

A manual of dental economy : or practical instruction on the physiology and treatment of teeth, in order to check their diseases, repair their injuries, and insure their preservation / by Charles S. Rowell.

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A MANUAL
OF
DENTAL ECONOMY;
OR
PRACTICAL INSTRUCTION
ON THE
PHYSIOLOGY AND TREATMENT OF TEETH,
IN ORDER TO
CHECK THEIR DISEASES, REPAIR THEIR INJURIES,
AND INSURE THEIR PRESERVATION.

BY
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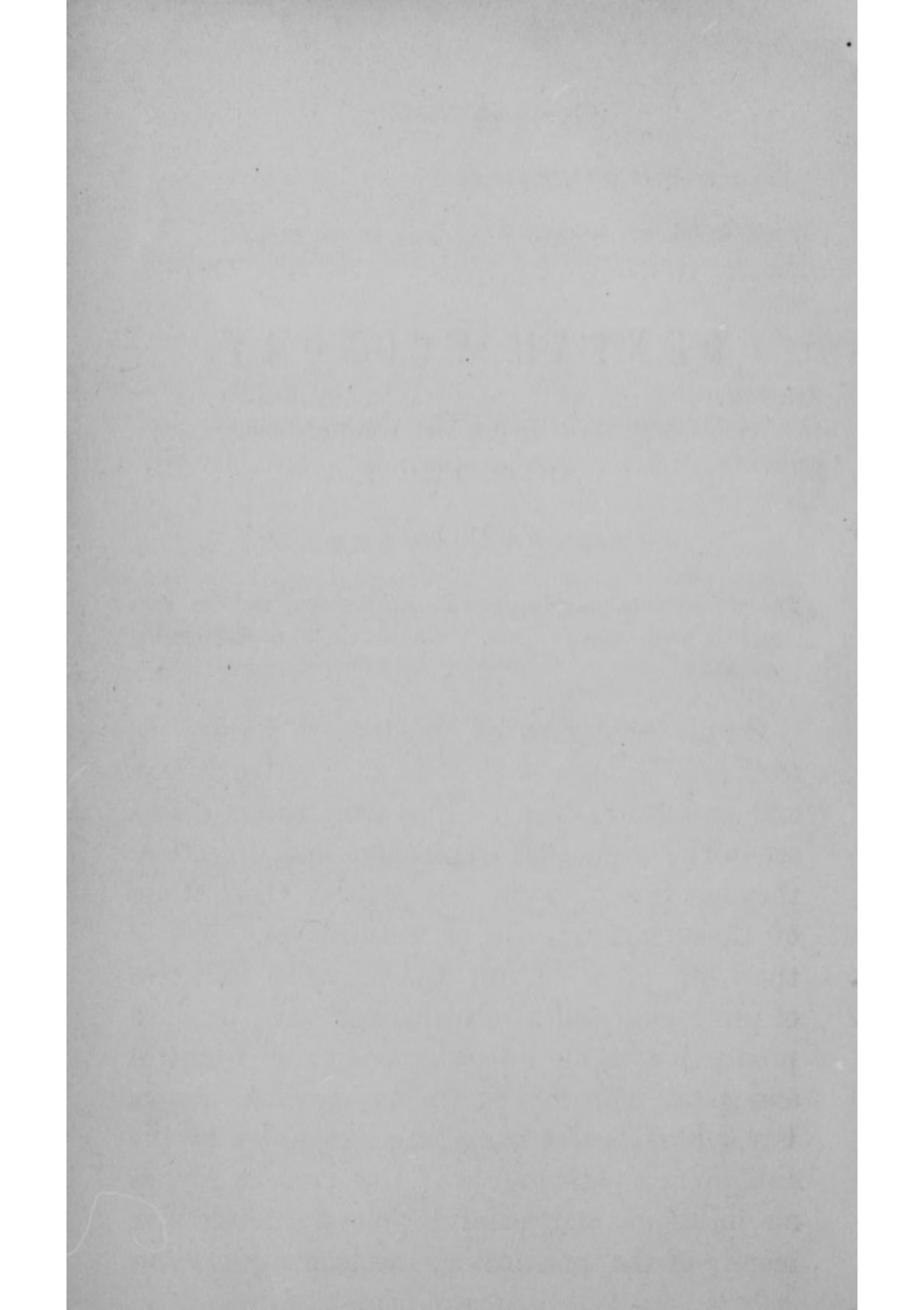
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DENTAL ECONOMY.

