometimes brown, and the polish of its enamel might cause it to be confounded with wearing of the teeth, if the inspection of the opposite teeth left any doubt about the nature of it.

Preservative treatment.—This consists in avoiding the exposure of the teeth to acids sufficiently concentrated to destroy them. In preventing the spontaneous formation of such solvents, and in refusing to take them into the mouth.

We will not name the different acids, the abuse of which, either in aliments or dentifrices may be so injurious.

To prevent the spontaneous development of acid in the mouth, let us remember that it is formed under two influences—1st, Under that of inflammation of the alimentary passages. 2d, Under that of decomposition of alimentary matters, or of the fluids of the mouth, in immediate contact with the teeth. It is then urgently necessary to preserve the digestive tube in a healthy state. This is the only way of preventing the predominance of acid in the buccal humors. As to the acid which may be formed in the decomposition of aliment and fluids of the mouth, we may prevent their fermentation by removing them before this has time to take place. The surest means to accomplish this, is to employ those means for the cleanliness of the mouth, which we have so often urged upon our readers in the course of this work.

Curative treatment.—We will first speak of the means used before our improvements, and then we will speak of the happy results we have obtained from our ethereal albuminous paste.

During the course of chronic gastritis, and all the diseases which attack the digestive organs, it is well to wash the mouth with warm water. By this very simple means, we may at once prevent decay of the teeth.

If the development of the acid progresses with great rapidity, we must have recourse to alkaline gargles, such as magnesia, lime-water, the pastilles of Vichy, and the sup. carb. soda. All these substances act by neutralizing the acid which predominates in the buccal humors.

The success of these means is far from being constant, while our paste, placed carefully upon the neck of the teeth, at the place where the gums cover it, never has failed us. It is, especially, as a preparative for plugging that we have uniformly found it efficient.

When proceeding to fill a cavity, some dentists do not take the trouble to remove the cartilage which carpets the cavity of the carious tooth; the consequence is, that it does not lose its sensibility, and sometimes goes on to decompose. Other dentists, who have more foresight, take away the cartilage with a cleansing instrument, or even with the actual cautery. The first means gives a great deal of pain, the second frightens the patients who apply to us for aid. Besides, it only stops caries by destroying the tooth, which always gives a yellowish tint by no means pleasant to the eye.

The use of our topical remedy unites the advantages of these two means without their inconveniences. By its often repeated application we modify the vitality of the organ, and cause the inflammatory condition to disappear. The pain and sensibility subside, the ivory returns to its healthy state, and we may put the gold or other metal into the cavity of an organ entirely healthy, and, consequently, in the best condition to benefit by it.

There is, nevertheless, a species of caries which energetically resists the sedative action of our paste. It is that which presents a dark and humid appearance. We have seen patients attacked with this affliction compelled to return frequently before a satis-

factory result was obtained, of which, indeed, we had advised them in advance.

We will speak more in detail of our ethereal albuminous paste, when we consider odontalgia; where we will show its superiority over the crowd of remedies, which one day vaunted to the skies, on the next are forgotten.

SEC. 3. *Consumption of the Roots, Exostosis of the Teeth, Spina Ventosa, Neurosis of the Teeth, Inflammation of the Alveolo-Dental Membrane, and the Dental Pulp, &c.*

Consumption of the roots.—This disease, which is slow in its progress, and does not produce its sorrowful effects until the lapse of several years, manifests itself under different circumstances, either in persons 40 or 50 years old, and of bilious temperament: in those who, in the autumn of life, experience a marked change of constitution, and, finally, in ladies of younger age whose health is deranged after confinement.

What are the causes of consumption of the roots? Inflammation of the periosteum, or rather of the fold of the dental matrix, which is reflected upon the root of the tooth, and the suppuration of the other leaf of it, which covers the alveolus.

This inflammation soon reaches the alveolar border, and the root becoming a strange body in the alveolus, is separated from it, consumes insensibly, and the desiccation of the dental nerve is the result. These disorders are far from being limited to a single tooth, they interest the others gradually, and sometimes extend even to the alveolar border of the two jaws. Local in its beginning, this disease, as we have seen, makes most rapid progress, and may attack the whole dental arch. It is necessary then to be diligent if we would avert serious consequences. We must extract the tooth, the gum of which discharges most, giving the patient to understand that the less the tooth is loosened, the more likely the disease is to be local, and, of course, most easy to be cured. But when this terrible disorder has attacked an entire jaw or two at once, what remedy can we employ? Must we despair of saving the teeth? Not all, but the most of them; we must sacrifice two or three to the safety of the rest. The employment of tonic applications to the gums, will check

the disorder, but, unquestionably, the most efficacious means is to pierce the gum with the actual cautery, at the point corresponding to the roots of the loosened teeth; there results a very acute irritation, which modifies the condition of the alveolar walls, and converts the chronic affection, which disorganizes them, into an acute disease, which rapidly tends to cure.

Exostosis of the teeth.—This is a disease whose diagnosis is very difficult before the extraction of a tooth. Commonly it only affects the root. Sometimes it only exists on one side of the tooth; it presents a rounded and angular form, and in some cases it occupies the entire length and breadth of the root. Sometimes, also, it is complicated with encysted consumption of it. The cause of this disease is, almost always, engorgement and ossification of the dental periosteum. We observe it, particularly in persons whose teeth are painful, either as the result of caries or wearing, or from consequence of a gouty or rheumatic diathesis.

The only symptoms we have, by which we may recognize this affection, are the deep heavy pain, the swelling of the alveolus, the mobility of the affected tooth, (a symptom not met with in every case,) and, finally, the loss of level which the diseased tooth presents when compared with the rest.

We have no other means of treatment than to combat the pain by emollient and narcotic applications, and better yet by the employment of our ethereal albuminous paste, whose very palliative action should be seconded by local bleeding and revulsives. But if the pain continues, and the tooth becomes movable, it must be extracted. Fox speaks of a woman, yet young, who was obliged to have all her teeth extracted on account of exostosis of the roots.

Spina ventosa.—This is a very rare disease, which, like the preceding, only attacks the roots of the teeth. Indeed, it bears great analogy to that affection, of which it presents similar signs and indications. Its characters are the following: the root is larger than ordinary, it is hollowed, its opening is very large, and its walls very thin.

Necrosis of the teeth.—Differing but little from consumption of the roots, this affection ordinarily follows suppuration, destruc-

tion or disorganization of the alveolo-dental membrane. Sometimes it results as the consequence of external violence, but oftener still it is the sequel of chronic or gangrenous inflammation of the soft parts which are in connexion with the roots of the teeth. Teeth affected by necrosis may be recognized by the following signs: they lose their natural color, become loose; sometimes even fall out spontaneously; at other times they remain in the alveoli, where they produce purulent and fetid suppuration, which shows itself between the neck and gum. When the tooth is extracted, the root is found to be rough, yellowish or blackish,

Inflammation of the alveolo-dental membrane, (*periodentitis.*) This may be acute or chronic, and in the last case it produces consumption of the roots. It is the acute form that we are about to consider.

This inflammation is characterized by pain, at first dull, then acute and pulsating, while the tooth appears to be sound. The gum soon becomes red and painful. Sometimes the swelling reaches the cheek. This disease may terminate by resolution, or by the formation of an abscess. The means by which we combat it, are emollient and narcotic gargles, the application of leeches to the angle of the jaws, derivatives, pediluvia, and warm emollient drinks.

Inflammation of the dental pulp, (*odontitis.*)—This inflammation is more common in carious than in sound teeth, and in adults than in children. What is strange, it is not most violent when the caries has made a large opening into the cavity of the tooth, but when it first approaches the cavity. We observe the same phenomena in the wearing of the teeth. When most considerable, the pain is most tolerable.

The most particular characteristic of this inflammation is an acute pain, which augments when the sides of the teeth are struck. This pain is not propagated at first to the gums and jaw. This does not occur until towards the third day, when, if it should not have previously abated, all the nerves of the face participate, and the pain becomes pulsating and intolerable. Sometimes, however, before it arrives at that point, it suddenly disappears, and there only remains a soreness of the tooth. If

the paroxysms are frequent, the patient comes to you to beg to be delivered from the cause of such great anguish, and if the dentist yields to his entreaty he recognises in the extracted tooth all the traces of violent inflammation. As for ourselves, though we be accused of being controlled by one paramount notion, truth compels us to say that the employment of our ethereal aluminous* paste has enabled us to preserve the teeth of our patients, even when these organs were attacked with most intense inflammation. Its sedative and extraordinarily anti-spasmodic quality does not fail to triumph over the inflammatory erythism of the dental nervous system and its appendages, to such an extent that all pain and all irritation cease at the end of some days, sometimes on the next day. Let the incredulous put us to the proof, and test for themselves the truth of our words.

The faith that we have in this remedy, which has almost never failed us, renders it unnecessary to name a crowd of means, all more or less inefficacious, and dangerous to the neighboring teeth, such as narcotics, incense, myrrh, or other gum resins, nitrate of silver, caustic, sulphate of potassa, concentrated acids, ethers, essential oils and creosote. We do not include in the proscription, local bleeding, emollient gargles, and a plaster of the extract of opium behind the ear. When the inflammation passes certain bounds these are certainly excellent remedies.

Fungosity of the Dental Pulp.—This can only happen when the orifice of the dental canal is dilated by disease or is accidentally opened. In the first case the swollen pulp becomes more firm and red. It forms a larger band than in the natural state, which is continuous with the alveolo-dental membrane. In the second case the swollen pulp appears externally under the form of a small red tumor, circumscribed by the border of the dental opening. This tumor is generally very sensitive to the touch of foreign bodies. In some cases it grows hard and disappears. The only means of cure are excision of this fungus, and cauterization. The case is not so extreme as to justify extraction.

Destruction of the Dental Bulb.—Without any appreciable

* Printed by mistake in the preceding part, *albuminous*.

cause, without preceding lively pain, one or more teeth sometimes become yellow, brown or even black. Their substance often loses its solidity, and readily breaks in the mastication of hard bodies. If we extract the diseased teeth and divide them, longitudinally, we find their cavity nearly empty; containing nothing but the debris of the nervous and vascular substance of the bulb. The diagnosis of this affection is always very obscure. We certainly do not know how to cure it, and art even fails to provide means of prevention.

The teeth of old men almost always grow yellow. Prolonged jaundice sometimes produces a similar effect, which proves that if the osseous substance, and indeed, the entire tooth, does not communicate with the general vascular apparatus, that it suffers the variously colored or altered liquids with which it is in contact to penetrate its tissues.

Ossification of the Dental Pulp.—This presents two varieties. In a tooth worn down, the pulp ossifies in the neighborhood of the plate which yet intervenes to shut the dental canal; and far from being regarded as hurtful, this ossification ought to be considered a good arrangement of nature. It adheres to the old plate, and by reinforcing it, prevents the exposure of the cavity to the air and to aliment, and thus protects it from certain destruction. In treating of the wearing of the teeth, we have already spoken of a little bony substance which remains suspended in the dental pulp and which wears in proportion to the rest of the organ.

We have passed in review all the diseases capable of affecting the dental substances in general. If we have spoken of some neuroses and of odontalgia, properly so called, we did so because these affections, and the last particularly, are the result of different disorders of the teeth, and we thought we could treat of them separately, with more satisfaction, after having exposed the several diseases which have relation to them.

CHAPTER VII.

Sec. 1. *Loosening of the Teeth.*

This may be considered both as an affection of the tissue of the teeth and of the parts with which they are connected. The causes are very numerous. Some are traumatic, as blows and falls; others pathological, as inflammation of the gums and periosteum, fleshy excrescences which grow to the gum near the neck of the teeth and press them from their sockets, and the softening of the alveolar periosteum by the use of mercury. The teeth also are loosened from the want of corresponding teeth in the opposite jaw, and by the attachment of artificial teeth which draw them too forcibly, especially when the point d'appui is awkwardly made. Rheumatism or gout may also cause the denture to lose its habitual solidity; the same sometimes occurs at the critical period. Some women at this time, not only discover many teeth to vacillate, but even to detach themselves from the alveoli, as a leaf whose dried stem is no longer able to furnish the necessary aliment.

The mode of remedying this state of the teeth must vary with the causes of it. If purely traumatic, we must advise not to use it in mastication; not to tease it with the tongue and the fingers, and several times a day to wash the mouth in some tonic infusion.

Some dentists recommend the use of a soft brush moistened in the same infusion, gently to rub the gums and teeth and remove the slime from them. We think this hurtful, inasmuch as all movement however slight, will interfere with the entire re-establishment of the loosened organ. As to mastication, the surest way to avoid mischief is to put the patient on fluid and soft diet.

If the loosening be caused by ligatures, &c., there is but one thing to do: we must at once remove all this artificial pressure, and when the organ has recovered its accustomed strength, to rectify any defect in our mechanical contrivance or to seek our point d'appui upon some more distant tooth, whose size promises a better result.

As to the projection of those teeth which have no antagonists,

and in whose alveoli ossification has filled up all the part abandoned by the tooth, we can do nothing more than to shorten them if they rub the opposite gum, or better still, to extract them. We have seen old men whose mouths were entirely deformed by the overlapping of the inferior jaw, caused often by the presence of a single tooth that might readily have been extracted. We have been unable to comprehend how such persons could prefer to endure so great deformity rather than submit to an operation, so trivial to aged persons, whose teeth will fall out almost by the force of a breath.

When the teeth are loosened by the accumulation of tartar about their neck, we must hasten to detach it carefully. If it has not destroyed the gums or rendered them unhealthy they will re-embrace the teeth and fix them more firmly in their sockets. As soon as the tartar is removed, it permits the gums to adhere to the teeth, anew. It sometimes happens that the incisors and canines, much longer than the molars, are loosened by their antagonists. We may remedy this defect by filing these teeth, which renders them sufficiently regular. But when the displacement results from constitutional causes, the task of restoration is more difficult. Local means are inefficient; we must attack the general disorder. The treatment under such circumstances belongs to general practice and would be irrelevant in a work like this.

We must not forget that when an inflammatory disease has loosened one or more teeth, the re-establishment will be spontaneously effected in persons of sound constitution, who are under forty. After this age, and in scorbutic persons, perfect re-establishment is impossible. This rule has few exceptions.

Sec. 2. *Accidental Luxation of the Teeth.*

This consists in the displacement of a tooth, which is pushed forward or backward, and more or less removed from its alveolus. This accident may be simple, or complicated with contusions, wounds of the gums, fracture of the alveolar processes, or even of the body of the jaw. The consequences are more or less serious, accordingly as the gums are more or less healthy,—or in a state more or less natural. The causes of accidental luxation

of the teeth are the same as those which loosen them, with the exception that they act with greater force, or in a direction more favorable for the partial dislocation of the dental organ.

We may readily perceive that the incisors and canine teeth are more exposed to this kind of injury than the molars, not only because they have but a single root, but also because their situation is such that they are less protected than the other teeth.

Luxations may be complete or incomplete. The treatment is very simple. We have only to replace the tooth in the alveolus and maintain it in that position by a ligature fixed to the neighboring tooth. It sometimes happens that in the movement of the jaws, the tooth thus replaced may be jostled and displaced again by contact with its antagonist. To remedy this, we have one thing to do, viz: to apply upon one of the bicuspids a little plate of platina or other metal, and thus hinder the jaws from passing one another. Then the tooth, being perfectly protected from contact, will become as firm as ever. In the meantime, the patient must be kept upon spoon food for ten or fifteen days.

In the eighth chapter, devoted to "orthodentosy," we will consider all the inconveniences of artificial luxation, and show how much our extensor springs excel the defective and cruel means in use.

Sec. 3. *Of the Replacement of Teeth in their Alveoli.*

When from any traumatic cause, whether a fall or blow, or the shock of a projectile, or even the awkwardness of an inattentive and inexperienced dentist, who draws a sound tooth instead of a diseased one, a healthy tooth is displaced from the socket, it must be instantly replaced. But the chances of success will be more or less favorable according to the age and health of the patient. Although apparently simple and easy, the operation demands precautions which cannot be disregarded but at the risk of serious inconvenience. We must also observe that the patient is not of too irritable nervous temperament; for I have read in a medical journal, a case of nervous tetanus, induced by the replacement of a tooth, the root of which irritating the dental nerve, produced violent symptoms, which were not abated by the removal of the tooth, but proved fatal.

Maury, in his Treatise upon the Dental Art, cites the case of a youth, fifteen years of age, who was thrown from his horse, and received from the animal a kick, which displaced three incisors and one canine tooth of the upper, and two incisors and two small molars of the lower jaw. The unfortunate young man being insensible, laid for nearly two hours upon the ground where he had fallen, lost much blood, and spit out the dislocated teeth. When consciousness returned, he walked home, and the next day a dentist was called in consultation with a physician, to render assistance. They, first, sought for the teeth, cleansed them, detached the fragments of the alveoli that adhered to them, and replaced them in the mouth. We may suppose that a fracture like this must have left some fragments in the alveoli. They were not removed. The consequence was, violent inflammation and profuse suppuration before they could be expelled, and obliteration of the alveoli followed this great loss of substance. The patient, after so awkward an operation, was obliged to submit to a severe regimen. During eight months he could eat nothing but pottage and "semonle;"* but at the end of two years after the accident, finding that the teeth were not firm, he had them removed, and from that time his mouth was in perfect health.

In a case as serious as this, we must have regard to the age of the patient, and not replace the teeth until after shortening them by the crown. For example, if six or eight teeth have fallen out, we should only replace four or five, choosing those which would be most likely to recover their firmness. The alveoli not used, should be permitted to close up, and thus strengthen the teeth replaced. Finally, if, before the operation, any splinters be discovered, we must hasten to extract them, and, if they be sufficiently large to denude a part of the external or internal border of the alveolus, we should avoid replacing a tooth there, as it can never acquire sufficient firmness to retain its place.

Sec. 4. *Abnormal Concretions upon the Teeth.*

The saliva, the mucous liquids which incessantly flow into the mouth, and the special secretion of which the borders of the

* A paste made of fine flour, and reduced to small grains.

gums appear to be the seat, furnish to the surface of the teeth a slimy, whitish or yellowish fluid which clings to them with considerable tenacity. This matter, which gradually hardens, applies itself, at first, to the neck of the teeth, then between them, and spreads, in many subjects, over a fourth, a half, and even over the whole of the crown. It is not rare to find a large part of one of the two dental ranges covered with a concrete brownish or blackish mass, many lines thick, which pushes out the cheeks, and occupies, within, a large part of the space reserved for the tongue.

This matter has different names, as tartar, odontolith and buccal calculus.

The elements which compose it are the same as those of the saliva and salivary concretions. According to a recent analysis of Messrs. Vanquelin and Langier, it is composed of

Phosphate of lime, - - -	0.66
Carbonate of lime, - - -	0.09
Animal matter, - - - -	0.14
Oxyd of iron and phos. of magnes. -	0.03

When analysed with the greatest care by other chemists, French and foreign, this substance has never furnished the same results. This has resulted from its being taken from different individuals, as it is far from being precisely the same in all persons. Thus the black and dry tartar, which is found in small quantity around the neck of the teeth of those who have good constitutions, is dissolved, with difficulty, in hydrochloric acid. The yellow and dry tartar of those who have a bilious temperament is more easily dissolved in it. The white and soft tartar of persons in whom the mucous element predominates, is very little soluble in acids, and on the contrary, very readily in alkalies. This contains a great deal of fibrine, and the others much much more of earthy bases.

With M. Delabarre, and all other dentists, we ask, whence is this buccal calculus derived? Is it a secretion, as some say? Is it a deposit from the saliva, as has been maintained for ages, in all the books of medicine? Or, rather, is it not an earthy, and unhealthy exhalation from the mucous membrane of the gums?

We have already spoken, in the first part of this work, of the dental glands discovered by M. Serre, to which he attributes the secretion of tartar, comparing them to the Meibomian glands. But as these glands decrease with age, and as it is with children that we observe the least of those buccal concretions, and with old persons the most, it is contrary to the laws of sound physiology to say that an organ secretes the more as its volume diminishes. The production of tartar by these glands, is probably a gratuitous supposition.

The best sustained hypothesis is, that the earthy salts contained in the saliva, being precipitated by the presence of a chemical agent, are gradually deposited upon the teeth, where they are glued by the mucus of the mouth. When we observe that the lower teeth which are the most constantly bathed in saliva are, almost exclusively, those coated with tartar, the upper teeth being very rarely the seat of it at all, or if at all, in small quantity, we cannot but be driven to admit this theory. For if these concretions be constantly observed below, it is explained by the fact that the saliva accumulates upon the floor of the mouth, where the earthy salts which it contains are precipitated, and crystalized on the inferior teeth.

M. Delabarre contends against this explanation, and to sustain his new theory, invokes the aid of a fact, recorded in all the works on pathology, to wit: that we find concretions not only in the cavities destined to receive certain fluids, but in the stomach of certain animals, in their intestines, in the articulations of gouty persons, in the ducts of certain glands, &c. It is, nevertheless, worthy of remark, that the mucous membranes, the synovials, and the glands which furnish mucus are more particularly liable to form concretions, though we find them in the body of the muscles themselves. Thus they are found in the amygdalæ, in the nose, in the maxillary sinus, in the external auditory foramen, &c., whence the author just mentioned infers that they are the product of an accidental exhalation of the arterial capillaries, to which the mucus and synovial system are more than others disposed.

According to him the exhalents of the gums furnish the tartar. They convey it in quantities larger or smaller, as they are

healthy or inflamed, and as the blood they circulate contains more or less earthy matter.

The same author tells us that when the gums are unhealthy they are covered with a whitish coat, at first soft, but which gradually accumulates on the teeth and then hardens. That when they are healthy they furnish more of this matter. Hence the tartar is a product of the buccal mucous membrane.

As for us, until this proposition shall be demonstrated by conclusive evidence, we will coincide with the opinion of the majority, which appears to us the most simple and rational. That phlogosis of the gums may have some influence upon the formation of dental concretions, we by no means doubt, but this does not prove the truth of M. Delabarre's theory, and we feel authorized to say, that if this inflammation favors the secretion of tartar, it is by imparting too great acidity to the buccal humors, which then, necessarily deposit the acidifiable bases combined with such acid. I give this theory for as much as it is worth; and I attach no particular importance to it.

It is far more important to the practical dentist to enumerate the disorders caused by buccal calculus, and point out the means of cure.

The presence of tartar irritates the gums. As it increases, it separates these organs from the teeth, bares the neck of the latter, and accumulating more and more upon their bases, gradually draws them from their sockets. Thence result the foul and hideous appearance of the mouth, the disagreeable and fetid odor, the ulceration of the gums, cheeks or tongue, and finally the loosening or falling out of the teeth.

Neither neatness nor the action of solid aliments, will prevent the formation of tartar on the teeth. We know how rare it is in the country among people who live soberly and who divide with their teeth hard and savory bread. On the other hand, in subjects subsisting upon soft food we have seen the tartar cover the whole teeth like a continuous and very thick cement. This substance has a great tendency to deposit itself upon teeth which are not used, or upon those parts, which, as the neck, are least exposed to friction. There is no means of preventing this accumulation but diligent use of the brush. As to the rest, the

greater or less quantity of tartar deposited on the teeth depends almost always upon temperament, health, and particular idiosyncrasy. In some persons it is so abundantly formed, that the teeth, completely encrusted with it, look as though they formed a single bone.

Next to caries, tartar is the most efficient cause of the loss of teeth. These concretions, by increasing in size, and hardness, sometimes irritate the cheeks, the lips, and even the tongue. As to the gums, we have already exposed the disorders which are caused in them by these accumulations. They are afflicted with inflammatory engorgement, whence results a purulent discharge which renders the breath exceedingly offensive. We have even known ulcerated gums become gangrenous, and cause necrosis in the subjacent bones. What frightful disorders, to result from an affection which may easily be prevented by cleanliness!

In order to relieve the teeth of a substance so hurtful to them, there are two modes of practice—to remove it by acid dentifrices, or by mechanical means.

Acid liqueurs, and the powders and opiates which contain acids, attack the teeth upon parts not protected by the enamel, and destroy them. The tartar is not completely dissolved, nor detached from the internal and lateral faces. We, therefore, proscribed this practice as hurtful and inefficacious. Indeed, if they cleansed the teeth perfectly, we should still protest against them, for acids are the greatest enemies to the teeth, and I do not hesitate to condemn them utterly, when I have at hand, a far better means of relief.

With scrapers, scaling instruments, and other appropriate means, we remove tartar more certainly and more safely. Brought to bear upon their interstices, or upon their surfaces, these instruments detach and remove, by fragments, the foreign substance which concretes upon them.

This operation, always tedious, when the whole of the mouth is to be cleansed, is sometimes delicate, and the dentist ought, above all, to endeavor, by the lightness of his hands, and the precision of his movements, to render it as little disagreeable to patients as possible.

When the teeth are already loose, more precaution is necessary. It is always necessary to sustain them with one or more of the fingers of the left hand placed on the top of the crown, and to use the instruments so delicately as not to catch in the neck and extract the teeth unintentionally. At the same time that the removal of the tartar permits the gum again to enclose the tooth, it almost always creates a local bleeding of the most salutary character. It appeases the irritation of the surrounding parts, and, therefore, should always be encouraged by lotions of warm water.

As to the means of preventing the formation of tartar, they are very simple. It suffices, as we have said, to attend to cleanliness, and to be careful to eat on both sides. If a painful tooth prevents this, it should be extracted, or if it be in a condition to be improved by treatment, it should be, and at once, with our ethereal aluminous paste. To remove the daily deposit, we may use a hard brush, moistened in a slightly tonic or alcoholic liquor, or powdered with a vegetable or alkaline dentifrice.

Sec. 5. *Odontalgia.*

The disorder, whose history we are about to trace, is, beyond contradiction, one of those which cause the most insupportable agony, and which have taxed the ingenuity of all physicans in all times and countries.

As it may result from many affections, sometimes nervous, sometimes inflammatory, we consider it last, as, otherwise, it would have been difficult to class it.

In odontalgia we distinguish two things—the evil itself, and the accidents which result from it, and are, so to speak, its echo, to wit, frontal neuralgias, and the phlegmonous inflammation of the buccal walls.

Let us first consider the local symptoms. It is a serious error, which we cannot too strongly combat, to believe with Maury, "that bones as hard as the teeth, and of a structure so well organized, are not secure from pain;" for, in odontalgia, they are not more sensible than the sheath of the tendons in panaris. The dental pulp being contained in a sort of inextensible capsule, its inflammation is accompanied with a compression, which

causes the intolerable pain suffered by the patient; a pain only equalled by that caused by phlegmon of the finger, before a a deep incision, dividing the tendinous sheath, has relieved the horrible constriction.

Whenever the dental pulp is laid bare, or when the ivory substance has only lost a part of the enamel covering, odontalgia, appears in vivid lancinating pains, the intolerable anguish of which is explained by the vicinity to the encephalon. Partly nervous, and partly vascular, the dental pulp, contains the elements most favorable to inflammation. It is also extremely sensible to the impression of the external air, and to the sensations of hot and cold aliments. Thus the least cause is sufficient to cause the most acute irritation. When the dental pulp has been inflamed, we find its vascular nervous tissue disorganized and converted into a soft fungous matter, pultaceous and insensible. When the disorder has progressed so far, the tooth becomes inert, deprived of vital action, and, in short, a foreign body. But this sort of gangrene does not take place until the tooth has been the seat of successive inflammations, and often the patient seeks relief in extraction, before the sensibility of the tooth has been destroyed.

As we have already said, there are inflammations, not seated in the dental pulp, which are, for the most part, confounded with odontalgia; such as the inflammation of the alveolar periosteum, and the dental cords beyond the tooth, at the extremity of its root. In such cases, besides the pain, we have swelling of the gums, exaltation of their sensibility, and tumefaction of the cheeks. A tumor distends the cheek, not discoloring the skin, without any external signs of inflammation, unless swelling and increased temperature of the part be regarded as such; or, indeed, the tumor increases, reddens, and is accompanied with painful throbbing, which are severely felt through the head. Fever appears, delirium is manifested, morbid sympathies are developed, and the whole body feels the disorder of which the maxillary regions are the seat.

For the most part, these swellings, which are developed with a promptitude, varying with the sensibility of nerve, and the sanguinary development of the patient, resolve themselves at the

end of a week, but as there is sometimes a disposition to suppurate, it is well to prevent the bluish cicatrix which might result, and which, to ladies, especially, would be a serious evil, by local depletion either of the gums or the base of the inferior jaw of the affected side. It is well, also, to employ emollient cataplasms, or little bags, with elder flowers, moderately warmed, and steeped in hot water. Soothing drinks, and injections, and mustard pediluvia may also be useful. In the meantime, the patient may make use of a gargle of sweetened decoction of mallow root, to which is added small quantities of some proper preparation of opium.

If, in spite of these means, or, indeed, the sooner for them, suppuration takes place, the abscess proceeds rapidly to cicatrization when seated upon a part whence the egress of matter is easy. But if the disease attacks the soft parts, near the spongy cells of the maxillary bones, in either jaw, which by the laxity of their tissue, facilitate the spread of inflammation, suppuration may be very tardy, the matter may fail to discharge itself, and we may find openings, more or less distant, from the seat of the disease. Ulcers and fistulas of the mouth and face may result.

But let us return to odontalgia, properly so called. In Nysten's Dictionary we have an excellent division of the several kinds of odontalgia.

1st. Rheumatic or gouty, also, called odontagria. This attacks sound or carious teeth, particularly in damp weather. The gums are neither swollen nor red. It may be combatted by sudorifics, warm and aromatic frictions, flannel next the skin, and all the means calculated to recal the primitive disorder to its habitual seat.

2d. Inflammatory or sanguineous odontalgia, which ordinarily depends on the suppression of some hæmorrhage, as hæmorrhoids, or the menstrual flux, or upon the use of irritating food. The gums are red, hot, and somewhat swollen, and a pulsating pain is felt in them. We advise, in such cases, leeches below the ramus of the jaw, or upon the gums, cooling gargles, emollient drinks, enemata and baths.

3d. Catarrhal or serous odontalgia, characterised by swelling of the gums, the secretion of a quantity of saliva and buccal

mucus, with clammy tumefaction of the cheek. We observe it, principally, in cold weather. At first we combat it with antiphlogistics, local, and general; but, if it should be somewhat prolonged, we have recourse to aromatic washes, and fumigations of the same nature. At the same time we employ sudorifics and purgatives.

4th. Nervous odontalgia, or dental neuralgia, which appears to have its seat in the dental nerves themselves. It often exists, independently of any disease of the gums, teeth or alveoli. The pain consists principally in the darting anguish which sometimes occurs periodically. If the patient be plethoric, we employ bleeding or leeching, emollient and sedative lotions, cataplasms of the same kind, warm baths and purgatives. When the odontalgia is intermittent, or remittent, and periodical, we oppose it with tonics, bitters, and, especially with the sulphate of quinine—the anti-periodical remedy, *par excellence.*

The last kind of tooth-ache presents capricious phenomena. The cause of pain is not always to be found where the suffering is felt. Often one tooth will ache, while the disorder is in its neighbor, which has sometimes led to the extraction of the wrong tooth. We have seen persons, in similar cases, point to one jaw as the seat of pain, when the disorder was seated in the other, and, sometimes, complain of one side when the other was, in reality, in fault. Sometimes there is violent pain without any carious teeth, which may lead us to suspect certain disease of the alveoli and alveolar periosteum.

As every dentist, in the course of practice, may be called upon to treat these embarrassing cases, we will describe the symptoms by which we may certainly ascertain the seat of pain.

When it is a carious tooth or root, the cause is evident. The nerves, which will not bear the slightest touch of the instrument, promptly indicate the seat of pain. When we produce pain by moving the tooth with the nail, it is a sign that the alveolar periosteum is diseased; but as there may be a complication of disorder, it is for the sagacity of the practicien to judge, after examining all the signs. Causing pain, by striking or shaking the teeth, or by hot or cold fluids, is not sufficient justification for extraction. We must ascertain the existence of caries by the

point of the stylet, or, at least, be well convinced that a disease of the periosteum causes such particular teeth to ache.

Treatment.—We approach a part of the dental art, upon which many persons, more or less scrupulous, have speculated, being themselves more or less confident in the efficacy of remedies which they have caused to be proclaimed by the hundred tongues of fame.

The reader may well suppose that we will not enumerate all the substances and formulas more or less empirical, which have appeared and disappeared, from time to time, after having vainly endeavored to combat this terrible pain. In order to proceed systematically, we propose to divide the treatment of odontalgia, as follows: general means and remedies, local means and remedies, and under the last head, surgical means.

We believe we have dwelt sufficiently long upon general means; we, therefore, consider the local means, on which the inventive genius of dentists has been most fully exercised.

Surgical means.—These are cauterization, inoculation, filling and extraction.

Cauterization.—There was a time, when, in order to avoid terrifying the patient by the sight of a red hot iron introduced into the cavity of the tooth, dentists contented themselves to destroy the dental nerve, by piercing it with a metallic needle, sufficiently fine to reach the extremity of the root. This, however, seldom succeeded in entirely destroying the nerve, and the pain remained or even increased after the infliction of very severe suffering in order to relieve it. Nevertheless, some dentists still prefer this means to the actual cautery.

As for ourselves, our ethereal aluminous paste, generally, enables us to dispense with all these measures, nevertheless, as a treatise like this should be complete, it would have been culpable to pass over cauterization in silence.

This operation, recommended by Ambrose Paré, acts very efficaciously either to arrest the spread of caries, or to destroy the pulp of the teeth, and reduce them to a state of inertia, which, we may observe, is not to cure but to kill the organ.

Inoculation.—Where the pain is entirely neuralgic, this is the means recommended by M. Bureaud-Rioffrey, an English

physician. Called to a young lady, twenty-two years of age, who was suffering with a very acute pain in the jaw, attributed by her, to the cutting of a wisdom tooth, but which was, in reality, a neuralgia of the dental nerve; he proposed to inoculate it with morphine. She consented: as soon as the little operation was performed, she felt herself relieved and half intoxicated. The pain suspended for several hours, reappeared in the course of the day. The operation was renewed, and the cure was completed.

I cannot see what, in a similar case, should prevent similar treatment.

As to filling and extracting, we will speak of them at the proper time and place.

The therapeutic part being strictly devoted to operatory processes, we can consider, in detail, the different remedies and formulas projected for the cure of odontalgia. There are a great number, but we will notice only those most generally known.

At the head we may place the celebrated creosote, a name which we may see written in large letters before almost all the apothecary shops in the kingdom. After having been vaunted for the cure of a crowd of diseases, it was finally rejected by all physicians. Nevertheless, M. Regnard, a medical dentist, thought that he had found in it a wonderful capability of allaying certain pains which usually attend dental caries. The great Broussais himself was experimented upon by this gentleman. He called to have a tooth extracted, and by the application of creosote, returned cured. At the end of twenty-four hours the pain returned. The remedy was again applied, and the cure, it is said, was then completed. Such success did not fail to give great celebrity to the new specific, but failures soon caused it to fall in public estimation as rapidly as it rose. According to the declaration of M. Regnard, himself, "in order to its success, the pain must be seated in the dental pulp itself, in all other cases it does more harm than good." This is not the gravest charge that is brought against it. One of the most serious consequences which follow its application is the decay of the neighboring teeth upon which its corrosive qualities produce the most unhappy effects. In short, creosote is a blind agent, whose action

cannot be confined to the diseased organ; which explains its ravages upon others.

The famous Paraguay Roux has not made less noise in its time. M. Foy, pharmaceutist in chief of the hospital, St. Louis, gives the recipe in his learned formulary, and sums up his opinion of it in these words—"An odontalgic remedy, which has been vaunted for some years with great success—*to the inventors.*"

Here is the formula:

Take

Leaves and flowers of the inula bifrons,	1 part
Flowers of Para cresses, - -	4 "
Pellitory root, - - -	1 "
Cut, incise all the substances, macerate them for 15 days in alcohol, at 33, -	8 "

Express and filter.

Next to the Paraguay Roux, came Dr. Oudet's odontine, better known by a certain stormy discussion of the faculty of medicine in Paris, than by the cures it has made, here or elsewhere.

It is a received axiom in medicine, that the more vain efforts men of art have made to combat a disease, the more has the nomenclature of remedies increased; thus, for the affection we are now considering, open the first formulary you meet, and you will find a crowd of anti-odontalgic washes, plasters, essences, mastics, mixtures, pastes, pills, solutions, and topical remedies, all more or less specific.

Every where are employed, leeches, hydrocyanic, nitric, and pyroligneous acid, alum, carb. of soda, "the animal oil" of Dippel, and, finally, morphine. Cups, vesicatories and acupuncture, have not been forgotten, but you will always find to close the list, what is pleasantly called in vulgar language, the balm of steel—the extraction of the tooth.

With the good nature of a patient experimenter, we have, by turns, employed all these remedies, and, in despair of success with them, we have been driven to seek another which might fulfil the indication more certainly for the patient, and with more satisfaction to the dentist.

After many attempts, repeated with all the care of which we are capable, we have finally discovered this simple and certain means, which we have already mentioned in the course of this book, and which consists of an ethereal aluminous paste, the properties of which, tried and sustained by long experience, are to arrest caries, and to dissipate in a little time, and forever, the pain which attends it. Our paste possesses the immense advantage of curing the diseased organ, and of exercising no deleterious influence upon the neighboring teeth it may touch. To such an extent is this the case, that we often use it, when the gums only are dark or fungous. Never, in the course of ten years, has a patient of ours complained that this substance has caused the loss of a sound tooth.

Doubtless, we will be asked, how does this topical agent act? In the first place, we will describe what occurs after its application, and then, if we can, we may discover its mode of action. Immediately after we have, with a small spatula, introduced some of it into the cavity, and around the neck, and in the interstices between it and the neighboring teeth, the patient feels an abatement of pain, sometimes so complete as to cause the cry, that we seemed to remove the pain with the hand. Sometimes it produces a pricking, which, for the moment, increases the pain, and produces profuse salivation, but, sometimes, eight or ten minutes after, the organ resumes its healthy feeling, the sanguine congestion of the gums disappears, the dental pulp loses its extreme irritability, and the organ itself becomes entirely insensible to contact with the tongue. But we are not always so happy as to obtain a cure so promptly; it may demand eight or ten days' treatment, and as we have already frankly avowed, in speaking of caries, there is a dark and humid kind, for which, as yet, we have found no remedy.

Here then is a fact: there is a paste, for the most part composed of alum and acetic ether. This paste super-excites at first, the inflamed organ, the dental pulp, and produces an abundant salivation, and the pain is lulled, and the disease itself stayed. Now, we are asked, how this is accomplished? Ah! if an answer be exacted, I may plunge into the convenient regions of theory! You have an ulcer on the leg; you apply to it a

slightly caustic solution, you change its nature, its mode of existence. From a chronic disorder you convert it into an acute one, which rapidly runs through its phases, and is cured. Is this not precisely to cure homœopathically, as the followers of the famous German physician say? It is to substitute one disease for another and better yet, to modify the vitality! *modify the vitality.* Two great words of which modern medicine avails itself, according to its own confession, as a cloak to cover its ignorance; for in the action of certain medicines, there are mysteries as yet inscrutable. Why then do you wish to prevent me, humble and obscure in the medical hierarchy, to avail myself of a little piece of this mantle, which renders so essential service to the learned body? May I not, in my turn, repeat the convenient phrase—My etherial aluminous paste cures the teeth by modifying the vitality of the organs that nourish them, and the vitality of the gums, themselves, which have more to do with odontalgia than people generally are aware of?

Our paste, like every thing new which has appeared in the world, has met with many opponents and detractors, but, through mercy, the results have been so often repeated that the most incredulous have been constrained to give way before its incontestable sedative qualities.

CHAPTER VIII.

Treatment of Congenital and Accidental Deformities of the Mouth—Orthodentosy.

This branch of dentistry was long in its infancy. The greater part of dentists, ignorant of the facility with which we can impress upon the teeth the direction we wish them to take, imagined that so many difficulties were to be overcome, that they could expect no aid except from artificial luxation. And, as few patients were disposed to submit to this cruel process, it has happened that this ridiculous plan, having, perhaps, never been submitted to experience, has continued obstinately to hold a place in the annals of science.

May we, an experimental practicien, be permitted to deplore the little knowledge, we will even say the little conscience, with which the greater part of the dentists attached to boarding schools, for the purpose of directing, as they call it, the second dentition, perform their work! Our thorough conviction is, that instead of aiding the accomplishment of the dental evolution, they only interrupt it by their violent manœuvres, which deprive nature of the "points d'appui" which she has given herself, to combine the arrangement of the precious organs of which we treat. Hence the beginning of all these imperfect and distorted dentures, where the teeth vault one upon another in the most deformed manner. One thing of which they seem to be careless, and utterly without thought, is, that the expression of the face, as to grace and dignity depends mainly upon the mode in which second dentition is effected. When through the evils of ignorance, they have adorned the jaws with overlapping teeth, the palatine vault, a true elastic cupola, which enlarges or contracts with the enlargement or contraction of the denture, contracts upon itself, and thence, my word for it, arise those elongated jaws, and sharp visages, which are so grotesque and unpleasant. Nor is this the greatest mischief. If the person afflicted with this artificial contraction of the palatine arch, be destined, by his superior faculties, to speak in public, his voice is indistinct, and his pronunciation difficult and embarrassed. So that with the most beautiful thoughts, with sentiments the most noble, expressed in the most brilliant language, he is cursed with a stubborn and intractable organ, which will only imperfectly convey the passionate emotions which he struggles, in vain, to communicate to his audience.

See what conseqences, to result from one miserable tooth, which an inconsiderate man has prematurely extracted! See the prospect of a whole life blasted! If the victim be a young girl, her face has no longer the beauty and grace which might have governed all hearts, and assured her a brilliant position in life. If a young man, his countenance will not display that dignity, which, if he be called to high employments, has so powerful influence upon the multitude; and his voice, as we have just said, will not correspond to his sentiments; it will not give

to his words that sweetness and harmony, which add so much to the value of thought, and impress the mind so powerfully.