CHAPTER I.

INTRODUCTORY.

The pre-eminent prevalence of Dental Disease, and its connexion with many other Diseases as a superinducing cause.

OF all the organs of the human frame, the *teeth* are the most subject to destructive disease and premature decay. Prevalent as are diseases of the organs of respiration and digestion, they are incomparably less general than those of these instruments of mastication. Nor is there any other organic disease more inflictive of protracted and intolerable suffering, or more productive, as an infecting cause, of frightful and fatal maladies in the more vital organs. For dental disease is no longer regarded by the enlightened pathologists of the present day, as an insidious and painful process, destructive merely of the masticatory mechanism, however

necessary the latter may be to the comminution of food for healthful digestion, and to the natural expression of the human countenance and voice ; but it is now justly classed among those deeper and darker fountains of evil, which, however seldom suspected, spread their infection at the roots and through every fibre of the tree of life. Seated, like the fabled dragon, at the main entrance and portal of the profoundest avenues of the corporeal fabric, dental diseases corrupt not only the food which is passed through the mouth into the stomach, as the only source of sustenance to the whole system, but also, and perhaps chiefly, poison every breath of vital air that is received into the lungs, through the same pestiferous cavern, to revivify the blood and sustain its circulation.

However startling and unwarrantable it may appear to attribute the prevalence of pulmonary consumption, and especially that predominant form of it, known as *phthisis pulmonalis*, to decayed teeth and ulcerated gums, the opinion, nevertheless, is fully established, by abundant and invincible evidence, as well as by the sanction of many of the highest authorities in the medical profession. It might not suffice to allege the remarkable fact that those countries

and climates which most abound with pulmonary mortality are also the most unhappily distinguished for an endemic diffusion of dental maladies ; nor might it be deemed conclusive to adduce the converse corroboration that, among those races of mankind, and in those equable climates, which are comparatively exempt from diseases of the teeth, pulmonary affections also are proportionably rare. But the pathological evidence upon the subject cannot be resisted. It appeals alike to the common sense of the unprofessional reader, and to the cultivated intelligence of the scientific.

It is nowhere contested that local diseases are often propagated from one part of the body to another, and frequently to parts far remote from their original locality. It is, moreover, admitted to be an almost inevitable result of local affections, of an inveterate character, that they *must*, sooner or later, seriously affect the health of the entire system. If this be true, as a general rule, how emphatic and forcible does it become in relation to cankerous, virulent, and inveterate diseases of so important an avenue as the mouth ? “ One of the first effects of diseased teeth,” says a standard writer upon this subject, “ is to contaminate the air which

passes over them ; this they do, more or less, in proportion to the extent and state of their disease ; in some cases very slightly, in others the affected tooth or teeth are in a complete state of putrefaction, and the air which passes to the lungs, through the mouth and back again, is so greatly contaminated as to be rendered exceedingly offensive to every person near the individual, and often to the sufferer himself. It is a subject of astonishment to reflect upon the quantity of offensive matter thrown off from one or more diseased teeth, for although the air which passes over them is changed every instant, still it is constantly affected and rendered offensive ; and the whole air of the room is soon contaminated by the breath of such a person. We respire about twenty-thousand times in twenty-four hours, and yet, for months and years, this vast quantity of air is rendered poisonous by one or more diseased teeth. How little does it avail such a person, if by every possible means the natural purity of the air is preserved ; if no impurities are suffered to remain in the streets, his tenements kept clean and his apartments ventilated : or that he make distant journeys, at a great expense of time and money, for the benefit of pure air, if,

at the same time, he carry a very fount of filth in his own mouth ? If this state of the breath, caused by bad teeth, so affects the olfactory nerves of a person standing near an individual having bad teeth, what must be its effects upon the delicate and susceptible tissues of the lungs of the individual himself ? It must be a baneful influence, armed with pestilence, scattering disease over the lungs, and pouring streams of deadly poison through every vein of the system. The morbid matter thrown off from the teeth in a state of disease, and also from diseased gums, and thus perpetually infused and deposited in the lungs, is of a very acrid nature, as is demonstrated by its so vitiating the saliva as to cause it to dissolve and oxidize a pure metal like silver, and even to tarnish gold. We know that many of our organs have the power of resisting, for a long time and in a wonderful manner, the effects of pernicious agents ; but the lungs are so notoriously susceptible of injury from impure air, that even slightly injurious impressions, so incessantly repeated and continued as those from decayed teeth, cannot ultimately fail to produce disease and disorganization."