What we say is no idle declamation, but we speak of facts, of which we will furnish the proofs in the course of this chapter.

To convince young men, who are called to cultivate the dental art, of the truth of our words, it may not be useless to tell them what has happened to us in an establishment of the kind already mentioned, of which we took charge. Being solicited by a friend of ours, who is at the head of the house, we readily consented, but upon condition that we should rarely extract a tooth; in other words, that we should be permitted to manage things according to our own notions. I contented myself then, with directing them to make traction upon the jaws with the fingers, &c., as I have already advised, in speaking of second dentition. The result was, that without having recourse to the violent extraction of the temporary teeth, I had the satisfaction to see that no denture was irregular, and that there was none of the overlapping, so common in the subjects of these establishments.

As, unhappily, but little pains are taken to prevent the evil, we will direct our attention to the means of remedy when it exists.

For a long time the necessity of restoring the teeth to order has been felt, but it must be told, that up to the present time, this branch of art has been so imperfect, that even in our days we find dentists of the best reputation, sacrificing one or more teeth to remedy the irregularity of others. We think that this is paying too dearly for relief from a deformity, very great to be sure, but by no means comparable to the loss of an important organ, a loss which nature herself can no longer repair.

The dentist then should correct these aberrations of nature, either by hindering their escape from the rules of arrangement prescribed by nature, while they are taking their position, or by forcing them into their proper places when their eruption is entirely completed, and the teeth present deformities, resulting from vice of conformation or want of care.

We will not repeat the detailed description of the dental arches, which we have already given in the commencement of

this book. We will only say that the direction of the teeth is vertical, and that this arrangement is peculiar to the human species. Moreover, the superior teeth should pass before the lower teeth which they cover, and the lower, at least the anterior ones, should incline from before backward. As to the great molars, they fall immediately upon one another. If we look at the length of the teeth in general, they ought to be nearly equal, as should be the triangular spaces that separate them.

But in the cities, where the population is heaped together in narrow and unhealthy streets, in Paris particularly, nature, faithless to her laws, gives way to all sorts of aberrations. Hence the variations, always disagreeable, and often inconvenient, and, sometimes, monstrous, that the practicien is called upon to correct. It was, therefore, indispensable to repeat, briefly, the natural disposition of the dental apparatus, before passing to the study of its deformities; for we cannot know how to apply a rational treatment to them, unless the normal condition be well understood by the operator.

The principal deformities reduce themselves to the following:

1st. The teeth often present obliquities, which may be anterior, posterior, or lateral.

2d. Sometimes, some teeth undergo a displacement according to their axis, and present a true rotation.

The dental arches may present three principal modes of vicious relation.

1st. The prominence, in which the anterior teeth of one or both arches are very oblique, and salient forward. Under these circumstances, the teeth appear very long, and, sometimes, the alveolar arches appear to have followed the direction of the teeth.

2d. Retrocession, is an opposite deformity to the preceding. Indeed, in the subject of it, we remark that the anterior teeth are inclined obliquely backwards. This deformity impedes pronunciation.

3d. The inversion of the dental arches; when the inferior jaw passes before the upper.

In many cases, the teeth, while planting themselves regularly upon the alveolar border, nevertheless, contract anomalies of direction, which must not be confounded with prominence and

retrocession. These are the abnormal directions, which are called obliquities, and which are more frequently in the incisors and canines, than others. Sometimes they affect only one or two teeth, sometimes all the anterior ones of one or the other jaw, and constitute repulsive deformities, as the following:

1st. The anterior obliquity which may exist in the two dental arches. Where this deformity exists in the lower jaw, the upper arch instead of overlapping, is itself overlapped, and the two arches, bear an inverted relation to one another. This latter deformity constitutes one variety of the "galoche" chin.

2d. The posterior obliquity also may exist in both jaws. When it attaches exclusively to the upper, it occasions a deformity similar to that just described—the upper range of teeth being overlapped by the under. Another form of the "galoche" chin.

Obliquities differ from prominence and retrocession, in this, that in the former the teeth are regularly planted upon the alveolar border, while in the latter the order is more or less imperfect; some being placed too far forward, others backward. When only the two canines of the upper arch project, the range presents the form so characteristic of carniverous animals, engrenement* is a consequence of a combination of all the preceding deformities, and exists generally with projections, retrocessions and obliquities. It is one of the most obstinate of all the obstacles which we have to overcome, and by many dentists is regarded as incurable.

Such are the principal deformities observed in the dental apparatus; but we repeat that we are far from having named them all.

The temporary teeth rarely present vicious directions or deviations. Among the permanent teeth, the anterior are, beyond all comparison, more subject to these deformities than the posterior. The reason of this is so evident that we need not specify it.

* To explain the nature of this deformity, it may be necessary to say, that the word "engrenement," indicates the mode in which one wheel is made to turn another by the interlocking of the teeth of the one into the spaces between the teeth of the other.—TRANS.

Among the causes of dental irregularities we may regard as the most frequent, the neglect of proper supervision of the second dentition. Very often the temporary teeth are too precipitately removed, and often again the opposite error is committed of suffering them to remain even after the permanent teeth have partly appeared.

There results from this, an error of relation between the development of the palatine arch, and the superior alveolar border, or of the two arches at once, relatively, to the size of the teeth.

Another cause is the bad habit of permitting children to suck their thumb, and continually to be putting their hands into their mouths.

Another, is the frequently repeated action of the tongue in the pronunciation of certain syllables called lingual, in which that organ, striking against the anterior superior teeth tends to push them forward. This cause gives rise to the anterior obliquity of the upper arch. We may remark, that this deformity is very frequent with the English, resulting from the pronunciation of lingual syllables.

Shall we remark upon traumatic causes? We must confess that they are rare, but it is easy to perceive, that under certain circumstances, they may determine the luxation and deviation, at the same time, of one or more teeth, and that the restoration to firmness, being accomplished by unaided natural efforts, may result in various deviations.

But enough has been said about the causes of deformities. The mechanism of their formation is of at least equal importance to the causes themselves. We may readily perceive that when, at the moment of the shedding of the first teeth, a permanent one arriving, finds a space too narrow to contain it, it must press upon the two teeth, which bind it on either side, and if these latter hold their places in the jaw, the edges of the new teeth, gliding upon them as upon inclined planes, must cause them to yield either anteriorly or posteriorly, as the new teeth has pierced the gum upon the side of the lips, or upon that of the buccal cavity.

Let us pass now to the most important part of our subject; the therapeutics of dental deformity.

But before describing the methods of cure which we daily practice with constant success, let us rapidly review what our predecessors have accomplished.

Of course the means used to the present time have varied with the nature of the deformity. We will, therefore, rapidly review what has been proposed for each of them.

Many means have been advised to separate the teeth when too closely approximated. The principal are, the employment of a piece of wood, interposed between them, which, being swollen by the absorption of the fluids of the mouth, will thus press the teeth apart; the employment of the file, and the extraction of some teeth.

For the simple rotations or deviations of teeth upon their own axes, some have also advised the file, when the deformity depends on want of room. Ligatures, plates and forceps have also been used.

M. Oudet has advised to luxate them and then to turn them with the forceps while supporting them with the fingers, and confine them in the desired position by a silken ligature.

We cannot contend too strongly against this artificial luxation. When but one tooth is affected with this deformity, this means is barely practicable, but when all the upper anterior range, and, sometimes, the inferior, too, present obliquities forward and backward which cause them to serrate with one another like the sutures of the cranial bones, we would defy any man to maintain and confirm in position all the upper incisors after he had luxated them. The operation is very cruel, and its success exceedingly problematical. In theory it is all very well to fix them with silken ligatures precisely where the operator shall please; but in practice we very much doubt if it would be so easy. The patient is irresistibly inclined to press the point of his tongue against organs uneasy and loose in their sockets, and these touches, often repeated, will be enough to prevent the success of the operation. But there is another difficulty yet more insuperable, for it will not do merely to restore the teeth to position, it is necessary, also, to give them the room they need, and luxation cannot do this.

This difficulty, it has never entered into the thoughts of other

dentists to overcome, but we have completely resolved the problem for ourselves, and that, too, without having recourse to the file, which, indeed, is not to remove deformity, but substitute it by another; for, certainly, teeth once filed never possess the elegant and graceful appearance of those which have never been subjected to this process. In the course of this chapter we will furnish the proof of what we have said.

To return to the different deviations. Solitary ones; that is those which affect only one or two teeth, have been combatted by metallic threads, wedges of wood, and the inclined plane. This last means has also been employed to remedy the reciprocal interlocking of the two arches.

For anterior obliquities, or deviations forward, we have been advised to extract the bicuspid neighboring to the canine, and to use plates and metallic threads fixed to an artificial palate. When this obliquity occurs in the lower arch, recourse has ordinarily been had to the inclined plane mentioned by Hunter.

For posterior obliquities, or deviations backward, which are regarded as incurable by certain practiciens, operators have generally used the file, a dental gag or the inclined plane. We will not mention artificial luxation, except to remind of what we have already said. We regard it as one of the vain theories, constructed in the closet, which even the author never hoped to submit to the touchstone of experience.

For lateral obliquities, some have advised the application of a ligature, which, being fixed to a neighboring tooth, may gradually draw the erratic one towards it.

For that total deviation, which rather belongs to aberrations than to irregularities of dentition, the extraction of the tooth is often indispensable, especially, when, by its situation it impedes pronunciation, or creates inflammatory conditions, followed by abscess, after having given origin to a tumor, whose nature is not perceived until the pus is discharged, and the tooth exposed. These aberrations are of various kinds, each calling for different management, as may readily be perceived, if we reflect for a moment that they not only result at times from the vicious direction of a tooth in the interior even of the alveolus, consecutive, generally, to a deviation of the dental follicle, but, also, from the

displacement of the latter, since, as we have already said, teeth have been found implanted upon the palatine arch, the internal surface of the cheeks, the tongue, the pharynx, in the stomach, and in the orbit.

The numerous means we have recounted, are far from being sufficient to remedy all the deformities we may meet with, of which we have named the most important, and this fact is so well known to those who have devoted themselves to this matter, that in the books of greatest reputation, the authors frankly acknowledge the incompetency of these means to relieve many of the deformities in question, and, especially, the vaulting of one on another, which occasions a deformity, until the present considered incurable. The case is worse, when the cure being pronounced possible, the treatment begins with the extraction of the two first bicuspids. This operation is the *sine qua non* condition of every attempt at cure, and the evulsion of one or more teeth has been advised, at least as an adjunct means, for the remedy of almost every kind of deformity.

We have long thought that this was to begin in a manner by no means attractive to the persons who are to be the subjects of the treatment, and in order to avoid this painful operation, submitted to with the more regret, as the teeth, whose extraction is indicated by the nature of the deformity, are generally sound, we have earnestly sought a means, which, avoiding the pain of the operation, might yet fulfil the object proposed to be attained by it.

No instruments or methods hitherto employed, being found to answer, our researches had a double purpose, viz. to remedy the deformities of the teeth without extraction, except in some rare and entirely irregular cases; and, secondly, to simplify the series of means to be employed hereafter to combat the deformities of the teeth.

One consideration has conducted and powerfully aided us in our researches. We had remarked, indeed, that in the immense majority of cases of anterior, posterior and lateral obliquity, the summit of the root was always displaced, or, in other words, that these deformities resulted from a vicious direction or disposition of the dental follicle, which produced a tooth situated out

of the parabolic line constituted by the dental arch, as appeared to be the case in some instances of prominence and retrocession.

Thence it was easy for us to comprehend, that in order to remedy these obliquities it was indispensable that some force, yet to be determined on, acting sometimes concentrically, sometimes eccentrically upon the arch, should be brought to bear upon the crowns of the affected teeth as near as possible to the free border.

The preceding considerations furnished us with an idea of the proper springs, the application of which has completely confirmed our expectation; and, better still, experience soon taught us to extend their application, and we rapidly acquired the assurance that they constituted a means of treatment for all kinds of dental deformity; whether with or without the peculiar inequality hitherto regarded as incurable; and, besides, that by their employment we might remedy the narrowness of the palatine arch, a discovery which we confess surprised us very much.

It is, therefore, now, a fact in science, that the vault of the palate, and, much less, the dental arches, are not unchangeably fixed in their dimensions, as has long been believed on the credit of certain dentists, wiser in theory than in practice. This idea, or rather this serious error, so deeply imbedded in all heads, was one of the greatest obstacles to the progress of orthopedic dentistry. Practiciens, firmly convinced that they had to act upon an inextensible circle, found no better means to restore the symmetry of the teeth than to extract one or more of them, or to gain space for one by filing all, which did not contribute a little to narrow yet more the alveolar arch, and to destroy the relation of dimension between the upper and lower jaw.

The two cases of most common occurrence, are the following: simple inclination, forward or backward, without rotation of the teeth upon their axes, or the latter complication.

In the former case we need only one golden spring, to which we shall give the name of *passive*.

It is fashioned like a horse-shoe, and in such a way, that upon the sides it is adapted exactly to the anfractuosities of the teeth, and in front, or in the centre, there is a certain space preserved between it and the teeth we desire to redress.

We are careful to give it a little more play than the space it is to occupy, and as the metal of which it is composed has elastic properties, it acts incessantly and eccentrically upon the crown of the great and small molars. Its extension is singularly favored by the function of mastication. Now, upon each tooth that we wish to redress, we pass a thread which acts as the *active* spring, having its "point d'appui," upon the central part of the *passive* spring. This is upon the supposition that the teeth are inclined outwardly. If the case be different, which generally only occurs in a single tooth, we must place the active spring in front, and the thread will take the place of the passive spring. The two agencies being united, the elasticity of the gold semicircle on the one hand, and the traction of the silk thread on the other, we have a power so great, that if we did not occasionally dispense with it, we might fall into the opposite extreme to the evil we wished to correct. What we say is the fruit of experience.

In such cases when we not only desire to restore the incisors to position, but to redress some of them which are twisted, we employ a second spring, which consists of a little golden plate, larger or smaller, as we may wish to act on one or more teeth at a time. By the aid of two silken threads, we bind its two extremities upon the great passive spring, so calculating the pressure, that the centre of the plate may act only on the border of the teeth we wish to bring into line. Now, we may perceive that in this lever we have a power easily controlled, but constant and irresistible, which cannot fail to reduce the organ to its normal state. In truth, this means has never failed us.

One of the greatest merits of this method, which is altogether new, is that it gives no pain nor discomfort, and, moreover, being constant, it more promptly relieves the deformity than when the instrument employed is only temporarily applied, and exerts only an intermittent action.

We will narrate some cases which will prove incontestibly the superiority of our springs over all means whatever, hitherto used.

First Case.—A young English vocalist, aged twenty-one years, had, from infancy, been deformed with an anterior obliquity of the incisors and canines of the upper jaw, which not only inter-

fered with the pronunciation of French and Italian, but gave to her mouth a disagreeable appearance, especially when she was singing.

With the hope of getting relief from this deformity, which was not only disagreeable, but to her a great prejudice, as in her avocation it is important to possess as much attraction as possible, this young woman had consulted three of the most distinguished dentists of Paris, who all united in advising the extraction of all the incisors, canines and molars of the upper range! in order that an artificial set might be inserted. Others advised that a third part of the teeth should be filed away, for they saw no other way of remedying the defect.

Terrified at the first proposal, she determined to try the second, but soon disgusted with it, she abandoned all hope of relief, when having called upon us in order to obtain relief for a a diseased tooth by our aluminous paste, she obtained a knowledge of our springs, and at her request we undertook her case with confidence of success.

We found an anterior obliquity of the incisors and canines of the upper jaw, carried to such a point that the free border of the median incisors projected three lines from the vertical line of the anterior part of the alveolar border. This projection was less in the case of the lateral incisors, and still less in that of the canines.

The principal cause manifestly consisted in a defect of relation between the remarkable size of all the teeth and the narrowness of the alveolar border, and, therefore, of the palatine arch, which, between the two bicuspids, was only eight lines in diameter, and ten and a half between the two great molars. We must add, the remarkable size of the molar teeth, and the action of the tongue in pronouncing certain lingual syllables, peculiar to the English language, in which the tongue strikes the anterior teeth of the upper arch, and tends to push them outwards.

These latter causes could not be removed; especially that which belonged to pronunciation, and being unwilling to use the file for the purpose of gaining room, we applied ourselves to increase the extent of the alveolar border, by exercising there the agency of the spring, improperly called *passive*, for it is at

once active and passive, by an eccentric action upon the molars, and a concentric force upon the incisors and canines, approached to the vertical position, by ligatures of thread, thrown around each of them, and fastened to the centre of the great spring.

Such was the treatment indicated by the nature of the case, and such the obstacles we had to encounter. If we declined using the file, or extracting the first bicuspid upon each side, in order to gain space, it was only because we were persuaded that in acting upon the molar teeth we should also act upon the alveolar border, and that in augmenting its extent, we should gain room enough to permit each tooth to range itself in a vertical position.

Time confirmed our anticipations, and by the aid of these simple means, by the use of which the young lady was not incommoded for a moment, we succeeded in restoring the teeth to their proper place. At the end of six months, the cure was completed, and the palatine arch which was so narrow, had acquired fourteen lines and a half between the two first bicuspids, instead of eight, and eighteen lines between the two last molars, instead of ten and a half. One must have a similar case in order to believe it.

Second Case.—A young man, nineteen years of age, very rich, and of agreeable appearance, had an exceedingly bad denture, not only from bad arrangement of the teeth, but more yet from serious alteration of the gums.

This young man was much grieved on account of his condition, and, indeed, his mouth was repulsive, not only from the dirtiness of his teeth and their strange arrangement, but more still from the fact that his spongy and ulcerated gums, united with that uncleanliness, to communicate a very bad odor to his breath.

The palatine arch and alveolar border were well enough developed, and the volume of the teeth was well proportioned to the development of the alveolus. We, therefore, could only attribute the evil to want of management and care at the moment when the first dentition was replaced by the permanent teeth.

Be that as it may, the upper range was squared like that of wild beasts, by the prominence of the canine teeth. Besides,

there was, in this young man's case, a reciprocal irregularity of the two dental arches; that is to say, that many teeth of the upper arch, as well as of the lower, especially the anterior, had, in their direction, the strangest deviations, each one differing from the rest.

We must add, that the spongy and ulcerated state of the gums had so loosened many of the teeth, that professor Alibert, who had been consulted before us, had not hesitated to advise their extraction.

In this young man's case, therefore, we had to combat the bad disposition of the teeth and the state of the gums, which, preventing cleanliness by their ulceration, contributed powerfully to increase the bad state of the mouth, and the fetor of the respiration.

The use of our springs, preceded by the inclined plane, which had been worn for six days, previously, in order to correct the anterior obliquity of the middle incisors of the upper arch, has entirely triumphed over the multiplied irregularities of the mouth. Their use was not intermitted until the cure was perfected.

The bad state of the gums has been completely relieved by the use of our ethereal aluminous paste. Under the influence of this medicament, the ulcerations cicatrized, the gums passed from a fungous to a normal condition, and as their tone returned, the loose teeth became firmer in their sockets, and, ultimately, their mobility disappeared.

We might quote numerous cases of a similar kind, in which our ethereal aluminous paste has afforded us powerful aid. We must say, however, that in the case of the young man, just related, the mobility of the small right incisor of the lower jaw was so great, that we could not avoid extracting it. This operation, however, favored the restoration of the other misplaced teeth, and the space thus made, was completely filled by them.

The treatment was continued for three months and three weeks, and the result obtained left nothing to be desired.

Third Case.—A young lady, twenty years of age, consulted us for a very defective denture, resulting from defect of relation between the superior alveolar border and the teeth, the latter being better developed than the former. This natural defect

was evidently increased by want of care during the second dentition.

By consequence of these united causes, there resulted such an arrangement of the upper range that it presented an acute angle similar to that seen in certain fish, especially those of the splyrene kind. Indeed, the arch seemed to have been submitted to a lateral pressure, from which had resulted an angle, the summit of which was represented by the space which separates the two middle incisors of that arch.

The two superior median incisors had undergone a rotation upon their axes, to which was added an anterior obliquity both of the lateral incisors and canines, but which diminished from the first towards the second. This arrangement was more remarkable on the left side where it was favored by a posterior obliquity of the great molars.

The lower jaw only displayed one posterior obliquity of the incisor teeth.

This young lady had consulted two of the best known dentists in Paris, before applying to us, and had been advised to submit to the extraction of the two middle incisors of the upper jaw. We saved her the necessity of this operation, and by the aid of our springs alone, at the end of eight months, procured her a perfectly symmetrical denture.

We might swell the list of cases, but what advantage could we expect from merely increasing the number of facts? The three we have selected, from many, combine in themselves the various deformities which are ordinarily encountered in practice. We should, therefore, only encumber our work with superfluous details, without rendering more evident the efficacy of our springs.

Our object was to show their superiority over all other means previously tried; and, we trust, we have done this, by exhibiting the cases above mentioned.

We may be told that we employed other known means in conjunction with our springs. Certainly we do not proscribe what others have done; nevertheless, we have rarely found it necessary to call in other instrumentalities to the aid of our own. Thus, in one of three cases mentioned, we were compelled to

extract a very loose tooth, and to apply the inclined plane for six days, yet we think this was very different from using the violent means recommended to our patients before we were consulted.

We may remind our readers, that in the case of the young vocalist, no plan remained but the extraction of all the teeth of the upper jaw! and the replacing them with an artificial set. What would have been the result of this painful operation? Inevitably, the alveolar circle would have contracted still more, and the deformity, resulting from this retraction, would have been increased instead of being diminished. It is true, that a third dentist had advised the shortening of the teeth, one-third by the use of the file; an operation which was only avoided by the repugnance of the young lady to submit to it.

Professor Alibert had also advised the extraction of all the teeth in the instance of the young man whose case is stated as No. 2, as much on account of the bad condition of the teeth as of that of the gums; and the two median incisors of the upper jaw were similarly doomed in case No. 3.

Nevertheless, none of these things have been done, and we affirm that our efforts have succeeded to the utmost of our wish, without causing any kind of pain, or even that sensation of discomfort which many of the ordinary instrumentalites produce, and which is as insupportable as pain itself. To avoid entailing suffering, and to escape the necessity of violent operations as much as possible, have been the objects of our labors. We believe we have succeeded, and we will leave every judge to decide whether we are deceived.

The second case affords an example of the great advantages we may derive, in certain circumstances, from the use of our ethereal aluminous paste, employed as an adjuvant, wherever deformity of the teeth is attended by morbid alteration of the gums.

We will remark, in conclusion, that one of the most valuable advantages of our springs is, that they act uninterruptedly, and, especially, during mastication. Indeed, it is then that the teeth, being moved by the pressure of the aliments submitted to their action, tend to sink into the alveoli, whence they are repelled by

the elastic walls. Therefore, if a third force, represented by our springs, is brought to bear at this moment in a way opposed to that in which the movements of the teeth are effected, we perceive a consequence which the laws of physics explain, viz. that this third force, (our springs,) in decomposing the two others, will more readily move the teeth in the direction towards which it acts, than if the latter forces were not in action.

Observation of facts has confirmed a physical law when applied to physiology. A result which, indeed, we never doubted.

CHAPTER IX.

Diseases of the Gums.

In their healthy state, the gums are firm, and of a rose color. They present some differences, according to the age of the subject. Smooth and even in infancy; in adult age, they present a festooned appearance, and in old age they are hard and resisting.

Maury, in his Complete Treatise on the Dental Art, has explained very well, and very briefly, the several disorders that may attack them.

They inflame, he says, they swell, and, in certain cases, even are excoriated by their own action. Sometimes they become the seat of plegmasias, more or less severe, of aphthæ, excoriations, fistulas and ulcers. Sometimes they diminish in volume so as hardly to cover the alveolar border; at other times they engorge and swell, and give rise to fleshy excrescences, which it is often difficult to remove.

Dr. Aubry, in his inaugural thesis entitled, "An Essay on the Diseases of the Gums," has made three principal sections: an arrangement which we shall adopt.

The first treats of aphthæ; of inflammation at dentition; of abscess; of phlegmons, or gumboils; of dental fistulas, and adherence of the gums to the cheeks.

The second comprehends scorbutic affections, the gangrene of the gums, and the different alterations, which result either from scrofula, syphilis, or mercury.

The third includes "epulies," and some other gangrenous tumors of the same kind.

Sec. 1. *Aphthæ.*

Aphthæ, an affection characterized, sometimes by papulæ, and, sometimes, by vesicles which appear upon the mucous membrane of the mouth, have been divided into vesicular and ulcerative.

Some authors have comprehended, under the same name, the erythamatous stonatitis, muguet, and gangrene of the buccal mucous membrane; disorders, nevertheless, very different from one another.

Aphthæ are, especially, frequent in infancy, and in the new born child. All authors, who have treated of the morbid affections of the very young infant, have recorded this well established fact. Females seem to be more liable to the disease than males. It is also more common in feeble, soft, lymphatic temperaments. Aphthæ are especially prevalent in cold and humid countries, and in narrow, unwholesome streets, deprived of sunshine and fresh air. They are more common in autumn than in any other season. Acrid and irritating substances may produce this malady.

Aphthæ are generally found upon the internal face of the lower lip, on that of the cheeks, the inferior and lateral parts of the tongue, the amygdalæ, and the velum of the palate.

The vesicular and ulcerative forms are, in fact, the same affection, at different stages.

In the first kind, the vesicular, the appearance of the aphthæ is, sometimes, preceded by general symptoms, especially, in children. We notice general distress, fever, nausea, diarrhœa, &c., and, at the end of an uncertain period, the eruption appears.

We then see it manifest itself upon the buccal membrane, in little salient, red, hard and painful points, which rapidly grow white on top, while they preserve a tinge of lively red, and considerable hardness at their base. This is the passage of the papular to the vasicular form. The eruption may, sometimes, be distinct, sometimes confluent.

Aphthæ may stop at the vesicular stage, remain stationary for some time, and then gradually disappear, or continue their progress, and present the following symptoms:

The epithelium, which covers the vesicle, rapidly breaks, and the thick and whitish liquid contained in the latter, is liberally poured out. We then see a little superficial ulcer, rounded, with somewhat pointed edges, but always of a very lively red color, the bottom of the ulcer is of a white and slightly greyish cast, owing to the exudation of a thick, paltaceous matter, which sometimes concretes and forms a crust. This latter is detached by the saliva, and is speedily brought away. After a while, cicatrization takes place, which, as in ordinary cases, proceeds from the circumference towards the centre. The bottom is cleansed by degrees, the borders approach each other, and the ulcer disappears, leaving a little violet colored spot at the place where it appeared.

The treatment is local or general, accordingly as the phenomena are confined to the mouth, or involve the general system. In the former case, when the aphthæ are inflamed, but the pain is slight, it will suffice to wash them with emollient lotions, medicated with mallows or barley, and sweetened with honey, plain, or flavored with roses. Milk and water is yet more soothing. When the pains are very severe, we may add some drops of laudanum to the emollient decoctions. In the case of chronic aphthæ, accompanied by subacute inflammation, we may have recourse to astringents, such as alum, nitrate of silver or borax. We may, successfully, touch these little ulcerations with alum, hydrochloric acid, mixed with roseated honey, or, what is better still, with lunar caustic. When this affection is accompanied with intense inflammation of the mouth, we should use general bleeding and leeches to the angle of the jaw.

Sec. 2. *Muguet, or Stomatitis.*

This affection called, also, the *pig-skin* aphthæ, is a form of inflammation resembling that of the larnyx in croup. Its seat is commonly in the mouth, but it may extend to the posterior fauces, the œsophagus, and even the interior of the stomach.

Muguet occurs as an epidemic and endemic, but is, especially, common in hospitals devoted to the care of young infants. There we see it rage with the greatest violence. The causes of its frequency, in such establishments, are found in the artificial nourishment, whether milk or more unnatural aliment, with which the want of the mother's breast is supplied; the vitiation of the air by the congregation of very young children; the want of neatness, and, finally, contagion—for the influence of which last cause, we need not suppose any syphilitic principle.

Muguet commences by a fiery redness of the mucous membrane of the mouth, a prelude to inflammation. The surface of this membrane becomes hot and dry, and, as the disease spreads, fever, which, indeed, may precede these symptoms, is lighted up. This forms the first period of the disease, and, sometimes, comprises its entire history; but, more commonly, a second stage manifests itself by the appearance of white points upon the surface of the inflamed parts. Gradually, these points multiply, spread, reunite, and form irregular thin plates, which, sometimes remaining distinct, fall off, and reappear again and again; sometimes, on the contrary, they thicken and increase, and unite from all sides into one continuous coating which covers the walls of the mouth and surface of the tongue. When this occurs, the life of the child is in great danger. The thick coating increases day by day, flakes are detached from it; the œsophagus becomes covered with elevations, inflamed, and disposed to gangrene; in a little while the child is reduced to a skeleton by marasmus, colliquative diarrhœa ensues, and death speedily terminates a disorder, as terrible from the rapidity of its course, as from its dangerous nature.

Treatment.—In the outset it is sufficient to employ soothing lotions and emollient gargles. We must not give articles much sweetened with sugar; for this article has, sometimes of itself, caused the disorder. When the disease resists these first remedies, we may have recourse to astringent gargles, always excluding the mineral acids, which, when swallowed, induce violent colic.

Should a period arrive, when, instead of abating, the disorder assumes the general symptoms of exhaustion, and threatens to

destroy the patient speedily, it would be proper, though there is little room for hope, to employ tonics, such as syrup of quinine, pink and orange peel dissolved in a sufficient quantity of soothing drink.

Finally, when gangrene occurs, there remains no farther remedy, unless we employ the terribly energetic means which has succeeded in the hands of an English physician, viz. to apply the actual cautery to the sphacelated parts.

Sec. 3. *Inflammation of the Gums caused by Dentition.*

At the time of the first dentition, as we have said in a previous part of this work, we observe inflammatory affections of the gums. The children tormented by the itching of these parts, continually carry their hands to them. The alveolar border swells, the gums redden, aphthæ appear, the salivary secretion augments, and the little sufferers press their gums upon their corals, or the breasts of their nurses. Some fever, colic, vomiting, diarrhœa, and, sometimes, even convulsions accompany these symptoms.

We, sometimes, find the inflammation become so intense, as to spread to the face, and even the sub-maxillary glands. The maxillary bones themselves, have often shared the disorder, and so great is sometimes the devastation, that the gums of the permanent teeth are destroyed, completely deforming the face.

To calm the pain which attends this buccal inflammation, there is nothing better than the mother's milk. This possesses the double virtue of allaying the tormenting thirst of the child, and to soothe and soften the tissue of the gums, which will, therefore, not present as much resistance to the teeth. If the child be raised by the bottle, we must use some kind of emollients, either as gargles or collateries. If these means fail, we have no alternative but the breast of a good nurse.

When, from the use of a coral, crystal or ivory, the tissue of the gums is so hardened that the teeth encounter in them an insurmountable obstacle, we repeat, what we have already advised, that we must make one or more incisions upon the swollen part; the trifling bleeding, which results, is never trou-

blesome; on the contrary, it has the advantage to disgorge the swollen parts, and dispel the inflammatory symptoms. If, however, it should continue rather too long, it will suffice to have recourse to simple lotions, with vinegar and water, or some other slightly acid preparation.

Second dentition presents accidents as grave, and, sometimes, even more intense than those of the former. We have seen it occasion abscesses, very serious in their results, especially when they break on the outside. The means by which we may combat these inflammations, are the same as above described, only that, in these cases we must ascertain whether any piece of the first tooth is in the way, and if so, extract it; which, generally, can be done without difficulty.

As to the general symptoms which almost always accompany the local disorder, it is prudent to meet them by general baths, or foot-baths slightly medicated with mustard, and with soothing drinks. With these simple means alone, the physician has often the satisfaction to see all put to rights.

Sec. 4. *Phlegmon, or Abscess of the Gums.*

When inflammation of the gums is carried to a high degree, abscesses and phlegmons are developed in the gums, which terminates sometimes by resolution, and sometimes by suppuration. In some circumstances they assume the most serious character. These kinds of tumors may arise from many causes, as, some peculiarity of constitution, rheumatic affections, a metastasis, the inflammation of the proper tissue of the gums, the caries of a tooth, of the maxillary bone, &c. We have seen these abscesses appear at the close of an acute disease of the alveolar periosteum, by the tearing of some of its fibres by a traumatic cause.

We may also number among predisposing causes, the irritation of the dental nerve, the accumulation of tartar upon the gums and teeth, the inconsiderate use of mechanical agents, badly prepared elixirs, and, finally, the manner in which one or more teeth have been plugged, or the way in which artificial teeth have been inserted.

These phlegmons, or abscesses, have received the peculiar name of "parulies," (gumboils,) when they are not developed under the influence of distant and deep seated injuries of the dental roots, the alveoli and maxillary bones; in a word, when it is a simple affection.

Most of the severe irritations of the bulbs of the teeth, and of the membranes that cover the roots of these organs, and the alveoli cavities, are capable of causing inflammation and suppuration of the remarkably vascular and irritable tissue which constitutes the gums. This inflammation discovers itself by an intense burning and throbbing pain fixed upon a part of the alveolar arch. In the simplest cases, the disorder is limited to the affected gum; in the greater part of those of another kind, the symptoms are propagated to the adjoining cheek, which swells and becomes the seat of a fluxion, sometimes considerable. In two or three days the disease attains its height; at the end of that time all the symptoms abate, the inflamed point of the gum grows soft, acquires a whitish hue, and presents a manifest fluctuation to the touch. The seat of the abscess is almost constantly upon the external face of the alveoli border. Its form is oblique, and it seems to depress the fold of mucous membrane which passes from the gum to the cheek.

The abscess will break of itself if permitted, but it is better to abridge the sufferings of the patient, a suffering which is sometimes very severe, by opening it as soon as the fluctuation is perceived.

There are other abscesses of a similar character occasioned by carious teeth. They are more frequently observed near the front and small molar teeth than the multicuspids. It has also been remarked that they are much more frequent in the neighbourhood of the incisors of the upper jaw than in that of the other teeth. It does not suffice to attack this evil with gargles and small revulsive bleedings. We must go to the source of the evil; that is to say, extract the tooth, whose dead root is the cause of the mischief.

Sec. 5. *Fistulous Ulcers of the Gums; adhesions of the Gums to the Cheeks.*

Dental fistulas are, so to speak, nothing more than abscesses, become chronic by a disease of the teeth or maxillary bones, consisting in caries or necrosis. Fragments of a tooth or alveolus remaining in the gingival tissue suffice to prolong the duration of these sorts of ulcerations. We may discover this disease of the gums, when, after opening the abscess, the ulceration makes no advance towards cure, notwithstanding the general means properly employed. The principal characteristic of this affection is a small ulcer situated along the base of the lower jaw, or what is very rare, near the ascending ramus of the maxillary bone. The edges are callous and swollen, the circumference, more or less red, smooth or mammelated, and, generally, a little ædematous. Sometimes this ulcer only presents a small orifice almost obstructed by the presence of a serous ichor, which flows from it, and which the air dries upon it. At other times we perceive two or three of these orifices instead of one, and very near one another.

Whenever there is suppuration or necrosis of the bones, two or three openings give vent to a fetid sanguinolent fluid. When the probe is introduced, the bone is found to be denuded and movable. The pus escapes into the mouth, but the tooth in which the disease is located is no longer sensible. It is loosened. As soon as this tooth, and the sequestrum, if there be necrosis of the alveolar border, are removed, the ichorous exudation ceases, the sides of the ulcer approach and cicatrization is completed.

Let us now consider adhesion of the gums to the cheeks. This affection, which is almost always accidental, rarely congenital, frequently comes in the train of some ulceration of the gums or the cheeks. The abuse of mercury may cause it, as well as phlegmons and fistulas of the gums. As to the extent, it is sometimes partial; sometimes it extends along the entire side of the gums, sometimes it exists on both sides at once.

These adhesions interfere with the functions of the mouth, in proportion to their extent. In order to prevent them we must

use mucilaginous gargles and frequently pass between the gums and the cheek, a pencil dipped in a collutory made of barley water and roseated honey. When in spite of these means, or rather through neglect of them, the adhesion is established, if it be recent, it is sufficient to pass the finger between the internal walls of the cheek, and the gums to break it up. But when it has been neglected for a long time we must have recourse to a cutting instrument, and when we have separated the parts with a narrow bistoury, we must, by interposing pledgets of lint, covered with some oily substance, or the collutory we have mentioned, prevent the divided tissues from coming in contact and reuniting.

Sec. 6. *Affections of the Gums in Scurvy.*

Scurvy causes great disorder, not only in the gums but also in the alveoli and the maxillary bones themselves. It is not foreign to our subject to consider this disease so far as the gingival tissue is concerned. It is this which is almost always primarily attacked. The symptoms manifest themselves in the following order: the gums are first the seat of distressing itching; they soon swell, become red, and bleed whenever they are touched. It may happen that the disease will be arrested here, but more generally it progresses. The gums become fungous and livid, and exhale a fetid odor. To the considerable swelling, ulcerations soon succeed, which cover the whole circumference of the dental arch. Hæmorrhages become more and more frequent; the teeth, affected even in their alveoli, become loose and often fall out. From their white color they are changed to brown or blackish. This disorder sometimes attacks the maxillary bone itself, causing caries more or less extensive, which sometimes lays bare the dental nerve and causes the most terrible odontalgia.

Cases are sometimes observed in which the dark color of the gums would make the physician to fear that gangrene had taken place, if the absence of the peculiar odor of mortification did not allay such suspicion. In this disorder, we sometimes meet with fungous excrescences of considerable size. Instead of the livid red tint, which we have mentioned, the gums sometimes

assume an ash grey hue, especially when they are the seat of these excrescences, the form of which varies greatly. Sometimes they appear as fungosities, with a large base, or a narrow pedicule; at other times, they seem to be flakes, as if torn off; sometimes their consistence is very firm, generally it is soft and bleeds easily.

The treatment of scurvy belongs rather to general medicine than to dentistry, nevertheless we may mention it. From the moment that the gums are observed to be swollen and spongy, and the teeth to be loosened, we should have recourse to gargles acidulated with the sulphate of alum and sulphuric acid; which will also be very useful in arresting the passive hæmorrhage. If the excrescences be hard and firm, it will be better to excise them. In the case of simple ulcerations, emollient and slightly astringent washes will be very useful. Where the dental nerve is exposed we must satisfy ourselves with filling the carious tooth with cotton, moistened with an anodyne mixture or with laudanum: we must not think of extracting the tooth, for owing to the disorganization of surrounding parts we might induce a bleeding not easily to be arrested.

We must by no means attach too much importance to this local treatment. It is evident that a disease which so seriously pervades the entire economy can only be combatted by general remedies, but it would be to travel beyond our proper sphere to pursue this subject further.

Sec. 7. *Fungus of the Gums.*

This affection called, improperly, by certain writers, scurvy of the gums, is purely local in its origin. Often, hardly inconvenient at first, it may, if neglected, terminate in the most serious consequences. It is characterized by the softness, lividity and swelling of the gums, which bleed at the slightest touch. The parts between the teeth are the seat of this swelling. It results in fungous conditions. The surface rapidly excoriates. Sometimes the inflammation subsides and is succeeded by ulcerations which destroy a part of the gums and denude the teeth. A purulent, glutinous and fetid matter flows between the gums

and alveolar walls which are in a state of suppuration, and sometimes finally destroys the tissues which supply it. The teeth become loose and ultimately fall out. Sometimes the disease affects only a small portion of the gums, and sometimes it extends its ravages over the two jaws at the same time.

The causes of this affection are, ordinarily, extreme dirtiness of the teeth, swelling of the gums and congestion of their vessels. It is most commonly met with in men between the ages of thirty-six and forty; and in women about the time of the "change of life." Those of the latter who labor under irregular menstruation are also predisposed to this disorder of the gums, as, likewise, are those of a lymphatic temperament. We may also enumerate, among the causes of it, residence in moist and unwholesome places, and the repulsion of some cutaneous disease.

The treatment principally consists in cleanliness. An indication which may be fulfilled, by removing the foreign matters from between the teeth, either with the brush or by frequent lotions.

It sometimes happens that the gums are painful and so engorged as to extend beyond their proper level. Some dentists advise to cut, scarify or cauterize them. We think it will be better to content ourselves with rubbing them frequently, during the day, with a hard brush, so as to make them bleed and thus empty themselves.

It will also be a proper precaution to employ some anti-scorbutic means; to cause the patient to chew water-cresses, for instance, and, when the mouth is restored to health, to recommend that it be constantly cleansed with tonic and astringent lotions.

It remains for us to mention some other affections of the gums, which we will consider in one paragraph, leaving ourselves at liberty to speak more at large concerning "epulies," at the close.

Sec. 8. *Grangrene of the Gums, &c.*

We have already spoken of gangrene of the gums as it occurs in stomatitis; in the present case it is only the same affection on a smaller scale.

Scrofula. In scrofulous persons the gums are generally pale and soft, and often they even swell and ulcerate. This morbid state is evidently connected with a vicious condition of the whole economy. Internal treatment is, therefore, evidently indicated. Nevertheless, we may use some local means, such as lotions of quinine, or frictions, with some vegetable powder mixed with magnesia. This latter substance should only be used in small quantity.

Syphilis. When the syphilitic virus comes in contact with the mucous membrane which covers the alveolar tissue, ulcerations may be occasioned, which differ entirely from those commonly observed in this situation. We will abstain from describing the treatment which is merged in the general plan of curing the venereal disorder.

Mercurial treatment is as dangerous to the gums as syphilis itself, causing in them excavations more or less deep, which are called mercurial, being observed in the gums of workmen employed in the mines of mercury, and all those who habitually handle this mineral. The following is the history of this latter affection: the gums swell, and the ulcer is, at first, paler than usual, which appearance results from the fact that they are covered with a greyish exudation, beneath which the gums are red enough. The parts which are most swollen and most exposed to compression, rapidly ulcerate, and the ulcers enlarge and present a greyish, soft and fungous surface, from which the blood flows with facility. But the most remarkable phenomenon is the excessive flow of saliva, which has been known to reach the enormous quantity of eight pounds, when exaggerated use of mercury was in fashion.