Another eminent writer, Dr. Rush, remarks :

“When we consider how often the teeth, when decayed, are exposed to irritation from hot and cold drinks and aliments ; from pressure by mastication, and from cold air ; and how intricate the connection of the mouth is with the whole system, I am disposed to believe that they are often unsuspected causes of general, and particularly of nervous diseases. And when we add to the list of these causes, the morbid effects of the acrid and putrid matters which evolve from carious teeth, or from ulcers created by them in the gums, I cannot help thinking that our success in the treatment of all chronic diseases would be very much promoted by directing our inquiries into the state of the teeth of sick people, and by advising their extraction in every case in which they are decayed. It is not necessary that they should be attended with pain in order to produce diseases, for splinters, tumors, and other irritants, before mentioned, often bring on diseases and death, when they give no pain, and are unsuspected as causes of them. This transition of sensation and motion to parts remote from the place where impressions are made, appears in many instances, and seems to depend upon an original law of the animal economy.”

Nor is this hypothesis, that the system ~~in~~ general, and the lungs especially, are subject to derangement and delapidation by imbibing the morbid virus distributed from a diseased mouth, as its primary and principal focus, by any means a modern or novel doctrine in medical science, although general practitioners, in relinquishing dental surgery to its distinct and exclusive professors, have neglected to teach this branch of the subject with the assiduity and emphasis which its importance demands. It was taught by the great John Hunter, with an array of evidence and minuteness of detail which should arouse and astonish the modern school of physicians by whom it has been so commonly pretermitted ; and by a host of other eminent authorities, American, English, French, and German, with surpassing force of illustration and proof.

The number of cases on medical record, in which incipient consumption has been arrested and cured by the mere extraction of decayed teeth, amounts to a demonstration of this hypothesis, as far as it relates to their being a frequent cause of pulmonary complaints, without claiming that the removal of this cause would suffice to restrain its deplorable defects in cases

of longer standing, where its ravages are necessarily irreparable. In the course of my own practice, which has been extensive for a period of more than twenty years, indubitable instances of the kind have been continually presented. In many of these, the commencement of pulmonary disease—hacking cough, fever, expectoration, emaciation, and general debility—has been distinctly traced to some particular exacerbation or paroxysm of dental decay, and the concomitant ulceration of the mouth. And when to this is added the correlative fact that, in the greater number of such instances, the pulmonary symptoms have dated their amelioration, with equal distinctness, to the removal of the decayed teeth, and the consequent cure of the cheeks and gums, no doubt can rest upon the question in any observant and practical mind. Indeed, every dental surgeon of ordinary observation and experience, must have become as familiar with the same facts and conclusions as with any others of repeated occurrence in his practice. It may, therefore, be received as an established and incontestible medical doctrine, that diseased teeth and gums are a frequent, prolific, and prevalent cause of pulmonary irritation, ulceration and consumption.

Equally conclusive are the highest medical authorities, and the whole practice of dentistry, that diseases of the digestive organs are propagated, as well as aggravated, from those of the teeth. This is effected in a two-fold manner : first, by preventing a proper mastication of food, and, secondly, by transmitting the putrid, ulcerous, and infectious matter, exuded by the carious teeth and gums, into the stomach and bowels, in admixture with the saliva, drink, and food.

That digestion of food in the human stomach can proceed as well without previous mastication as with it, would be to assume that nature has furnished us with a beautiful and peculiarly elaborated apparatus, for that purpose, altogether unnecessarily and in vain. It is, on the contrary, constructed in express design and adaptation to the omnivorous character of the human species, combining the powers and advantages separately possessed by that of gramnivorous, and carnivorous animals. So important, indeed, is perfect mastication to the sustenance of some of the former species, that the ruminating varieties chew their food twice over, while the teeth of man, in a sound and healthy state, or properly replaced by art, enable him to com-

pletely comminute precisely the same kind of food in a single operation.

“Mastication,” says one of the eminent writers before cited, “is the first step in that series of processes by which the food is rendered subservient to the purposes of nourishing and supporting the animal system. It seems to be an indispensable requisite, in order to the accomplishment of healthy and speedy digestion, that the food should be reduced to very small pieces. It is an old maxim that food well masticated is half digested ; indeed, the practice of swallowing the food in large pieces, in almost all cases, sooner or later, produces dyspepsia, and greatly weakens the powers of the stomach.” And to this testimony we may add the remark, that persons who have incurred this habit, without the excuse, or rather necessity for it, arising from bad or few teeth, are almost invariably of that voracious and lean kind whom no amount of food can endow with flesh, simply because the first stomach never receives it in a state from which it can be properly prepared for assimilation with the general system in the second. Such persons resemble those carnivorous animals who, devouring large quantities of food, with little or no mastication, like the hyena and the wolf,

are rarely if ever fat ; while the unfortunate victim of decayed or lost teeth becomes reduced, by dyspepsia, to the same condition, by the same cause, even in instances where his appetite is retained after his digestive functions have become impaired.

In relation to the second and co-operative effect of diseased teeth, in producing dyspepsia, and ulceration of the stomach and bowels, by the direct contact and absorption of morbid virus, it is only necessary to quote the brief but forcible remarks of the most eminent authority upon the subject in this country, with which he introduces demonstrative exemplifications occurring in his own practice. "Dyspepsia may be occasioned by the putrid and ulcerated matter from the diseased teeth and gums, mixing with the aliment and passing into the stomach. Upon this head of the subject I need scarcely make a remark, as it must be self-evident to every reflecting mind ; for no person can doubt that matter received into the stomach, which is the result of the mortification and diseased excretion of the adjacent parts of the same body, must infect and impair the condition of that organ and the connecting viscera, and vitiate, more or less, the alimentation and cir-

culuation of the whole system." If it did not, the exception would be a marvelous anomaly in pathology which has never yet occurred.

But there is a third and equally obvious cause of dyspepsia from diseased teeth, which claims at least a passing notice : and that is the irritation which they produce in the nervous system generally, and in that of the stomach especially. "It is a well known fact in the pathology of disease," says the author last cited, "that excessive pain, occurring in any part of the system, will derange all its healthy functions, and no organ is sooner affected than the stomach, as it is the grand centre of sympathetic action in the animal system." No fact is more notorious than the loss of appetite, nausea, and diarrhœa, produced by the dentition of infancy. It is the principal cause of that very prevalent and fatal complaint among children, the *cholera infantum*; and the irritation from diseased teeth, affecting, as it does, precisely the same nerves, is a cause, however little suspected, of a proportionate amount of pernicious derangement in the visera of adults.

To the same prolific source must we attribute many of those affections of the ear which eventually result in the total loss of hearing. "It

often happens," says Dr. Fitch, the dentist, "that painful teeth, and those affected with complicated caries, are the cause of great pain and inflammation in the ear, so as to affect its proper functions. So great is the sympathy between the nerves of the teeth and of the ear, that remedies applied to the latter will relieve pain in the former. Laudanum, dropped upon a lock of cotton, and introduced into the ear, will often relieve the tooth-ache. This is quite a popular remedy ; and it is upon the same principle, or a knowledge of the same facts, that the actual cautery has been applied to the anti-helix of the ear to relieve painful teeth." Indeed, every dentist of experience must have become familiar with the fact that agonizing and dangerous suppurations in the ear are frequently occasioned by carious molar teeth, and entirely cured by their extraction. Nor is it less clearly established, by innumerable concurrent cases, that inveterate inflammations and opthalmic opacities of the eye, often terminating in utter deprivation of sight, have had the same common origin. Medical journals abound with such cases, although it may be fairly presumed that very few of the actual number are ever recorded.