The only way of relieving this state of things is to suspend the use of the medicine which occasions it. When the salivation continues, there are many means vaunted in medicine to relieve it, but these belong to the domain of general practice.

Sec. 9. *Epulies.*

This name has been given to fungous tumors seated in the gums, or in the parts of the maxillary bones which they cover, which make their appearance in the mouth.

The fibrous vascular tissue of the gums has a remarkable tendency to vegetation. The texture of tumors which it developes is usually soft, spongy and vascular. They swell and harden under the influence of buccal excitements, and dwindle and lose their size, when the blood ceases to be directed to their tissue. At other times they are hard, fibrous and incompressible, being composed of a close tissue, but little vascular.

The seat of these tumors is very variable: soft and vascular epulies are almost always implanted in the gums themselves. Those which are fibrous, or fibro-cartilaginous, more frequently arise from the alveolar walls. When these vegetations appear between the teeth they denude, and loosen and push them outward. It is almost certain that these originate from the dental periosteum and the interior of an alveolus.

These tumors are rarely larger than a hazle-nut or a walnut. We sometimes see them, however, reach beyond the dental arch, and push out the cheek, and deform the face, or else, growing inwardly, encroach upon the tongue, and in both cases interfere materially with mastication and articulation. Their base is sometimes narrow, feeble, and pediculated; sometimes large, thick and resisting. Their surface, for the most part, is smooth and polished, being covered by the proper membranous covering of the gums. Those which are hard and fibrous, rarely cause any pain. In other cases, especially where they have been irritated, or where attempts have been made to destroy them with caustic, they become red, bleed at the slightest touch, cover themselves with a coating of sanious fetid matter, and give rise to darting pain, more or less sharp and frequent. These epulies are true cancers. Their surface ulcerates and becomes the point of departure of a devastating ulcer, the progress of which can be arrested only with great difficulty.

Fungous tumors of the gums are more or less serious, according to their volume, consistence, the degree of depth to which their roots extend, and their painful, indolent or cancerous condition. M. Begin, from whom we have borrowed a great part of these remarks on epulies, quotes the case of an officer who had one of the size of a pigeon's egg. This tumor, arising from the inner side of the right branch of the lower max-

illary, pushed aside the tongue and interfered with its movements. Upon examination, he found it to be supported by a pedicle so narrow and so little resisting, that he easily tore it away with his finger, and brought it out of the mouth. After a very inconsiderable discharge of blood, the patient retired, and was never troubled with any return of the tumor.

When the tumor is pediculated, a ligature would answer, but it is better to tear it away with the fingers, or forceps of Muscaux. If the base be large and solid, excision with the bistoury will succeed much better than the caustics which have been recommended for this purpose. They are hard to apply, and, at the same time, may produce a cancerous degeneration of the tumor. The epulies which spring from the interior of the alveoli, make it necessary to extract the teeth in contact with the diseased part, and subsequently to take away the morbid growth itself. It is almost necessary in these cases, in order to prevent a reproduction of the tumor, to introduce a caustic, enclosed in a canula, to the bottom of the affected alveolus, and to disorganize the parts from which the morbid growth originated. Finally, when these tumors have become cancerous they should be destroyed to their very base, by incision and cauterization, with as much carefulness as other cancers. These vigorous measures are the only ones which can succeed against an evil always more rapid in its ravages in proportion as it has been unsuccessfully combatted.

Sec. 10. *Ozena of the Maxillary Sinus.*

Although this affection does not properly belong to the disorders of the gums, yet it seems proper to notice it here.

Ozena of the maxillary sinus is a sort of depot, which is formed in the cavity of the upper maxillary. It may be caused by a blow upon the malar apophysis. It results also, sometimes, from acute inflammation of an important organ, and it frequently occurs without appreciable cause. A severe and deep-seated pain fixes itself in the thickness of the jaw, and sometimes along the alveolar border. In the latter case the pain has been attributed to caries of a molar tooth, the extraction of which did no good. The pain goes on to increase in intensity; fever occurs,

and all the symptoms gradually subside, and the patient is relieved. But sometimes the sinus is filled with purulent matter, the acridity of which induces caries in different parts of the walls of the sinus, and thus produces fistulous openings, through which it escapes. Sometimes it penetrates the orbit; sometimes it is poured into the thickness of the jaws, and sometimes it perforates the alveolar walls, according as the very acrid and fetid pus has corroded its way through the parts adjacent to one or the other of these points.

The simplest and surest way of curing ozena is to open the maxillary sinus, through the alveoli, or the lower part of the canine fossa.

When it is attended with caries of some large molar teeth of the affected side, when the teeth are loosened, or the pus finds way between them and the gums, they should be extracted, and the opening enlarged by a perforating trephine, or by excision of the corresponding alveoli, so that the opening may be large enough not to be obstructed by the swelling consequent upon the operation. But, if the teeth be sound and solid, they ought to be preserved, and the sinus opened in the anterior part, at the base of the canine fossa. When the opening has been made with the trephine, when the first inflammatory accidents have been dissipated, and suppuration well established, we may be contented with injecting detergent liquids into the sinus. By this proceeding the disease is generally cured by the end of six weeks.

THERAPEUTICS.

THERAPEUTICS, as applied to dentistry, is that part of the science which relates to the rules of treatment proper to diseased conditions of the dental apparatus.

Already, in the preceding part of this work, while treating of pathology, we have been compelled, by the very nature of the subject, to state and discuss the greater part of the most important questions involved in therapeutics. Had we confined ourselves strictly within the limits of pathology, we believe that our labor would have been uninteresting and our expositions less clear. What is to follow will, therefore, be only a kind of supplement to the pathology; a sort of appendix, in which we will assemble together some means of cure with which we have not as yet entertained the reader, and some others which we have purposely avoided discussing fully, in order that we might reserve them for this their proper place.

It will be useless to recapitulate the operations relating to dentition, and we will only recur to the measures proper to give them a suitable direction, in order to say a word about the inclined plane, modified in theory by M. Delabarre, and put in practice by ourselves with great success.

CHAPTER X.

SEC. 1. *Of Straightening the Teeth.*

In our ninth chapter we have considered in detail the manner of remedying general irregularities of the teeth by the aid of extensor and counter-extensor springs of our invention. This

means, as we think we have proved, is excellent when we wish to procure an enlargement of the alveolar arch, in order to restore a tooth to its place beside the others when it has been excluded by arrest of developement in the arch.

But it would be irrational to apply this mode of treatment to all cases. It is evident that where only one tooth is turned forward or backward, and that, too, without its neck being out of line, there exist more simple means, already in use by our predecessors, which are abundantly sufficient to correct the evil.

When the teeth have taken a bad direction, nothing is easier than to act upon them by a slight but continued effort. This is so true, that persons who have had one or more teeth filed on account of caries, sometimes produce a partial dislocation of them by the habit of pressing the tongue against the parts in their involuntary efforts to explore the unaccustomed void which is there met with. This fact, attested by experience, has given rise to an erroneous notion, that filing teeth causes these deformities. It can only do so indirectly, in the manner described.

Of all the means in use to procure the restoration of irregular teeth to their proper position, the simplest is a silken thread passed round the tooth very near the gum; the tooth is soon loosened, and then readily yields to the force which draws towards the proper place.

We will observe, that, in this operation we have not to overcome a mere vim inertiæ, but an active force, the direction of which must be constantly modified, which is a very different matter. The following is the explanation of the manner in which a thread is generally sufficient to restore a tooth very much displaced forward or backward.

In order to accomplish this happy result, we fix the thread upon the teeth adjoining that we wish to replace, and make it pass around the latter; the moisture swells the thread, which shortens, and draws the tooth in the line resulting from the antagonist action of the two forces which act upon it. After changing or re-adjusting the thread every two or three days we will re-establish the tooth in the same direction as its neighbors.

In cases where the deformity exists less in the defect of par-

allelism of a tooth with the others, than in a rotation upon its axis, we advise the use of the means we have already described in the eighth chapter; that is to say, the great extensor spring, which affords a point d'appui more solid than the neighboring teeth, and the little arched plate of gold upon the edge of the tooth which projects outwardly.

When one or more teeth of the lower jaw are inclined backward, the dental art possesses a means of the utmost energy to force a restoration. It consists of an inclined plane, upon which we force the oblique tooth to bear, by its cutting extremity, in such a way that every movement, masticatory or otherwise, tends to push it forward. This means is infallible. In a little time the tooth resumes its normal position. The first dentists who used it, contented themselves with a sort of metallic trough in which they enclosed the whole range of inferior teeth, but the alimentary matters which were arrested in this apparatus, produced the serious consequence of producing caries in the teeth submitted to their action, or at least to impart to the breath of the patient a disagreeable odor. M. Delabarre proposed to modify the inclined plane by reducing it to two metallic pieces, a millimetre in thickness, fitted exactly to all the anfractuosities of the denture, re-united by a narrow bridle at their two extremities. Moreover, to solder upon the anterior piece a plate of gold, folded at an obtuse angle at one or two millimetres from its upper edge, according to circumstances. It being understood that this oblong plate should be soldered in such a manner as to be in relation to the tooth upon which we propose to act.

We do not know whether M. Delabarre has had occasion to apply the plane thus modified, but we have tried it very much to the benefit of our patients. It preserves all the advantages of the first means, without its inconveniences. The teeth on which it is applied are perfectly relieved from a hurtful envelope, and the debris of food imparts no fetor to the breath; for it suffices to rinse the mouth in order to relieve it of all deposits in the dental interstices.

Almost all the writers who have treated on this subject have spoken of artificial luxation. This is a means which we have already condemned, and which we cannot too frequently dis-

approve. The ancients, and some of the moderns yet imitate them, employed the "pelican" for this purpose; a violent manœuvre, which exposed them to the risk of breaking the tooth at the neck, and thus to replace a deformity by a mutilation a hundred times worse. Besides, it is a cruel operation, which should be rejected the instant that mild means can be employed, which, at least, are equally efficacious.

Sec. 2. *Taking away the Tartar.*

In order to preserve cleanliness of the mouth, the brush will not always suffice. The bristles with which it is armed cannot always, especially on the posterior parts, make their way into the interstices of the teeth, and expel the tartar which lodges and accumulates there, especially in the lower jaw, where the molars, small and large, are often encrusted with this deposit. In this case it will be necessary, in order to detach it, to practice the little operation which will be the subject of this paragraph.

The removal of tartar requires address and precaution, but it is not painful, and should be practised whenever the tartar begins to collect upon the teeth.

The preliminaries to this operation are very simple. The patient sits upon an arm chair with a high back; upon the left is a table, on which is a tumbler of aromatised water, with which he may rinse his mouth as often as shall be necessary. As much as possible, the dentist should avoid letting his breath strike the face of his patient, and if his hands have any odor, either through the heat of the room or the temperature of the season, he should avoid the disagreeable impression, by covering his fingers with a towel. When the odor of the patient's mouth is insupportable, we may remedy the inconvenience by strongly scenting the water with which he rinses his mouth.

The dentist, having selected the several instruments which he expects to use, proceeds to remove the tartar in the following manner:

The patient's head is reclined upon the back of the chair. Then—the reader will pardon me, but instead of using dogmatical language, I prefer to tell, as simply as I can, how I have ope-

rated for these fifteen years; some authors advise to break the tartar at first with a scaling instrument; some, indeed, employ a sort of small chisel, upon which they strike with a mallet; if I did not know this to be true I should have supposed it to be told as a joke—I use, as well adapted to the purpose, a broad graver, sharpened at the end, and sloped from the back to the point. With the end of this very simple instrument, nothing is easier than to bring away the tartar. In order to do this, it is only necessary to insinuate the point between the tooth and the calcareous matter, and by giving to the handle a slight movement to and fro, or rotatory, to break up the calculus. In the external face of the teeth, one of the triangular scrapers in the interstices, the chisel shaped for the body, and the pointed graver round the gums, are sufficient. Other instruments are used for the internal faces of the teeth, whether incisors or small or large molars. The judgment of every dentist must be his guide in the selection of the proper instrument in each; it would involve needless details and unfruitful repetition to attempt to give more particular directions as to this matter. We beg our readers to remember, that except in a few extraordinary cases, I rarely employ more than three or four instruments, but there is one to which I would especially call attention, as it is of great utility, this is the explorer. It is shaped like a very small penknife blade, very pointed, thin, and a little bent at the end. At the termination of the operation, we introduce this between the teeth and take away whatever of tartar may remain in the intervals. Until this has been done, we cannot be sure that the mouth has been perfectly cleansed.

I have always taken care to move the instruments from the gums downward, in order to avoid the danger of wounding them, which is not only unnecessary but hurtful.

When I have to operate on a loosened tooth, I am always careful to sustain it with the index finger of the left hand, so that I may not luxate it more.

For the practicien it will be needless to enter upon more minute details, but the beginner, who sometimes finds serious difficulties in very simple things, will not be sorry to find here

some precepts taught in M. Laforgue's work, a book which we advise him to read and think upon.

The teeth differ in color in the same individual and in different individuals. We find them firm or loose, soft in their bodies and painful at the neck, or hard and insensible, well enamelled and very smooth; and in other cases, with the polish of the enamel partly destroyed and more or less deeply scratched; some present erosions with furrows which traverse them; sometimes there are prints more or less deep in the midst of these furrows, &c.

We need not try to make the canines as white as the incisors, because they are always more yellow, and if we employ acids to effect this, we destroy the enamel, and the next day finds them more yellow than before.

We need not try to make the teeth of all persons equally white, because constitutions are not the same, and the materials which form the teeth are different in different people. We must take away all the tartar and superabundant slime, and then we must stop.

Teeth whose crowns and especially whose necks are soft, must be treated tenderly. We need not take away all the tartar in these cases at once. We had better delay the operation from time to time until the teeth obtain strength and lose their extreme sensibility.

The author describes various methods of cleansing the teeth. Among the rest he names acids, which we condemn, and will therefore pass over in silence.

The deep color which internal caries gives to the exterior of the teeth cannot be removed by external means, because the coloring matter is in the cavity. We may clean the tooth, and if it has not been plugged, we should advise the patient to have it filled.

The yellow spots which we find upon the enamel of the teeth may be let alone. It is not in our power to remove them.

In spite of all the pains taken to cleanse the teeth, they will, in certain persons, maintain a very yellow hue, which is natural to them. It will be useless in such cases to scratch them, in order to give them brilliancy; and if the instrument glides over

extremely thin concretions, they may be removed by a piece of soft wood, covered with very finely levigated pumice stone.

Finally the operation ends by causing the patient to rinse the mouth carefully, and brushing the teeth with dentifrice.

Sec. 3. *How to File the Teeth.*

The file is, beyond contradiction, one of the most useful of all the instruments used in dental surgery. It is put to a number of uses, and great advantages are obtained from it; sometimes to remove caries, sometimes to separate teeth which have approached too closely, sometimes to reduce to the level of its neighbors, a tooth whose unusual length impedes the closure of the jaws. When, after a fracture, there remain eminences or angles, which wound the tongue, lips or inner surface of the cheeks, we blunt or remove them by the file.

I have seen persons in whom one or more of the teeth of the lower jaw were worn, eroded by an upper tooth of unusual length. It is in such a case that the file is of inestimable utility.

Again, when we wish to use a stump of a tooth to insert upon it an artificial one, we must employ the file to smooth the surface even to the gums.

In order to perform these operations it is necessary to have files uniformly cut, and entirely faultless, made of the best steel, and above all, carefully tempered. We have said that the file should be faultless, for if one tooth of it be placed at an unequal distance, or if one be omitted entirely, it occasions shocks which the patient cannot bear. It is necessary, too, that they be cut on one face only, and that the other be perfectly smooth, so as not to operate at the same time upon both the teeth, in the interstices of which it is used.

When the tooth to be filed is placed far back in the mouth, it is difficult to practice the manipulation. We, therefore, make use of a handle, called the port file. This instrument is very handy, inasmuch as it gives every facility for action, even between the interstices of the last molars. It consists of a piece twice bent at its extremity, at right angles, in such a way that the file which it carries is not continuous with the handle, but

parallel to it; being thrown beyond the axis of the instrument. Beginners, who use it for the first time are always ready to suppose that the bend at the end of the staff is to lodge the commissure of the lips, so that they hold the instrument in an inverse position to that in which it should be held. While on the contrary, the file should be so presented that its heel, fixed in the elbow of the staff, should work somewhat like a hook, alternately drawing out the commissure and suffering it to retire, as the instrument is moved to and fro. In this way we obtain the greatest possible advantage from the instrument. We avoid sawing the lips, as we should do if it be held as before described, and the file is carried to the deepest recesses of the dental arches.

It is an important maxim which should always be scrupulously observed, that a tooth should be filed in such a way, that it should be worn away much more upon the posterior than the anterior part; this is the only way of concealing the loss of substance. It sometimes happens that the file is strongly caught between the edges of two teeth; in such a case we must be careful not to draw it away too briskly; besides the danger of tearing away the enamel, the patient would suffer great pain.

When it is necessary to remove a carious portion of a tooth, if the pain do not prevent, it is better to remove too much than too little, that is to say, unless the caries shall have destroyed a third or a half of the tooth, we must file it until the whole caries is worn off, so that the extremity of the probe feels no more of it.

If after having removed the carious cavity, some black matter still remains on the tooth, if there be sufficient substance to bear the entire loss of the carious parts without opening the dental canal, the file should be used, until no more disease remains.

If the caries has destroyed, eaten into, the tooth, even to its cavity, we may yet file, but cautiously, so as to weaken the tooth as little as possible. At least so authors advise. As for ourselves, we do not like to use the file under these circumstances, but employ our ethereal aluminous paste, which, in such cases, succeeds perfectly, causing all sensibility to cease, and preparing the organ for the operation of filling.

This is the way to use the file. When we wish to act upon the upper jaw it is very simple. We take the instrument between the thumb and index finger. By-the-bye, we may remark here, that for use upon the anterior teeth it is better that the file should have no handle. The teeth are sustained with the fingers of the left hand, in order to avoid loosening them and lessening the sense of vibration which is felt over the whole body, and is so extremely unpleasant. Moreover, the file must, from time to time, be dipped in warm water, especially in winter, both to cleanse it from the detritus and to lessen the disagreeable impression attending the rubbing with it. To moderate these movements as we desire, it is well to take a point d'appui upon the gums or molars with the little finger. Finally, it is an important rule, when filing a tooth on its sides, to leave a shoulder near the gums, so that it may be impossible to approach closer to its neighbors, a result which will certainly take place unless this precaution be observed. It may happen that after having filed an incisor tooth, we are compelled to leave some caries remaining for fear of weakening the organ so much as to ensure its destruction. In these cases it is customary to cauterize the part. The best cautery, in my opinion, is the heel of the file itself; for what can more certainly accomplish the end than the extremity of an instrument, (heated to whiteness,) which corresponds exactly to the indentation, itself has made. By imitating our example in this respect, we may diminish by one piece, at least, the arsenal of dentistry, which exuberantly inventive geniuses have filled to excess.

We see many persons who have passed the age of forty, whose upper teeth, especially the incisors, loosen from the gum, elongate, and protrude beyond the level of the other teeth. Besides that this impairs the symmetry, the consequence of it is that they become wavering and threaten to be lost because of the continual action of the antagonist teeth shaking them to the very sockets.

Maury relates the case of a person of fifty years of age, who came to consult him for an enormous accumulation which covered, especially, the six lower front teeth. The immoderate use of anti-syphilitic remedies was partly the cause of this disorder.

The teeth had become detached from the gum to the extent of at least five lines, and so loose that the least pressure with the finger would have caused them all to fall out together. He began by taking away the tartar, and, in order to fix these teeth temporarily, he attached them to the neighboring ones by a silken thread. Things being thus arranged, he made, with a file, a horizontal groove at the place where he intended to shorten them, and then, with the cutting forceps, he cut them at this groove. These teeth being smoothed with the file, he untied the first ligature and put on a second. He recommended the patient to rinse his mouth, to brush the gums and teeth slightly, several times a day, with a vulnerary liquor, composed of equal parts of ratany root and quinine, suspended in water. In a month after the institution of the treatment, the gums and teeth were completely re-established in firmness, and since then the filed teeth have remained solid.

We have observed many similar cases in our practice, but we have been very fearful of shortening the lengthened teeth by a cutting instrument because, in doing so, we run the risk of breaking them further than we desire; to crush or split the part of the tooth we wish to preserve. We have thought it more prudent to level the teeth by the use of files. We take pains not to file equally and uniformly, as this operation would be too tedious and painful. Moreover, we form angles and prominences as much as possible, because this gives more play to the file.

One thing, to which great attention should be paid, is that, in shortening the teeth, we must be careful not to touch the dental cordon, as may be done in young subjects. In cases where this is likely to happen, it would be wiser to dispense with the operation. The inexperienced young practitioner need not expect that, in a single sitting, he can level all the teeth which impair the symmetry of a mouth, and impede the regular performance of mastication. Whether the operation be performed upon their free border, or whether with a file which cuts on one side only, we work upon the anterior face, such distressing sensations are produced that the operation must be deferred, and often cannot be resumed for one or two months. Then, all the sensibility has disappeared, and we may recommence; nevertheless, if it be

necessary that the work be finished at once, it may, perhaps, be done by using the cautery in proportion to the degree of sensibility.

To shorten the pieces of teeth upon which artificial ones are to be inserted, or to remove bony eminences which may wound parts of the mouth, we use round files. The cutting forceps will also answer this purpose very well.

The management of the file, though apparently very simple, is not quite as much so as might be supposed. It does not suffice to push it to and fro, and to direct it with more or less force, it is also necessary to avoid shocks and not to make it cut except with the edge. However, nothing but long practice can impart dexterity in the use of the file.

There was a time when many eminent practiciens declared themselves strongly against the use of the file. They went so far as to say that, so far from preventing caries, it produced this disastrous disease. Time and experience are the best arguments against this unfounded charge. There are few persons who are not indebted to this little operation for the preservation of their most precious teeth, the upper incisors or canines.

Sec. 4. *Cauterization.*

This is practised either to combat odontalgic pain, or to limit the progress of caries. There are two sorts of cautery, the *actual* and *potential.*

The actual cautery, or fire, acts suddenly upon the part to which it is applied and transforms it into an eschar. For this purpose we may make use of metallic needles of different forms, but the mode now preferred, is to employ a stylet of platina armed at some lines distant from its extremity, with a little globe, which serves as a reservoir for the caloric and furnishes it to the needle long enough to enable it to act efficaciously upon the part with which it is brought into contact.

Where the carious cavity will admit of it, we use a cautery, armed with a button extremity, of a size proportionate to the part to be acted on. With the latter instrument the caloric acts longer and more directly than with any others.

The potential cautery acts slowly, but we cannot be too cau-

tious in the use of this means. These cauteries are acids either pure or diluted, and soften the dental substance; besides they may act upon the neighboring parts and do them harm. The substances chiefly used for this purpose are liquid ammonia and sulphuric and nitric acid. The manner of using them is very simple. It consists in soaking in the caustic matter a piece of cotton, of a size proportionate to that of the diseased tooth; introducing it into the cavity and then covering it with another piece of cotton or a little wax.

The actual cautery is the more used of the two. In bleeding after the extraction of a tooth, especially, it is of the utmost advantage.

Nevertheless, we must not conceal the fact that the application of fire is sometimes insufficient; indeed it sometimes increases the pain, instead of relieving it. We will even say, that where the caries is far advanced, this operation, far from prolonging the duration of the tooth, renders it more friable, and consequently hastens its destruction. What we say is not intended to depreciate a means which we regard as excellent, especially for the incisors and canines; the caries of which is often so profound that we cannot take it all away without enfeebling them too much. For such a case, we are glad to avail ourselves of this means in order to stop the progress of the disease.

When we wish to disorganize the dental pulp by aid of fire, we generally use a platina stylet, five or six centimetres long, and presenting, as we have said above, a spherical enlargement eight or ten millimetres from its extremity. In order to avoid alarming the patient, we should heat the instrument merely in the flame of a spirit lamp, whose heat is more than sufficient to impart the incandescence desired. As soon as it is sufficiently heated, it is rapidly applied, and carried deeply into the dental canal, giving it some rotatory movements before withdrawing it. This procedure succeeds very well, especially for the root of the incisors, canines, and small molars. Unhappily, there are people of such extreme sensibility that the very mention of contact with a red hot iron excites so lively an apprehension, that they even prefer to suffer extraction. As for ourselves, we

never use this painful means, except to arrest the spread of caries, and when it is only necessary to contend against the inflammation of the pulp, our ethereal aluminous paste renders it unnecessary for us to use any other means.

As to the dentists who prefer the employment of the actual cautery, after having ascertained that the operation has perfectly succeeded, (which they do by giving the patient cold water to take into the mouth, and finding that this gives no pain,) they fill the cavity with a little cotton, moistened with some spirituous water, then, when the interior of the caries is perfectly dry, they proceed to plug the tooth.

There yet remains another means, but far inferior to the first. We mention it in order to omit nothing, and instruct the reader in all the details of this department of therapeutics. Several wires of platina are taken together, and, without being heated, are thrust suddenly into the dental canal, and turned about several times, thus making an instrument, which sometimes brings away with it the whole dental pulp. This means, some say, is excellent when we wish to avail ourselves of a root for the insertion of an artificial tooth.

If we wish to cauterize a tooth very profoundly carious, we take away, with a file, the greatest part of the caries. By the aid of a sound and picker, we take away as much of the soft part from the cavity as we can, dry it with cotton, and then introduce into it an incandescent cautery, the extremity of which is proportionate to the size of the diseased part. It often happens that the substance of the tooth, nevertheless, continues to decay, and it is necessary to repeat the severe operation again and again.

We only mention the potential cautery to expose the numerous inconveniences attached to a blind medication, of which the operator can neither foretell nor limit the action, too often hurtful to all the neighboring parts. Teeth, upon whose enamel fall some drops of acid, caustic, potash, or nitrate of silver, do not delay to become as bad as those for which they were used. Sometimes even the tongue, the gums, and the internal face of the cheeks, are very much inflamed and ulcerated by contact with these dangerous substances.

After these two means, come several others, more innocent, perhaps, but certainly less efficacious; these are myrrh, incense, balsam of Tolu, extract of opium, ether, essences of cinnamon, cloves, mint, and a crowd of essential oils, and highly concentrated alcoholic tinctures.

We repeat that we only employ cauterization in certain extraordinary cases, and particularly when persons who wish to have a tooth plugged, or an artificial piece inserted, cannot remain in Paris long enough to give our ethereal aluminous paste time to effect a radical cure. We have, therefore, spoken of these different kinds of cautery rather as historians than partisans, for we use them as seldom as possible.

Sec. 5. *Filling the Teeth.*

This consists in filling the cavities, made by caries, with a ductile and malleable metal.

An important matter before proceeding to plugging is, to ascertain if the tooth is perfectly insensible to the contact of strange bodies, and that the caries does not present that sanious and humid aspect which renders cure of it so difficult. The first of these two precepts suffers some exceptions. There are teeth whose caries is perfectly without pain, and which, nevertheless, give distress because the alveolar periosteum is diseased. We distinguish this peculiarity by percussion, which gives pain, while the contact of the probe in the interior of the tooth does not. Again, it sometimes happens that the tooth does not manifest the darting pain which characterizes odontalgia, and when the cavity is exposed to cold or heat, or touched with cotton moistened with alcohol, it proves to be altogether insensible.

Evidently in these two last cases there can be no contra-indication to plugging. When the caries is humid and bleeding, as this circumstance always compromits the success of the operation, it is a rule, without exception, to cure the disease of the tooth before filling.

Many dentists boast of having discovered compositions of invaluable virtue in these cases. We confess they have been more fortunate than we, and that our ethereal aluminous paste,

in other cases so efficacious, requires in this to be aided by fire. We must destroy the cartilaginous substance into which the dental pulp has degenerated, or else all the topics in vogue will fail, one after another.

Whatever may be the kind of caries which has destroyed the dental walls, if the precepts we have laid down be neglected, we may cause, in operating, such acute pain, that we must instantly remove the substance introduced, which always is injurious to the dentist.

To explore the caries of the teeth, and especially that of the large molars, Maury advises the employment of a spiral sound, because its different curves permit it to be introduced into all the openings which may occur in the dental walls, whatever may be their seat.

This sound is very simple. It is a steel probe, whose two extremities terminate by a spiral semi-circle, the one being curved towards the right, the other towards the left.

When we have ascertained that a tooth is susceptible of being plugged, we commence by removing the portions of aliment, strange bodies, and all the soft parts which are found in the cavity. Then it is well to form some asperities in order to procure more certainly the retention of the metal. Nevertheless, this last maxim is far from being generally put in use. Then we take a piece of cotton, moistened with an alcoholic liquor, or some aromatised essential oil, we introduce it into the dental cavity, and after leaving it there for some time, we replace it with a piece of dry cotton, which we change until we can discover no more humidity. The chances of success depend, also, to a certain extent, upon the teeth to be operated upon. The molars preserve the metal better than the canines, and much better than the incisors; the teeth of the lower jaw better than those of the upper.

Whenever we remark circumstances unfavorable to the success of the operation, we should never fail to apprise the patient of it, lest he should attribute to our want of skill what depends upon the nature of the evil.

Another point to which it is necessary to pay great attention is, the formation of the unnatural cavity which is to be filled.

When the opening is more narrow than the inside, we have every possible chance of making the operation permanent; when, on the contrary, the carious part does not present this conformation, there are means of giving it this shape. For this we use instruments of different sizes, called excavators. They are metallic staffs, surmounted with an extremity, with very sharp edges. This rounded extremity is introduced into the cavity of the tooth we wish to fill, regulating the size of the instrument by that of the orifice of the cavity. This done, we give it a series of rotatory movements, by the aid of which we increase the size of the excavation laterally and in depth in such a way that the metal to be introduced may present volume sufficient to prevent its escaping with facility.

After these preliminary and indispensable precautions, nothing remains to be done but to select the metal to be used; a choice which is frequently made by the patients themselves.

Five kinds of metal have been used for plugging the teeth. Lead, tin, gold and platina, which are used in leaves, and the Darcet metal, which is employed in fusion.

Lead is now rarely employed, because it oxydizes and blackens almost at the moment of introduction. We prefer to this the leaves of tin, such as are employed by gold beaters, because they are much less accessible by oxygen; nevertheless, in the end they oxydize too, and this oxydization, by penetrating to the bottom of the caries, tends to perpetuate it. This serious evil has led to a decided preference for gold and platina. Of these two last named metals, gold is the better. When well prepared, it answers admirably. Its color is not very different from that of the teeth, as is the case with platina and tin, which are of a steel grey. We only have to regret that it is very difficult to procure pure gold in Paris. This is not the case with the gold of Vienna and the United States, where it is unquestionably the best prepared and the least alloyed.

To employ the tin, gold or platina in leaves, we form them into a species of tube or little ball, or, what is yet better, into several folds, leaving them of considerable length; then, with a plugging instrument, we introduce the metal gradually into the cavity, taking care so to pack it that it may bear equally

upon all points. We are in the habit of employing these metals folded simply upon themselves, without rolling them into tubes or balls, because, in this form they appear to be more sure to exactly fit all the cavity of the tooth. The following reasons have led to this conclusion: the metallic leaf superimposes itself by layers, which form themselves the one upon the other, on all the inequalities of the cavity; in short, we thus obtain a kind of successive stratification much more exact, and at the same time much more dense; for it is impossible that there can be any void. Again, the plugging is more solid, because it is easy to compress the metal; the different portions superadded being readily incorporated into one another.

When the cavity of the tooth has been accurately filled, we remove any asperities from the surface of the metal, and burnish it well. Sometimes in caries upon the crowns of the teeth we suffer the metal to project above the level of the teeth, so that it may longer resist the process of mastication.

There are yet two other metallic compositions in use for filling the teeth—the fusible metal of Darcet, and the silver paste of M. Taveau. Let us first consider the fusible metal, composed of eight parts of bismuth, five of lead and three of tin. The temperature of boiling water is sufficient to melt it, and M. Regnard has still further augmented its fusibility by adding a tenth part of mercury. After having prepared the tooth for the reception of the metal, a quantity of the composition proportionate to the size of the cavity is introduced into it; then an instrument of proper form, such as is used for cautery, is heated to the temperature of boiling water, and applied to the metal, which immediately fuses. If this portion be not sufficient to fill the cavity, another is added. The asperities are then removed, and the surface of the filling burnished. This fusible metal offers several great advantages. It forms a compact homogeneous mass without fissures, which will not admit the saliva or buccal humors to permeate it. Nevertheless, it requires the use of a degree of heat which, though not sufficient to burn the teeth and surrounding parts, may yet be sufficient to inflame the latter, and to dry the enamel until it cracks. Besides, it requires the utmost skill, acquired by long experience, to seize the pre-

cise point of temperature; not to suffer it to fall short of the degree desired, and thus defeat the operation; and on the other side, not to suffer it to be exceeded, so as to burn the organ we wish to save, or the surrounding parts, whose injury would not be less serious.

We will now say a word about the amalgam invented by M. Taveau, and called, by him, the silver paste. This is prepared with virgin silver and mercury. A given quantity of mercury is saturated with silver, powdered very fine and purified. The whole is worked in a mortar for about two hours, until the metals are well incorporated; then we pass, or rather press it, forcibly, in a piece of kid skin, deprived of the epidermis, so that the mercury shall be almost entirely extracted. The residuum thus obtained is a paste sufficiently compact to be put in a flask, stoppered with emory, for use when required.

This preparation is employed cold, and is placed in the cavity of the tooth in the same manner as gold leaf. The mercury evaporates, by the heat of the mouth, in three or four days, and the silver remains in the cavity in a single piece, fills all the irregularities of it, and becomes as compact as though it had been melted and poured into the cavity; at least, so says the author of this plan of treatment. For our part, we object to this preparation. First, that it takes a yellowish black hue, by no means agreeable to the sight. Second, that it must considerably contract upon the evaporation of the mercury. Third, it is sufficiently porous to permit the buccal juices to find their way into the diseased cavity; finally, which is a disadvantage yet more great, it may occasion, by the mercurial evaporation, a disease of the alveolar periosteum. I have had opportunity to examine many who had been subjected to this operation, and whose gums manifested a sanious, fetid and disagreeable discharge.

M. Taveau, in defence of his views, quotes the fusible metal of Darcet, which, as modified by M. Regnard, contains even more mercury than his silver paste. In reply we remark, that when we have had occasion to use the fusible metal, we have taken good care not to add the mercury, for the reason that, as after the employment of the amalgam of silver and mercury, we

have observed sorrowful results from the use of it, to the health of the gums and alveolar periosteum.

We have passed, in review, the different modes of plugging employed in our day. We may object to them all that they do not sufficiently identify themselves with the substance of the tooth, and, especially, that they differ in color from the teeth, which prevents their use in cases where the caries is visible. We hope that at some future day, some dentist, more fortunate than his predecessors, may discover a mastic which shall unite to solidity the advantage of possessing a color identical with that of the restored tooth.

Nevertheless, plugging, in the perfection to which it has now been brought, renders immense service. If all persons who have the misfortune to have carious teeth, had also the wise foresight to have them filled, we do not hesitate to say that eighty out of every hundred which are now extracted, or which crumble to pieces, might be saved.

One of the great advantages of plugging, is to protect the diseased cavity from the deleterious action of the buccal humors, and the alimentary debris, which undergo putrefaction and acid fermentation. It is incontestible that, by aid of this means, the progress of caries is stayed, and even sometimes altogether checked. It is true that a time will arrive when its sorrowful effects will be experienced anew, and when the metal will separate from the bone, vacillate in the cavity and ultimately spontaneously drop out. In such case the only thing to be done is to plug the excavated organ anew, and thus, again, reprieve it from destruction.

Before closing this paragraph on filling, it remains to us to examine a case, in which the plugged tooth suffers violent pain. The patients, after the application of the metal, experience sometimes, in spite of the precautions we have pointed out, an obscure feeling of pain and distention in the filled tooth. It may be that this unpleasantness can be obviated by some antiphlogistics and some derivatives upon the lower limbs; a soothing dietetic regimen may also arrest the developement of inflammation in the dental bulb, or the alveolar membranes. But it may be, also, that all these means will be unavailing. Then it becomes abso-

lutely necessary to remove the filling, and, in order to habituate the part, by little and little, to the contact of a strange body, to put into the cavity, first a piece of cotton, then of wax, and finally the metal. By this wise course we cannot fail to obtain the result desired. Some authors advise, instead of removing the filling, to luxate the tooth so as to break up the vascular and nervous cordon which gives it its sensibility. Is this any thing more than theory? Could a carious tooth offer sufficient resistance to the forceps or key, to be thus luxated?

Sec. 6. *Luxation.*

When a tooth is the seat of a pain more or less acute; possesses a crown of considerable size and presents a cavity of such a shape that it cannot be plugged, some dentists recommend artificial luxation.

There are two kinds of luxation, complete and incomplete. Each has its partisans. Some advise to remove it altogether from the alveolus, others to raise it two-thirds, believing this to be sufficient for the end desired, namely, to rupture the nervous cordon which gives vitality to the tooth.

It is certain that if this means would always succeed, it would be a very good thing to luxate a tooth and immediately replace it, for by this means we would cure the pain for ever, and preserve the organ in the mouth.

But besides the great difficulty of regulating the amount of force to be used, which must depend upon the health or disease of the alveolar membranes, there are many unhappy consequences which conspire against the success of this operation.

Thus the multicuspid teeth resist with great tenacity, and cause the alveoli to be fractured more or less and the gums to be lacerated. The splinters which are caused by the first of these accidents create suppuration and an inflammation which may be communicated to the whole alveolus, thus singularly defeating the success of the operation, by hindering the roots of the teeth from recovering their firmness and the alveolar walls from closing upon them.

In the teeth whose roots converge in curving, a greater or smaller fragment of the maxillary bone may be broken in the

effort to luxate, which causes the same results as those already enumerated, and prevents the closing of the alveoli.

If the luxated teeth belong to the anterior part of the upper jaw, they are pushed outwards by the tongue and the teeth of the lower jaw, a derangement generally facilitated by fracture of the alveolar borders.

In the case of these teeth, we are indeed taken in a dilemma. They have a relation to other teeth of the other jaw, or their antagonists being lost there is no longer any resistance. In the first case, they run the risk of being shaken or pressed either forward or backward; in the other, experiencing no pressure to sustain them in their sockets they will insensibly fall out: pushed sometimes by ossification, or displaced by a process of suppuration.

If the success of the operation be as complete as possible, it is rare that the luxated tooth does not occasion an incurable fistula at the corresponding part of the gum. Besides, being no longer supplied with nourishment, the dental substance acquires a blackish hue which is very disagreeable to the sight.

In short, it is rare that a luxated tooth lasts longer than four or five years; it perishes in consequence of softening and corrosion by buccal humors; and, when this takes place, there is no longer hope of preserving the root, in order to place upon it an artificial one in case of need.

These different reasons are more than sufficient to cause the abandonment of an operation of which the success is so doubtful. Nevertheless, as we wish this treatise to be as complete as possible, we will proceed briefly to describe how the operation was performed formerly.

Recourse was only had to luxation when a sound or carious tooth, which they wished to preserve, because it was apparent, was the seat of severe or long continued pain. The operation could never be undertaken unless the crown was sufficiently strong not to break under the instrument used in the process. It was also necessary to examine the gums to see if they were in good condition, and to ascertain if the patient was affected with some scrofulous taint, which would infallibly compromise the success of the operation. The luxation could, also, only be

undertaken upon certain teeth and at a certain age. The age which appeared to present the greatest advantages was from thirteen to thirty; the incisors, canines, and small molars were the only teeth subjected to this process.

It is not necessary to deceive oneself about this operation: for it is easier to extract a tooth than to luxate it. The latter requires a management, a moderation, and a steadiness of hand in the operation which can only be acquired by long experience.

As to the operation itself, it does not differ from that of extraction, of which we will soon speak, except in this, that the tooth seized, instead of being entirely removed from the alveolus, is only turned upon the side and immediately replaced and sustained in position, as if it had been luxated by a traumatic cause. The patient must be instructed to eat soft food, and to wash the mouth with astringent and tonic decoctions.

Maury, after having advised and described the operation, abandons it for the great and even the smaller molars. As to the rest, it is necessary to fill the tooth as soon as it shall be sufficiently firm. Some dentists advise to plug it immediately after luxating it from the alveolus; we prefer the first plan.

Sec. 7. *Transplantation.*

This is a wicked operation, which consists in replacing a tooth just extracted, by another and sound one, purchased by money, and which is torn from the jaw of another person, whom necessity compels to submit to the mutilation. We consider it a sacred obligation to unite our voice to that of all the French dentists, who have written upon this matter, in a unanimous cry of reprobation against men who do not blush to lend themselves to the selfishness of the rich, which would avail itself of the misery of the poor to extort a tooth, to replace one, which, perhaps, was lost by intemperance and debauchery.

We repeat it, that this traffic is almost banished from France, and that there is not a single dentist here who would lend his aid to it. We regret that England and Germany do not yet follow so praiseworthy an example.

We hasten to say, in conclusion, in order that no one may venture to restore the practice of dental transplantation, that one of the chief causes which have led to its abandonment, is its general failure of success. Some transplanted teeth become solid, but they soon blacken and the gum shrinks from them. Perhaps a full half, failing altogether to become firm, finish by falling out themselves, or by creating so much pain as to drive the patient, who had vainly thought to repair an irreparable loss, to pull them out himself. A feat which, by-the-bye, costs no great effort; so small is the resistance of the strange body. In a word, transplantation may be coupled with transfusion—both are dead.

Sec. 8. *Excision of the Crown of the Teeth.*

A. Paré mentions this operation.

Maury, in his treatise, gives his views upon the coronal excision in a most philosophical way. It would be well if all who write on the dental art would do so with similar impartiality.

M. Fay, an American dentist, was the first to bring this operation in favor in London. Journalists, paid to puff this new treatment to the skies, have not hesitated to say, that of every thousand diseases of the dental organs, nine hundred and ninety-nine have their seat in the crown and not in the root, so that it only requires to take away the former and the pain will instantly cease, "as is daily confirmed by experience!!" It is also added, which, by-the-bye, is true, that new bony matter will form to protect the root against all external impression.

The English dentists, on the other hand, have not failed to assail their new confrere with fire and sword; declaring, that after the excision, the nerve not being entirely destroyed, the least impression of cold or heat, or the slightest contact, will suffice to produce the most acute pain; that M. Fay in practising it had often done mischief; in short, that this operation is not only very difficult to practice, but that, when performed, it did more harm than good.

It is easy to see that both panegyrists and critics have fallen into the similar error of going to extremes. As for ourselves

we agree entirely with Maury. We believe that the excision of the teeth is a very good means of preventing extraction, and that out of twenty cases, which demand the latter remedy, more than one-half might be subjected to excision without the least danger, provided always, that this operation be not undertaken prior to the twentieth or twenty-fifth year, because at this period the dental canal has so far retroceded as to leave but a small opening after the excision.

Maury and ourselves have performed the operation with complete success. Nevertheless, we ought to advise not to operate upon any, except those endowed with sufficient wisdom not to be influenced by the popular prejudice, that a tooth broken at the neck will pain as much as if left entire, and will be extracted with more difficulty if this operation should at any future time be required.

The author, whose name we have already mentioned twice in this paragraph, absolutely denies the possibility of the formation of a little bony kernel, which afterwards closes the dental canal. We do not agree with him here, on the contrary, inasmuch as after a fracture, which lays open the dental cavity, or after the wearing away of the triturating part of the crown to an extent which produces a similar condition, we observe in the dental canal a sort of ossific concretion which opposes itself to the contact of the external air, and to the introduction of alimentary matters, we think that the same phenomenon may take place in circumstances similar, though produced by an artificial instead of an accidental cause.

We have observed that when M. Fay introduced the operation of excision into London, his confreres objected strongly to it; now they have overcome their scruples, and the English dentists have become great partisans of the plan. In France we have long since abandoned the excision of the molars, reserving this operation for the incisors and canines, whose roots we wish to use for fixing pivots. A day will come, we doubt not, when excision will be naturalized in this country, and our opinion is based upon this consideration, that the roots of the teeth of all classes, when well cauterized, become entirely insensible, and are

of great importance in sustaining the gums and supporting the adjacent teeth.

Sec. 9. *Excision of the Dental Nerve.*

In a number of the *Revue Medicale*, which appeared in February, 1825, we find the following article upon a means proposed by M. Fateari to remedy extraction of the teeth:

"This method is entirely based upon the principle, that whatever may be the cause of pain, it ceases, when we divide the nerve which supplies the part, or when, by any other means, we suspend its influence. It is necessary, then, in order to remove the pain of the teeth, to discover a method by which we may incise the dental nerve at the point where it is distributed to any tooth; this M. Fateari has accomplished by means of a trephine, with the point of which he divides the dental nerve. This surgeon having for a long time devoted himself to this matter, and having examined a great number of teeth, has arrived at a knowledge of the precise spot, where, in the greatest number of cases, each nervous filament is to be found; and by means of needles, of a greater or less length and size, according to circumstances, adapted to his trephine, he divides the nerve, after having perforated the painful tooth, rapidly and without causing suffering. By this means the organ is rendered insensible. When it happens, by chance, that the application of the trephine has not caused the pain to cease, the nerve not having been perforated, owing to its being irregularly distributed, he has recourse to a second operation, which never fails."

As may readily be seen, by the date of this quotation, fifteen years have elapsed since this operation was proposed, and it is not yet adopted in general practice. This fact is easily explained by the difficulty and uncertainty of such an operation. Indeed, whatever the author of the paragraph above quoted may think, the number of cases in which the nerve would be reached by the first operation, would form the exceptions, and not the majority of the cases operated upon. No doubt the apprehension of the patient, during the preparation for this operation, is quite

as great as when dreading extraction; therefore the pain vanishes so suddenly. Moreover, we believe that the inventor acquired a sort of instinctive sagacity which cannot be shared by many. Upon the whole, we consider the excision of the dental nerve as a thing very pretty in theory and very difficult in practice. If the nerve pervaded a soft part, the section would be easy enough, and we should give praise to the ingenious inventor; but how can we accurately arrive at the passage of so small a thread through a bony wall, by means of a hole of very small diameter? M. Fateari may have have often succeeded in working this miracle; as for us, we despair of being so fortunate.

CHAPTER XI.

Sec. 1. *Instruments used in the Extraction of Teeth.*

Before speaking of the operation itself, we think proper to describe the implements from time to time invented to facilitate the process.

According to the plan of M. Begin, we will arrange these instruments into three classes. The first act only upon one point, and receive directly from the hand the impulse by which they act. Such are the crotchets, repellers, &c. The second seize the tooth on each side, without touching any of the neighboring parts, as the fingers, forceps, &c. Finally, the third class comprises the key of Garengeot, the pelican, the "langue de carpé," the lever, and all the instruments which take a point d'appui, whether upon the maxillary bone, or upon the neighboring teeth to the one to be extracted.

As this work is entirely practical, we see no reason for condemning ourselves, to describe, one after the other, all the instruments with which inventors, more or less successful, have augmented the arsenal of the surgeon dentist. We will content ourselves with enumerating such as possess incontestible advantages, advising the reader to consult the history of dental cutlery, in the nineteenth chapter of the second edition of M. Laforgue's work.

Nevertheless, we think that it will not be unprofitable to give a short sketch of the efforts of our predecessors. Their first instruments were in the form of pincers, and made in a very clumsy way. They were led, by the small progress of improvement, to devise the straight forceps. We find engravings of it in the oldest books. Then came the bird-beaked forceps, and successively Fauchard's extractor, the hind's foot, the pelican, yet used in the north of Europe, the key of Garengeot, the elevator or carp's tongue, the forceps, curved towards their articulation, the same, very thin in the beak, the root extractor of Angermann, Laforgue's extractor, all the keys improved with different curvatures, &c. &c.

One thing which we cannot too much deplore is, the confusion which exists in the nomenclature of instruments used in extraction of the teeth. There is no petty modification to any known instrument which has not been unbaptized and rebaptized. Hence, with a dash of the pen we have no hesitation to obliterate all of the first category of instruments, cacording to M. Begin's classification; those which only act upon one point of the dental organs, and receive, directly from the hand which holds them, the impulse which causes their action; and, indeed, to what end should we preserve the list of crotchets, repellers, &c., when the hind's foot, simple or double, and the carp's tongue, especially the former, will sufficiently accomplish all the purposes to be obtained by them? It is evident that the former acts as repeller or lever, according to the mode in which the operator may employ it. We proceed to notice the most indispensable instruments.

Sec. 2. *Sound, and Key of Garengeot.*

Sound.—As we shall notice hereafter, the first thing to be done before extracting a tooth, is to assure ourselves, with the sound, whether that one which the patient indicates is really the seat of the pain experienced. The instrument is so simple that it is not worth the trouble of describing it.

Key of Garengeot, or English Key.—Whenever we wish to extract a large molar, (the teeth most commonly attacked with

caries, and most readily sacrificed by the patient,) the key of Garengeot, with all the modifications suggested by experience, is, beyond contradiction, the best instrument; the most expeditious and certain in existence. This key is composed of a steel staff four or five inches long. This staff, which was originally straight, has been bent towards its acting extremity, to great advantage. This is made of a solid piece, of greater or less length, which forms two shanks, being a sort of hinge, which receives the hooks, by the aid of which the tooth is seized. Formerly, these hooks were retained in place by a screw, which traversed them in a line with the axis of the instrument; now there is a pivot, which, by the aid of a button, is secured to the staff in the same manner that a blade of a penknife is fastened to the handle. The other extremity, which is that by which the operator holds the instrument, has been, for a long time, a cylindrical handle, into the middle of which the staff is inserted. One of the parts afforded a turn-screw for the purpose of changing the hooks. Maury, in order to give more energy to the lever, has suggested an important modification; at least so he regards it. This is what he calls his moveable handle, retained by a spring, and which, for more than two-thirds of its extent, is pressed by the hypothean eminence of the right hand, the part chiefly employed in extracting a tooth.

But to avoid confusing ourselves with all the varieties of the instrument, we will proceed to examine them in succession.

M. Begin speaks of a very useful improvement, which consists in this, that the hook is implanted into the centre of a nut capable of turning on its axis, in the midst of the straight holding pieces. A pin serves to fix the nut, and of course the hook, in the position which may be thought most favorable. In this way the dentist may use the key on either side of the mouth, without being obliged to change the hook, and what is still more important, this latter being capable of being placed obliquely or directly in front of the head of the instrument, can be applied to the wisdom teeth, incisors and canines, as easily as to the molars.

This form of key is a most valuable instrument, and after the service it has rendered in our own practice, it would be ungrate-

ful in us not to give it all the praise it deserves. We, nevertheless, owe it to truth to say, that we have made a modification, in our estimation, very essential. All the keys of this kind have their bolsters altogether cylindrical, and we have experienced for ourselves that this form inevitably causes tearing of the gum. To obviate this difficulty, which causes a great deal of pain to the patient, we have very much flattened this part in the direction of the axis of the instrument. In this way we have been able to leave the gums altogether untouched, and, moreover, to extract the wisdom teeth, by giving to the hook an oblique direction, and not continuous with the direction of the staff itself, which forces us to make a fulcrum of the last molars, and consequently exposes them to be loosened to the most unfortunate extent.

We will observe that an improvement, apparently so slight, has, nevertheless, important results in practice.

In truth, as will be hereafter seen, we are by no means fond of innovations. Their utility must be well attested before we adopt them, whether they have been introduced by others, or are the result of our own observation.

As to the subject we are discussing, we will say that the simplest and the least complicated have always appeared to us to be the best. We are, therefore, far from approving the moveable fulcrum, which some have appended to certain keys, which are also furnished with curves utterly useless, and particularly embarrassing to the operator. We cannot repeat it too often, that the more the instrument is complicated, the more liable it is to bruise and lacerate the gums; I may even say, the more likely it is to break the teeth.

As for ourselves, who claim to be partisans of the simplest means and the least complicated instruments, and who, especially, have great regard to the pain inflicted upon the patient, we have always attained this double end, *tutó et jucundé*, either by interposing between the instrument and the gum a thick compress, or else wrapping the instrument itself with many folds of cloth. The interposition of the compress and the folds of wrapping are means to which we attach too much importance to be passed over in silence.

Let us speak first of the compress. We cannot urge upon young practiciens too strongly, to avoid the inhumanity, I had almost said the barbarity of those who make no scruple of extracting a tooth with a naked instrument bearing upon the gums. It adds the pain of attrition of these organs to the sufficiently severe one of extraction. We are constantly endeavoring to avoid giving pain as much as possible, and without vanity, let it be said, for the encouragement of beginners to follow this philanthropic rule, that perhaps it is owing to this laudable attention that the public confidence has rewarded the efforts which have made us worthy of it.

But, to return to our subject: we wish to explain our ideas upon the utility of an interposed compress between the instrument and the gum. This compress ought to be larger or smaller, according to the size of the hooks, the thickness of the shanks and the size of the tooth. We may be accused of too great minuteness, but we may rely upon it that little things are of the greatest practical importance. The thickest side of the compress should be turned towards the hand of the operator.

When we operate upon a great molar we have but little room to lodge the instrument, which will render the compress more embarrassing than useful. In such case we are in the habit of enveloping the instrument with more or less folds, according to the tooth to be extracted, and the instrument made use of.

By this simple means we may vary the form of the instrument as we please, modifying its thickness according to circumstances. Also, for our use, the best keys are those the shanks of which are the thinnest and narrowest, because it leaves us more room to give it whatever dimensions we may judge most advisable for the case presented.

Hooks.—The semi-circular hooks are complained of as mounting towards the crowns of the tooth, occupying too much room, and forcing the mouth more widely open than is necessary, which, as Maury says, becoming very fatiguing, especially for some persons who have it so small that it is difficult to press the instrument to the second molar. Nevertheless, we will say, with all frankness, that these semi-circular hooks are those which we use in general, and they appear to answer their pur-

pose very well. We wish, indeed, that the right angled hooks were the better; nevertheless, we must have some doubt about it until it shall be demonstrated that they are not more likely to break the crowns of the teeth than the others are. As to the greater or less fatigue of jaws experienced by the patient, it can hardly be called suffering, and the extraction is made so rapidly that but little time is given the patient to tire in. This, then, is a consideration which need not be taken into the account.

Dr. Tesse has made that part of the hook which is pivotted in the screw of the instrument to terminate in a point, and this, in order to permit the extraction of the teeth of the upper jaw, without being obliged to use the finger in fixing the crotchet. This, we regard as a modification of very little importance.

Curvatures of the Staff.—Keys with straight staffs can never be used to extract inwards the wisdom teeth of the inferior jaw. On the contrary, those which present, at their extremity, a curve more or less marked, are applicable to all cases of extraction of the small and great molars, and are on this account very much to be preferred. Without this curve we could not draw the small molars of the upper jaw from without inwardly, a proceeding very much more sure, though it is not yet universally pursued.

As, by this method, the alveolar border remains in perfect soundness, if, after having plugged the extracted tooth, we endeavor to replace it in its alveolus, in order that it may be fixed firmly there again, we would have much greater hope of success. Without exaggerating the curvature, as Maury does, to a right angle, it is certain that the instrument is more free, and gives greater opportunity to the eye to follow it in all its movements. It is also certain, that this inflexion of the lever gives it more power, and decomposes its action in a direction the most propitious to the removal of the organ to be extracted.

Besides this curve, which we call general, there are others of a special kind, for the rarer cases, where it is necessary not only to modify the direction of the staff of the instrument, but also that of the hooks, as well as their form and the dimensions of the shanks.

We will relate the case of a subject who had a molar developed in an abnormal manner, so that the grinding surface of

the crown looked towards the buccal cavity. M. Lemair, who was then alive, sent him to M. Pernet, who discovered so many difficulties in the way of extracting the tooth, that he declined to undertake it. The patient then applied to us, and, far from being discouraged by the obstacles presented, we took an impression of the mouth with a view of having a key constructed especially for this case. The curves were so arranged as not to hurt the incisors nor bicuspids, and as the two molars opposite to the tooth to be extracted, left a small space between them, we gave to the hook a complicated form, so contrived as to act between these two teeth without luxating or fracturing the one or the other. We were obliged to give the bolster many obliquities, without which, it would have been impossible to have seized the tooth, and especially to perform the movement of elevation. The success was equal to our expectations, and M. Lemair, who, certainly, was a skilful man, paid us compliments upon it, to which we were very sensible.

Mode of using the Key.—When we wish to extract a tooth with this instrument, after having placed the patient in the most convenient position, we fix the points of the hook below the neck of the tooth; then we seize it in such a way that the entire crown is lodged in the curvature of the hook, and the extremity of the bolster should be always a little lower than the hook, so that the resistance may be upon the crown of the tooth, the point d'appui upon the side opposite to the alveolus, and finally that the power be exerted at the extremity of the instrument. By such a procedure we obtain the effects of a lever of the first kind. After these preliminary precautions, we execute a rotatory movement of the key, making the extraction from within outward or from without inward, according to the nature of the case and the position of the hook. Ordinarily, the key of Garengeot, is sufficient for the purpose of extracting the tooth. During the operation it is important to moderate the effort for fear of breaking the alveolar border too much, or of tearing the gum unnecessarily. When such accident has occurred, the extraction should be completed with the straight or curved forceps, giving the instrument a rotatory movement to prevent further fracture of the alveolus, or detach the portion of the gum which

still adheres to it. Some dentists, pride themselves upon the rapidity with which they extract a tooth. To do this, however, they run the risk of breaking off the crown. It is far better to perform this operation without precipitation or unnecessary violence, and thus avoid serious consequences.

Sec. 3. *Pelican and Tirtoir.*

These two instruments act in a manner almost identical. They have both fallen into disuse and deservedly so too, for they are by no means as useful as the key. We would not mention them at all, if some dentists did not still adhere to the use of them, defective as they are.

No instruments have undergone more changes than these. Of course we have no intention to describe them all. Two only require any notice. The first consists in an immovable staff curved at a right angle at its widened extremity, upon the first third of which is articulated, by a hinge, a second staff, broad in the middle, shorter than the first, and extending beyond its extremity some lines and terminating in a rounded hook. This hook presents two acute points, as does the English key, and when the *movable* staff is entirely brought to bear upon the immovable one, the hook tends to rejoin the bent extremity at the angle of that staff.

In order to use the instrument, we seize forcibly the extremity of the immovable staff, making a point d'appui upon the gums. With the hook the tooth is seized upon its internal face and extracted by a see-saw motion. This instrument cannot be employed upon the great molars on account of the commissure of the lips. Hence the necessity of another kind of pelican.

This latter, which we will not trouble ourselves to describe at much length, presents for its point d'appui, a plate of metal slightly concave, oval, an inch long, eight or ten lines broad, covered with leather and articulated with its handle by a hinge. The movable hooks are capable of motion, not only forward and backward, but from left to right by means of a screw, an arrangement which avoids the necessity of multiplying and frequently changing them. There are also bent hooks which facilitate the extraction of the wisdom teeth.

To extract teeth by the aid of this instrument, we place the hook on the internal face of the tooth, or of the roots when the crowns are wanting; we take a point d'appui upon the crown and the gum of the neighboring teeth, and drawing towards ourselves we luxate the teeth from within outwards.

We must not lose sight of the fact that the posterior teeth are firmer than the anterior, because of the greater number of roots which they possess; besides the commissure of the lips hinders our taking a point d'appui upon the posterior teeth when we wish to extract the anterior molars, and it follows that we are obliged to apply our force to the weakest teeth, in order to extract the firmest, which causes them very frequently to be loosened during the operation: sometimes, even, they fall from their places before we have succeeded in extracting the diseased tooth. An accident, which caused the judicious Laforgue to say, "That it would be better for a patient to keep his diseased teeth in his mouth, than have them extracted by this instrument, even in the hands of the most skilful operator."

It has been thirty years since this distinguished dentist expressed himself so strongly, and it is hardly possible to believe that any dentists still employ an instrument capable of doing so much mischief.

As to the *Tirtoir*, it is the pelican in miniature, under the form of a very long forceps, whose superior hook, moved, by one of the two branches, crosses above the other, which is curved in the same manner as itself, instead of going to meet it. Certain dentists, of whom I have spoken, vaunt its efficacy in extracting the incisors and roots close to the gums.

Sec. 4. *Forceps.*

There are two kinds of instruments which may be easily confounded, for they only differ in the arrangement of their beaks. In the *pincers*, being perfectly symmetrical, in the *forceps* being unequal, and crossing one another.

This slight resemblance does not seem sufficient to justify the different names which have, for a long time, been given to them—therefore, we shall consider them under the common name of *forceps*.

We have, then, three sorts of forceps, straight, curved, and parrot-beaked.

The straight forceps is employed for the extraction of incisors, canines and small molars. The branches should be six or eight inches long, the beaks not more than fourteen or sixteen millimetres, with the angles slightly rounded. The internal face of the beaks, instead of being indented as they usually are, should be hollowed, and very sloping.

As to its use, this instrument is very well adapted for extracting loose teeth, and those of the first dentition.

It is necessary to remark, that cutlers, for the sake of imparting elegance to the instrument, often give it a form, too much arched between the beaks, whence it happens, that it only seizes the tooth by the narrow and cutting extremity, and thus becomes a cutting forceps. It is desirable then to have forceps whose beaks shall be as nearly as possible parallel, so that they may embrace at once every point of the crown, and thus secure it from fracture.

It is indispensable to have straight forceps, with very narrow and thin beaks, to seize the small incisors of the upper jaw, especially in infants. And for the very large molars an instrument should be in readiness, whose beaks shall be in proportion to the volume of the teeth to be extracted.

The curved forceps is bent at the place where the two branches are articulated. It is especially employed to take away the large molars from the bottom of the mouth after they have been loosened by an instrument of more energetic action.

The parrot-beaked, very much resembles the straight forceps. It has two beaks, arched at their articulation. The superior, as we have already said is longer than the inferior. Their extremity ought not to be more than from three to five millimetres in thickness, which gives them, altogether, the appearance of a parrot's beak.

This instrument is useful for the extraction of the incisors, canines and molars of the lower jaw. In using this sort of forceps, we begin by placing the upper beak towards the internal face, and upon the neck of the tooth, the inferior, as low as possible, touching the gum lightly. This done, we pull upon the

branch which is found in the palm of the hand, at the same time we gently press the beak which bears upon the tooth—and after drawing the tooth gradually from before backward, we finish the extraction by lifting it from the socket.

Nevertheless, even by the confession of those gentlemen, who laud this instrument, the forceps is not safe, for there is great danger of cutting off the tooth, as its form necessarily gives it, to a greater or less extent, the power of the cutting pincers.

As we have said before, we make no distinction between the forceps and pincers; we have described several modifications which dentists are obliged to give to this class of instruments in order to adapt them to all kinds of cases.

There are only three fundamental forms—all others are but varieties of these, differing only in slight modifications, important, indeed, in practice, but, absolutely, unworthy of notice, as affecting the unity of the instruments themselves.

We trust that our readers will admit that we have rendered some service to the dental art by grouping under one name these instruments, which resemble each other so closely, and, we hope, that this example may be followed by others. Precision of language is more important than many suppose, for upon it depends the precision of ideas.

Sec. 5. *Simple Lever—Carp's Tongue—Hind's Foot.*

The instruments we are about to describe have great similarity of action.

The simple lever is nothing more than a staff of steel, with a flattened and cutting extremity. It serves to extract certain roots.

To accomplish this, we bury one of the angles of the instrument by the lateral part of a tooth, under its neck, (which often no longer remains,) and endeavor to lift the root from its alveolus, or, rather, execute a movement to and fro, taking a point d'appui upon a neighboring tooth, which, nevertheless, is wrong in principle, as we run the risk of loosening a second tooth.

The carp's tongue, also called the pyramidal lever, is a staff

of a smaller size, whose extremity, shaped like a lance with a broad base, is bent at a very oblique angle.

This instrument offers very great advantages in the extraction of the wisdom teeth, but it requires a very experienced hand; otherwise, it is capable of inflicting serious wounds upon the important organs in relation with the posterior fauces, and the pillars of the palate.

From a conviction of the danger to which the patient is exposed in the use of this instrument, especially when we act upon the posterior teeth, we never fail, in every such case, to place the pulp of our index finger upon the opposite side of the tooth to be removed, so that, should the crown give way more readily than we expect, the point of the instrument may encounter, in our own finger, an obstacle which may prevent the wounding of the tongue and other soft parts of the mouth. In this way we have avoided all accidents, and our fingers have escaped with a few slight injuries, which were abundantly compensated by the advantages of the cautious plan pursued.

The carp's tongue may also be very well made to fulfil the office of the simple lever.

The hind's foot is a metallic staff, bifurcated at one of its extremities, and near which is a small hook, also bifurcated, but the instrument is better without this appendage. This instrument is used as the two others, for the extraction of roots, by introducing its bifurcated extremity between them and the alveoli, and taking a point d'appui, upon the jaw, near the hook upon the staff. The hook serves also to draw the root towards itself by seizing it upon the internal face, instead of repelling it, as is done by the extremity of the hind's foot.

Our opinion is, that it would be better to make two instruments of this than to unite them in one. Experience convinces us, that they are often much in the way of each other, and that the functions of both would be far better performed separately.

We may also object to this instrument, that as it is ordinarily constructed, it does not give sufficient hold for the hand of the operator. We would, therefore, suggest the preparation of one with larger dimensions. This instrument, which is about two decimetres long, including the handle, is composed of a cylin-

drical staff, five millimetres in diameter. This staff is terminated by a strong hook, curved at a right angle, and slightly hollowed. This hook is about eight millimetres long, towards its extremity it presents a slight bifurcation.

An essential thing is that the handle shall be sufficiently large to fill the hand. Its length should be about eight centimetres.

We have constantly used this instrument to great advantage in the extraction of roots, and, especially, of those of the wisdom teeth. The reason is, that it would be very difficult to use the hind's foot or carp's tongue in extracting these teeth; while our hook, seizing them from within outward, gives much more power, and, certainty, to the operator, and inflicts infinitely less pain.

Indeed, necessity is the great inventor of instruments. We recollect that such was the case in the following instance: A patient presented himself to us with a wisdom tooth so far carious, that none of our instruments could be employed upon it. We had a hind's foot, furnished with a hook, but the prolongation of its extremity, prevented us from getting it sufficiently far into the mouth. Nevertheless, the only means left us, was to seize it from within outwards, because, on that side, the crown being rather less shattered, offered a somewhat better purchase. It was then that the idea struck us to fashion upon the spot a piece of iron wire into a rough resemblance of the instrument which we have since perfected, and described.

Sec. 6. *Different kinds of Pincers.*

Having given the name of forceps to the instruments heretofore known as *pincers*, our intention has been to reserve the latter denomination for the very useful instruments vulgarly known as watchmaker's pincers. We have modified some of these instruments, in a way which we think has rendered them much more convenient. There are four kinds of them. Two straight, and two curved. Of each kind, one has cutting beaks.

Those which are blunt, are used to remove splinters which may remain after the extraction of teeth, especially after the

removal of the great molars, which is always attended with more or less fracture of the alveolar border. The thinness and length of their beaks renders them very suitable for this purpose. Those which are cutting, serve to remove the sharp angles and little eminences which are found upon the roots of the teeth when, from any cause, the crown has been broken.

There is a case, above all others, where these instruments are very valuable. It is, when the gums have shrunk so far as to uncover the alveolar border, and, of course, the neck of one or more teeth. The impression of the air and strange bodies makes their presence intolerable, and compels extraction. After this operation has been performed, the denuded bony parts will keep up a focus of suppuration for a long time before they can be removed by absorption or necrosis. It is, therefore, far shorter to remove them with the cutting forceps.

SEC. 7. *An opinion as to the value of the Different Instruments.*

The key of Garengeot is, beyond contradiction, superior to all others. Attempts have been made to supersede it by instruments far inferior to itself. What are the inconveniences that innovators would avoid? The fracture of the alveolar border? In the first place, a skilful hand can avoid this accident, which, after all is of little consequence. To avoid this difficulty, we encounter another far more serious, in taking a point d'appui upon a neighboring tooth, by which it is almost always loosened. Besides, when we would act upon the great molars, we cannot avoid the fracture of the alveolus, since the roots, generally divergent, cannot be extracted without this accident, and, besides, when the crown is ever so little carious, we run the risk of substituting one operation for another, taking off the crown, instead of extracting the root.

The tirtoirs and pelicans ought to be abandoned, and the same may be said of Maury's hook.

In short, the key, the straight, curved and parrot-beaked forceps, the carp's tongue, hind's foot, and the simple lever, these are the only instruments of which the skilful dentist will have need, to enable him to overcome all the difficulties which he may en-

counter in this branch of practice. These are rare exceptions, such as call for the invention of special instruments.

We repeat it, that innovators are in a dilemma from which they cannot escape, the fracture of the alveolar border, or the loosening, sometimes even the luxation of neighboring teeth. As we have before said, the former of these accidents is, for the most part, unavoidable, and to escape it, we are exposed to do more serious injury, or, what is hardly better, to fail in the operation by breaking the tooth instead of extracting it, an accident which, if often repeated, is sufficient to destroy the reputation of the dentist forever.

CHAPTER XII.

This will be a long-winded work, indeed, if, in order to consider the extraction of the teeth, we must anticipate every possible contingency which may, at any time, embarrass the dental surgeon. We doubt, indeed, whether it would be possible, even if it were desirable.

A work much more extensive than this might be written in vain to accomplish such an object, and after all, the operator would find that he had much to learn. It is needless then to attempt to conceal the fact, that books are written for the purpose of giving certain elementary instruction which it is necessary to get from a master, but it is only by experience that the sagacity is acquired which enables the true practicien to triumph over, to sport with every difficulty which he may meet.

In the meanwhile, it may not be fruitless to lay down some general maxims upon the principal obstacles encountered in the extraction of teeth, and to point out certain peculiarities of formation encountered in some of these organs. This shall be the subject of the first paragraph of this chapter.

Sec. 1. *Obstacles to the Extraction of Teeth.*

Laforgue thus classifies them: small mouths; diseased lips; scars; absence of the crowns of teeth; extreme depth of the roots; softness and consequent fragility of the dental substance; length of the roots; their tortuosity; curvature; convergence and divergence; adherence of the teeth to the alveoli; resistance of the alveolar walls; internal oblique line of the coronoid apophysis; uncommon size of the masseter and pterygoid muscles; (we will point out a very easy way of overcoming this difficulty;) inclination of the two last teeth of the upper jaw, towards the coronoid apophysis of each side; softening, swelling, and caries of the bones; diseases of the maxillary sinus; position of the carious teeth beyond the alveolar arch; their enclosure between sound teeth; and, finally, the escape of teeth into the maxillary sinus or other bony cavities formed by diseases of these bones.

This list is sufficiently long, and yet we have not enumerated many things mentioned by Laforgue, which do not appear to us to be real obstacles to extraction.

As to the peculiarities which concern each tooth, we will describe them in a few words.

In the lower jaw, all the anterior teeth as far as the small molars, inclusively, present in their roots more or less of convergence or divergence, and more or less length. They may be oblique or curved at their extremity, and, sometimes, may be furnished with a supernumerary root.

The second large molars offer peculiarities more extraordinary, but it is more rare to observe divergence of their roots, and it is the parallelism of these prolongations which causes their alveoli, in extraction, to be frequently broken, and brought away with the teeth.

But the wisdom teeth present the most remarkable anomalies. The crown more or less complete, more or less voluminous, is sufficiently like those of the other teeth, but the roots exhibit the most extraordinary forms; double, rarely quadruple, they diverge and converge; twist upon one another; separate and approxi-

mate, blend, bind, warp, or lastly are either abortive, or grow beyond measure. It is utterly impossible, amidst all this variety of configuration, for the operator to perceive the true state of things at all times, and, therefore, he should always be on his guard when proceeding to extract this sort of teeth.

Another thing to be regarded in the lower jaw is the greater or less salience of its oblique line. As it forms with the base of the coronoid apophysis the external wall of the alveoli of the second and third molars, it sometimes happens that the roots themselves make but little resistance compared to that of the alveoli thus fortified, and however little the roots may be thinner in these than in other cases, it is a real obstacle to extraction. Hence we may not hope to remove them entirely with the key: it is better to start with this, and then remove them with the forceps.

Let us pass to the upper jaw.

The teeth may here be characterized by the length of their roots, their obliquity, their hooked extremity, and their great tenuity. This is frequently remarkable in the canine teeth, and becomes a great difficulty in the way of their extraction.

The first large molars are tricuspid, and some of them have roots which are bent at their extremity, so as to form a sort of cramp, which embraces a strong piece of bony substance. This conformation, however, is more rare than is generally supposed.

The second great molars present no other peculiarity than the divergence of one or two roots, or their reunion in a mass more or less closely united.

As to the wisdom teeth of the upper jaw, they are almost always more or less imperfect. Some hardly attain the size of a small molar. And others present an appearance absolutely embryotic.

The crown of the wisdom tooth, instead of being perpendicular is sometimes thrown outwards, augmenting very much the difficulty of getting an instrument upon it, and especially of obtaining a point d'appui.

Sec. 2. *Extraction of the Teeth.*

The medical treatment which we have been in the habit of employing for the cure of carious teeth has singularly diminished

the cases upon which we have found it necessary to practice extraction.

Whenever a tooth has disease of the alveolar membrane, attended with fistulas of the gums or complete loosening of the tooth, although its crown has undergone no change but in color; whenever, in short, the crown is not the sole or principal seat of the disease, we have recourse to the extreme measure of extraction. In some other cases when the patient is unwilling to abide a treatment of several days' duration, we immediately remove the tooth which causes his suffering.

It is not always as easy to ascertain the diseased tooth as may be supposed. It would be very imprudent to remove a tooth upon the simple statement of the patient, however positive he may be. As we have already observed in describing caries, we observe the most fanciful phenomena, and, among others, we sometimes have a patient point out a tooth as diseased, when, in truth, it is the one of the opposite side which causes the pain. These mistakes have sometimes led to the extraction of sound teeth.

It is necessary, therefore, to examine the teeth very carefully, slightly sounding them if the caries be apparent, or, if otherwise, striking them one after another with the rounded extremity of a stylet.

The case is more embarrassing when all the teeth are the seat of violent pain, which sometimes is purely neuralgic. Under such circumstances we should always advise medical treatment at first; fifteen or twenty leeches to the angle of the jaws, stimulating pediluvia, inoculation with morphine at the place of exit of the superior or inferior maxillary nerve, emollient and narcotic gargles; when all these means have failed, we may examine with the sound or stylet the tooth apparently most concerned.

To reiterate our preliminary precaution, we should never extract a tooth, until satisfied, by all possible means, that it is really the seat not only of pain but of caries.

In describing the instruments used for the extraction of the teeth we have not been able to avoid entrenching upon the proper domain of manual operations. It would be repetition

to treat of that matter again. We will content ourselves with a rapid glance at some details, omitted in the preceding chapter.

All the incisors, canines, and small temporary molars, can be readily removed by the simple or parrot-beaked forceps. But the operation must be performed with caution, lest we press too hard upon the tooth to be extracted, break it, and leave its fang in the socket. Hence, we advise the use of the key, when these molars have their natural firmness; when the permanent molars are to be removed, this instrument is indispensable. One of the greatest objections to it is the difficulty of placing it, owing to the pressure of the cheeks, but nothing is easier than to obviate this inconvenience. It is only necessary to tell the patient to keep his mouth in a half-shut position. The cheeks being then completely relaxed, the instrument meets with no impediment. A country physician, who had tried in vain to extract a tooth from his father's mouth, applied to us; giving us, at the same time, warning of the great difficulty which we must expect to encounter in the effort. We told him that we did not apprehend any such trouble, and, indeed, as soon as he heard us give the direction to his father to half-close his mouth, he struck his hand upon his forehead, and stood greatly confused, at not having thought of a means so simple. We have already had to remark that these are the kind of measures always the last to be employed, and yet those which in daily practice are the most successful.

In operating upon the large molars of the upper jaw, some operators being unable to place the hooks upon the internal face of the teeth, and upon the part of the neck or root which affords sufficient resistance, place them upon the external face in order to loosen them.

This method has some inconveniences, as the teeth are larger upon the external surface, they force their neighbors to give way in order to give them passage, and loosen them, sometimes to the extent of insuring their loss, their roots being in a direction contrary to that in which the movement of extraction is performed.

This, at least, is the opinion of good writers. As for ourselves we think that they exaggerate the evil consequences of this

procedure, and that it is very rare, that the extraction of one tooth is followed by the undesirable loss of its neighbors. We may perform the operation without hesitation after having assured ourselves that the tooth can pass, and after having protected the palatine arch with a compress, folded several times.

For the large molars of the lower jaw, especially the two last, in front of the wisdom teeth, we must assure ourselves that the oblique line is not too salient, as, otherwise, we run the risk of breaking them. In order to avoid such an accident we should luxate the teeth from the exterior to the interior, seizing it by the external face. If caries have destroyed this latter part of the organ, the operation becomes exceedingly difficult, and we have but one resource left, the employment of the lever or carp's tongue.

Finally, one of the greatest difficulties which we have already pointed out, is found when the large molars of one or the other jaw present roots whose extremities converge towards one another.

In persons of rude health, a sort of ossificiation of the alveolar periosteum unites very closely the roots of the teeth to the maxillary bone. It seems that they form but one substance. Under such circumstances, the teeth does not vacillate at all, and the extraction is attended with greater or less fracture of the alveolar border. This is an accident which we need not fear in patients of twelve to twenty-four years of age, nor in those of a soft lymphatic temperament.

As to the extraction of the wisdom tooth, we have first to ascertain whether it be not already loose, in which case the carp's tongue will take it away with the utmost facility. But if its solidity in the alveolus indicates great length of its roots, we must have recourse to the key we have described in the preceding chapter, which is provided with a movable nut, which permits us to give the hook the most suitable direction for the extraction of these teeth, which otherwise present almost insurmountable difficulties.

Whatever mode be chosen for the extraction of a tooth, certain precautions are indispensable. It is necessary, at first, to seize the tooth firmly, to select a proper point d'appui, and not

to act with precipitation. Whatever be the kind of tooth, luxation should precede extraction. To effect this, we must give it a circular inclination, seizing it below the crown, as near the gums as possible.

When one understands his business, he will be able to decide at a glance whether a tooth will be difficult to extract. If it be so, we should let the patient know it, in a way not calculated to frighten him, but to secure ourselves from censure in case of failure. It is well to take this precaution when the carious crown bids fair to break under the instrument, and still more so when the crown being too low, indicates as it generally does, that the roots are divergent, and too long.

Although this operation is very simple, it is sometimes contra indicated. Fouchard, Lucas and Barau, were much afraid of performing it on pregnant women. Indeed, abortion has sometimes resulted from it in the case of timid and very irritable subjects. A second and more positive contra-indication results from the presence of a high grade of inflammation, great tumefaction, or a purulent collection in the walls of the mouth. We must wait the subsidence of these conditions which might be aggravated by the violence of extraction.

The precautions to be taken after this extraction of one or more teeth are very simple.

Before causing the patient to rinse the mouth, it is well to let the blood run for some time. We may favor the discharge by lotions of warm water slightly aromatised. Tonic or acidulated lotions are only used when the wound continues to bleed, many hours after the extraction.

Some dentists, Maury for instance, advise to close the gums with the fingers. It is useless, except when there is a considerable wound.

The fragments, of the alveoli, if any, should be removed, as they might induce and keep up suppuration.

While returning home, the patient should keep his mouth shut, to prevent the entrance of the air; a precaution which should be, (as much as possible,) observed for several days. It is also well to advise him to use vulnerary lotions, and never to suck the gums, which might produce a second hæmorrhage,

more considerable than the first, and occasion no little trouble by imparting a permanently hæmorrhagic character to the part.

As to the bad odour exhaled from the part, it cannot be avoided. Aromatic pastilles, are attended with the inconvenience of irritating the bleeding edges of the gums.

Sec. 3. *Extraction of Roots.*

In the greater number of the books, and dictionary articles which treat of odontalgia, we have noticed a blank—they say nothing about the extraction of the roots, a point so important in dentistry, and often so difficult to accomplish.

Among the roots some are simple, others multicuspid. We will first treat of the simple. When loose, and offering some hold, we will consider ourselves very happy to extract them with the forceps. When they are neither too strong, nor too deeply set in their sockets we may remove them with the lever or hind's foot.

The roots are difficult to extract, especially in the upper jaw, because they are soft, at the point of junction with the crown, and, consequently, do not offer sufficient resistance to the instrument, or this softening extends to the middle of the alveolus.

In other cases, absorption has reduced the walls of the roots to the thinness of a piece of paper, or caries has eaten more than a third of the roots, so that they are hidden at the bottom of the sockets.

The difficulty is still farther increased, when, though not softened, they preserve an intimate adherence to the alveolar periosteum.

Whenever we see the gums inflamed and redder than usual, while at the same time they are soft, we may conclude that the roots have but little adhesion to the periosteum, and that extraction will be easy. Nevertheless, the fistulas and ulcers which they occasion, do not soften all the parts by which they are united to the maxillary bones. They resist all efforts to this end, and it is necessary to extract them, for their presence perpetuates the fistulous ulcers.

If their walls offer little solidity, the screw of Angermann, modified as we have described, that is to say, less strong and more conical, is a good resource. We may also recur to the levers, whose point may be passed between the root and alveolus. It sometimes happens that by a slight effort at elevation we are so happy as to extract the tooth.

As a general rule this is the way in which we proceed to extract roots. We ascertain with a stylet whether the remainder of the root affords sufficient resistance to permit the use of the hook of the key which is infinitely preferable, and much more sure. When it is otherwise, which occurs less frequently than authors suppose, we make a longitudinal incision upon the gum from above downwards, then we place upon the root the hook of the instrument, intrenching a little upon the alveolar border itself. This done, we bear strongly, causing the heel of the hook to ascend while its point is abased, bringing the root with it. We can assure our readers that this plan has always succeeded with us.

We have enumerated the difficulties which hinder the extraction of roots. We must not suppose, however, that these obstacles exist in the majority of cases. On the contrary, there are many persons, in whose case absorption has so remarkably diminished these dental remains, as to have considerably facilitated the ultimate extraction.

Before concluding this paragraph it is important to say a word about the extraction of multicuspid roots.

If these roots ars not yet separated, but cling to a part of the crown, they should be extracted as entire teeth.

If, on the contrary, they are isolated from one another, they require as many different operations as they constitute separate fangs. As to the rest, this peculiarity, and their deeper position in the mouth excepted, which augments the difficulties, all that we have said of the simple roots may apply to the multicuspid ones.

When the roots of the last molar but one, are to be extracted, we must take care, in raising the lever, not to loosen or entirely dislocate the wisdom tooth, which, in certain cases, is so irregular, that it yields to the least effort.

Finally, we have a last advice to give, which is to extract no

roots unless they are painful, as their presence hinders the alveolar borders from approaching, the gums from withering, and, consequently, the jaws from wrinkling, the prominences of the jaw-bones from protruding, and all the features of the face from deformity.

SEC. 4. *Accidents consequent upon the Extraction of the Teeth.*

Whatever care and dexterity may be manifested, serious accidents sometimes occur, which the operator can neither foresee nor prevent.

These, however, occur less frequently than certain authors suppose. Some, however, are fairly attributable to the awkwardness or carelessness of him who wields the instrument.