Among the nervous affections which are frequently superinduced by diseased teeth, those of epilepsy, hysteria, hypochondriasis, rheumatic affections, tic doloureux, sympathetic head-ache, hemicrania and palsy, have been frequently well determined. The teeth being supplied with nerves from the fifth pair, a lively sympathy with all their affections must necessarily prevail over the very wide and distant parts of the system to which that pair of nerves extends. No dentist can be ignorant of the frequent cures of tic doloureux which are effected by the extraction of decayed teeth ; or of the paroxysms of hysteria into which patients are often thrown by the mere apprehension of the operation. The convulsions of children, from the pains of dentition, are scarcely better traced to their origin than those of many female adults to the same organs, in a state of decay. And it may be sufficient to hint, as regards female patients, that, in very numerous instances, every where occurring, paroxysms of pain and ulceration, both in the upper and lower jaws, recur at regular intervals, thus showing the connexion between dental disease and some of the most serious irregularities in the functions of feminine organization.

But it would exceed the limits of a little work of this kind, to give even a synopsis of the many maladies which are clearly proved, by multitudes of authenticated cases, to be dependent upon this cause. Dr. Rush remarks: "I have been made happy by discovering that I have only added to the observations of other physicians, in pointing out a connexion between the extraction of decayed and diseased teeth, and the cure of general diseases." Several instances of the efficiency of this simple remedy, in relieving headache and vertigo, are mentioned by Dr. Darwin. "Dr. Gater says that M. Petit, a celebrated French surgeon, had often cured intermittent fevers that had resisted bark for months and even years, by this means;" and he quotes from his work, two cases, one of consumption, the other of vertigo, both of long continuance, which were suddenly cured by the extraction of two decayed teeth, in the former case, and of two supernumerary teeth in the latter. "Almost unappreciable," says a humane and standard authority, "are the beginnings of many fatal diseases; and could the grave reveal its secrets, I have not a doubt, when I consider the number of dangerous complaints produced by diseased teeth, but it would

be found that thousands are there in whom the first fatal impulse was given by a neglected decay of those organs ; and could I raise my voice so as to be heard by every medical man in America, I would say to him, attend to your patient's teeth ; and if they are diseased, direct such means as shall restore them, and if in health, such as shall keep them so. And know, for your own satisfaction and honor, that you will always thus administer to the well-being and best interests of your patients, and preserve many valuable lives."

In concluding these introductory considerations, the following comprehensive testimony from the pen of the distinguished Dr. Charles A. Lee, late professor of Materia Medica, in the University of New York, are impressively appropriate : " Unless the teeth are preserved in a sound condition, ill health is almost sure to be a necessary consequence, and a life of pain and suffering will be the penalty of their neglect. Every person, therefore, should consult a scientific dentist regularly, at stated intervals, and every youth should have indelibly impressed upon his mind, the important truth, that by the advice and aid of the skillful dentist,

NO TEETH, AFTER THE SECOND DENTITION, NEED

EVER BE LOST—that as in texture they are naturally the most compact and indestructible part of human organization, so will they prove to be through life, if submitted, in time, to the treatment of the experienced and judicious dentist.”

CHAPTER II.

PHYSIOLOGICAL HISTORY OF THE TEETH.

A physiological history of the teeth, embracing all the details of their natural history, anatomy, abnormal deformities, irregularities, and distinctive characteristics, would require a large volume. Enough, however, of each of these branches of the subject, will be given in two or three chapters, to enable the reader to understand the account of dental diseases, with their curative treatment and prevention, which will be found in the subsequent pages of this manual.

The full and regular number of teeth allotted to the human species, of both sexes, at adult age, is *thirty-two*, there being sixteen in the upper and as many in the lower jaw. By a provident forecast of nature, only a few of this number are allowed to be produced at one time, but are developed at different periods of life, in order to allow time for the growth of the bony arches of the jaws which they are designed to

occupy in the full number and dimensions best suited to the animal wants of their possessor. Nor is this the only arrangement of nature for this purpose. Of the thirty-two teeth which constitute the complete and permanent set, twenty are but temporary, and have to undergo expulsion and renewal before they can become permanent. Those first produced are too small for the adequate occupation of the full-grown jaw, and as they are of a hard concrete substance, and covered with an enamel which does not admit of their keeping pace in growth with the freer and more rapidly enlarging cellular structure of the bones from which they spring, they are extruded, in due time, by successors of a larger size, which were originally mere germs, or buds at their roots. The remaining twelve permanent teeth, which are produced but once for life, do not all appear until the jaws have acquired their mature dimensions and form. It is usual, however, to divide the whole process of dentition into but two periods, the first embracing the formation and protrusion of the temporary or deciduous teeth, and the second including that of all the permanent teeth, although the last of these are frequently not developed until after an interval of many years.