These accidents are—1st. Bruising or tearing of the gums. 2d. Fracture of the alveoli. 3d. Extirpation of the germ of the permanent tooth in taking away a temporary bicuspid. 4th. Hæmorrhages. 5th. Luxation and fractures of the jaw. 6th. The fracture of the tooth to be extracted, or one of its neighbors. 7th. The loosening of the latter. 8th. Their extraction.

Besides the accidents we have enumerated, there is another from which we cannot deliver the patient, viz. the pain of extraction, and the nervous disorders which are sometimes the consequence of it. At the moment when the tooth is lifted from the socket, the patient experiences severe pain, which, sometimes, subsides immediately, and, at others, endures for some time after the operation. This pain may continue with so much poignancy, as to cause serious disorders in the nervous system, as we have already observed. Some persons faint; others still more impressible, especially very nervous women, experience general shuddering, attacks of epilepsy, sometimes even, though much more rarely, a species of tetanus, and, often, an involuntary weeping. It has even happened that the menses have been arrested, and abortion induced by extraction of a tooth.

It is certain that it is not in the power of the surgeon dentist to prevent such accidents as these, but, by his address and promptitude he can much diminish the sharpness of the pain. It is, therefore, a matter which should be studied. We must,

also, respect, as far as we can, the condition of pregnancy, for two reasons—1st, because instances of miscarriage have occurred, and, 2dly, because pregnancy always induces congestions about the head, which disappear with it; hence odontalgia, which is altogether secondary.

Sec. 5. *Bruising and Tearing the Gums—Fracture of the Alveolus.*

The bruising of the gums is always caused by the compression of the bolster of the key of Garengeot, or by their being made the fulcrum of some other instrument, especially if not protected by a compress, folded several times. Their tearing, which is more rare than the other accident, is almost always occasioned by the hooks, which, being too large, permit the bolster of the key to reascend, and carry with it a part of the free border of the gums, or by the rupture of the alveoli, in consequence of the extraction of the great molars, especially. Serious accidents, very rarely ensue; nevertheless, certain precautions are necessary to prevent inflammation. Emollient washes will suffice to accomplish this. The most serious consequence that can happen is bleeding; always, however, easily arrested by the employment of astringent and acidulated lotions.

It happens, quite frequently, that with the teeth, issue portions, more or less great, either of the alveolar border, adherent to the surface of the roots, or of the partitions which separate the alveoli of the molar teeth. This is observed, especially, when the roots converge by their extremity. When such an accident happens, we should always try to take away the pieces of bone adhering to the tooth before showing it to the patient. When it is not the fault of the operator, he ought to demonstrate, for the integrity of his reputation, that the accident has only been caused by the vicious conformation of the organ extracted. As to the rest, there ordinarily results no serious consequences from these losses of substance, which do not hinder the parts from approaching, and getting well. If inflammation or hæmorrhage threaten, we must only recur to the means already described.

Sec. 6. *Hæmorrhage.*

Those who are not familiar with dental surgery will be surprised to see hæmorrhage, with all its alarming consequences, figuring in the number of the accidents which may follow the extraction of a tooth. When it is restrained within proper bounds, far from creating uneasiness it ought to be regarded as very salutary. Instead of cutting it short, it is even prudent to favor it by warm lotions so as to prevent the inflammatory symptoms which tend to develope themselves, especially, when the alveoli have been very much fractured.

But, besides, this hæmorrhage, which we may call normal, there are others much more serious, which may depend upon the size, situation and form of the tooth, the distribution of the different vessels which are sent to it, the habit which some persons have of sucking the gums, great fatigue after the extraction, and, especially, a scorbutic vice, or a predisposition to that terrible malady.

What is remarkable about this bleeding is, that it does not occur always at the moment of the operation, but many minutes, nay hours, sometimes many days afterwards, a fact which can only be explained in two ways—either a coagulum of blood, which filled the alveolus falls out, or the patient in some way or other irritates the yet open vessels.

The blood may have two different sources. It either escapes from the capillaries of the gums, bleeding from which is kept up by fragments of bone, or from the arterial branch which constituted a part of the pedicule of the extracted tooth, and was, necessarily broken at the moment of separation In the first case we must search for fragments of bone, extract them, and inject into the places which they occupied, a solution of alum, or simply acidulated water. When, on the contrary, the blood is furnished by the artery itself, which we may know to be the case when it rises from the bottom of the alveolus, without considerable fracture of the bones, tearing, or pathological alteration of the tissue of the gum, the best means we can employ is to plug up the cavity with wax, which may be retained in its

place by the pressure of the jaws; a pressure which may be materially aided by a bandage, passed around the chin and tied upon the sinciput. When these precautions are not taken, the blood by the force of its jet, forces out the wax, which only adheres to the walls of the alveolus. Some authors recommend only little pledgets of charpie, moistened with acidulated water. We would prefer morsels of tinder, or of agaric, powdered with rosin. Nevertheless, wax is preferable on account of its impenetrability to liquids, and the ease with which pressure may be made upon it.

When, in spite of these means, the bleeding obstinately proceeds, there remains but one resource, the actual cautery; but it is a very painful means, and the employment of it is not always followed by more marked success than the plugging with soft wax.

We ought to warn the reader, before the close of this paragraph, to be very careful when the subject is scorbutic; for the bleeding which results in such cases, though trifling in appearance, is so obstinate that the surgeon endeavors in vain to combat it, and often it results in the most serious consequences, exhaustion and death.

Sec. 7. *Rupture of the Maxillary Sinus—Fracture of the Alveolar Border—Luxation of the Jaw.*

We will not dwell long upon these accidents, of which two at least are very rare, and the other, the fracture of the alveolar border, is seldom of sufficient extent to be a matter of serious concern.

M. Duval, in the essay which he published in 1802, upon the accidents which may attend the extraction of teeth, cites many examples, where the maxillary sinus has been ruptured by the awkwardness of the operator. It is a thing easy to conceive of, when we reflect upon the extreme thinness of the walls of the sinus.

Maury gives, at length, the case of a workman to whom he gave his attention for the fracture of the lower jaw, resulting from the extraction of a large molar, by the key with a straight

staff. This accident suggested the changes which he made in that instrument.

When the fracture is recent, we must attempt to consolidate the fragments. If too long time has elapsed, and fistulous openings have been formed in the gums, or these last are fungous, we must take away the necrosed portions, however large they may be. We have no other means of effecting a radical cure.

Luxation of the jaw is an accident by no means serious. It depends less upon any fault in the operator than peculiarity of arrangement in the articulating surfaces, or an improper direction of the ascending branches of the lower jaw. If such an accident should occur, the luxation must be immediately reduced. In order to effect this, it will suffice to seize the lower jaw, by placing the thumb, enveloped in linen, within the mouth, and pressing with the other fingers below the chin. The left hand is placed below the nose or forehead, and with the right, we draw the jaw obliquely from above downwards.

Sec. 8. *Loosening of the Teeth—Rupture—Complete Extraction.*

When the use of the pelican was more general than it is now, the loosening of the teeth, upon which the point d'appui was taken, was not rare. At present, the case is different. If a dentist happens to loosen the teeth in the vicinity of the one which he wishes to extract, it must be the fault of the patient, who, by using his hands, or by some thoughtless movement, deranges the instrument of the operator.

In such cases we must act according to directions given, when treating of luxated teeth.

Either, through the formation of the roots of the teeth, or the softness of the substance which forms the crown, or the awkwardness of the dentist, a tooth may be fractured at its neck. Nevertheless, this accident is much more unpleasant to the operator than serious to the patient. Under such circumstances, we must divert the attention of the patient; then, losing no time, we must seize the root with the hook, if this be possible, if not, we must quickly seize the lever, and repair the fault, before, so to speak, the patient shall have perceived it. When, un-

happily, the latter, frightened by the accident, and losing all courage, will no longer permit any efforts to be made to extract the root, antiphlogistics and emollient gargles will suffice to dispel this assemblage of inflammatory phenomena. One thing well worthy of remark is, as M. Begin has pointed out, and as we have frequently observed, that out of ten persons for whom we are obliged to prescribe antiphlogistics, scarcely one is the subject of notable consecutive symptoms. The pain abates, the roots become inert in their alveoli, and mastication is performed upon them with perfect impunity. These cases tend to justify the predilection which some are beginning to manifest for the section of the dental crowns, instead of extraction.

An accident still more serious than the one we have described, and which is utterly unpardonable, because, with the exception of certain cases of exception, it may always be attributed to the inattention or ignorance of the operator, is the total extraction of one or more teeth.

Sometimes, in the endeavor to extract a single tooth, two have been drawn united together. We have, in our possession, two teeth which present this phenomenon. Of course, in cases like this, the fault lies with nature, but the case is different where a sound tooth is mistaken for a carious one, a permanent for a milk tooth.

When a blunder so serious has been committed, it should be, as far as possible, repaired, by replacing the tooth in its socket, and maintaining it there, as heretofore directed. We have already observed that this effort would often succeed, and the tooth thus extracted be rendered as firm as before.

We have finished that part of our essay which has relation to pathology and therapeutics. There remains for us nothing more than to discuss the different procedures which constitute dental prothesis.

PART III.

DENTAL PROTHESIS.

CHAPTER XIII.

We are now about to consider a department of the dental art, which is at once one of the most difficult and most important. If to insure the teeth from all accident, and procure for them a duration equal to that of the life of the man, it would suffice to undertake the care of them in childhood, and watch over and direct them until maturity, our task would be nearly finished. Unhappily it is not so. Disease, bad diet, sickly localities; dentifrices, whose composition makes them worse than useless, and many other causes too numerous to mention, conspire against the organs of mastication, and, too frequently, destroy them wholly, or in part. In order to remedy these inconveniences, efforts have been made from time immemorial to disguise the disagreeable deformity, caused by the want of one or several teeth.

The means employed up to a period not more than ten or fifteen years ago, had arrived at a certain degree of perfection. Nevertheless, much remained to be done. The very flattering approbation with which the public have honored our practice, is, I think, the best evidence that our efforts, directed to this branch of art, denominated, scientifically, "prothesis," have not been in vain. Yielding to the urgent requests which have been made to us, and, at the same time, desiring to contribute to the cause of

science, we have resolved to give to the public the fruit of our observations.

Before initiating the reader into the several more or less ingenious processes, by which we fashion and adjust artificial teeth with such perfection as to impose, completely, even upon those of the keenest sight, we think proper to premise some considerations upon the numerous inconveniences, which are consequent upon loss of the teeth.

Sec. 1. *Influence of the loss of Teeth upon the Features, Mastication and Voice.*

The little bones which so agreeably furnish the human mouth, never perish all at once. They are destroyed one after another. Sometimes the large molars begin to give way, sometimes the incisors; but whatever class first succombs, the jaws always change their shape, and premature wrinkles advertise us that the face has lost somewhat of the dimensions which formed its character. Therefore, it is its primitive configuration which dental prothesis proposes to restore.

We proceed to pass rapidly in review the changes which are observed after the fall of the teeth. When they are those of the upper jaw, the alveolar borders draw back towards the centre of the palate, and the flesh of the face follows the movement. The parts of the face formed by the upper maxillary, are decomposed, in a mode more or less fanciful, and the following phenomena result:

When the superior incisors only are wanting, the labial opening remounts in the middle, takes an oblique direction, the lower lip projects, the cartilages of the nose approach, and the lobule of the same organ falls lower than the alæ, which causes it to be vulgarly said that the nose and chin are married together. As to the palate, it tends to resume the form which it had in infancy, and the borders of its circumference return upon themselves the more readily, in proportion as violent evulsion of a great number of teeth has been followed by great loss of bony substance. An accident which especially accompanies the extraction of molars.

It may happen that all the teeth of the upper jaw are absent. In this case the lower teeth, sally forward, and as the arc, upon which they are implanted, has preserved all its extent, while the upper jaw is considerably diminished, the harmony necessary to mastication is destroyed.

The subject of this sorrowful inconvenience cannot masticate his food; he can do nothing more than saturate it with his saliva; which, by a remarkable foresight of nature, is secreted in greater abundance, so that the aliment may be well digested, notwithstanding, that it is conveyed to the stomach in a state of very partial division.

M. Delabarre, in his excellent work upon "Dental Prothesis," has introduced a very remarkable dissertation upon the influence of the palate upon the modifications of the voice. He compares the palatine arch, augmented by a complete series of the upper teeth, to the wide extremity of a horn. The player, by closing this wide part, renders the sounds sharper, or deeper, according as he makes the closure more or less complete; so, also, when the palatine arch has been diminished in extent, and, especially, when it has lost its concavity, the accents of the voice become acute and effeminate. An excessive flattening, produced by the total loss of the upper teeth, gives to the speech the nasal tone so remarkable in very old people. By only considering the palate relatively to individuals yet in the flower of their age, whose mouths are yet provided with an uninterrupted denture, M. Delabarre affirms, that upon its form depends all the infinite variety of voice. Individuals, whose voice is a common pitch of base, have, according to him, regular teeth, and a vast palate, under which the sounds seem to travel at leisure, while a piping and guttural voice results from a flattened palate, which may be either large or narrow. Finally, a nasal voice proceeds from a mouth, the palate of which, instead of being a rounded arch, presents an angle.

These remarks are certainly far from being idle, and we invite our confreres never to lose sight of them when about to prepare artificial teeth to a certain extent. We will even say that, since by the aid of springs, dentists are successful in modifying the form of the palatine arch, in certain cases of nasal voice, they

ought never to forget, that nothing is more easy for them than to stretch the anterior arch of the superior alveolar border, and to relieve it of that angular form, to which M. Delabarre attributes the defect of the vocal organ, which we are now considering.

The influence of the loss of all the lower teeth upon the physiognomy, is as follows: The fall of the eight or ten anterior teeth of the lower jaw, causes the inferior lip to sink, and the chin to point, but their loss does not create the remarkable changes produced by the loss of the upper teeth.

This loss, when joined to a similar one in the upper jaw, gives a squarer form to the lower part of the face, and impresses upon it an air of chagrin.

The loss of the molar teeth only flattens the cheek, makes the face longer, elongates the lips, and causes the mouth to assume a muzzle form. The cheeks become flaccid and pendant, the labial opening extends further, and, although, the grand diameter of the face sensibly diminishes, the facial angle of it is never modified.

As to the mastication, the want of the lower teeth obliges the jaw to perform very great movements of elevation, during the act, which, nevertheless, is more difficult when only the upper teeth are absent. One of the most serious inconveniences is, the involuntary escape of saliva which is no longer contained within the inferior dental arch.

It only remains for us to consider the voice. The tone is not changed, but it is not so with the pronunciation. The guttural consonants, such as *g*, take a sound intermediate between that which is proper to the letter, and that of *gh* and *ch*. Speaking becomes laborious, and the end of the tongue frequently escapes from the mouth, to play between the lips.

Now that we have mentioned the inconveniences, we will make some general remarks upon the *remedies*.

Sec. 2. *Artificial Teeth.*

By the term *artificial* are designated the teeth which we adapt to the place of those which, from any cause, have been destroyed. When they have been skilfully adapted, and, especially, firmly

fixed, they render almost the same service as natural teeth. They repair, in a perfect manner, a breach always very unpleasant to see, and more unpleasant yet to show, when a canine or incisor has been lost. They restore to the pronunciation its distinctness and agreeableness, and they hinder the saliva from escaping upon the lower part of the face. But when mastication is to be performed, they are no longer of equal worth. The food must be triturated with the greatest care, and a little bone placed under the artificial tooth will suffice to break it or its attachments.

Another advantage of artificial teeth is to contribute to support the teeth which have escaped the ravages of caries, especially when the latter are long, and liable to be loosened. Moreover, they preserve the alveolar border, and oppose the retraction of the palatine arch. But, in order to fulfil the design for which they are employed, certain conditions are required.

In the first place they must, as far as possible, resemble in form and color the destroyed teeth, and those which are near them. It is, moreover, necessary, that in order to be maintained with the utmost firmness, they should have their point of support upon the neighboring teeth, without causing pain or injuring other parts of the jaw. It must be especially provided, that the springs and hooks be broad enough to prevent the cutting of the neck of the teeth to which they may be applied.

We need not further insist upon the immense advantages of dental prothesis. As the ingenious author of the "Hygene de la Bouche" has said, "every body who has unfortunately lost teeth, and, especially, front teeth, in early life, feels how precious is the resource of art." "Ah! ladies," he adds, "if I were not checked by the fear of being suspected of pleading for the interests of the dentists, as much as for the cause of truth, it would be easy to prove that there is no man who does not like to find in the person of a dearly loved wife, something which, in the absence of the reality, reminds him of the treasures of a mouth which he has so much prized?" M. Taveau indulges a good deal more in this strain. We will spare our readers the balance of the tirade, which we confess is a little too *amorously* scientific.

It is not necessary to say, that artificial teeth require great at-

tention to cleanliness, and that in spite of the utmost care, when the subjects have habitually difficult digestion, and when the saliva, from its constituent condition, deposits a great deal of tartar, they will become dull, corrode, and, finally, be destroyed, especially if made of the hippopotamus material. They must, occasionally, be resupplied. The teeth called incorruptible or mineral, last longest. They have no bad smell, and when they are destroyed, it is generally by their mounting.

Sec. 3. *Substances suitable for replacing Teeth.*

To perfect artificial teeth, the dentist lays under contribution the animal and mineral kingdom. In the first we find the bones of certain animals, their teeth, and those of the human subject. In the second, we have earths, quartz, talcs and oxyds.

In some cases, a sort of practical instinct determines us in the choice of what is best. For example, if we have but one tooth to insert, and that in front, and if the coloring of the others be such as cannot be perfectly imitated by an artificial tooth, we must insert a human one. For, whenever we cannot imitate nature, we must employ natural things.

We propose to throw aside many things, the inconveniences of which have long been known, and with which, nevertheless, authors have, by a sort of routine, amused themselves in works upon this subject. Of this number are beef-bones, which were used not to make teeth, but the basis of gums; ox-teeth, horse-teeth, stag's-teeth, &c., the enamel of which has not the proper hue; ivory, which has no enamel, and soon corrupts after being placed in the mouth. Finally, mother of pearl, which common sense will forbid the dentist to dream of.

In short, of animal material, we admit nothing but human teeth and those of the hippopotamus.

Sec. 4. *Hippopotamus Teeth.*

These are procured from Africa, and the most distant parts of Asia. It has not been long since it was suggested to substitute them for ivory. Their grain being much more close, finer, and

more easy to work, would justify this preference, if, unfortunately, they were not so easily destroyed by the corrosive property of the saliva, as it exists in certain persons. We have had occasion to verify this remark in the case of one of our patients, who, at the end of two or three months' wear, returned to us a complete set, in such a state of destruction, that it was really impossible to use it. This material may be employed with or without enamel.

The incisor teeth of the hippopotamus are short, semi-cylindrical, externally, and present a deep furrow behind. Their enamel is frequently very beautiful, and very thick, and its color, when polished, very closely resembles that of the human teeth. Their semi-cylindrical form permits us to cut from them many enamelled pieces which well coincide with the labial part of the denture; in such a way that we sometimes find pieces from which we may carve six, or even eight teeth.

The tusks are much larger and longer. They are bent like the tusks of the European boar. Their weight is sometimes three or four kilogrammes. Unfortunately, these large ones are rare; the ordinary weight is from a kilogramme to a kilogramme and a half. They are flattened on their external face, and convex behind, and as only the half of the latter face is enamelled, this disposition renders them incapable of rendering the same service as those we have before described. Nevertheless, we must not conclude that they are useless, on the contrary, they are sufficiently large to permit pieces to be cut from them, and to be used either for complete unenamelled sets, or for foundations for human teeth.

When, by a transverse cut, a hippopotamus tooth is divided through the middle, we find there a furrow more or less large, and deep, in proportion to the age of the animal. We must not forget that this is the feeble part of the tooth; and we should avoid incorporating this furrow in an artificial tooth. If, however, it cannot be avoided, we must, at least, arrange it in such a way, as to make it escape observation, for this spot is liable to putrify, and undergo change very rapidly.

The preferable teeth are those whose internal surface is more compact, whiter, more polished, and less crossed than that of

the other kinds of ivory. The best are white, rounded, enamelled on the smallest and internal part of their length. They have no large sides, nor deep furrows, and are not at all split in the direction of their curve.

To preserve them in the best possible condition, a wise precaution is to preserve their humidity, and, when working them, to shield them from the sun, or the heat of the fire, or even to a current of air. If these precautions be not taken, we may see them crack and split in many places, especially where there is no enamel.

The hippopotamus tooth, as we have said, furnishes very good material for fashioning artificial teeth. We must not deceive ourselves, however, and forget that in spite of having chosen the most faultless piece, its extreme whiteness, which, at first, is so striking, changes sooner or later into a bluish or yellowish tint. It is this which has led some dentists to insert human teeth upon foundation of the sea-horse material.

When we have determined to do this, we must take care not to arrange the grain of the bone perpendicularly ; it ought to be horizontal and crosswise, because, in this position, the bony substance offers more solidity.

Maggiolo has left us a very good article upon the preparation of the tusks of the hippopotamus. When we happen to procure them of sufficient size, we saw them into two parts along their whole length, and from each side select the pieces we wish. As to the enamel, as it is rather hurtful than useful, we take it off in scales by a chisel struck by a mallet. When this is done, we place the material in the cellar, so that it may be preserved from splitting, and may not become too dry for carving when wanted.

If we only need a fragment for one or more teeth, we choose an incisor, which we cut into slices of suitable size, and blanch the enamel upon the grindstone.

Use is also occasionally made of the teeth of whales and certain amphibious animals, which, in commerce, are sometimes found mixed with those of the sea-horse. They are strong enough, but they differ very much from the latter in form, and are very inferior for wearing.

By what we have said, it will appear, that the sea-horse teeth never can be made perfectly to imitate nature. At first they are too white, but they soon become bluish, and thus betray the artifice of the dentist.

Sec. 5. *Human Teeth.*

Some dentists, M. Delabarre, among them, have expressed scruples about employing teeth taken from dead bodies. As, for the most part, the teeth are taken from subjects destined to be cut into a thousand pieces in dissecting rooms, we cannot see how the extraction of the teeth can add to the profanation of these miserable relics taken from the hospitals of the metropolis. We have partaken of the indignation with which all French dentists regard transplantation of teeth, but we see nothing to condemn in the use of the teeth of dead subjects.

Of all materials which have been lauded for the prothesis, human teeth are, beyond all contradiction, the best suited for the purpose. They supply the place of organs precisely identical, and, after a little time, become so completely like their neighbors that the substitution cannot be detected.

Not only are these teeth procured from the dead of our hospitals, as I have said, but there are people, who, like the sharks which follow in the wake of a ship, wait for the conclusion of battles, in order that they may extract the best teeth from the dead bodies stretched upon the ground. There is certainly something in this trade which it is painful to think of, yet the kind thus obtained are certainly most durable. Those procured from hospitals seem to partake of the successive changes wrought by disease, while those from the field of battle are taken from persons slain in full health, and in the vigor of life. This last point is more important than is supposed. From the eighteenth to the fortieth year, they possess all the hardness and firmness desirable, and are in condition to resist longest the corrosive action of the saliva and gases which are extracted from the stomach. When the teeth are procured from younger persons they are too tender; their canal is too large, and they readily yield to the means of destruction which assail them.

As to those of old men, it is true that they are hard enough. Their canal is almost entirely obliterated, but they are liable to the serious objection of having a yellow hue which will increase, and also of being liable to crack. Thus, then, the teeth of adults are the most perfect, especially if extracted early. We must not forget that caries of an artificial tooth proceeds precisely as it does in a living one, a reason why we should be careful to select those that are perfectly sound. We will also remark, that when teeth are reddish or blackish in the interior, they very readily blacken in the mouth, and last but a short time in comparison with those which possess all the conditions enumerated above.

It is not sufficient to know how to choose teeth, we must also know how to preserve them. For this, they must be subjected to a preparation which fits them to be used, subsequently, to the greatest advantage. The first point is to remove them, from the subject without breaking any part of the enamel; then to detach fragments of the alveoli, periosteum, or tartar from them. This being done, they are pierced at the extremity of their roots, so as to be arranged in sets, upon a thread, which passes through the hole thus made. The teeth of each individual being kept together to form a set.

When they have been thus disposed, they are steeped in water, seven or eight days; the water being changed every twenty-four hours. If any foreign matter remain upon the teeth, it may be removed with pumice-stone, powdered on a piece of soft wood. We recommend, in opposition to certain writers, that the little yellow spots, which may be found upon the enamel, should not be removed, for we may meet with cases where these little spots will be very valuable, as they will match others which present similar peculiarity.

The teeth generally chosen, are the eight of the upper jaw, viz. the four incisors, two canines, and two small molars. Nevertheless, it is well to be provided with corresponding teeth of the lower jaw, in case we should need to make a complete lower set.

What is more important than all the rest is, to preserve them pure and sound, as when prepared for use. For this purpose,

they must be covered with some substance which may preserve them from the influence of the air, and from heat and cold. Some use finely levigated stone, others bran, others saw-dust. As for ourselves, we have been happy in the choice of flax-seed, which answers all purposes perfectly well.

We will only mention the mixture of alcohol and water, into which some dentists are in the habit of plunging teeth to be preserved, to express our disapprobation of so bad a plan. The teeth thus kept will grow yellow and crack, whenever they are, unluckily, exposed for a few hours to the air.

We cannot conclude this paragraph without advising never to use the teeth found in grave-yards. Having been in the ground for several years, their enamel has, always, lost its brilliancy; besides, when we work them, they break under the slightest shock, and when worn, they blacken and undergo prompt alteration under the salivary action.

However perfectly we may imitate nature by the substitution of human teeth, we cannot conceal the fact, that like all other animal substances, they are permeable, and, therefore, will soften, become carious, and decompose with more or less rapidity. They tarnish, grow yellow, and give the mouth a very disagreeable odor. These are the inconveniences, unfortunately too real, which have led to the manufacture of teeth from earths, susceptible of being hardened by baking, and of being enamelled almost like porcelain. These have received the name of "*Incorruptible Teeth.*"

Sec. 6. *Mineral Teeth.*

At the conclusion of this third part, we propose to enter upon some details, upon the manner of fabricating mineral teeth. To do so now, would be to fetter our thoughts, and interrupt their chain, we will content ourselves, therefore, for the present, with the simple history of mineral teeth.

M. Duchateau, apothecary at Saint-Germain-en-Laye, had a set of ivory teeth, from which he suffered a good deal of pain. In 1774, he conceived the idea of removing them, and substituting one of porcelain. For this purpose, he applied to the

porcelain factory of M. Guerhard, at Paris, but as the first essays were unsuccessful, owing to the drying of the porcelain in the oven, and the impossibility of preventing shrinking, M. Duchateau employed the unbaked porcelain. In order to perfect these efforts, and, especially, to get knowledge upon the manner of applying the set, he addressed himself to many distinguished dentists, and among others to M. de Chemant, then a dentist at Paris.

The composition of this tender paste received an addition of coloring earths, which made it more fusible, and more easily baked at a simple fire. It was, after many attempts, that he obtained at last a piece of greyish-white, bordering on yellow, and very little warped. This was the best which he had obtained, for it was capable of being used.

Encouraged by this success, he wished to construct teeth for people of quality, but being entirely ignorant of dentistry, he never succeeded. Nevertheless, in 1776, the academy of medicine, to which he communicated his invention, voted him their thanks, and granted him the honor of a seat.

M. de Chemant took up the idea where M. Duchateau had left it. He ameliorated the composition by employing the sand of Fontainebleau, the soda of Alicant, marl, red oxyd of iron, and cobalt. In a word, he succeeded in making and inserting many sets, so well, indeed, that about twelve years after, he obtained a patent from Louis XVI. Oh! Americus Vespucius, it was thou who gavest thy name to Columbia! So goes the world—inventors wear themselves out with thought, ruin themselves by expensive experiments, and, after all, never reap the fruit of their labors!!!

Since then, Messrs. Desforges and Maury have fabricated and inserted this kind of teeth with great success. We, ourselves, have made great use of them, and our patients have never complained of them.

If we are asked for our opinion, as to the different substances employed for the preparation of artificial teeth, we will say,

1st. That the hippopotamus material is best when we have to execute work of great extent. It is, especially, precious for the formation of foundations for human teeth.

2. That human teeth, for the reason that they take the place of organs of the same nature, are daily employed with the greatest advantage.

3d. That incorruptible teeth, in the degree of perfection to which they have now been brought, leave nothing to be desired as regards the imitation of nature, hardness, and their usefulness under all circumstances.

Some authors, among whom is Gariot, maintain, that it is the province of the dentist to place the pieces, and point out the mode of manufacture, but that the making of them should be left to workmen employed for that purpose. We cannot too strongly resist this view of the subject. To succeed in any thing, we must be able, if necessary, to put our own hands to the work, and, indeed, to have sufficient activity and love for one's art, to do so often. Common sense dictates the precept, that to be masters of any thing, we must first be apprentices.

The public, who, in this case, are the best judges whom we can call to aid our opinion, when they speak well of a dentist, never fail to add, that he makes his own artificial teeth. Therefore, before embracing this profession, it will be well to consult tastes and aptitudes, and to be well assured that one has the mechanical talent sufficient for it.

Sec. 7. *Upon some objections to Artificial Teeth.*

It is generally remarked, and with truth, that artificial teeth can never perform one of the principal functions of the natural organs, namely, mastication. Indeed, if we eat without much precaution, upon an artificial tooth, in chewing aliment somewhat hard, we will run great risk of loosening the natural teeth which support it, or to luxate entirely the root on which its pivot is placed.

This objection is somewhat puerile. It is certain that, however perfect mechanical contrivances may be, it is impossible that an artificial organ can render the same service as that whose place it supplies more or less imperfectly, but, because an invalid cannot run a race with a wooden leg, are we to say that it is of no use to him? The same remark applies to arti-

ficial teeth, which possess this peculiarity, that the greater their extent, the more resistance they offer in the efforts at mastication.

Many old people, who had passed the age, when they might have applied to a dentist for purposes of coquetry, have been furnished by us with complete sets of teeth, to enable them to eat the crust of bread, which, as every body knows, is more nourishing than the crumb. None of them were disappointed, and we have often had the satisfaction to see them return to our office to thank us for the service we had rendered, in restoring health, which had become wretched and tottering, in consequence of laborious digestion, the invariable sequel of imperfect mastication.

Here, then, we see one of the principal objections reduced to its proper worth. As to the services which artificial teeth can render, they are incontestable. One of the most important, beyond contradiction, is, the restoration of clearness and precision to the pronunciation. A fact easy to understand, after what we have said at the beginning of this third part.

A reproach to which it will be more difficult to reply, is the bad odor which exhales from teeth made of dead animal substances. They require great attention to cleanliness, and they must be renewed as soon as they begin to be decomposed, which happens in a longer or shorter time, according as the qualities of the buccal mucus are more or less active.

When the saliva is so acid as to destroy the teeth almost as fast they can be made, we must employ mineral teeth, which are really incorruptible, and require no farther care than if they rested naturally in the alveoli.

Persons ignorant of dentistry, suppose that the insertion of an artificial tooth, is a very painful thing. This apprehension is entirely unfounded and chimerical. It never happens when the operation is performed by a good practicien, when the gums are sound, without swelling or irritation, and when the root is not the seat of any diseases, neither in its interior, nor in the alveolar periosteum. But it is the state of the gums which requires the greatest attention.

We can, also, complain that animal teeth, into which pla-

tina pivots are screwed, become loose, through the enlargement of the canal of the screw. Mineral teeth, however, are not subject to this evil, and can only fail upon the infliction of a blow sufficient to break them.

Finally, many persons suppose that artificial teeth are very troublesome, because they must be removed from the mouth every night. This is not so. They need never be removed, even to clean them.

This remark applies, especially, to the teeth whose pivots or clasps must not be deranged for fear of destroying their firmness. Entire sets must be cleansed out of the mouth, but less frequently than is supposed.

To conclude, we advise our professional friends to advertise the lady, for whom they have inserted an artificial tooth, that she will, at first, experience a sort of difficulty and embarrassment in the movements of the tongue and the articulation of words. But a few days will suffice to accustom the parts to the presence of the new guest, and to render the pronunciation more easy, and the tones of the voice more agreeable than before.

CHAPTER XIV.

In the preceding chapter we have discussed generalities, which we thought indispensable, to give the neophytes of our profession a first idea of all which concerns dental prothesis. Now, we proceed to explain every particular, and in the circumstantial details which we will give, with all the precision we can, we will furnish all elements necessary to guide the first essays of any who may wish to practice our art. We will begin by describing the way to take impressions.

Sec. 1. *Best way of taking Impressions.*

Our first masters, to whom the idea of taking an impression of the mouth, in which they wished to repair the devastations

of caries, had never occurred, were compelled to have the patient always under their hands, and to make a thousand trials upon the mouth itself, before succeeding. All this was distressing enough to the dentist, and much more so to the patient, who, besides the loss of his time, was compelled to open and shut his mouth a great number of times before he could be delivered from this true torture.

Assuredly, it is a great improvement to take a cast of the mouth with geometrical accuracy. The artist having the model before him, can, at his leisure, proportion upon it the dimensions, configuration, and direction of his work.

Before setting to work to prepare an artificial tooth, the first thing to be done is to arrange properly the place which it must occupy, to take a model of it, and of the neighboring, and, sometimes, even of the antagonist teeth, in order the better to combine the relations which the artificial teeth will have with the natural ones of the opposite jaw.

Some dentists employ a preparation of modeling wax, colored red, in order to take the impression. This is made of ten parts of wax, and one part of turpentine. Although this preparation has the advantage of being very pliable, it is subject to the inconvenience of softening very easily, so that, however cautious we may be in taking away the wax, it will be deformed, and the plaster or whatever other substance we run into it, gives a model, which is, by no means, a faithful representation of the dental series.

As, for ourselves, it is our opinion, that pure wax, as it occurs in commerce will perfectly fulfil the end desired. We may color it with cochineal, or some other harmless dye. Practice teaches us the quantity which will be sufficient to fill the void left by the tooth, and for enveloping one, two or even three of those which adjoin it on either side. The wax may be well warmed in hot water, or even by the warmth of a fire, while working it with the pulps of the fingers, and which ever of these means be employed, we must take care that the entire mass be well penetrated with caloric, even to the point bordering on fusion. We must also take care not to apply it to the fire in such a way that the external parts may be almost melted, while the internal are

scarcely warmed. In such case it will be brittle under the fingers, instead of presenting a soft and ductile mass. There is but one way of reducing it to this state, which is by the warm-bath, and we employ no other.

The wax being suitably softened, and the conduit of the root being prepared, as we have already said, we introduce into it a a pivot of wood, which fills the dental canal sufficiently well to preserve the direction of it, especially, when so arranged as to pass the other teeth, two or three lines. Then we take the wax, suitably warmed, and giving it an elongated cylindrical form, about the thickness of the finger, we present it to the portion of the jaw of which we desire to take a model; we apply it regularly, below, and direct pressure upon it in such a way as to cover the neighboring teeth and their gums. This done, for about a minute we leave the wax in this position, in order to give it time to cool a little.

Before removing the wax, there is a very essential precaution to be taken, which is to press with the finger from below, upward, upon the spot which corresponds to the pivot, which we should have made to diminish a little at its extremity. By this little manœuvre we cause it to pass through, and seizing it with a forceps we draw it forward about a line. It requires care and dexterity, lest in doing this, we do not change the direction. Nothing now remains but to take away the wax, taking care not to alter its shape by pressure with the fingers. Immediately, that it is withdrawn, we push back the little peg with the finger into its place, in order to preserve an idea of the length which must be given to the metallic pivot.

Before passing to the second operation which is to take the mould, we must wait until the impression is sufficiently cold, and we must avoid laying it down upon a very cold body, such as marble, because, in cooling unequally, the form of the mould varies, and loses its correctness. A woollen cloth is the best place for cooling the wax upon.

It only remains to temper the plaster, which should be liquid enough to descend, of itself, to the bottom of the little cavities which the teeth have left in the wax. Whenever we are in a hurry to have the model, and, consequently, wish the plaster to

solidify promptly, the best means is to add to the water, in which we dissolve it, a fourth part of a solution of sea-salt, in saturation. A good precaution, in order to make the model more solid, is to implant threads of wire in the mould, at each tooth to be represented. In this way we can fashion above the plates which are to support the artificial teeth, without the fear of seeing the plaster teeth break, which happens too often when we neglect this precaution. To introduce the plaster, we let it glide, layer by layer, commencing at the place where a prominence corresponds to the empty space in the jaw. If we pour the plaster in too fast, and in too great quantity, the air will not have time to escape, but will form porosities and bubbles, which disfigure the model, and, at the same time, impair its strength and perfection.

An important thing which we have omitted to mention in this description, which is already very complicated, is, before introducing the plaster, to form upon the impression a border with glazier's putty, or a little thick paper folded, so that none of the plaster can escape. This border should be about an inch high; it will be seen how it will secure the solidity of the model.

The plaster should be of the fine kind, called "figure plaster." We should stir it as little as possible, lest we fill it with a great quantity of air-bubbles, which, in escaping, will certainly produce blemishes. As to the threads of wire, of which we have spoken, they are to be inserted in the plaster when it is yet liquid. The task of the dentist is not yet completed, he must yet extricate his model from the wax-mould. To do this, he first removes the putty, playing cards, or whatever else he has used to make the border, he softens the wax a little with hot water, it being understood that the plaster is sufficiently hard, and the mould is removed with the greatest ease. We may accomplish the same end by removing the wax in fragments without softening it, but we run the risk of breaking some part of the model, and if this part be indispensable, we must do our whole work over again. It is better then to take care; the way we have explained takes a little time and patience, but it is much more sure.

Sec. 2. *Preparation of a Metallic Model.*

When the model which we have prepared, is found to be devoid of prominences and depressions which would be obstacles to withdrawing it from the middle of a substance enclosing it hermetically on every side, but that from which it is to be extracted, nothing is more simple than the process of forming a metallic model. We take a lump of potter's clay, sufficiently humid, and carefully insert the plaster cast into it, and in order that the impression may be exact, we press the clay upon the cast in all directions; we then carefully withdraw the cast without enlarging the opening, and when the metal is in a melted state, we slowly pour it into the mould of clay thus formed.

This applies, especially, to casts in lead, but when we wish to employ copper, we must employ the means used by founders. That is to say, we take founder's-sand, slightly moistened, press it strongly against the cast so as to make it receive the impression of all its parts, and if the model has no inequalities, make as many inner moulds of sand as is necessary for reliefs. When once the impression has been carefully made, a conduit of melted copper is led into it, after having taken the precaution to let the sand dry a little to facilitate the running of the metal. We need not be surprised if this kind of model wants the precision of the preceding ones. The pieces which confine it will always vary a little, and thus require careful reparation after the models. This is affected in the following way: First, we steep the font thus obtained, in a little water, and as it is generally rough, smooth it with very fine grit and a piece of soft wood.

The object of procuring these metallic models is, that we have a material firm enough to permit us to stamp plates of gold or platina upon it. But in order to this, we must have a counter-mould, for to stamp a plate it must be placed between two bodies more resisting than itself, so that, by the impression of a heavy mallet, we may give it exactly the shape desired.

Let us then consider the counter-mould. It is indispensable that it be made of metal much more soft than the mould. Thus,

then, the mould may be made of an alloy of bismuth, with alloys of tin and lead in a font of copper, or, rather of iron, while pure lead is preferable for the counter-mould.

There are two ways of executing the counter-mould. The first is, to take, as before, a piece of potter's-clay, a little moist, or of fine founder's-sand, contained in a box; then we place the metal cast flat upon it, and press it to the depth of four or five lines. This done, we surround it with a piece of tin or playing card, leaving between it and the model an interval of some lines. This should be so done that the lead cannot escape. Finally, when all is ready, the melted metal may be poured on to the depth of one or two centimetres. The second procedure is yet more simple. In some clay, we form a hollow corresponding in form to the first mould, we pour the melted metal into it, and when the latter is upon the point of solidifying, we place the model in it, in such a way, that all the parts to be used in stamping are instantly covered. In each case we let the moulds cool, and separate them with blows of a hammer.

Sec. 3. *Insertion of Artificial Teeth.*

Whatever may be the number of teeth wanted in a jaw, it is always possible to replace them. Whether, two, three or four, a whole arch, or even a full set above and below, be needed, we can adjust these pieces with so great perfection, that so far as appearance, and some of the uses are concerned, they can supply the place of their predecessors. There are different ways of keeping them in place; we have pivots or metal plates, or foundations of sea-horse material fixed by ligatures, hooks or springs. All this is, of course, subordinate to the primitive arrangement of the natural teeth.

All the incisors, the four canines, and the two first small molars may be replaced by pivot teeth, at least, whenever their roots remain, or present, by their healthy condition, a suitable point of support. When this is not the case, we must have recourse to metal plates, a complicated means, and inferior to the preceding.

We will begin by describing the manner of inserting a pivot tooth.

Sec. 4. *Pivot Teeth.*

Before inserting a pivot tooth, the first thing to be done is to prepare a place for it, and the procedure differs accordingly as the tooth remains, wholly, or in great part, or presents only a few sharp fragments, the debris of the crown.

To give an example of the first kind. It happens, every day, that a lady, the enamel of one or more of whose incisors is destroyed by caries, which erodes the anterior of these organs, desires to be rid of the very disagreeable deformity occasioned by the spots which alter the color of the teeth or cavities which change their form. When we have to do with such a tooth, it is not necessary, as certain writers advise, to employ cutting forceps, to take away the crown, under the supposition that the operation is less painful. Besides, that the shock thus inflicted gives at least as much pain as the saw when rapidly used, we run the risk of breaking the root which, then, would not be fit to bear the pivot. It is then to the saw that we should have recourse, but before using it, we should touch the tooth with a stylet or sound, to ascertain whether the nerves have been destroyed. Sometimes the eye alone will satisfy us of this. If we are assured that the vasculo-nervous organ still exists, it is well to warn the patient that there will be a little pain to bear. When he consents to endure it, we ascertain whether, at the level of the neck, the space which separates it from the adjoining tooth, will permit the introduction of the saw. If not, we use the file to enlarge the opening, remembering to use only the diseased tooth. This being done, we take a very fine saw, and perform a section of the tooth, following precisely the contour of the gum. To avoid the saw being entangled, we moisten it frequently during the operation, which, with a proper saw, will not last but a half minute. If, in spite of the utmost care, the section is, nevertheless, irregular, or has not been made sufficiently near the gum, we must take a round file, and not a scaling instrument, and with it file down the root, until the gum, overlapping it a little, may cover the point of junction comprised between the root and the artificial tooth.

If the nerve be still sensitive, we must take a steel stylet, very sharp, and not tempered, bent at a half millimetre from its extremity, and before proceeding to the little operation, we must fix the head of the patient firmly against ourselves and the back of the chair, pass the left arm round the head, raise the lip with the thumb, and make the index finger slide into the interior of the palate, in such a way that the root may be comprised between the two fingers. These precautions taken, we introduce the instrument very quickly and without feeling the way, to the very extremity of the root. At this moment, the patient generally raises his hand, suddenly, towards yours, to arrest the impulsion. The operator should be on his guard against this, and make such good use of the time as to accomplish his object before this effort can be made. It only remains to draw the instrument out, giving it a rapid turn, so that it may bring with it the dental nerve.

By the cavity of the dental canal, nature herself seems to have indicated the best means of replacing teeth by introducing them into it by a pivot. But this canal needs to be prepared by art. For this purpose we make use of a squarer of untempered steel, two centimetres long, with three faces, and cutting edges, mounted upon an octagonal handle four or five centimetres long. We reject the five-sided instrument, because it clogs more quickly with the detritus of the tooth, and, consequently, is more apt to break during the operation, which is a diabolical accident. We must have several of these instruments of different sizes. The first used should be finer at the end than the base, that is to say, of a conical form, so that the point engaging itself without difficulty, in the passage already existing, may make it easy to follow the direction. The second, and larger, should be a little less conical, and, finally, the third or fourth as the case may be, should be exactly cylindrical, from one end to the other, so that the pivot, also cylindrical, may adapt itself to the canal with more exactitude and firmness, we may readily see that a conical plug would naturally tend to fall out by its own weight. Although the instrument be triangular, unless care be taken to draw it out, and wet it from time to time, it may become fixed and break. When the hole has been well bored,

we take a stylet wrapped with a little cotton, and steeped in spirits of wine, to cleanse the interior of the canal, where some detritus will yet remain; a little operation which has also the advantage of completely drying the cavity just enlarged.

We beg the pardon of our readers for the "agains," "finallies," and "so that's," by which we are so often compelled to bind our phrases together, but there are such a prodigious number of details, that we do not know how else to arrange them. Thus, then, it remains for us to say, that in the preceding directions, we have supposed the dental nerve still to exist. When the caries has penetrated the canal, the vascular nervous ganglion itself is often destroyed, a very happy circumstance, for then the operation is entirely without pain.

Let us now suppose the second case, where the whole crown, has been totally wasted away, or a little of it is wanting. The saw is useless here. The cutting pincers and the file suffice to take away the little debris which extend beyond the gum. We may observe, that this kind of roots are less durable than those to which the crown remains.

Sec. 5. *Mode of Inserting Pivot Teeth.*

In the first place, we say in the outset, that, cost what trouble it may, the dentist should accustom himself to take an impression of the part of the jaw whose void he wishes to fill. This is the most certain way of giving to his work all the perfection and solidity desirable. We cannot too strongly condemn the method of Maury, which consists in preparing the place, taking measures for the length of the pivot, and daubing the dental arch and the palate of the patient with red coloring matter, in order to take upon his person the necessary steps for the exact jointing of the tooth with the root. Besides, the length of the process, it ought to be as killing to the dentist as to the patient.

It is, then, a thousand times better to make a pivot, push it to the bottom of the root, and then take a model as above described. This once done, the patient may go home. The dentist no longer needs him in order to prepare the tooth, and he escapes the frequent manipulations which we have so strongly censured.

When once the plaster-model is made, we prepare the tooth, either animal or mineral, as we prefer. As we will not describe the way of soldering the pivots of the mineral teeth until we speak of united pieces, for the present, we will suppose that the selected tooth is human. In this case we begin by sawing the tooth near the neck. But, in the first place, we must select it with judgment, of the same kind, and belonging to the same side as the one to be replaced. It is well that it should come from an individual nearly of the same age as the one in whom it is to be inserted. It is indispensable that it be of the same color, and of this we cannot be assured until we have soaked it for a half hour in warm water. After having sawed off the neck, we cover the place in the model, corresponding to the vacancy to be supplied, with a layer of red paint, not too thick, and upon this we apply the tooth by its upper, or lower extremity if it belong to the lower jaw. We can thus ascertain how much must be removed in order to perfect co-operation, upon which, we must remember, depends the solidity, and durability of the tooth.

These trials, often numerous, require a great deal of patience, and we doubt, that upon the living subject, we could arrive at the same degree of exactness as upon a plaster-cast, always under the eye and hand.

As to the pivot, the wooden one gives you the size, length and direction, better that any means you can take. It is, therefore upon this pivot that we form the model to fashion the gold or platina one, which is to serve as the means of union between the root and its new crown. We introduce one of its extremities into the proper instrument for giving it a screw-form, so as to fix it into the tooth, into which it must also be riveted, to secure the solidity by a double guaranty.

Now that the tooth and pivot are prepared, we proceed to fix the latter in the root. Maury advises to make some little notches in it with a knife. We consider this advice to be of little importance. He also advises to surround it with the whitish epidermis, which covers the external bark of the birch-tree. "These pellicules," he says, "being composed almost entirely of resin, resist the longest maceration," and, again, "they answer

better than cork, hard-wood, filaments of asbestos, and they do not, as thread, cotton and silk, alter readily, and contract a fetid odor." In our days, we have discarded all these substances in favor of gold, lead and platina, beaten into leaves sufficiently thick to be wrapped round the pivot and offer some resistance to it. When the pivot is thus furnished with a metallic leaf, we seize the tooth with the fingers; some dentists use ivory forceps for this, and present it to the orifice, pressing it so rapidly, that the metallic leaves have not time to be torn and turned down upon the pivot. This done, we assure ourselves of the solidity of the tooth by some tractions and slight touches.

We have omitted an important point in this description, which is to place the tooth in its place, without the wrapping of the pivot, in order to make ourselves certain whether the teeth of the opposite jaw do not strike against it; for such a shock, constantly occurring, would be very painful to the patient, and disastrous to the duration of the tooth. When we find that it would be pushed forwards by one of the opposite teeth, we must take it away, rub it down on the grindstone, or lessen it with the scaler, and then make a new trial.

When we insert an animal tooth, we object to the use of leaf of lead, because, in the long run, it will oxydize, and some particles of it, penetrating the porosities of the tooth, will give it a blackish hue. When we use a mineral tooth there is not the same difficulty, and we will say, that if lead does impart a villainous hue to the animal teeth, it gives so great solidity to the pivot, that it is difficult to extract it. We cannot recommend it too highly when using mineral teeth.

When we wish to give a pivot-tooth the utmost solidity, and also to preserve the root upon which it is to be fixed, we prepare the root by making a little larger hole than in ordinary cases. Into this hole we screw a gold cylinder, hollow and open throughout its whole length, exteriorily and interiorily. This done, we fix in the artificial tooth which is to replace the lost one, a cylinder perforated on the exterior only, and of an equal diameter. The difficulty is to give the two cylinders the same direction, and place them exactly opposite one another. To arrive at this precision, we must only be governed by the mould,

which gives at once the exact place and direction of the pivot, which has been placed in the cylinder. When the two tubes are ready, we prepare a suitable screw, of a size proportioned to the diameter of the cylinders, place the artificial tooth in its place, turn the screw which fixes itself in the root, and the artificial tooth will find itself fixed and pressed against the root with a precision which cannot be obtained by any other process.

We may perceive, without difficulty, that we may change the artificial tooth three or four times, without giving to the root sufficient shocks to compromise its durability. Neither need we fear the breaking of the pivot in the dental canal, an accident so serious to the patient and the dentist.

Whenever the patient can make the sacrifice attendant upon so long and complicated a process, you cannot do better than to replace the tooth by an artificial piece thus prepared.

We are not always happy enough to find the root in good condition. It is then that the genius of the dentist must devise some means of remedying this obstacle. Some recommend to bury in the root some small wedges of wood. This is a bad plan, for the saliva and debris of alimentary matters do not delay to make it a centre of putrefaction; the least injurious, we think, is a small metal envelope which hinders the pivot from vacillating at the orifice of the root, while it seeks at the extremity of it whatever of solidity remains, in order to find a point of support.

We meet with roots more or less carious in their length, or, rather, whose alveolar periosteum is affected towards the extremity of their canal, with purulent inflammation, which gives rise to a discharge of pus, of greater or less extent.

This affection, which is particularly apt to occur in persons still young, between twenty and thirty, for instance, has, hitherto, been regarded as a decided contra-indication to the insertion of pivot-teeth. A very pretty girl, who found herself in this predicament, and was very anxious to conceal a little breach which spoiled her smile, suggested to us the idea of a hollow pivot, so that the matter might traverse it from one end to the other. We folded a little plate of platina upon itself, forming a longitudinal canal, and then managed it, as though it were an

ordinary pivot, except that we cut the upper end like the beak of a flute so that the canal was not obstructed, and, finally, we rivetted the inferior extremity by means of a very blunt instrument in such a way as to turn outwards the borders of this little tube. The result fully answered our expectations, and since then we have often employed the same means, which has never failed us.

The most unpleasant accident that can occur in fixing a pivot-tooth, is to have the metallic pivot break in the dental canal. There are two ways of remedying this. When the pivot is but little above the plane of the orifice of the root, and yet cannot be seized by the forceps, we avail ourselves of a drill which wears down the root circularly, so as to disengage a little more of the end of the pivot. But when in the depth of the root, I have had recourse to small steel tubes, terminated by saw-teeth, which are drills in miniature. I select one whose hole can hardly enclose the pivot. This is only to begin with. Then I take another yet smaller, and with this I work upon the pivot only, thinning it to the height of ten millimetres, without attacking the root itself, which should be saved, in order to serve for the insertion; finally, I take another tube of a calibre somewhat smaller than the last, and opened interiorily. I screw this instrument, cautiously, upon the thin extremity of the pivot, which becomes sufficiently fixed to permit its extraction. This is performed in the following way: I sustain the two neighboring teeth, with the index and thumb of the left hand, and, then, with the other hand, I slowly draw the handle of the instrument in the straightest direction possible. Ordinarily, the pivot yields to the first effort.

Either from peculiar predisposition, or from some disease of the root, or of the alveolus, it sometimes happens after the insertion of a pivot-tooth, that an abscess appears in the gums, which may change to a fistula, or a general phlegmasia, called fluxion, or a pain resembling odontalgia. Before taking away the tooth, which occasions these disorders, we should combat the disease with antiphlogistics and revulsives, leeches to the angle of the jaws, gargles, local bathing, with a decoction of mallow-flowers, rendered slightly narcotic by one or two poppy-heads. Irritating pediluvia, are also very useful.

After what we have said of pivot-teeth, it will readily be admitted that they are the most solid, and afford the best resemblance to the original. Unhappily, the bad state of the roots, or their complete destruction sometimes forbids us to recur to this procedure, and then we must use plates, ligatures, hooks, and springs, which we will describe, together with the manner of stamping plates, and placing ligatures.

Sec. 6. *Manner of Stamping Plates.*

We will not repeat the method of obtaining the moulds and counter-moulds, which serve for stamping plates. To make these last undergo this operation, we make a protector, either of strong paper, or a leaf of lead about a millimetre thick. This is placed between the moulds and slightly stamped. When this new protector has been procured, we use it to cut out the true plate, which we do with the greatest care. It is the best means of economising the gold or platina, which we are to employ.

It is indispensable to begin by heating the metallic plate, in order to give it more ductility, then we give it the print of the mould, either with the fingers or with pincers, whose jaws have been rounded. When this first impression has been brought to the perfection desired, we place the plate between the mould and counter-mould; then, in order to prevent deforming it, we strike it from above, giving light blows with a hammer. All this is only to prepare it for the last operation, which consists in placing the whole apparatus upon an iron anvil, and covering it with the proper covering, in order to strike upon it with a heavy hammer. This procedure enables us to stamp the plate much more regularly, than if we struck immediately upon the counter-mould.

It only remains to finish with the file the plate thus stamped. If dentists had not adopted this very ingenious plan, it would have been impossible for them to have inserted their artificial teeth, in the mouth, with the admirable precision which is attained in our day.

Sec. 7. *Of Ligatures.*

Before speaking of the plates, which would naturally follow the description of the mode of stamping them, it is indispensable to say a word about the different ligatures used to sustain the artificial pieces.

We number four ligatures, ordinarily employed to keep artificial teeth in place, viz. the ligature of unboiled silk, another called the Chinese root, the Florence hair, and, finally, threads of platina or pure gold.

We will begin by informing the reader that the ligatures for a long time employed, not only to fix the pieces but also to attach human teeth upon bases of sea-horse material or metallic plates, are execrable instrumentalities, which should never be used, except in extraordinary cases, and where they are altogether temporary.

Thus the silk-thread is not to be despised, when we would adapt a piece for the first time, and when we would fix the piece against the neighboring one's, especially, when these last are exceedingly short, or when, on the contrary, they are extensively denuded of the gum.

In every case, it is very soon necessary to exchange the thread of unboiled silk, for the Florence hair, which we think preferable, for reasons presently to be given. But, in the employment of this means, there is a great difficulty to overcome in obtaining the dexterity necessary to form the knot in such a way that it will be lodged exactly in the interval between the two teeth. In order to do this, we tie the two tails of the ligature by causing them to pass, the one before, the other behind the jaw, and so direct the crossing of the threads, that they shall end and fix themselves immediately upon the side of the tooth. The end proposed, in this arrangement, is to prevent the extremities of the thread from wounding the tongue or lips.

Now we will say a word about the silk-thread, in order to exhibit its inconveniences. The unboiled silk, it is true, alters less promptly than ligatures of the ordinary silk, hemp or thread ;

but, when it is applied upon the teeth it is very apparent, and when it is more twisted than ordinary, it swells very much, and shortens sufficiently to cut the tooth in a very little time, if no attention be paid to it.

The Florence hair, is nothing else than a preparation made with silk-worms taken at the moment when they are about to spin. They are steeped in vinegar, and having been stretched into threads of two feet in length, they are fastened by the extremities, and placed upon boards to dry. Very much more solid than the unboiled silk, this ligature has the advantage of being very transparent, which prevents its being perceived upon the teeth. Nevertheless, it is attended with one inconvenience, the humidity causes it to elongate. This, however, may be avoided by preserving it in water, or steeping it in warm water, a half hour before use.

We no longer use the Chinese root, a fanciful name given to a thread of unboiled silk, well twisted, and drawn out, and covered with copal resin.

As to metallic ligatures, we should only employ them in very rare cases. They are hardly applicable to very large pieces, and when the ligature is to be applied to the large molars. As to the rest, as we have recommended with regard to other ligatures, when we seize the extremities of the gold or platina thread, which we have previously carefully subjected to heat, it is necessary to twist them together with the pincers in such a way that the knot will be found between the interval of the molars, for, otherwise, it will wound the lips or tongue more than the Florence thread.

Metallic ligatures are more difficult to disguise than the others, and, besides, they more readily cut the teeth upon which they are applied.

Sec. 8. *Plates, Hooks and Springs.*

In speaking of the manner of stamping plates, we have already explained the principal conditions which they should fulfil, in order to supply as exactly as possible, the space occupied by the natural teeth. We have but few things to add. These

plates are always of gold or platina. It is necessary that they be adapted with great precision to the alveolar border, and that, in certain cases, they should pass it for the space of several lines on the internal surface. It is well, also, so to manage the pressure which they exert, that they may not depress the gums too much, and that they shall not denude the neighboring teeth.

Hooks, which in defect of pivots, are the most solid and most durable means of attachment, are, like the plates, made of gold. They are little half-rounded branches, which are soldered to artificial teeth, in order to fix them to the neighboring ones. The direction of this kind of claws should always be taken upon the plaster-model, according to the disposition of the gums themselves, beneath which they are to act, so that they shall not betray the existence of an artificial tooth when the patient has occasion to smile, or open his mouth fully. These metallic pieces should always be subjected to heat again, as before observed, in order to increase their consistency, and their form must be determined by that of the gums themselves. We sometimes find it necessary to leave them somewhat visible, because, if they be too narrow, we run the risk of entirely cutting away a tooth already worn by a preceding piece, upon which we fix the hook with more or less force.

Springs, which can only be made of gold of $\frac{750}{1000}$, only differ from the hooks, in that they are often much larger, and that they insinuate themselves into the intervals of two, three, or even four teeth, in turning around them with great exactness, while passing to be fastened upon a more distant tooth, which offers more solid support, and permits the means of attachment to be more completely concealed. Here we strenuously recommend to take an impression of almost the entire jaw, which is to be supplied with new teeth, so as to fashion, with all possible precision, the various curvatures which must be given to the springs.

CHAPTER XV.

COMPOUND SETS.

We have arrived at a very interesting part of dental prothesis, that which regards *compound sets.* It has been agreed to give the name of *pieces* to many teeth, united, among themselves, in different ways, and fixed in the mouth by ligatures, plates, hooks or springs.

Compound pieces are fabricated, either by sculpturing the entire set in a piece of sea-horse material, or by mounting human or mineral teeth upon a base of sea-horse, or upon metallic plates. The latter proceeding is preferable.

Sec. 1. *Pieces of many Teeth, sculptured out of a piece of Sea-Horse Material.*

As must be done, in all cases, when we wish to take an impression, we first prepare the portion of the jaw which is to support the artificial piece. If we find any debris of teeth protruding beyond the gums, they must be removed with the cutting forceps, and smoothed down with the file. This method is much better than removing the roots, for, as we have said before, the roots help very much to sustain the gums. These first dispositions being taken, we take the impression, by proceeding as already directed.

It is useless to take a metal-cast. The plaster-moulds are even better for the preparation of pieces in hippopotamus material. Maury advises to take two impressions perfectly alike, so as to be provided with two moulds, upon one of which we may begin the piece, and upon the other, finish it with more exactness. We must not forget that the plaster swells in drying, so that the breach is narrower in the model than in the living person. Authors advise simply to take away three or four millimetres from each side with a scraper. This means will not give sufficient precision to it. We advise rather to take wax, such as we use to take impressions, and to fill with

it exactly the interval to be supplied with artificial teeth. In this way we are sure of being just and exact, when the wax perfectly fits the breach in the model. Now we must select the sea-horse material. It should always be larger than the interval to be supplied; it should also be enamelled on its anterior face, in order, that in carving the artificial teeth we may have only to cut and file the enamel upon its superficies. This done, we take up our model, which we cover with a layer of red paint, a little gummed, and moistened with water. The reason why we use the red-dye is, that in applying the piece, we may ascertain the points at which it touches the model, and those where it does not. Indeed, it is easy to perceive, that by carrying the file over all the colored parts, we may, at length, be able to make the hippopotamus piece correspond exactly to the model, of which we are assured, when every part is found to be equally colored, after being applied to the model, which serves to guide the file, and sometimes, though more rarely, the scraper.

When once the base is properly adjusted, we may, fearlessly, set about the carving of the teeth. It is useless to say that we must give them the length, size, aspect, in short, the form of the natural teeth, which they should imitate with the utmost exactness possible.

We do not feel obliged to furnish, in this work, the education of the sculptor. This can only be acquired by going to work, so we will dispense with instructions, which would merely enlarge this book, without being at all useful to the reader.

What we have just said, applies to all compound sets, whatever be the number of teeth which they are destined to replace.

Sec. 2. *Base of Sea-Horse—Natural Teeth.*

Whether it be designed to carve the teeth from the sea-horse material, or to insert human teeth upon it, the first thing to be done is, always to rest its base conveniently upon the alveolar border, with the precautions which we have already mentioned.

As to the face which serves for the implanting the teeth, we will not describe here the manner in which the festoons of gums are carved, as we propose to treat that subject very much in detail, in the third section of this chapter.

This operation being finished, we choose the natural teeth, and assort them in such a way that, as far as possible, they may resemble the teeth to be replaced, it being understood, of course, that they be of similar order, species and series. We saw their roots at a suitable height, and place them upon the sea-horse material in their respective positions, and maintain them there with gum lac, which is far preferable to sealing-wax. Nevertheless, before fixing them thus provisionally, it is necessary to pierce them with two holes, by means of a drill, which may be much better done before they are in position than after. Indeed, it is easy to see that it must be much easier to bore the sea-horse material, when the hole of the tooth guides the instrument. The holes being pierced, we introduce two rivets, of which one extremity is fastened in the heel of the tooth, and the other in the gutter in the bases of the hippopotamus material. Sometimes we employ a strong screw instead of the rivet, especially for the incisor and canine teeth. It is understood, that in this case, we only bore one hole in the middle of the teeth.

It only remains, after thus fastening the teeth, to color the base of sea-horse material, so as to imitate the gums. Nevertheless, we do not proceed to this coloring until we have perfectly polished the piece with wet shave-grass, (a rough herb used for polishing,) and, afterwards, with very fine pumice-stone, sprinkled upon wet linen. We then wash the piece, rubbing it with a soft brush, so as to take away all strange bodies, and proceed to stain the hippopotamus material, in the following manner: We first treat it with hydrochloric acid, diluted with water. We then moisten the tooth in common water, and after having dried it well, we lay on with a pencil many coats of the vinegar, called red vinegar. When the human teeth present some spots, or some inequalities, which it is often proper to preserve, we may remove them with pumice-stone, and polish them with Spanish white.

Sec. 3. *Basis of Sea-Horse—Incorruptible Teeth.*

The base remains the same as far as relates to the gutter by which it encloses the alveolar border. The face by which it is

adapted to the teeth only demands other preparation. According to the number of teeth which are wanted, we make a similar number of rounded notches beneath the anterior face of the artificial base, so as to imitate the gums. We must be careful that these festoons overlap, for the length of a half millimetre, so as to cover the upper extremity of the mineral-tooth, in order that the point of union may not be perceived. When this first work is finished, we stick on, behind the base, as far as the middle of its free and lower face, a band of wax, which may serve to adjust the incorruptible teeth with harmony and propriety. In order to maintain them in the position we thus give them, and, at the same time to enable us to take the measures necessary for adjusting their posterior face, we place in front of them, another band of wax, and withdraw that which is found upon their posterior face.

This change permits us to mark with the point of an instrument, and to circumscribe, with entire exactness, the place which each one of them will occupy. A little further back, at a distance of three or four millimetres, we draw another line to hollow in the interval comprised between that line and the posterior part of the teeth, a trench of about a millimetre deep, which may serve for the attachment of a metallic plate, the use of which we will intimate presently. We then fashion this plate, to adapt it to the trench which has just been made, and when it is finished, we solder to it, all at once, the mineral teeth previously prepared. This is not the place to describe how this soldering is done: we will fill this vacuum some pages farther down.

The teeth being well and solidly soldered, we place the metallic plate in its place, and then make two or three holes with a drill so as to fix it in the sea-horse base, by the aid of a screw called a *drowned* screw; that is to say, we enlarge the superior borders of the hole, so that the head of the screw may be completely buried in it, so as not to injure the gums.

We may, if we cannot do better, content ourselves with two or three rivets; but the screws are infinitely preferable.

We do not know whether this proceeding has been employed by any of our brethren; but, it is certain, that it never was sug-

gested to us by any body, and we have devised it after having rejected, in succession, all the measures suggested by writers, means which only differ from each other in degrees of unsuitableness.

When the gums are much shrunk, and it is necessary to employ the sea-horse material to fill the void, the metallic plate, fixed in this ivory matter, is a means, the more precious, because when the latter is corroded by the saliva, it is easy to detach the plate with the teeth fixed on it, and adapt it on another base.

Sec. 4. *Natural Teeth mounted upon Metallic Plates.*

When we have many teeth to replace, if the roots of each of them present all the solid qualities desirable, we implant pivot-teeth upon them. Now, if among the number, one or two be diseased, we are compelled to recur to another means, whose explanation demands some attention.

1st. When, for instance, of six teeth, we find two diseased, we must be sure not to put four pivots in the set. We plug two or three among them, so that we may be able to use them, when the two we make use of first shall become defective.

2d. When we have only one good root under our control, we must do one of two things. If the root is at one extremity of the breach, we solder to the plate a pivot on one side, and a hook or spring upon the other; or the root is in the middle, and then the plate should have a median pivot, and two hooks or springs at the extremities.

Plates may serve for the attachment either of natural or mineral teeth. When the teeth are natural, the following is the mode in which we habitually proceed. After that the plate has been properly stamped, we fix it upon a plaster-model with gum lac; we mark out the place, which each tooth must occupy, and covering with red color, successively, each point which the teeth ought to occupy. The neck is prepared with a file, in such a way that it exactly fits between the eminences which the models have impressed upon the metallic leaf. When this little operation has been completed for each of them, we pierce

them with one or more holes, according to the necessity of the case; then we stick them upon the plate with gum lac, in such a way that they may guide the drill which must pierce the metal itself.

It only remains then to fix them permanently, either with one or two rivets soldered to the plate, and riveted upon the heel of each tooth, or with a screw. But this means is not as good as the other, because the movements of the tongue will be sufficient to move them, especially in the case of the natural teeth, the tissue of which is so easily softened by the action of the saliva.

Many dentists fail in perfecting their artificial sets, because they are not careful to cut the upper extremity of the teeth in such a way, that making a slight projection above or in advance, they apply so exactly to the gums that they seem to spring out of them. To do so is a salutary advice, which we give once for all, whatever may be the kind of teeth or species of work which we fashion from them.

Sec. 5. *Manner of Working Mineral Teeth.*

Before baking mineral teeth, we implant on their posterior face three little knobs, between which passes a longitudinal furrow. These knobs of platina adhere to the body of the tooth in the most intimate way, and they serve to solder to it, either a pivot or some metallic plate.

Ordinarily this kind of teeth have not the slightest heel, we have found this to be very advantageous, as they are not liable to be rubbed by the teeth of the opposite jaw. Besides they occupy less space in the mouth, and we find it easier to mount them as sets. It is good, nevertheless, especially, when we have only one pivot-tooth to manage, to form a heel in metal, which can be done very readily with solder.

Before describing the way of cutting mineral teeth, we must advertise the reader, that when we have to prepare a pivot-tooth, we immediately submit it to the action of the grindstone. But when we wish to prepare a piece of several teeth, for reasons which we will mention hereafter, we commence by filling with

fused solder the furrow which exists along the whole length of their posterior face, and then we cut them, as though there was no solder there.

To cut the teeth under consideration, we must provide ourselves with a good grindstone, sufficiently hard, twenty-four to thirty-five centimetres in diameter, similar, in short, to those used by grinders. This stone, in which many angles are made upon one of its faces, by elevating it upon its thickness, by the aid of an instrument of untempered steel, presents a sort of cutting instrument, very advantageous for cutting teeth. It turns vertically, and plunges in a trough filled with water. We may add all the accessories which we may think proper, either to catch the teeth which may escape from the fingers, or to hinder the spilling of the water.

Independently of this stone, we should furnish ourselves with a turning instrument, such as is used by glass-cutters. To this may be adapted other Lorraine grindstones, of less hardness, from ten to twelve centimetres in diameter, and from six to eight millimetres thick. We must be sure to moisten them with water whenever we have occasion to use them. Maury prefers grinders of soft iron in the first place, because they wear much less rapidly than stones, and, secondly, because they need not be so thick, and may be of smaller diameter. The same author speaks highly of steel-grinders, hardly a millimetre thick, and very handy, whenever we wish to rub down the lateral edges of the tooth, when, for example, they are mounted, and we desire to mark their separation.

Thus, then, the mineral teeth may be cut in all directions, except upon their enamelled surfaces, which we must respect, at least, except when it is too shining; and when in order to give it a tint more or less dull, we rub it with moistened pumice stone.

There are cases where the teeth are too convex. In order to obviate this inconvenience, we can only flatten them upon the grindstone, but, to restore their polish, we may expose them to the friction of a wooden cylinder, moistened and powdered with very fine pumice stone, and we finish giving them their smooth and polished aspect, by employing upon it still finer pumice stone, which is used without moistening.

Sec. 6. *Manner of Soldering a Pivot to Mineral Teeth.*

We have remarked upon the three little knobs implanted in the mineral tooth; it remains now to explain the way of soldering them with pivots or plates. It is done in a similar way to that employed in the manufacture of jewelry; but to succeed in this little operation, there are certain precautions which we think it necessary to point out to the reader.

If we too briskly heat the teeth, to which we wish to solder a metallic pivot, we run the risk of cracking them; an accident which happens, when, in using the blow-pipe, we do not direct upon it a jet of flame, well moderated, and the intensity of which is gradually augmented. One rock to be avoided is, the excess of caloric, which causes too great exposure of the solder, and destroys the solidity of the piece. Finally, we must not forget, that under the fire of the blow-pipe, the enamel of mineral teeth, becomes red, and becomes so tender, that contact with some hard bodies may spot or tarnish it. This then must be most carefully avoided.

In soldering a pivot, there are two processes, either to glide the metallic pins, successively, into the furrow spoken of, on the posterior face of the tooth, and solder them there without further delay, or else we begin, as in the case of compound pieces, by filling this furrow by platina solder, which serves afterwards as a means of adhesion for the pivot. We think that the disposition of the canal of the tooth to be replaced is much to be consulted in the choice of one or the other of these two processes. It is easy to perceive that, according as the tooth is to be pushed, more or less, forward, we will solder it with or without the platina previously poured into the furrow.

Whatever be the means adopted, we carefully scratch the two bodies to be soldered, cover them with borax, and adjust them, using for solder, gold of fourteen to eighteen carets, in sufficient quantity. Then we fix the tooth upon a piece of pumice stone, the numerous anfractuosities of which are exceedingly propitious for solidly establishing the tooth and its pivot. If we wish first to fill the furrow with platina, we fill

this metal to the level of the tooth, and solder upon it a pivot, whose length corresponds to that of the dental canal which it is to fill. The best way of retaining the pivot in its place, during the exposure to the flame of the spirit lamp, is to fix it upon a pumice-stone, by its free extremity, with Spanish white, slightly moistened. There are some who advise to surround the tooth and pivot with a thread of iron, nealed and very fine. If we wish that the metallic pin shall be inserted into the furrow itself, which answers, especially, when the mineral tooth is considerably thick, there will be only one soldering to do instead of two. It is well, in all cases, in order to make the work more solid, to form at the point, whence the pivot issues, a sort of heel, with a plate of metal which we solder there, and in order that this second soldering may not destroy the first, we must cover the portion which we wish to secure, with moistened Spanish white. The same means are excellent to hinder the enamel from being so affected by the flame as to give away under contact with some hard body.

Sec. 7. *Mineral Teeth Mounted on Metallic Plates.*

In order to mount mineral teeth upon metallic plates, the first thing to be done, is to stamp that plate, in the manner already described. When this plate, properly prepared, is fitted upon the jaw for which it is destined, the following is the mode in which the teeth are fixed.

Maury gives the advice to solder the pivots upon the plate, at the place corresponding to the teeth, to insert these pivots in the furrow which exists upon their posterior face, and then to solder them. We consider this plan a bad one, because it is far from affording the solidity necessary to resist the effects of mastication. That which we have, for a long time, pursued, seems to us preferable, and this we will submit to the consideration of the reader.

We place the stamped plate upon the mould, and with gum lac we first adjust the teeth temporarily, having first filled these furrows with platina solder, and cut them upon the sides and posterior faces, by rubbing down the vitreous matter, and the

metal, simultaneously, upon the grindstone. When the teeth are so prepared as to leave nothing further for us to desire, as to symmetry and direction, we pour the plaster, mixed with a third part of grit, all along their anterior face, which is the best way of preventing them from moving in any way during the soldering. In this latter operation, we do not satisfy ourselves with merely soldering the heel of the mineral tooth, we fix it, besides, by a circular plate, which occupies at least three-fourths, sometimes even four-fifths, of its posterior face in a vertical direction.

This mode of soldering, being a complicated operation, we are forced to enter upon minute details, for which we claim the particular attention of the reader.

The point of junction, between the plate and each mineral tooth, forms a right angle, which ought to be filled by solder, and to resemble a sort of metallic heel, so that instead of an angle, this part may form a gutter. To obtain this result, we have only to apply a sufficient quantity of solder.

Now, for as many teeth as we design to insert, we must prepare little plates of platina, which we dispose upon the posterior face of each tooth, and unite them together by the flame of a lamp, by the means of solder, which we put in the interstices.

When all things are properly arranged, we place the piece, secured by the plaster, upon the coal, and with a blow-pipe, which gradually augments the intensity of the flame of the spirit-lamp, we blow until all the several solders enter into fusion, and form only one mass with each distinct portion.

We may, in like manner, apply this mode of procedure to the preparation of a complete set, except that for the great molars, another is necessary, which we will describe at the proper time and place.

When the soldering is finished, to terminate the work, and give it the degree of perfection which it should have, we cleanse the piece, smooth the metal with an exceedingly smooth file, and finish it with the burnisher. In this state, we may fearlessly place it in the mouth. The tongue can find then no asperity which can render its presence unpleasant.

There are some dentists, who, in order to give their work an

appearance that is something more flattering to the eye, gild the platina with the finely powdered gold which is used by gilders of porcelain. They mix this powder with a little gum water, to which they add about a fifth part of calcined borax, and when they have spread a small quantity upon the platina plate, they pass it through the fire, and burnish it.

Maury has said, with reason, that in order to have a work of this kind well done, we should economise neither time nor material. For the fabrication of pieces, with long platina springs, especially, we should use as little pure gold as possible, because it has the serious inconvenience of impairing that metal, and rendering it excessively brittle.

Sec. 8. *Pieces with Interrupted Series.*

Teeth destroyed, either by caries, or shrinking of the gums, are not always situated side by side. Frequently, on the contrary, we meet with mouths offering many breaches, separated by some organs untouched and solid. The problem to resolve in such instances, is to make a piece fashioned in such a way that it may sustain the good teeth which remain. We may perceive that the breaches, and the organs which separate them, may present a thousand different dispositions which it will be useless to undertake to describe in advance. It will suffice for us, then, to lay down certain rules applicable for all cases. We first take the print of the damaged jaw, and then two models, the one of plaster, the other of metal. Upon the plaster model we cut a *pattern*, which must exactly correspond to each anfractuosity. We lay out this pattern upon a metallic plate, and cut the latter by it. This done, we stamp this same plate, making use of the metallic model, as we have before remarked.

In this way, we will have a plate furnished with indentations to fit the remaining organs. But this is not enough, it is necessary, besides, to strengthen with the same metal, as that which composes it, the places where it is hollowed, and this for two reasons, 1st, because this operation augments the solidity of the piece; 2d, because it hinders the cutting of the tooth by the sharp edges. For greater security, we ought even to give a perpendicular direction to the borders which grasp each sound tooth.

Sometimes, we arrive at the same result, by cutting isolated plates, stamping them, and uniting them by appropriate springs, soldered by the blow-pipe. But the former means is the better.

We may perceive, that with an impression well taken, there can be no variety so fanciful, that an ordinary dentist cannot succeed by applying the simple rules which we have just given.

CHAPTER XVI.

As we progress in dental prothesis, the labors which we encounter become more and more interesting by their importance and their complication. Until now, none of the pieces with which we have had to do, had more than five or six teeth, those of which we are to treat in this chapter, occupy a whole arch, sometimes, even, both at the same time.

We shall also have to call the attention of the reader to *obturators*, a sort of metallic roof, contrived to remedy perforations of the palate, whether congenital or accidental.

SEC. 1. *Complete Sets, in general.*

These are pieces, the object of which is, as we have just said, to supply the total loss of all the teeth of a jaw, and even of both at once. They are generally adjusted by means of springs, the description of which will be given hereafter.

As the maxillaries are not always despoiled of all their teeth, and the jaws are never alike, it follows that there must be great variety in the mode in which these sets are constructed. They differ, besides, in form, volume, and the means necessary to fix them, accordingly, as they occupy one or both jaws. They are constructed of similar materials to those used for partial sets. In the most simple cases, they are natural, or, better, mineral teeth, mounted upon bases of gold or platina. When there has been great loss of gums, in consequence of the diminution of the alveolar borders. We are obliged to have recourse to bases of hippopotamus, furnished with one or other of these varieties of teeth.

The first thing to be done, even before the impression is taken, is to extract the loosened teeth or roots which remain, and, if the latter have preserved their entire solidity, to file them to the level of the gums, so that they cannot hinder the coaptation of the set. Many times already, in the course of this work, we have endeavored to show how useful it is to permit sound and not fetid roots to remain. Their presence sustains the gums, and opposes that shrinking of the maxillaries which is attended with such unsightly alteration of the features of the face. It is necessary, also, that the gums be neither red nor bleeding, and that they be sufficiently firm to permit the piece to be applied to them without causing them to shrink. When the site is thus prepared, we get ready to take the impression.

SEC. 2. *Model of the Lower or Upper Jaw, taken separately.*

If the impression be necessary for the preparation of partial teeth, for the making of complete sets, it is perfectly indispensable.

When we wish to take the impression of an entire dental arch, we must be prepared with a sort of trench of melchior, or silver, having the form of a horse-shoe, and having a short handle towards its smaller part. This is called the port-print. We fill this instrument with wax, prepared and warmed as we have described in the paragraph relating to partial impressions. We seize it by the handle, and after placing it in the mouth, we request the patient to bite upon it. With the index finger we adjust the wax towards the gums, begging the patient to keep the jaws well closed and firmly fixed, so that the model may not vaccillate in the least. Then we make him open the jaws cautiously, and without separating them too much, for fear that on account of this separation, the opening of the mouth, when again closed, may offer some difficulty to the withdrawal of the impression. This done, we cool the wax, and pour in the plaster.

The presence of some teeth in the jaw of which we wish to take the model, need not occasion any change in the procedure here advised.

I need say no more, than that the manner of taking the impression does not differ, whether the upper or lower jaw be the

subject, except that the trough of the port-imprint, is turned either upwards or downwards.

Sec. 3. *Articulated Model.*

Where there are no longer in the one jaw or the other, sufficient teeth to guide the exact closure; a thing which may, at first sight, surprise those who have not reflected, that it is very difficult to take a double impression with justice and precision, it is in vain to endeavor to take the impression by causing the patient to bite upon the prepared wax; for models, thus obtained, more commonly lead the operator into error, than aid him in his work.

As for ourselves, having been long since convinced, that this mode produces defective results, by never reproducing the relations which the jaws bear, we begin by taking, separately, an impression of each jaw, and then we prepare the plaster-mould, then two others, in copper or iron, which are indispensable, when we wish to prepare a complete set. By the aid of these two last models, of which we take a counter-mould in lead, we stamp the metallic ranges, and place upon each of them our spring-supports, soldering them, however, very slightly, and in a way merely temporary, for a double reason, which we will explain hereafter.

Before going farther, we think we ought to establish two facts. 1st. As a general rule, the under-teeth tend inwardly, and the upper-teeth, outwardly. 2d. Another point, not less important to be noted, is, that one side of the dental arch is often more fully developed than the other, so that measurements made upon the impression, according to the geographical medium, will by no means correspond with those which naturally exist; since, almost, constantly, one-half of the vault of the palate, does not at all correspond with the other, either in extent or configuration. The utility of these details will appear hereafter.

The piece being stamped, the spring-supports being in place, we proceed to adapt to the latter, permanent springs, and not temporary ones, as some dentists advise; because, when they are not of the same metal as the material of which the piece is com-

posed, we cannot be certain that their action will be similar. Things being so arranged, we figure, in wax, all the teeth upon the lower range; and upon the upper, we solder three small pivots of the same metal used in forming the pieces, which being placed, the one in the middle, and the two others in the centre of each lateral portion, will serve to guide us in the length and direction of the teeth.

Now we must show the reader the utility of the preliminary measures which we have just described. We introduce the two ranges into the mouth, and then we request the patient to close the jaws slightly, and in the most natural way possible. Then is the moment to ascertain, whether the direction of the three metallic pivots harmonises with that of the wax teeth. If, as almost always happens, the contrary is the case, we rectify this direction by approaching and separating the wax teeth, making them to pursue the same movements, in unison with the three pivots of the upper jaw, which are placed there for that object.

While taking these measures, we ascertain whether the spring-supports are fixed at the suitable point. This is the reason why we solder them, provisionally.

But let us return to the principal end. It is not sufficient to be assured of the proper direction of the teeth, it is still necessary to ascertain the length which should be given to them. For this, the only guide which can possibly be obtained, is the tact and skill of the coup d'œil; for you have nothing to consult but the features of the lady who has confided herself to your address, and natural capacity. This matter demands some explanation.

It is certain that the length of the teeth has an immense influence upon the aspect and expression of the face, hence it is proper to make them longer or shorter, according to the perpendicular or transverse developement of the person. If they be too short, and the face be large; if they be too long, and the face naturally be elongated, in either case we may readily perceive that the natural defect will be exaggerated. We were then right in saying, that the taste of the artist only can guide in this part of the business.

Thus, then, when the exact direction is given to the pivots,

and the wax teeth, nothing remains to be done but to limit the length of the teeth. As they have been made longer than the pivots, we cut them more or less, observing, at each time, the aspect which they give to the face. When they have been reduced to a point which is thought right, we are sure to have the total extent of the interval which ought to separate the two ranges, and without troubling ourselves with the partial height either of the pivots or the wax teeth, we measure the length of the teeth after the middle of the space between the two ranges. But before withdrawing the latter from the mouth there are two things to be done.