The thirty-two teeth of an adult person are divided into four classes, which have received names descriptive of their respective forms and functions :

The 1st Class consists of *eight* teeth, or four in each jaw, called INCISORS, or *incisores*, from the Latin *incidere*, to cut, on account of their thin, keen edges ; and this class is subdivided under two extra names, indicative merely of their relative positions, namely, *central incisors*, because they stand in the middle or front curve of the jaw, or maxillary arch ; and *lateral incisors*, because they stand on each side of the others. The incisors are all somewhat wedge-shaped, widest at the cutting edge, and diminishing downward, so as to leave a small pointed opening between each. They are slightly concave on the inner side, and more slightly convex on the outer. The central incisors of the upper jaw are much larger than the lateral incisors adjoining them, and also much larger than the central incisors of the lower jaw, although closely resembling them in shape.

The 2d Class consists of *four* teeth, or two in each jaw, called CUSPIDS, or *cuspidati*, from the Latin *cuspis*, a spear, because they terminate in an apex or point. These are vulgarly known by the

name of canine or dog-teeth, from a partial resemblance to the latter ; and are sometimes called eye-teeth or stomach-teeth, from their nervous connexion with those organs. They are situated, one on each outer side of the lateral incisors, and are nearly alike in the upper and the lower maxillary. The use of the cuspids, appears not to be that of the incisors, to cut and divide substances by incision, but more similarly that of the canine teeth of carnivorous animals, which is to seize and tear obstinate substances, preparatorily to their mastication. And it is an interesting fact, that in monkeys, apes, and other animals of the *simia* genus, these teeth become more prominently canine in proportion as the species approximate to the *carnivora* in other characteristics.

The 3d Class, like the 1st, comprises *eight* teeth, or four in each maxillary, called BICUSPIDS, or *bicuspidati*, from *bis*, twice, and *cuspis*, pointed, from their being *crowned with two points, instead of one, like cuspids. They are situated immediately behind the latter, and were formerly called the first and the second grinders, but as they do not possess the true figure and full power of the grinders, next to be described, and hold an intermediate relation

between these and the cuspids, they are now considered and denominated as a separate class. Those of the under jaw are smaller than those of the upper, and the points upon their surface are less distinct. The lower ones, moreover, have only one fang, or root, like the incisors, while the upper, especially the first two, have two small fangs, sometimes nearly united by compression at the sides, with merely a small groove or depression, running between them.

The 4th and last Class consists of *twelve* teeth, or six in each jaw, called MOLARS, or *molaes*, grinders, from *molaris*, a grindstone, or *mola*, a millstone. They are situated next behind the bicuspid, three on either side of each jaw, and are mentioned as the 1st, 2d, and 3d molars ; the third having the specific name of *wisdom teeth*, or *dentes sapientiæ*, because they seldom appear until a person has arrived at a mature age, the time varying, however, from the seventeenth, to the twenty-fifth, or even the thirtieth year. The first and second molars are almost alike in every particular. They are the largest teeth in the head, having a broader base and crown, the latter furnished with several points suited to their function of grinding food, and they have several fangs or long roots.

Those of the under jaw have but two fangs, one placed forward and the other backward, in their *alveoli*, or sockets, thus giving them a firm mechanical hold, especially as they are broad and somewhat flat, to their terminations. The upper molars, have commonly three fangs, two on the outer side of the tooth and one on the inner, the latter being very oblique in its direction, and much larger and rounder than the others. Sometimes, indeed, the upper molars are found with four distinct fangs, and there are examples on record of even five ; while three fangs are occasionally possessed by the lower molars ; but these are phenomenal aberrations from the general law. The third molars, or *wisdom-teeth*, are smaller and rounder than the others, and their fangs are less regular and distinct, sometimes appearing as if squeezed together into one, and at others greatly curved.