We must ask the patient to apply the upper jaw slightly upon the lower, so that the extremity of the three pivots shall leave its impression upon the series of the wax teeth. Then it is necessary to take a view of the whole countenance, and, after a line, which passing by the middle of the root of the nose, will fall upon the symphysis of the chin, to mark with a steel point the middle of the two ranges. The lobule of the upper lip is a guide which, sometimes, we must distrust, the first means is preferable.

These two precautions being taken, we withdraw each piece, which must be done with extreme care, so that we do not derange the wax-teeth.

When the whole are withdrawn without injury, we detach the springs, and we place the inferior range upon the plaster model which served to adjust it. But, previously, we make furrows, sufficiently deep in the posterior part of this same model, and we take care to moisten it. When it is thus prepared, we form behind it a very small kind of trough, with a leaf of lead sufficiently thin to be easily folded. Into this trough we pour the plaster which prolongs the model by forming a heel to it, at each angle of which we make two holes, to receive the tenons which are fitted to the upper model. The latter is thus obtained.

We place the upper range upon the lower, by reapplying the extremity of the three pivots to the little holes which are impressed into the wax; upon this range, we place the model which belongs to it, lest it be altered, which is sure to happen when the plaster dries, and we fix it firmly, with many turns of very fine

ductile wire. Finally, we oil all the parts newly added to the lower model, and pour liquid plaster upon both at the same time. It being understood, that the upper model has undergone the same preparation as the other to facilitate the adherence of the new plaster.

We understand, that the mortices of the lower model receiving the tenons of the one which corresponds to it, their just relations become invariable, and the artist has an exact model for placing and adjusting teeth.

In the midst of this crowd of details, there is one which we have omitted, it is to give the smaller part of the ranges a day, so that we may examine how the posterior face of the teeth answers, when we fix them to the ranges with gum lac.

Finally, as the last thing to be done, when the model of relation is thus obtained, we cut off the metal pivots, now useless, and file them carefully, until no trace of them remains.

Such is the proceeding which we employ to obtain the model of relation; it is entirely new, and we consider ourselves to have rendered a real service to our brethren by making it public.

Sec. 4. *Complete Set—Bases and Teeth of Hippopotamus.*

For hippopotamus sets, there are two methods of preparation, and both are good. The one much more expeditious than the other, affords the best results in the hands of a skilful man, to whom practice has imparted the tact and art which constitute the true surgeon dentist. We begin, by cutting out of a hippopotamus tooth, a piece large enough to afford material for a complete set. But before setting about the sculpture of the piece, we must take the impression of the upper and lower jaw, simultaneously, if we have to supply a mouth totally destitute of natural teeth. We cut the two bases according to the plaster model, obtained as above described, by applying them to the model, dyed red, until the piece shall exactly fit the gums.

This being done, we pare it down, leaving every part of it five or six millimetres longer than is necessary; with gum lac, we attach on each side the spring supports, and to them we provisionally append the springs. When things are thus prepared,

we introduce the denture into the mouth, put it into its place, and after attentive inspection, we pare it away again in such parts as we think necessary. In doing this, the operator has no guide but his eye. He must examine the countenance of his patient, and judge according to the lineaments of the face, whether the size or length of the teeth should be diminished. He should be careful, however, to leave those two or three millimetres too long. He then finds his central point, and having marked it with a pencil, he draws the piece from the mouth, in order to set himself to fashion the teeth. Here he needs no other master than nature, and, especially, he must remember that the teeth of the upper jaw do not correspond exactly to their antagonists, but rather to the interstices which separate each tooth, in such a way that an upper incisor corresponds to the halves of two lower incisors; finally, every body knows that the front teeth only overlap the lower, and that the molars fall plumb upon their antagonists, interlocking their tubercles reciprocally. When the teeth are made, we try the denture again; we notice, particularly, that it does not cause one cheek to project more than the other. If such should be the case, we have only to use the file, for no material affords more facility for working than the sea-horse. If, on the contrary, we find that the denture gives a good outline, we give it the last finish, by forming the tubercles of the upper molar teeth, and the depressions in the lower ones to receive them. In providing for this interlocking of the molars, the denture loses its undue length, and is found to have no more than the necessary dimensions: besides, there results the position which enables the upper incisors to cross the lower ones.

This proceeding, as we have already said, is very expeditious, but it exposes the inexperienced to the risk of making irremediable mistakes, which compel him to recommence his work, upon other pieces of material.

Before describing the second procedure, we think it proper to give some precepts for the preparation of the bases. The part which embraces the gums, ought to be as large as possible, so that it may perfectly enclose these organs. It ought not, nevertheless, to encroach upon the palate so as to hinder the move-

ments of the tongue. In short, it is well that the complete dentures should extend as widely as possible, so that touching at many points, and being surrounded more completely by soft parts, they may not be so liable to be disturbed. The heavier the inferior set, the better it will keep its place; the lighter the upper, the better it will preserve its position. These are general rules, which are always subordinate to the conformation of the mouth with which we have to do.

The second procedure consists, simply, in stamping two plates of virgin silver, or other less costly metal, and then doing precisely as we have described for making the model of relation. In this way we will have the exact direction of the upper and lower teeth. It will, to be sure, require more time aud pains, but we will be recompensed by the certainty of the guidance thus afforded.

The articulated model, representing the jaw, with all the exactitude and precision which are desirable, we must try our work, and add any necessary modifications. Nevertheless, we must observe, that every artist prefers his own mode of working, and all are equally good in the hands of those who have been made skilful by practice.

Sec. 5. *Complete Sets—Bases of Hippopotamus—Human, or Incorruptible Teeth.*

We will not repeat what we have already said, as to the mode of preparing the bases in such a way as to apply them exactly to the alveolar borders. Of course, the proceeding is absolutely the same, whether we employ sea-horse, mineral, or human teeth. When the piece is well fitted, we sculpture the two great molars on each side, and leave between them sufficient space for the ten anterior teeth, viz. the four incisors, the two canines, and the four small molars. In speaking of partial pieces, with bases of sea-horse, we have dwelt, at length, upon the manner of fixing the teeth. We refer the reader to that part of the work, whether the teeth to be inserted be human or mineral.

We need not add, that the teeth should be like the natural

teeth which they replace, equal to them in number, disposed exactly in a corresponding manner upon each piece of the denture, and, especially, in harmony with the age of the subject. We have already said, that bases of sea-horse are a very good material, where there is loss of the gums, and that natural or mineral teeth, are particularly preferable to those cut in the piece of sea-horse itself, which rapidly change color, and become brown under the action of the saliva. Again, hippopotamus bases are better for a person who has never before worn an artificial denture; the gums not having been hardened by contact with a strange body, a plate of gold would be insupportable. An especial advantage in the sea-horse is, that when the gum is more sensitive at one point than at others, if it be a small space where inflammation causes the pain, we may relieve it by taking away the portion of the base which hurts the organ. We can do this with great facility.

Sec. 6. *Complete Sets—Metallic Plates—Human or Mineral Teeth.*

This kind of denture, especially when mineral teeth are employed, is the most impregnable to the action of saliva, and, consequently, the most solid and durable. To make it, the reader needs no further information than what has been given already.

We stamp the two plates, and adapt to them the teeth, mineral or natural, according to the will of the dentist. If natural teeth are used, they are fastened precisely as in the case of partial sets. We may observe, that for the large molars, we sometimes use the natural teeth, sometimes a piece of hippopotamus, which, of itself, may form two or even three teeth.

When we employ natural teeth, it will be of great advantage to procure a complete *mouth* of them; at the least, it is necessary to have all the molars of the same subject, because they are adapted to each other, with a nicety which cannot be imitated but at the expense of more or less of the enamel, which it is important to preserve entire.

When we employ mineral teeth, we solder them upon the

metallic plate by aid of the means indicated, sec. 7, chap. xiv.; to which we refer the reader. There is, nevertheless, a point which requires a process, of which we have said nothing; it is with regard to the great molars. We may use for replacing these, large independent mineral molars. To adjust them, we maintain them with wax, as already described for partial pieces. When they are properly ranged, we pour plaster mixed with grit on their anterior face. In this way they are fixed firmly enough to permit the dentist to pierce the metal by introducing the drill into the hole which is found upon the interior of each tooth. This hole, which traverses it perpendicularly, is wider towards the triturating surface, for the reason which we will presently explain. A pivot is soldered in the holes which have been made in the plate. This done, each pivot is introduced into a hole of one of the mineral teeth. They are cut short off, and as they find the canal of each tooth wider at its extremity, we cap them with a little metal tube, somewhat conical, which answers the purpose of a ferule; all is then soldered together, and the tooth is immovably fixed.

The soldering requires some precautions. It will not do to put on too much, and, moreover, we must not present the fire in such a way that the solder will glide to the neck of the tooth, which will certainly cause it to split in two.

In describing partial pieces we have mentioned, in connection with mineral teeth, a sort of border which covers them to the extent of two-thirds of their surface, and renders them exceedingly solid. The same precaution is necessary for the large molars. If we would have them render real service, without the risk of speedy fracture, we must never omit to bind them as far as two millimetres from their triturating surface, by enveloping them with a large band of the same metal of which the rest is made. This will give them sufficient solidity to resist all masticatory efforts. It is so important to support them in this way, that we find in cases where this band has not been extended far enough, the teeth break at the level of it.

This strengthening band need not be very thick. Indeed, it should be thin at its termination, so that the tongue may not feel it and be wounded at the spot where the metal ceases to envelope the tooth.

Maury advises to employ platina instead of gold. We think that this author, in other respects so excellent, is completely deceived on this point. Gold is, on the contrary, altogether preferable to platina; besides, being lighter, its elasticity permits it to recover when it has undergone a shock, while the platina, as we have already observed, will remain in the false position to which it may have been driven.

We are the more surprised at this assertion of Maury, because, in his day, platina was not worked with as much perfection as now.

Sec. 7. *Band for fixing the Superior Denture.*

This is a metallic plate, disposed so as to apply itself exactly to the length of the lower dental arch, in order to sustain the springs attached to a single denture which occupies the upper jaw. Some persons lose all their upper teeth, before the lower range is so impaired as to demand replacement. Indeed, the latter may be complete or may only be defective in large molars, the breach left by which is invisible, and the difficulty of mastication, ensuing from their loss, not considerable, especially when one of the sides is tolerably perfect.

In such a case we prepare an upper set, and after having taken the impression of all the lower teeth, we adapt a plate which takes, accurately, the contour of each tooth: we make it thick enough to enable us to solder some teeth upon it, should the lower jaw come to need them. To give great solidity to this band, and, especially, to prevent its rubbing the gums, painfully, during mastication, we solder upon the part corresponding to the great molars, a species of cap, which is applied to their crown in such a way that the bands are, as it were, hung upon them. There is, however, one inconvenience attending these caps. The alimentary matters glide between them and the tooth, and may ensure the destruction of the latter. We have entirely avoided this difficulty, by the mode in which the caps are now made. As the molar teeth are conical, it suffices that the cap have the form of a circular band, the circumference of which may be more narrow above than below, so that the border may be as completely suspended, as if the cap were complete.

Maury speaks of putting these caps upon the small molars. We think we ought to prefer the great molars, and reserve for the small ones, a sort of clasp, which seizes them from behind, and is altogether invisible.

We cannot insist too much upon the utility of these metallic circles around the crown of the teeth, so as to hinder the bands from rubbing the internal part of the gums so as to render the presence of the artificial denture insupportable. The modification we have suggested, secures the tooth upon which it is applied, and, therefore, we have nothing to fear from the use of a means so necessary to secure the solidity of the bands.

Sec. 8. *Spiral Springs—Manner of making them.*

So far we have used pivots, ligatures, or hooks, for fixing the pieces. The means employed to retain the artificial denture in the mouth differ essentially from the means we have enumerated. These are springs, formerly very complicated and troublesome, but now very simple, and free from all the inconveniences of those previously employed. These are the springs called *spiral*, which it would be more proper to call "helices," but as usage has, for a long time, confounded the two, we will not change their denomination.

Before learning to make simple springs, the dentists tormented themselves with efforts to construct exceedingly complicated mechanical contrivances, such as "*lever springs*," "*grasshopper-leg springs*," and others, more simple, yet altogether insufficient, such as cylindrical, elastic, &c., &c. Among other defects, all these contrivances pinched the internal face of the cheeks, and caused chronic inflammation, which might degenerate into ulcers of bad character. They were, besides, very difficult to construct, which render their use impracticable in the hands of inexperienced dentists.

The spiral springs are, in all respects, preferable. They are made with gold-thread of eighteen carats, which is wound around a staff of steel, tempered and well polished, so that the rings may have sufficient elasticity to be flexible in all directions. This thread having such a size, that three or four passages through the wire-drawer, will give the desirable diame-

ter, we anneal it for the last time, and the action of the wire-drawer will qualify it to make a spring. After this first operation, we wash it in boiling water, polish it with a piece of skin, sprinkled with very fine pumice stone, and then with a little polishing rouge.

When this operation is finished, we flatten it by one of the extremities, which we seize with pincers, to introduce it, with the staff equally flat at the end, into a hole made in a piece of ivory or wood, fixed upon a vice, and serving as a point d'appui to the staff. We stretch the thread, attach to it (with pincers, the beaks of which are covered with paper) a weight of about two pounds, and then with the other pincers we turn it round upon the staff, in such a way that the rings will be nearer or more distant, according to the degree of elasticity required. (Maury.)

M. Delabarre proposes a method which differs but little from Maury's. It consists in splitting a piece of wood which is placed in a vice, and passing into this split the gold-thread to be turned, being careful to let it pass about an inch beyond. This little end is seized by a ring pincers, together with a steel staff, cylindrical and thick as a large pin. Then by turning the pincers in the fingers, the gold-thread is rolled upon the staff, and the rings formed are very close together. It is well that the spring destined for the right side should be wound in that direction, and vice versa.*

So far we have entertained the reader only with the "spirals," properly so called, or the body of the springs, now we proceed to speak of "spring supports" and "spring-heads."

Sec. 9. *Spring Supports.*

These are ends of gold or platina wire, about a millimetre in diameter, and ten or sixteen long. At one of their extremities we solder a very flat ferule, of the same metal, at a millimetre from which we solder a second. The rest of the piece is occupied by the threads of a screw.

* We have given the mode of making the springs, but for our own use we prefer to get them already made. The time spent in making them costs more than the venders of platina ask for the article.

Maury advises, when we have to do with a base of sea-horse, to apply these spring supports by making a simple hole in the place judged suitable, and to screw them in. When we proceed in this way, the saliva is not slow to glide between the sea-horse and the staff of the spring-support, and so to deteriorate the material of the denture, that in persons whose saliva is very acid, the springs are useless at the end of a few months. It is preferable, then, we think, to insert, forcibly, into the sea-horse material, a hinge of platina or gold, grooved within, to receive the screw. To give more solidity to this apparatus, two operations yet remain. We groove on each side the hole, which penetrates the denture, and with a very blunt instrument, we turn down the two extremities of the tube. This done, we drill a small hole from the middle of the upper face of the base, through the centre of the platina tube, to the lower face of the same base. Into this we introduce a small metallic pin, which we rivet at each end, and as the tube is obstructed, we must cut the pin away as far as is necessary. These two contrivances are a great security for the solidity of the tube. We may readily see that the work when done in this way, will be as firm as possible.

There is yet another way of fixing the spring-supports in hippopotamus pieces. We take a plate of platina, a centimetre thick, and a centimetre and fifty millimetres long, and upon this plate we solder an "ear" of platina, of which we will give a description presently, and which is destined to give a movable point d'appui to the head of the spring. We will exhibit the advantages of this mode. When we would make trial of the denture, it suffices to fasten with gum, the plate at the place where we suppose the spring support ought to work. If we ascertain that this is not the proper place for it, all we have to do is to detach the plate, and stick it in another position. Then with a steel point we carefully mark the outline of the plate; we cut in the hippopotamus, the place which it must occupy deep enough to hide its thickness, in such a way that nothing shall project but the "ear" of the spring support. It is useless to dwell long upon the incontestable advantages of such a proceeding as this. The plate, held by four little golden screws, with sunk heads, is perfectly solid, and it permits us to make

all the necessary trials before fixing it definitely, while the hinge in which the spring supports are screwed, forms a hole difficult to close, when we find that we have taken the dimensions incorrectly.

We must now describe the manner of making the "ear" of the spring support. We take a leaf of platina, thick enough to hold the head of a small sunk screw, and give it a length of six or seven millimetres, and a breadth of four or five. This plate is folded in two, upon its breadth, in such a way, that the head of the spring, which is about a millimetre thick, may play therein: we round, posteriorly, one of the angles of the folded portion, then we solder the other part upon the metallic plate, which is to be incrusted in the hippopotamus. This being done, at nearly the middle of the "ear," we pierce a hole which traverses it, as well as the plate on which it is soldered. On the free side of the "ear," we enlarge the hole to receive the head of a sunk screw, and with a screw-borer, we form the place for the screw, only in the part soldered to the plate, in order to introduce a screw which may serve as a pivot to the head of the spring support.

When we have to do, not with a base formed of animal matter but of metal, instead of an oblong plate, we use a band of platina, two or three millimetres wide, and of length proportionate to the distance at which we wish to place the spring support. In some cases it is better to place it very near the gums, at others near the level of the triturating surface of the teeth, but, generally, it is placed in the midst of the interval which separates that surface from the neck of the artificial tooth. It being understood that the metallic band is soldered on the plate.

Sec. 10. *Heads of the Springs.*

The following is Maury's description of the heads of the springs. They are made with a wire of gold or platina, fifteen or eighteen lines long, and twice as thick as the thread of the spring. We turn them upon themselves, with very small round pieces, and form of them a kind of ring, bearing, laterally, two small branches, and into this we can easily introduce the staff

of the spring support. We then flatten this ring with a hammer; then we thin the two little branches with the file until they can enter into the body of the spring. The ring, thus flattened, may be very readily adapted to a denture.

Well, after all, we do not fear that we are deceived, when we say that these spring-heads are altogether bad. The following is our mode of procedure. We take the end of a gold or platina thread, and we give it the following dimensions: one millimetre thick, and two broad on the side by which it penetrates the "ear;" the other extremity, which will be soldered in a small box, which we are about to describe, is about a millimetre square.

To make the little box in question, we take a leaf of gold about half a millimetre thick, and four long, and so broad, that in turning it upon a steel mandrel, it forms a hollow cylinder, the capacity of which presents a diameter a little smaller than that of the exterior cylinder, formed by the spring, destined to enter it by some force. When the gold leaf is thus rounded, we solder, at one extremity, a plate which closes the opening. We must always take care that the solder shall not glide into the interstices that the two ends of the leaf leave between themselves in coming together.

We ought to advertise beginners, that solder has a strong tendency to insinuate itself into all fissures. Therefore, in the present case, if the two ends were soldered, the plate would lose the elasticity which gives it a sort of pincer power to seize the extremity of the spring, when introduced with sufficient force. To avoid this unpleasant accident, it will suffice to protect, with Spanish white, all that part of the little cylinder where the interstice in question exists.

Let us return to the little plate which shuts one of the openings. We pierce in this a hole to receive the squared extremity of the spring-head, where it should be soldered. In the flattened extremity of this spring-head we pierce a hole sufficiently large to permit a screw to traverse it readily. As sometimes the springs remount, we leave an arrest, which limits the flat part of the head of the spring, and thus obviates this inconvenience.

When things have been thus disposed, we place the head of the spring under the platina "ear," and traversing it by the

screw, fixed solidly in the plate which sustains the whole apparatus, we obtain the point d'appui which is most movable, least voluminous, and, at the same time, most solid.

If we wish to dispense with the screw, we may substitute it by a rivet, which, used similarly to the screw, only differs from it in being soldered at each end. In fine, it is a very delicate little operation, owing to the facility with which the solder insinuates itself every where. To avoid soldering the head of the spring to the "ear," or the rivet, we must carefully protect them with moistened Spanish white.

A very important point to which we find it necessary to recur, before closing this paragraph, is the attention which should be given to choosing the proper place for the spring supports. If one of them be too far forward or backward, it will twist the denture and prevent its sitting properly upon the gums. The place which M. Oudet assigns them is the geometrical centre of each branch of the denture. In this he is entirely mistaken. Nothing is more variable than the point of equilibrium. It is before or behind the geometrical centre, according to the different dispositions of the mouth. It is only by trial that we can ascertain the proper spot for the point d'appui of the springs.

With all the clearness and precision of which we are capable, we have initiated the reader into all the secrets of mechanical dentistry. If we use the word "secret," it is not without meaning; for there are many practiciens, who, far from communicatting a discovery to their fellows, employ all possible means to conceal it from them.

We have, in this book, taught every detail, however small, because having, so to speak, learned all these things, by our own efforts, we know how small things may, to a beginner, be insurmountable obstacles; and it is to save debutants from fastidious, and sometimes hopeless efforts, that we have described every thing with such minuteness.

CHAPTER XVII.

OF PALATINE, LINGUAL AND FACIAL PROTHESIS.

This last branch of the dental art is very far from having made the same progress as dental prothesis, properly so called. It is obvious, that disease destroys the palate, tongue, and walls of the face, far less frequently than the organs which garnish each jaw. Hence this part of the science is yet in its infancy, and we frankly confess that we have had so little opportunity of practice in this department, that we have not found ourselves in a position to suggest much improvement. We can only repeat the opinions of authors, modifying and criticising them as we shall have occasion, sometimes a priori, sometimes from the teachings of our own experience.

Injuries of the palate very unfrequently demand the aid of art, and we are very poor in means of reparation. For a long time, indeed, these means were more injurious than beneficial.

The causes which may determine the loss of the organs in question, are syphilis, cancer and gun-shot wounds. Perforations of the palate are, especially, liable to follow the diseases which attend debauchery.

Before occupying ourselves with the fabrication of machines, destined to repair the ravages of syphilis, or of war, we think we should glance rapidly at the influence which such lesions exert upon the voice, the physiognomy, and the mastication. M. Delabarre has, on this subject, written some very judicious and philosophical things, and we believe that we can do no better than adopt his opinions.

Sec. 1. *Absence of a portion of the Palatine Organs.*

As soon as any cause has affected a division or a loss of substance in the palate, and its velum, the communication of the nose and mouth is the consequence. When this division is congenital, it is found upon the median line. This results from defect of formation in the maxillary and palate bones, producing

a long fissure by default of coaptation. The soft parts participate in this imperfection. We often observe in congenital perforation of the palate, the separation of the lip, or "hare-lip," and, sometimes of the velum of the palate at the same time.

We will perceive, that in subjects thus affected, mastication will be difficult in proportion to the extent of separation of parts. This difficulty becomes extreme, when the dental arches are not in their natural relations. Nevertheless, individuals afflicted with this frightful affection, can yet chew aliment, and, in infancy, even suck; and this they do by a peculiar mechanical process, suggested by natural instinct, always fruitful in expedients.

Examine a new born infant. Although afflicted with palatine perforation, it will be no more backward than another, in seizing the breast of its nurse, and extracting from it the aliment necessary to its existence, only it will take it in a way altogether different. Instead of letting the nipple lay upon the tongue, it will carry it to the lower face of that organ, which performs the office of an obturator; for its upper face being applied to the palate, completely closes the fissure which nature has left there. It contracts the lips, and by skilfully combined movements, it draws in the milk, which is conveyed to the pharynx as readily as though the palatine vault were in a natural state.

As it grows, the child perfects this mechanism, and applies it, after a while, to the mastication of solid food. When chewed, it is conveyed between the tongue and the movable floor, which serves for a point d'appui to it, and thence it is brought back between the teeth. Thus it is, that the complicated operation of deglutition and mastication is performed without the alimentary morsel getting into the nose. If the latter does sometimes occur, it is the result of accident.

As to the articulation of words, as M. Delabarre has very judiciously observed, the child only perceives, when too late, the great importance of the free and clear emission of voice. Hence it entirely neglects this function. It articulates every word very badly, and makes no effort to render itself intelligible. All the sounds are nasal, and resemble a sort of dull murmur, disagreeable and difficult to understand.

We do not perceive the necessity of supplying an obturator until adolescence, when it is necessary, unless the subject has undergone the operation for hare-lip; for experience has proved, that in all cases where this has been done, the palatine fissure has been so far closed as to be obliterated, radically and completely.

Accidental lesions of the velum of the palate are of three kinds. They are only distinguished by the extent of disorder, These are, first, perforations of the velum only; second, holes which occupy the palatine vault itself, and are circumscribed by the osseous substance; thirdly, and, finally, the entire destruction of all the palatine vault, or, at least, a great part of it. To these ravages, which are sufficiently great, is sometimes added the loss of the lower portion of the vomer and the cornets.

Differing from congenital lesions, the accidental ones are generally situated at the side of the palatine raphæ, so that they only penetrate a single nostril. In these cases we have no longer the advantage of early infancy. Whatever be the extent, form and position of the accidental lesions, those who are afflicted with them, having contracted the habit of eating, by placing the aliment on the tongue, can take no nourishment without a part of it getting into the nose. We need not add, that the voice loses its natural tone. It is dull, and stuffed, the sounds are badly and confusedly made. Indeed, in some cases, speaking is impossible, and the patient has no resource but to pinch the nose when about to speak, so that the nasal vault, doing the office of that which is injured, some clearness may be given to the sounds.

The accidental or congenital division of the velum of the palate, causes changes, equally great, both in the tone of the voice and the mechanism of deglutition. M. Delabarre cites the example of a young man, who finding himself in this case, could swallow no liquids without a part being returned by the nose. He obviated this unpleasantness, by throwing the head so far back that the drinks had only to precipitate themselves into the œsophagus, the upper curvature of which was almost effaced by this process.

Sec. 2. *Loss of the Tongue—Accidental Perforation of the Cheek—Destruction of the Lips, &c.*

Loss of the Tongue.—The tongue is, beyond all doubt, one of the organs most necessary to articulation, mastication and deglutition. Hence, persons who have been suddenly and accidentally deprived of it, would run great risk of dying of hunger, if the facility with which men adapt the form of aliment to the nature of their disorders, did not place them in a position to sustain their existence, until habit gives to the parts, upon which the destroyed organ reposes, a superabundant contractility, by the aid of which they gradually accustom themselves to the important functions of mastication and deglutition. It is due to this happy tendency of nature to repair our misfortunes, that those in whom this privation is congenital, can, nevertheless, speak and eat with facility. As to those who lose this organ, accidentally, they are forever deprived of speech; nevertheless, in the memoirs of the academy of surgery, some cases are reported where the speech was recovered in consequence of a profound emotion produced in the mind by a happy and unexpected event.

Accidental Perforation of the Cheek.—Many causes may occasion this perforation. The most common are cancerous diseases and gunshot wounds. Cases have been observed, where a cancer, after having destroyed a part of the face, has suddenly been arrested, and has completely healed, but not without leaving after it so great a loss of substance as to occasion perforation of the cheek; a sort of fistula through which the saliva discharged itself incessantly.

As to gunshot wounds, it is easy to conceive, that when a great extent of substance becomes gangrenous, cicatrization may take place by leaving an opening of greater or less extent in the walls of the face. In this case, as in the former, the saliva percolates continually through the fistula; during mastication the aliments escape by the issue thus opened, and when this opening is of sufficient size, speaking is effected so badly, that the patients carry the hand there involuntarily in order to make themselves understood.

Destruction of the Lips.—It is especially, by warlike projectiles, that the wounds are produced which causes injuries of this character. Some soldiers have been deprived of lips and chin. In all these cases there is great difficulty in pronouncing words; it is almost impossible for them to retain their saliva; their physiognomy, we need not say, excites, at once, disgust and pity. These injuries are frequently attended with the loss of a part of the teeth. It follows of course, that machines intended to palliate all these disorders, must be of very varied combination, and appropriate to the kind of lesion with which we have to do.

Loss of the Nose.—Far less important than the tongue, lips and walls of the face, the nose, nevertheless, plays a considerable part in the pronunciation of words. Besides, the absence of it, occasions one of the most hideous deformities that can be imagined. Persons who have, unfortunately, lost this organ, present a countenance as strange as repulsive to the sight. We know that it was inflicted as a punishment in the wild uncivilized countries of the north.

Efforts have been made to engraft living noses in the place of those which have been destroyed. We will not speak of this painful and hazardous operation, because it is not within our province. We think that the time is far distant yet, when people will cease to prefer the mechanical prothesis, which is never painful, and which is superior to any surgical process which can only produce misshapen and reddish masses, which, so to speak, only substitutes one deformity for another, and that at the price of the most acute pain.

Sec. 3. *Different kinds of Obturators.*

The first obturator invented, is, without contradiction, the most detestable which could have been suggested by the mind of a man of skill. I speak of the obturator with a sponge. The Greek physicians, it is said, have used this instrument, which they call "hyperari." There are physicians who deny this, but it is because they have not met with diseases of the mouth at a time when a considerable part of the palate has been destroyed, without the affection being at all connected with syphilitic virus:

whence, they have concluded, that perforations of the cheek were never seen until the invasion of Europe by syphilis. It is true, that in most cases, syphilis is the cause of perforations of the palate, but it is also certain, that more than once, buccal abscesses have been observed to result from dental periostitis, followed by lesions, more or less serious, of the bones of the palate. May not this kind of phlegmon occur again, and occasion the ravages which we now perceive?

In 1585, Ambrose Paré prepared an obturator, of which he has left us an engraving, and which consisted simply in a plate of gold or silver applied to the opening of the palate, and which was maintained in place by a sponge fixed in a staff and retained by a screw. The sponge being dry, when placed in connection with the plate, swelled by the humidity of the nostrils, and prevented the instrument from falling into the mouth. But we may perceive that the nasal mucus, stagnating in the sponge, would become horribly corrupt, and infect the breath of the patient, so as to render his approach disgusting. Another still more serious inconvenience of this bad instrument, which wise, prudent, and rational practice should always reject, is its tendency to enlarge, continually, the opening which it is intended to close.

We cannot better demonstrate the sad consequences of the use of this instrument, than by reporting a case recorded by M. Baillif, a skilful dentist of Berlin, in an excellent memoir upon obturators, which has but one fault, it is too short, and goes too little into details.

"The 1st November, 1824, he says, Dr. Siedmogrodzki presented himself to me with M. de * * *, who had had the misfortune to lose his nose, and part of the vault of the palate by a syphilitic malady, in the years 1807, 1808.

The hole formed in the anterior of the palate was ten millimetres long and eight wide.

To remedy these accidents, an artificial nose had been made for him, and an obturator formed of a plate of fine silver, furnished with a sponge, such as recommended by Ambrose Paré, Gariot, and other practiciens of our day. The compression which the sponge of the said obturator has caused upon the

maxillary and palatine bones, during the period extending between the years 1808 and 1824, has so dilated the parts, that all the maxillary and palatine vault is consumed entirely, without any sign of disease, and in an imperceptible manner, leaving nothing but the velum and uvula at the posterior part. The anterior part of the maxillary bones is so thin that they are separated at their suture, in such a way that the obturator could no longer be applied.

In short, the opening, which was only twelve millimetres long and fourteen broad, to day presents the enormous extent of ten inches long, and an inch and a half broad. Such was the deplorable situation of this patient, who could not articulate a single syllable. All the sounds that she could utter by any effort, amounted to no more than a kind of bellowing.

This fact proves, incontestibly, that we should banish from use, obturators sustained upon the lateral parts by the compression of sponges; also, those with wings, plates and flat springs, because they dilate and destroy every part which they touch, either by compression or friction.

It would be inconsistent to describe the obturators we have just condemned so formally; we will, therefore, only occupy ourselves with such as appear to be free from the inconveniences mentioned.

But, before commencing, we find it necessary to lay before the reader, Bourdet's excellent remarks upon this subject. "Before determining," he says, "the cicatrized perforations of the palate to be of such a nature as not to admit of having their diameter diminished, practiciens ought to be careful to ascertain whether such be the case. I do not think so, because facts positively attest the contrary, and even as wounds made in the cranium by a trepan, close almost entirely, by time, so, also, wounds of the palate diminish incessantly. We should, therefore, be guarded in applying a machine, whose vicious construction impedes the cure towards which nature tends, at least, in most cases."

It does not suffice to cure a patient of syphilis, and then to give him up to the mechanic, who attending only to what he sees, and fearing nothing beyond the evil already existing, may

contravene the benevolent intentions of nature, instead of promoting them. It is better to place him in a position to enjoy the benefits of a cure, tardy it is true, yet spontaneous and radical.

Sec. 4. *Juxtaposed Obturators.*

The problem to be solved, therefore, was to palliate and hide the deformity without offering any hinderance to the kind efforts of nature, but the great difficulty was, to fix the metallic plate. At first, it was suggested to make a thin, slightly concave plate, from which might proceed, laterally, two prolongations which should reach the teeth and rest upon them so long as any of them remained. The first dentists, who had the idea of this juxtaposed obturator, wished to sustain it by threads, which tending continually to remount towards the gums, caused pain, either constant or fleeting, but always insupportable, when the patients were eating. Finally, the ligatures were apt to relax, if they were gold, and to break, if made of a substance less tenacious.

It was necessary, therefore, to abandon ligatures for other means more sure, and less painful. M. Delabarre speaks, in his work, of a juxtaposed obturator, maintained by elastic compressors. The person to whom it was applied had not been able to bear others, though fabricated by very experienced men. The perforation was on the left side of the palatine raphæ, in such a position that the vomer on one side, and the inferior cornet on the other, hindered the application of a winged obturator, and, behind, there was nothing to furnish a point d'appui, because the palatine bone was destroyed.

This complication of obstacles was easily overcome by an instrument resembling a man's hat, the crown of which is exceedingly low. This little crown enters freely into the hole, and is maintained to the plate by means of two screws. The patient is provided with several of them, gradually diminishing in size, so that, as he perceives the opening to diminish, he may change them. As to the rest, the crown, having no other design than to replace the loss of substance, in order to prevent an improper quantity of mucus from being retained in the cul-de-sac,

which results from the wound being closed only on the side of the mouth, it can be lowered.

As to the manner in which this obturator is fixed, by what M. Delabarre calls the elastic compressor, it is, in fact, a double hook, which surrounds the tooth upon which its point d'appui is taken. Then on each side of the plate project two sets of arms, which, in order to be lighter, are double, and are reunited at one extremity, where the two hooks are soldered. Ingenious as this method is, it is attended, at first, with the same inconvenience as the ligatures. The patient must suffer during mastication. Hence the artist fell upon the happy invention of soldering to the anterior hook a little spur, which, descending between two teeth, was bent below, to lodge itself in a furrow made for this purpose in the crown of one of them. From the moment that this plan was introduced, the patient suffered no more, and he could take away the obturator and replace it, with as much ease as he could remove and replace a ring. Here was a happy result, which should encourage others to follow the same course in all cases where they are called upon to remedy similar deformity.

Sec. 5. *Obturators Complicated with Artificial Sets.*

It is not rare to see palatine destruction accompanied by the loss of a certain number of teeth. Fouchard has directed, in such cases, to employ an artificial set, bearing an obturator. M. Delabarre has very properly remarked, that this piece would be very heavy, for it would be very complicated, and contain much material, and, besides, would have the great inconvenience of being sustained, only by nasal wings.

M. Fouchard, surgeon dentist, of Paris, presented to the society of medicine, a dental obturator, one similar to which he had applied for a man who had lost the two smaller incisors, the lateral incisor, the canine, and the first small molar of the right side, and, moreover, all the part of the maxillary bone in which these teeth were implanted, as well as a portion of the ascending apophysis of the same side, and nearly the anterior half of the bony plate which closes the palatine vault.

In spite of so great a loss of bony substance, the hole which

formed the accidental communication between the nose and mouth was only an inch in diameter, and was round.

M. Fouchard made a denture of two very distinct parts; the one of which was an obturator of gold, the internal face of which was concave, and the superior presented a rounded eminence, destined to engage itself in the opening of the palatine vault. The other was a piece of hippopotamus, to which was given the form of the parts destroyed, and into this human teeth were implanted by incrustation.

The obturator and the denture were solidly maintained in union, by means of a metallic staff, dove-tailed, in the posterior part of the latter. Two elastic plates of gold, starting from the lateral parts of the instrument, and pierced with holes passed behind the teeth, which remained on each side of the breach, and by their tendency to separate from one another, served to fix the machine in its place. The learned dentist, charged with the report upon this obturator, observed, judiciously, that the prolonged action of the elastic plates, would produce loosening and displacement of the supporting teeth. It is not for us to combat this opinion, for we have drawn heavily, in the course of this work, upon the property of elastic bodies to act upon the teeth, and cause them to change place and direction.

Mineral paste has also been used to make denture-obturators. It is certain that great benefit has been obtained from the use of porcelain, when it has been necessary to replace considerable substance. Unhappily, few dentists have the habit of this kind of manipulation, which requires a very troublesome array of furnaces.

Sec. 6. *Complete Palate, bearing a Denture.*

An individual, in consequence of syphilis, had lost the bony and membranous vault of the mouth, as well as the greater part of the upper teeth, (among which were the lateral ones,) which were best situated, for being embraced with hooks. M. Delabarre contrived a mineral denture, surmounted with a velum of platinum, bearing upon the side of the nasal fossæ a circle which surrounded the parts to be supplied. Within this circle was enclosed

a very light box, though representing the thickness and figure of the naso-palatine floor, so that, by this means, it gave to each of the cavities its proper form. This being done, the skilful artist supported, by spiral springs, this obturator, by taking a point d'appui upon a metallic case, which enclosed the inferior dental arch. This is what we have already described under the name of *band.*

The machine fulfilled a part of the conditions, that is to say, the nose and mouth were completely separated; nevertheless, the patient continued to talk through his nose, because the soft part of the palate was wanting; it was, therefore, necessary to replace it. In a similar case a jeweller named Cadet, had contrived a movable palate and uvula of metal. M. Delabarre preferred to substitute caoutchouc. He even conceived the ingenious idea of causing the mechanism of deglutition itself to further his design. He wished that the artificial velum should lift itself every time that the passage of aliments, and even of saliva should take place from the mouth to the pharynx. Consequently, the tongue became the means of putting the machine in action, and this was contrived in the following way:

The skilful dentist made an oval window in the forepart of the plate. To this he affixed a valve, closing itself, hermetically, and retained in place by an axis, and a small very soft spring. To this was soldered a lever, which, carrying itself backward, reposed upon another which was also held in a see-saw position by an axis. This last lever was long enough to reach the extremity of the principal plate, and it was flattened so as to fasten to the movable velum, which itself was attached to the pharyngeal border of the machine.

At the time of deglutition, the point of the tongue, applying itself against the palate pressed upon the valve, and this transmitted to all the other parts the movement impressed upon it. Hence the velum found itself raised, and from a vertical assumed a nearly horizontal position, in such a way that neither solid food nor drinks could find their way into the nasal fossæ. This artificial palate, complicated with an artificial denture, was yet by no means heavy, because the plates were of very thin platina, soldered with fine gold. The patient derived very great advantage from it, both in mastication and deglutition, and in the utterance of words.

Certainly it was an ingenious and happy contrivance. The thing which particularly strikes us, is the employment of the spiral spring, as the means of support. We cannot conceive why M. Delabarre, who, together with M. Ballif, the Berlin dentist, of whom we have already spoken, was acquainted with this instrumentality, did not make more extensive use of it. In fact, whenever the upper teeth are deficient to a great extent, or when their loose condition does not permit us to make a fulcrum of them, the artist can have no better expedient than that of establishing a band along the internal face of the lower dental arch, and attaching to it the extremity of a spring, the other end of which acts upon the metal plate which serves as an obturator. This means, tried often enough by M. Ballif, always succeeded perfectly in his hands, and, as we are carefully to employ springs of only moderate power, the pressure of the obturator cannot wound the parts against which it rests. We need not add, that by this process, we do not interfere with the efforts of nature to contract the edges of the perforation.

Sec. 7. *Destruction of the Velum of the Palate.*

This organ, so important in the mechanism of the deglutition, may be totally destroyed by a syphilitic chancre. In this case, we cannot do, as in congenital separation of the palate, where the art of the surgeon can remove the deformity and establish things in their normal condition; we must, from sheer necessity recur to artificial means, that is to say, we must apply an instrument, which, resembling the velum of the palate, restores to the voice its natural tone, and hinders aliments from ascending into the nasal fossæ during deglutition.

To construct a machine to supply this part, we must necessarily study its form and functions. The organ is nothing more than a sort of vertical curtain, slightly concave, anteriorly, when the muscles are relaxed; but, during the act of deglutition, the same muscles contract, raise the muscular curtain, and make it to assume the form of a horizontal vault, continuous with the palatine vault itself. By this momentary closure, the buccal portion of the pharynx is entirely separated from the nasal or superior

portion, so that it is absolutely impossible for the aliments to take any other route than that of the œsophagus.

M. Delabarre has had occasion to apply an artificial velum, from which, he says, the patient obtained the same advantages which we derive from that given us by nature. He fabricated a plate bent into the form of a horse-shoe. This plate embraced the posterior part of the naso-palatine floor. The nasal portion was hollowed so as to lodge the *vomer*. The palatine portion formed a vault, from each side of which projected a staff to fix itself upon the first molar, by means of small elastic arcs, to which were adapted spurs similar to those described when speaking of the palatine obturator.

This apparatus was only intended to sustain a leaf of caoutchouc, rendered very thin by the aid of strong compression made upon it while plunged in boiling water. This leaf took the form of the velum, and of the uvula, and was united to the apparatus by small rivets with very oval heads. This very simple machine fulfilled all the purposes of the velum itself. The voice recovered its natural tone, and the aliments no longer tended to enter the nasal fossæ.

Sec. 8. *Destruction of the Tongue.*

Happily, it is rare that we have occasion to remedy this frightful deformity. We know only of the single case mentioned by Ambrose Paré. The machine constructed to replace the tongue was simply a piece of wood fashioned by the individual himself, and which having the figure of the destroyed organ, reposed upon the inferior and movable floor of the mouth. We do not doubt that this piece of wood, rude as the invention was, answered a good purpose in mastication, which, without it, could not have been performed, except with great difficulty. Habit, however, renders the absence of the organ less distressing; the floor of the mouth acquires so great contractility, as, in some measure, to replace the tongue, whose functions it performs. Perhaps, therefore, it would be better to let nature compensate the loss from her inexhaustible resources, than to paralyse her efforts by the presence of a piece of wood or ivory, which would always be a

very imperfect relief compared with the amelioration which time might work.

Sec. 9. *Substitution of the Inferior Lip and Chin.*

When an individual presents himself to you with a chin and lower lip destroyed by any cause, you must take a mould from a person whom he will indicate as resembling him in these parts of the face. With this model an impression is procured in plaster, and then in copper. Stamp a leaf of platina, scratch it, so that the enamel may hold to it, and paint the whole flesh color, taking care to work the beard, if the patient be a man.

We dislike the enamelled mask, because it is too fragile, and is liable to break into scales under the slightest shock. M. Delabarre proposes another means, which, perhaps, is preferable. It consists in covering a plaster-model with a thin layer of India rubber in solution, and drying it in a stove. When no longer glutinous, another is laid on; then a third. Upon this is applied a heavy piece of hempen cloth; three or more layers of the solution are then laid on as fast as they become hard. Upon the last is spread a piece of linen. When the gum-elastic has acquired all the consistency desirable, a piece of kid is glued upon the mask, and colored by a skilful painter.

In order to maintain the machine in place, we use two straps of cloth, covered with skin, and painted properly. When the patient is a man, false whiskers are of great service in concealing the mode of attachment. Sometimes they are made to end in a piece of metal, which is turned around the ear, sometimes the straps, upon which the hair is implanted, are clasped behind the head. For the sake of greater firmness, plates of metal, covered with skin, may leave the sides of the artificial chin, and fasten to a collar concealed in the folds of the cravat.

When the upper lip is to be supplied, the mode of proceeding is much the same with the under one, except in the means of attachment. It does not suffice to fix the apparatus with straps covered with false beard, we must, moreover, have two small plates of metal which will attach themselves, by running along side of the nose to the two orbits, to a pair of *preservers*, whose branches will serve as the means of superior attachment.

Sec. 3. *Vanvres Earth.*

Vanvres earth is very argillaceous. In the factories it is employed, especially, to make the plates upon which the porcelain is baked. When baked it is of a shining rust color. It bears with impunity the highest degree of heat, and the most sudden transitions of temperature. We may understand, that a substance like this is beyond price for rendering the teeth capable of resisting the action of heat in the process of soldering.

This earth, which is only used after it has undergone a first baking in the oven of the porcelain manufacturer, is, then, an excellent conductor of caloric. When it enters into the composition of mineral teeth it renders them very hard, and by no means fragile. We might suppose that its deep color might interfere with the colors of the oxyds which enter into the formation of the paste, but it is not so. On the contrary, it combines very well with them, and, in unison, gives the most satisfactory results.

Sec. 4. *Petunzé or Limoges Flint.*

The Petunzé is a species of flint, which, when reduced to a very fine powder serves to form a cover for porcelain. It is employed alone to enamel kaolin, but dentists make it serve as a base for their oxyds. Its fusibility is such, as well as its transparency, that we are obliged to add a certain quantity of kaolin to it, to give it the bony character which is the end of our efforts.

Sec. 5. *Oxyd of Titanium.*

The oxyd of titanium is one of the most precious substances at the command of the dentist. Without contradiction it is the principal coloring matter for incorruptible teeth. We have only to vary the doses of it to obtain a great variety of yellow tints.

When we mingle it with other oxyds, its combination with them contributes to give to the mineral teeth the shades which approach nearest to nature.

Sec. 6. *Oxyd of Uranium.*

The oxyd of uranium resembles cobalt, in that it gives a fine blue color; it differs from it, however, in that it is a little tinged with green. This shade, combined with the color of other oxyds, especially with those of titanium and gold, gives the most natural, and, consequently, the most highly esteemed hues.

The enamels into which the oxyd of uranium enters, are, especially, invaluable for communicating to the teeth a bluish cast, which corresponds very well with the natural teeth which very often present a similar tint. We must not forget that its coloring principle is very intense, and, therefore, to be used in extremely small quantities.

Sec. 7. *Oxyd of Manganese.*

The oxyd of manganese has been, for a long time employed in the manufacture of porcelain teeth, nevertheless, we can never use it alone, for it does not always produce the same shade. It ought not, therefore, to be incorporated singly, either in the paste, or in the enamel; to render the coloring principle a little more fixed, it is indispensable to mix it with other oxyds; without this, the tint produced would be very uncertain.

Mingled with that of titanium and gold, the oxyd under consideration produces shades the more natural, because tending to yellow—but for this it must be employed in sufficiently strong doses.

Sec. 8. *Oxyd of Gold.*

The oxyd of gold is employed to give the mineral teeth a slight rose color, the propriety of which will be seen, when we remember that the circulation goes on in the interior of the teeth, as in other parts of the body, by means of ramifications which penetrate even the bony substance. This gives it a slight rosy hue, which is yet heightened by the presence of the dental pulp, whose rosy tissue is perceptible through the enamel and bony

substance of the tooth. It is, then, this lively and animated hue, this slight carnation, to employ a happy expression of M. Audibran, which the oxyd of gold has the property of transmitting to the paste and to the enamel into which it is introduced. We perceive that here we must be very careful not to exceed proper bounds; the oxyd is to be used in exceedingly small quantities.

Sec. 9. *Platinum.*

Platinum is a metal doubly precious in the preparation of mineral teeth. It is useful to make the hooks fixed behind the tooth, and, besides, its finely levigated filings are incorporated into the paste to give it a greyish cast, sometimes very useful to assort with other teeth, presenting a similar appearance.

But it is especially for hooks that the platinum is indispensable. The fine gold itself, which some wish to substitute, will not delay to enter into fusion, while the new metal will resist admirably the heat of the fire necessary for baking porcelain.

As to the filings, besides the grey hue which it gives the paste, it gives it very great consistence, and enables it to bear the utmost heat without splitting. It contributes to diminish the shrinking during the baking, and also hinders the dentures from *veiling*.

Certainly these capabilities are sufficient to render this metal invaluable in the eyes of dentists. Since it has been applied to dental mechanism, it has frequently been employed for the preparation of almost all the pieces. This infatuation ought to be checked, for, as we have already said, in the preparation of large pieces, where the metal to be used is very thin, and of considerable extent, gold is preferable, because it is much more elastic. We will not repeat the consequences which grow out of this quality.

Sec. 10. *Preparation and Mixture of Earths and Oxyds.*

Whatever may be the purity of the substances we may use, the success is always subordinate to the care taken in the preparation, and, especially, to the degree of heat to which they are

subjected. In vain the ingredients of which the teeth are made will unite all the required properties, if they are badly prepared, the results obtained will be very different from those expected.

The older and longer macerated the paste, the better it will succeed. It is well, therefore, to prepare a quantity in advance, which should be locked up in a cellar, in porcelain vessels.

It is no less important that the water with which it is mixed should be pure. Rain water is preferable to others, which may contain salts and different oxyds.

The preparation of the enamel demands still greater care and exactness; otherwise, we run great risk of having the teeth spotted on the surface, which would only answer in certain extraordinary cases.

The first enamels made were vitrious and transparent, which is far from being the aspect of the natural teeth. This inconvenience was perceived, and, subsequently, the enamel was rendered more opaque by the mixture of kaolin.

There are some dentists who advise to bake the mineral teeth in the furnace of the porcelain makers. We disapprove this method, convinced, as we are, that it is absolutely necessary to have a furnace of our own, in order to be able to direct, increase, diminish and extinguish the fire when we think proper. As the makers of porcelain heat their furnace to the degree of heat necessary for vases and other objects which they bake, they do not concern themselves about the cases in which the mineral teeth are enclosed, and we may imagine how prejudicial this may be to success, when we reflect, that a fire too hot or too long continued, is sufficient to enfeeble the coloring principles, and, sometimes, to destroy them altogether, by decomposing the oxyds.

Let us return to the preparation of the paste. An essential condition, in order to its being good is the intimate mixture and pulverization of the substances which enter into its composition. The manner in which the paste is brayed and powdered contributes much to the beauty of the products. When this operation has been badly done, particles of oxyd remain to form spots on the exterior.

Sec. 11. *Formulæ for different Pastes and Enamels.*

We now proceed to give formulæ for different pastes and enamels which we have invented ourselves, at the price of many sneers and trials. We again inform the reader that success depends upon a crowd of circumstances, often entirely fortuitous. He need not be surprised, therefore, if the formulæ which we give, should not afford the promised result upon the first trial.

No. 1.—*Paste for Mineral Teeth of a Deep White.*

Kaolin, or porcelain earth,	125.00
Oxyd of titanium,	3.59
Oxyd of manganese,	1.85

When we wish to deepen the shades, it suffices to augment, gradually, the dose of the oxyds. When, on the contrary, we would render the tooth more transparent, we must diminish the quantity. We make this observation, once for all, because it is applicable to all the formulæ.

No. 2.—*Paste for Mineral Teeth, of a Greyish White.*

Kaolin,	125.00
Oxyd of titanium,	3.80
Oxyd of manganese,	2.06
Platinum filings,	

N. B. The platinum filings ought to be pulverized with a small portion of paste, and that long enough to reduce to a paste so fine, that in rubbing it between the fingers no grains can be discovered.

No. 3.—*Paste for Mineral Teeth of a Bluish White.*

Kaolin, ...	125.00
Oxyd of titan.	3.15
Oxyd of manganese, . . .	1.53
Oxyd of uranium, or, in default of this, cobalt,	0.28

No. 4.—*Paste for Mineral Teeth, animated with a slight Rose Tint.*

Kaolin,	125.00
Vanvres earth, (baked,)	0.38
Oxyd of titanium,	2.98
Oxyd of manganese,	1.63
Oxyd of gold,	0.01

Enamels.

It is important that the shade of the enamel, should, as much as possible, resemble that of the paste.

No. 1.—*Enamel, a little deep-shaded.*

Petunzé,	15.620
Oxyd of titan.	0.135
Oxyd of manganese,	0.215
Kaolin,	0.440

No. 2.—*Enamel, a little clearer.*

Petunzé,	15.62
Oxyd of titan.	0.11
Oxyd of manganese,	0.16
Kaolin,	0.55

No. 3.—*Enamel for a Tooth, tinted with Rose.*

Petunzé,	15.620
Oxyd of titan.	0.220
Oxyd of manganese,	0.160
Oxyd of gold,	0.002
Kaolin,	0.330

With regard to the enamels, we make the same remark as we have in reference to the pastes. We have only to increase or diminish the dose of oxyds to deepen or lighten the shades.

No. 4.—*Enamel of the color of the Gums.*

Petunzé,	7.81
Oxyd of gold,	0.21
Kaolin,	0.21

No. 5.—*Paste for Complete Dentures.*

Kaolin,	125.00
Oxyd of titan.	0.21
Oxyd of manganese,	1.74

Sec. 12. *Manner of making Moulds for the Mineral Teeth.*

Use is habitually made of pieces of iron, four inches long, an inch wide, and an inch deep, filed at one of the extremities,

so as to figure in relief a tooth to which should be given, in length and breadth, an extent almost double of that ordinarily presented by the external part of the natural teeth. After having made as many models as there are forms of teeth, we take pieces of yellow copper, in very thin leaves, cut them into pieces of an inch square, then we stamp them with heavy blows of a hammer, upon a mass of pewter weighing ten or fifteen pounds. When the moulds begin to take the impression from the models, we cut off the superfluous borders, and stamp them anew. We then file them so as to leave a little height in the midst of the lateral parts.

When all the moulds are prepared, they are soldered to bands of tin or copper, having care to rub them inside with powdered pumice stone, so as to remove the oxydized parts, which would spot the teeth, when thrown into them.

Sec. 13. *Hooks of the Mineral Teeth.*

The manner in which the hooks are planted in the base of the mineral teeth, is, without contradiction, one of the most important things, since upon it depends their firmness when soldered to the supports which should maintain them in place.

Hence, the inventive spirit of mechanics has been set to work to discover a process which might answer their ends. We will explain their different methods.

To make the hooks, we take a thread of platinum of the smallest size, pass it through the hole of the screw machine, then flatten it sufficiently without effacing the screw-threads which should remain distinct upon the sides. The hooks are cut to a right size, and if the screw-thread be not deep enough, it should be deepened by a few strokes of the file. The hooks being thus prepared, hold very firmly to the substance of the tooth from which they cannot be separated without breaking.

Another and more simple process consists in passing a platinum wire, of the smallest size, once through the flatter—the hooks are cut of a suitable size, and then with the cutting pincers we divide the extremity by which it is to be fixed in the tooth.

We propose a third means more simple yet, which is to split the fixed extremity of the hook, and to bend the two portions of it inversely to one another, so that we should have a true hook, like those which we see every day fastened in walls. It is easy to see that after the baking of the tooth, it would be easier to break it than to remove the hooks.

Sec. 14. *Modelling of Mineral Teeth.*

This operation is not as simple and easy as may be imagined at first sight. To be well done it demands different precautions which we are about to describe, and which cannot be observed with too much care and exactness.

Before all, it will be necessary to work the paste well between the fingers, so as to render it as unctious as possible. It must not be too liquid, and to rid it of its humidity, it suffices to lay it upon a tablet of dry plaster, which will speedily absorb the greater part of it. When this is done, we may fill the moulds with the paste. Then, with a small platinum needle, we make a furrow on the posterior part of the tooth, dividing it from above downward, and on the borders of this, we bury, while the paste is yet soft, three hooks, disposed thus—two on one side, and one on the other. The latter should be in a spot corresponding to the middle of the space between the two others.

When the tooth is longer than ordinary, it is good, for greater security, to put four hooks instead of three, and it is not necessary to place them facing one another, this disposition offering less guaranty for solidity.

After having modelled the number of teeth which we desire, we let them dry in the moulds; as soon as all the humidity is drained away, we have but to turn the bands of tin to which the shells were soldered, to detach the teeth, which fall out themselves.

Sec. 15. *Mineral Teeth with Heels.*

Some dentists, M. Audibran among others, speak very highly of this kind of teeth. In order that this work may be complete,

we will give the "modus faciendi," reserving to ourselves the right to express our own notions at the end of this paragraph.

It is easy to add, before the baking, a little paste, which may form the heel beneath the hook, or better yet, after the soldering of the pivot to use a composition suggested by M. Delabarre, of which the following is the formula.

Porcelain paste,	7 parts.
Calcined gypsum,	1 part.
White sand,	A twentieth of the mass.

Such oxyd as we wish, 150 grammes for the kilog.

Incorporate them perfectly in a mortar.

The addition of the gypsum adds remarkably to the fusibility of this paste. To bake it we need not apply to a porcelain maker; an air furnace, which we shall describe, will be sufficient.

Now, that we have described the two best processes, we do not hesitate to say, that paste heels greatly increase the difficulty of mounting the teeth, and, especially of setting them in the mouth. This is truly an obstacle, because the teeth which antagonise the piece, and cross under it, often come in contact with and derange it. This has hitherto hindered us from using this kind of teeth, and we have been the more confirmed in our indisposition in this particular, by the fact that we could always attach mineral heels which would answer the purpose perfectly well, and, at the same time, be far less bulky, which is no small matter in the insertion of artificial sets.

Sec. 16. *Mineral Molar Teeth.*

The preparation of mineral molar teeth is not more difficult than that of incisors and canines. Indeed, it will suffice, in order to attain this end, to procure well shaped models, which should be made perfectly cubic. Upon these are stamped matrices of copper, and in these matrices the teeth are moulded. They come out readily when dry.

As to the means of attachment, M. Audibran advises to introduce into their interior, and by the part which is to repose upon the plate a single hook with a screw, for the small, and two for

the large. It will be seen, when we have described the mode in which the mineral teeth are mounted, that those we employ, are always pierced by a canal, the direction of which is vertical. We affirm, that these offer all the solidity desirable.

Sec. 17. *Enamel of the Mineral Teeth.*

There are two ways of enamelling teeth; but before describing them, it is well to explain to the reader what is meant by the *biscuit*. To bring the paste to the state of biscuit, we first expose it to a strong charcoal fire, always, after having placed it in a crucible, which is not taken from the furnace until the fire is extinguished.

Now we will speak of the enamel. Upon this depends all the beauty of the mineral teeth. It has, besides, the advantage of preserving them, by protecting them against external causes.

The most important thing is perfectly to powder the enamel. When this is done well, there is the best guarantee of success. However, as we have already dwelt at length upon this subject, nothing remains for us but to show how it is applied to mineral teeth.

As we have already announced, from the beginning, there are two procedures: the one consists in enamelling the biscuit, the other the teeth, as yet in a state of paste. Let us first speak of the first.

Each tooth is fixed upon the end of an allumet, furnished with sealing-wax, so as to hold the tooth by the hooks fastened to it. With a pencil we apply the enamel upon the tooth, taking the precaution not to put it on too thick or too thin, for, in either case, the result will be defective. This done, each tooth is laid upon a platinum grate to dry. When the enamel, being properly dried, adheres to the paste, they are placed in a casket to carry them to the porcelain furnace, if the maker have not one of his own, which is far better. The casket in which the teeth are placed should be powdered with sand; they should be laid, side by side, without touching, for fear that during the baking the fusion of the enamel may make them adhere, which might happen, notwithstanding the contraction to which they are exposed.

Let us consider the second procedure. The enamel is reduced to the consistence of the paste. This is spread upon the bottom of the mould, and a sufficient quantity of the paste is laid upon it. The mould is filled as usual; the posterior furrow is made, and the three hooks inserted; the teeth, thus enamelled, are placed in the fire, without being subjected to preparatory baking.

The concluding part of this paragraph is highly important. We should provide ourselves with teeth with small reddish spots, which are often very precious, by incorporating, sometimes in the paste, and sometimes in the enamel, a small quantity of Vanvres earth already baked, pulverised and passed through the finest silken sieve. Nevertheless, to obtain the effect we need not pound this material with as much care as for the enamel, for it is, precisely, its slightly granular state which creates the spots of which we speak.

We have now a part to consider, which is not less important than mineral pastes—complete dentures. This will furnish the subject of the next chapter.

CHAPTER XX.

Before describing the method of preparing complicated pieces and complete porcelain sets, we ought to give some detailed account of domestic furnaces, and, especially, the means of obtaining the requisite degree of heat. This is a subject of the utmost interest, and is necessary to complete what we have already said in the preceding chapter.

Sec. 1. *Inconveniences of the Furnaces of Porcelain Makers.*

The fire in which porcelain is baked, is very hot and long continued. In treating it in this way, the workmen have two objects in view: 1st. To semi-vitrify the ware—to thoroughly melt the enamel and varnish, and then to give it brilliant whiteness by decomposing the feruginous particles which always

exist in greater or less quantity in the earths and quartz of which it is composed.

But what answers very well for making porcelain is very unfavorable to the wishes of the dentist. Indeed, what is his object? He wishes teeth with different shades, but when the fire is kept up, long after the enamel is fused, its action decomposes and destroys all the oxyds upon which he counted for giving the proper coloring, and all his combinations are rendered nugatory. There are some, who, to obviate the decomposition of the metallic oxyds, have thought to introduce a great deal of coloring matter in a small quantity of paste or enamel, so that the action of the fire might, at least, leave some to give to the mineral teeth a brownish hue. The result would be, that such large additions of oxyds would increase, by their decomposition, the contraction of the teeth, and thus entirely jeopard an operation, which, by the aid of a proper furnace, and good management, might be as certain as the mixing of the paste itself.

Sec. 2. *Laboratory Furnace.*

In the porcelain factories the heat of the furnace may be raised to a hundred and twenty or a hundred and thirty degrees of Wedgewood's pyrometer. Well, hard as it may be to credit it, in a little furnace, prepared at home for the purpose, we can obtain a heat of one hundred and sixty degrees. Therefore, it is not true that mineral teeth, and incorruptible dentures, can only be made in porcelain factories.

There are two kinds of furnaces, the great and the small. We will describe them successively.

Large Furnace.—The most refractory porcelain semi-vitrifies very well in a furnace or reverberator twenty-four centimes square. In order to concentrate the heat as much as possible, it is essential not to give it more then three openings—one on top, serves to introduce the fuel; another, lower, responds to the midst of the furnace, and gives passage to the case which holds the teeth—the third, at the level of the grate, serves to give access to the bottom of the furnace.

To arrest the fire when it is thought necessary, the grate, upon

which the combustible reposes, ought to be easy to displace. It is customary to make it upon the plan of a see-saw, which permits the coals to fall in an instant. The ash-pan should be very large, so as to contain a great quantity of air.

Small Furnace.—The furnace we have described, devours a great deal of combustible matter in a very short time. Economy, therefore, prescribes not to use it except to bake earthy matters, which must acquire great hardness, such as complete dentures, of which we shall speak at the end of this chapter. But when we wish only to color, by means of the slow fire, or to bake the soft porcelain, the formula of which we have given above, it will suffice to use a small furnace of not more than half the size of the other. The plan is precisely the same.

Sec. 3. *Degree of Baking.*

After all we have said, we hope the reader will be persuaded of one truth, that is, to obtain good mineral teeth, it is indispensable to know how to bake, without leaving any thing to chance; to arrest the fire immediately, that we obtain the semi-vitrification of the enamel. It is the more necessary, because if it be not heated enough, the pieces do not acquire sufficient consistency, and the saliva alters them, and, on the other hand, if the fire be kept up too long they will be deformed.

The degree of baking must be our guide, for the duration of the fire, and the quantity of fuel employed, give no certain means of information. The variations of atmosphere, cause so many changes in the drawing, that in cold dry weather we may bake in a half hour, and with very little charcoal, compositions which demand two hours, and four times as many combustibles, in a foggy day.

The simplest and best way of ascertaining the degree of baking, is the following: on the end of a number of platinum wires, we fix small patterns, made of earth and covered with enamel or paint, and introduce them into the box where the teeth are. During the baking they are withdrawn, from time to time, to ascertain the state of the process.

When the patterns approach a yellow color, are no more im-

pressible by the file, and have acquired the semi-transparency of porcelain, the teeth are sufficiently baked—the grate should be overturned, and the dentures extracted.

The coloring also demands a certain intensity of heat; for if the pieces be withdrawn too soon, the color is not well diffused, and will promptly undergo alteration in the mouth. If the heat be kept up too long, the color will grow pale or yellow, it decomposes and gets black and burned.

It will be seen, that it requires much patience and skill, to conduct an operation which is continually exposed to two extremes, both fatal to success—the too much and the too little. Now need we be surprised if with the very best formulæ, it is often difficult to accomplish the end? Nevertheless, none need despond, but every one should say, inasmuch, as others have succeeded, by dint of perseverance, so may I.

Sec. 4. *M. Audibran's Paste for preparing Porcelain Pieces.*

"Multiplied experiments," says this dentist, "leave me no room to doubt, that I have succeeded in very materially lessening the contraction, perhaps overcoming it altogether. It is only necessary to explain the means by which the end has been attained."

It might be supposed, that a paste made of substances, two-thirds of which are already baked, might not be flexible enough to be easily modelled. This is a mistake; the paste is very flexible. Besides, the flexibility is increased by the glutinous earth which we mix with it, and which renders it easy to work. The contraction is hardly perceptible, when the several precautions are taken, which we are about to describe.

We advise the operator to preserve a very exact model of the mouth in which he is about to insert the artificial set, for, in order to succeed, it is absolutely necessary that the model should be exact.

Before filling the breach with a piece of paste, it is necessary to lessen upon the model, by nearly a fourth the size of the two teeth which will touch the piece, and particularly preserve their natural appearance. Then, taking a piece of paste, worked well in the fingers, until it is somewhat firm in consistence, we fill

the space with it, being careful to give it bulk enough, both in depth and thickness, to make the tooth as large as we desire. If holes are necessary, they are made while the piece is yet soft. For this purpose we use a thin tempered drill or a squarer. We permit the piece to dry slowly. Then we examine whether there are any cracks. If we find any, we close them with a pencil charged with liquid paste. We may use, for this purpose, a small grater, of ivory or platinum, which is made to travel over the cracks after moistening them a little.

After the pieces are dry, the biscuit is placed in a fire, heated by degrees, and carried to a considerable height and long continued. This is necessary to give the matter a solidity which permits us to work it without fear of deforming it. But, we must confess, the matter thus baked is always very fragile, and demands from the sculptor, an address and lightness of hand which few operators possess.

It is essential, adds the same author, to make the teeth a little too long, on account of the contraction. It seems to us, that by these words, he makes a serious charge against his *non-contractile* paste.

We enamel these pieces, taking care not to alter the form of the teeth; then we bake them; and, when taken from the furnace we present them upon their models, and if there is any imperfection in their adjustment, it is remedied by the grindstone or files charged with moistened grit. Then we try the mouth, and we place the piece if all is perfect. If not, we begin again to remedy any defects we may perceive. It is by the aggregation of such precautions that we succeed in rendering the contraction almost nothing, and succeed in making perfect pieces.

Thus concludes the paragraph of M. Audibran. We hasten to do justice to the many excellent precepts which it contains; but we confess that we have not much confidence in this non-contractile paste.

We would preserve all that is good in the mechanical details, but we would warn our brethren to use the paste ordinarily employed for this kind of pieces, by taking care to give to their model a seventh or a tenth more than the natural size. For, according to our notions, the best mode of avoiding contraction,

is to conform to the necessity by calculating how much the fire will lessen the piece, so that on coming from the furnace, it may be of the proper size. What we say will apply equally well to complete sets, of which we are about to treat in the following paragraph.

Sec. 5. *Complete Dentures of Porcelain Paste.*

Mineral teeth adjusted upon a plate of gold or platina are certainly the simplest and the best for complete sets, but where there has been great loss of gum, and when the buccal humors are of so bad a character that they soon attack the sea-horse bases which have been once adjusted, it is well to recur to the process of that celebrated manufacturer of porcelain teeth, M. de Chemant.

In connection with our different formulæ for the bases of mineral teeth and enamels, we have added that of complete dentures. It is, therefore, useless to repeat it here. It is, then, that paste which serves to model the sets. But, before speaking of that operation, it is absolutely necessary to explain the manner of obtaining a model a seventh or tenth part larger than natural.

We know that plaster has the quality of swelling when it dries. This quality has, for a long time, been turned to advantage in obtaining the proportions desired by many successive mouldings. But this procedure, which has the advantage of increasing the model, preserving the exact relation of the depressions, and the eminences of the base, presents the very great inconveniences of jeoparding the form of the teeth, which, however, is reparable by the aid of the file and grindstone. But there is a method which ought to be very much preferred. Statuary has been enriched by a process, by aid of which, busts and statues may be reduced or augmented with mathematical precision. Nothing can be more easy than to apply this process to the impressions of the jaws, which we may wish to enlarge, to the extent of a tenth part, for instance, and, at least we run no risk of seeing the model deformed by successive layers, which may be repeated ten or a dozen times.

We are then in possession of a mould fulfilling all desirable

conditions. We have now nothing more to do than to take a mass of well prepared paste, to apply it to the plaster-mould, and let it dry in the shade, taking care to heap it occasionally; when the earth has acquired the requisite degree of hardness, we draw out the denture, and take away all the particles which have found their way into the interstices of the several pieces of which the mould is composed.

At the place where the spring supports are to be placed, we pierce a hole while the paste is still soft enough to permit it. This little operation, very simple in appearance, nevertheless, demands very great care, and lightness of hand, for this paste cracks easily.

It is prudent to make at least six at a time, for there is no security that of six the fire will leave one without crack or torsion.

When the pieces are perfectly dry, they are put to harden in the large furnace, the description of which has been given at the commencement of this chapter. Finally they are withdrawn, such as have suffered least, are examined, and if we chance to find one which is not spoiled, it is easy to perfect it by the file and stone.

Two things remain to be done—to enamel the teeth, and to color the artificial gums. To proceed to the first operation, the artificer selects one of our enamels, the shade of which is not important, except for single or partial pieces—with this, the biscuit is covered, the piece is introduced into an oven prepared for the purpose, and by the aid of a fire of ordinary intensity, the layer of enamel is vitrified; the whole is left to cool, and then the gums are colored.

Sec. 6. *Coloring of the Gums.*

There are two processes for coloring the gums. The one consists in covering the biscuit with an enamel, the formula for which we have given in the preceding chapter, No. 4, and which covers the gums, following exactly the contour of their festoons. But when the piece is withdrawn from the fire, it may happen, that, through the effect of the heat having been a little too

intense, the vermilion has been somewhat paled, then we have another process by which to remedy the slight defect.

We take oxyd of gold, precipitated by tin, or the purple precipitate of Cassius; we reduce it to a very fine powder upon a tile of biscuit, with a pestle of the same material. To this are added equal parts of essence of turpentine and lavender. When the whole is perfectly mixed, some drops of thick oil are added to the mass in order to give more consistency to the color. Then, with a pencil, we paint the part which is to imitate the gum, we wait till the color is dry, and when satisfied that this is perfectly accomplished, the piece is introduced into a little oven, and exposed to a tolerably active fire. When the fire is well kindled, and the oven is quite red, we withdraw, through an opening which is made for this purpose, a pattern which has been placed at the end of a platinum thread, and if the color of this appears well diffused, we hasten to withdraw the oven from the centre of the fire, and permit it to become entirely cold before we withdraw the denture, for it will be apt to split if suddenly exposed to a lower temperature.

As to the degree of heat; the remarks we have made upon the rose enamel, are, in every respect, applicable to this method of painting the gums.

This method is as simple as it is easy. Unhappily, the color sometimes is rapidly changed by contact with the saliva. Nevertheless, we have instances of painted dentures, which have been preserved for a great length of time without undergoing the least alteration. If, however, the color should fade, we have only to renew it, which is no great matter.

When the enamel, of which we spoke at the beginning, succeeds as it ought, it is certainly the most durable.

CHAPTER XXI.

SEC. 1. *Washing of Ashes.*

DENTISTS, for the most part, use in their business none but the most precious and costly metals. After a while, by filing the pieces either of silver, gold, or platinum, there is amassed a quantity of filings of different metals, which have been carefully preserved in a leather apron, attached to the table for that purpose. We may even add the sweepings of the work-shop, for let us take what pains we may, some metallic particles will fall upon the floor This mixture of metals, dust, and charcoal, is called cinders. To separate these different metals, and reduce them to isolated ingots, they are subjected to different operations which we are about to describe.

We begin by Washing.—For this purpose, we first pass the cinders through a sieve of copper-wire to separate the charcoal and other foreign bodies from the metals. The portion which remains upon the sieve should be examined closely, and if it still contains metallic particles, they should be pounded in an iron mortar, and sifted again. This done, the washing may be performed in two different ways.

The first is the Washing with Water.—To do this we soak the cinders in water. Then we prepare ourselves with a wooden-bowl, and a bucket filled with water. In the bowl we put a fourth of the quantity of cinders. We plunge the whole into the bucket, and agitate with the hand or a stick, the mixture of filings and dust. It is easy to perceive that the earthy matters, being lighter than the metals contained in the cinders, will be spread through the water in the bucket, while the metals remain in the bottom of the bowl. The residue is laid aside, and we begin to wash another portion of cinders. When no more remain, it is well to examine carefully the deposit formed at the bottom of the bucket to satisfy ourselves that it contains no metallic particles, for if it does, we must wash again.

The Second Manner is the Washing in Water by means of the Mill.—The apparatus employed for this purpose is thus con-

structed. It is an ordinary cask-shaped vessel, the bottom of which, slightly concave, bears a wooden axle moved by a handle. Iron bands, in the form of a cross, and about an inch in size, are placed at the interior part of this axle. Two other bands, so arranged that they cut in two the angles formed by the two first, are adjusted below them. Besides, at about a third of its height, the vessel is fitted with a cock, having interiorily, a diameter of two inches. When the apparatus is properly prepared, water is poured into the mill, up to half its height, and then we add whatever steeped cinders we have. To facilitate the precipitation of the metallic matters, the handle is turned for three or four hours, and at the end of that time we introduce, gently, into the inside of the cask a stream of water. When the water runs off quite pure and clear, we may cease to introduce it by the pipe, and, as we have received the water in a bucket, we examine it to see that it contains no mineral matters. As to the different metals or residue which remain in the mill, they are treated by mercury. We will describe the process in the following paragraph.

Sec. 2. *Washing in the Mill by Mercury.*

We use the same mill we have employed for washing with water. We must carefully cleanse the mercury we employ, by acetic acid, and, subsequently, water. When it has undergone this operation, we pour into the mill a quantity proportionate to that of the cinders, viz. two pounds for one. The mercury and cinders being mixed together, they are turned in the mill for two hours. We have omitted to say, that the cinders should be moistened. Then we suffer the water which contains the earthy parts to run off, and wash the mercury to detach all foreign matters from it.

To separate the platinum, we must operate by decanting, either by means of a funnel, which is closed until the platinum has sunk to the bottom—the finger then is withdrawn for an instant, and the platinum runs out with the amalgam; or, more simply, by means of a narrow vessel. It is suffered to be at rest—then the amalgam is poured off and the platinum rests at

the bottom with some amalgam, as in the former proceeding. If we wish to purify it, we add a little more mercury, and decant again and again. In this way the amalgam is dissolved. Then the platinum remains only in junction with mercury, and this is driven off by the fire. There now remains nothing more than to pass the mercury through a piece of chamois skin by means of a press. Then the several metals contained in the mercury separate from it and remain upon the skin, while it falls in a shower from the thousand pores of this natural sieve. The residue is a solid amalgam. To drive off the mercury, we place the whole in an iron retort, composed of two pieces luted at their junction, and secured with screws. To the neck of this is adapted an iron elongation which is plunged into a vase of water. When all is ready, we proceed to distil the mercury. Then the residuum is heated in a crucible with an eighth part of saltpetre, and a sixteenth of borax. For a quarter of an hour we keep this alloy in fusion, and stir it until it forms a homogeneous mass, and, finally, pour it into an ingot mould to be assayed.

Sec. 3. *Mode of Separating Silver.*

When by means of washing, we have taken away all the earthy parts of the different metals of which the mechanic makes use, we place these last in a glass vessel, with three parts of nitric acid, at 20°, and warm it gently to facilitate the action of the acid. If lead, bismuth, copper, silver, and a little iron are contained in the cinders, the acid dissolves all these metals. The portion of iron not dissolved is oxydized and, together with oxyd of tin, gold and platinum forms the residuum. The liquors are decanted, and the deposit washed with water, which is added to the other liquids diluted with four times their weight of water. They are then filtered. When the solution is filtered, hydrochloric acid is added, until no more precipitate is formed. This precipitate is the chloride of silver, known by its whiteness, and flocculent curdy appearance. If we wish to reduce the silver, we have only to mix the washed precipitate, gathered and dried upon a filter, with chalk and charcoal. This mixture is introduced into a crucible, which is ex-

posed to a red heat for a half hour. It is left to cool, the crucible is then broken, and the silver taken out mingled with one or two per cent. of gold.

We may reduce the silver by means of a plate of zinc. Finally, if we would dispense with the reduction of the chloride, we may dry it thoroughly and weigh it. Every 1000 parts ought to contain 753 of silver.

Sec. 4. *To Separate the Gold.*

We have already said, that the residuum, insoluble in nitric acid, contained iron and tin in the state of oxyds, besides gold and platinum. To treat this residuum, it is placed in a vessel containing hydrochloric acid, which is exposed to a small degree of heat. The oxyds of iron and tin dissolve, and then it is sufficient to dilute the liquid in order to separate these two dissolved metals by decanting. Nothing remains but the gold and platinum. To separate these, they are dissolved in aqua regia, composed of three parts of hydrochloric, and one of nitric acid, at 34° of Beaumé. The solution is favored by a slight degree of heat, and when it is completed, the solution is weakened with water and filtered. Then two parts of sul. of iron are dissolved in four parts of water, and poured into the solution of gold and platinum. This done, in order to give the gold time to precipitate, the liquor is permitted to stand for ten days: it is then decanted, and the gold remains deposited in a very fine powder.

In order that the operation may be complete, we must assure ourselves that the whole of the gold has been precipitated. In order to this, a second portion of sul. ferri is dissolved in two parts of water, and poured into the decanted waters. We then wait forty-eight hours, and if a new precipitate be formed, we wash it and add it to the rest. As to the washing, it should be performed, first with water slightly tinctured with sulphuric acid, then with pure water. Finally, the precipitate thus obtained, is dried upon a filter, and if we wish to reduce the gold to the form of an ingot, we mix it with a little saltpetre and borax in powder, put the mixture into a crucible, expose it to the fire of the furnace for about an hour, let it cool, break the crucible, and take out a mass of gold twenty-four carats fine.

Sec. 5. *Manner of Separating Platinum from the Cinders.*

We have seen that the liquors resulting from the precipitation of the gold, by the sul. of iron, contain platinum in solution. To separate it, it will suffice to employ a very simple expedient. For fifty or sixty hours, we leave plates of zinc in contact with the solution, and little by little the platinum will be precipitated in the form of black powder. When all the metal is precipitated, we withdraw the zinc plates, and brush them gently, in order to remove the platinum which may adhere. This done, we boil the precipitate in water, and wash it with water slightly acidulated with sulphuric acid, in order to remove any zinc that may remain in union with it, then with pure water, and dissolve it anew in six times its weight of aqua regia.

Now it remains to remove the excess of acid. In order to this, the solution is evaporated to dryness. By this we obtain a saline mass, which we dissolve in water, and concentrate after filtering it. We also dissolve sal ammon. in cold water to saturation, and pour this solution into the first, until it ceases to form a precipitate, which is of a yellowish color, and is composed of hydrochloric acid, platinum and ammonia. It is placed upon a filter, washed gently with water and dried.

When sufficiently dried, put it into a crucible and expose it to a red heat, until no more white smoke passes off, for by this sign we know that the decomposition is complete. Then cool the crucible, and draw out the platinum in the form of a spongy mass. This is what is called spongy platinum.

It is not rare to find the mother liquid resulting from the separation of silver, retain a little platinum. In this case we separate the metal by the same process as above described; that is to say, we place the solution in contact with the zinc plates, wash the black powder with weak nitric acid, or, rather, with the hydrochloric, because tin may be present, which nitric acid would oxydize but not decompose, and this done, we treat the residuum in the same way with that extracted from the solution from which gold has been taken.

Sec. 6. *Assaying of the Cinders.*

Some dentists, who are not willing to take the trouble of washing the ashes, hand them over to persons who make a business of separating mixed metals. But it is essential, before trusting them to strange hands, to ascertain how much of the precious metals they contain. It is not so difficult to discover this as might be at first supposed. There are two modes of solving the problem. The first in which we have already instructed the reader, is the humid way, that which we are about to describe, is the *dry* way.

Here is the manner of performing this operation. We first take specimens of ashes from different parts of the mass, and carefully mingle them. Then we take thirty grammes which we melt in a crucible with thirty grammes of pure litharge, and sixty of black flux. The whole is exposed to the action of a forge fire for twenty or twenty-five minutes, and if it does not fuse readily, we have only to throw in a pinch of powdered borax. Then the mass promptly melts. The crucible is then withdrawn and left to cool, then the button of metal is withdrawn. We must take care that the scories which covers it does not contain any metallic globules, for in that case the assay would not be complete. The button weighs, perhaps, twelve grammes, and is composed of different metals, contained in the ashes, plus the lead, which has been reduced from its oxyd.

Now we proceed to a new operation, called cupellation. This is done by means of a cupelling furnace, of an elliptic shape; its diameter is from one hundred and sixty-two to two hundred and sixteen millimetres, its height five hundred and forty. It is composed of three parts, the ash-pan, furnace and dome, which ordinarily is surmounted by an iron funnel, in order to facilitate withdrawing. The metal is not placed in this until it is white hot. The metal enters into fusion with a considerable movement. We then see the alloy to diminish in volume, and the lead in oxydizing to draw with it the other metals, except silver, gold and platinum. We judge that the operation is finished when the movement ceases, and the interior of the cruci-

ble is, as it were, illuminated by a kind of brilliancy. The cupel is then withdrawn, and the metal permitted to solidify. When it is completely cold we remove it with pincers, in which we hold it until we brush it, and remove any portions of oxyd or cupel that may be attached to it. Exactly weighing what remains in the crucible, we ascertain the collective weight of the gold, silver and platinum, contained in thirty grammes of ashes. Now it remains to separate the metals. To do this, we weigh the mass exactly, add three parts of its weight of fine silver to it, then melt altogether by means of lead in the cupel, and when this is done, it should be left some time in the crucible to rid it entirely of the lead; then having taken out and brushed it, we flatten it into what is called the *cornet*. After this, it is treated with nitric acid of twenty-two degrees, for twenty minutes; we then decant the liquor in order to treat it with nitric acid of thirty-two degrees. We wash the cornet with distilled water. By this means we have dissolved all the silver and all the platinum, which colors the solution with yellow, which is deep in proportion to the quantity of platinum. If the color be light, we must repeat the process, in order to be sure that no platinum is left.

The *cornet* is well washed, dried, and exposed to a moderate heat in a small porous crucible.

To obtain the silver and platinum, we unite the liquors containing them, and pour in a warm solution of sea-salt, or hydrochloric acid, and then we collect the precipitate upon a filter; wash it and dry it thoroughly. We weigh this chlorate with the filter, and subtract the weight of the filter, (previously ascertained.) We calculate the silver in the chlorate which contains $\frac{7568}{10000}$, and we have only to deduct the weight of the metal added in the process. Knowing the quantity of silver, we ascertain the amount of platinum by subtraction. We can, if we prefer it, reduce the platinum, as previously described, and weigh it.

Before closing the chapter, we have to thank M. Barruel, who has afforded us his aid, to enable us to treat properly of a department with which we were not familiar.

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