Upon the relative situation of the teeth in general, it may be remarked that the incisors of the upper jaw being much broader than those of the under, cause the adjacent teeth to be placed farther back in the semi-circle than the corresponding teeth in the lower jaw. Hence, when the teeth are shut close, the central incisors of the upper jaw come over the central, and half

•

of the lateral incisors of the lower ; and the lateral incisors of the lower jaw, cover half of the opposite incisors, and more than half of the opposite cuspids of the lower. The cuspids of the upper also fall between and project a little over the cuspids and the first bicuspids of the lower ; and so, of course, the first bicuspids of the upper fall partly over and beyond those of the lower, so as to rest partly upon the first molars. So also the first upper molars cover two-thirds of the first, and part of the second, under molars ; the second upper molars shut down upon the remainder of the second and part of the third ; but the third molars, or *wisdom-teeth*, of the upper jaw, being smaller than those of the lower, shut down upon them evenly, and thus compensate the previous apparent disparity of position. But it is supposed that this irregularity of opposition, actually adds to the mechanical power, or at least resources, of mastication ; for if a tooth be lost, in either maxillary, the opposite tooth does not become entirely useless, as it otherwise would, since it can still partly act upon another.

The above classification and nomenclature of the human teeth, may be better understood and remembered from the following tabular form :

Class 1st, INCISORS, <i>four</i> front teeth in <i>each</i> jaw, . .	8
“ 2d, CUSPIDS, <i>two</i> side “ “ “ . .	4
“ 3d, BICUSPIDS, <i>four</i> posterior “ “ “ . .	8
“ 4th, MOLARS, <i>six</i> back “ “ “ . .	12
Whole number in an adult,	32

THE FIRST PERIOD OF DENTITION, is reckoned by *months*, and, as already stated, produces *twenty* teeth, which are termed *temporary*, because they are expelled by others, in the period of SECOND DENTITION, termed *permanent*. The following formula exhibits the average sub-periods, numbers, and kinds, in which the former protrude from the gums :—

From 5 to 8 months, <i>two</i> Central INCISORS, in <i>each</i> jaw,	4
“ 7 to 10 “ <i>two</i> Lateral INCISORS, “ “	4
“ 12 to 16 “ <i>two</i> First MOLARS, “ “	4
“ 14 to 20 “ <i>two</i> CUSPIDS, “ “	4
“ 18 to 30 “ <i>two</i> Second MOLARS, “ “	4
Whole number of temporary teeth,	20

It will thus be seen that, somewhere within these five average periods, the several teeth here named appear in each jaw in pairs ; but it is remarkable that they all usually appear in the lower jaw, a few days, and sometimes weeks, before they protrude from the upper. Of the two central incisors which first cut through the gum of the lower jaw, one generally comes a

few days before the other, and both before their larger namesakes in the upper. It may seem singular that the two first molars in both maxillaries, being of a broader top surface, should protrude before the more pointed cuspids ; but this is explained by the fact that the latter have to grow from a greater depth in the jaw, the *alveoli*, or sockets, of the first molars, being comparatively superficial.

It must not be supposed, however, that the entire growth of the twenty temporary teeth, from their commencement, is accomplished after the infant's birth. One-half of them, at least, are distinctly formed in the foetus, in a rudimentary state, five or six months before birth, and have doubtless begun to acquire their form as early as other parts of the organization. As soon, at least, as the jaws of the foetus have advanced from their first mucous state, and become cartilaginous, a process commences by which the cartilage is converted into bone ; and even thus early we may perceive, in both maxillaries, small membranous sacs, filled with pulpy matter, which are the rudiments of future teeth. In a foetus of about four months, the jaws have become thin grooved bones, having a cavity extending their whole length, in which

these sacks are contained, in a row, like teeth ; and, at this period, if the membranous covering of the jaw be removed, small bony processes may be discerned, shooting across from each side of the cavity, between the pulpy sacs, forming, eventually, those separate sockets for the teeth which are technically known as *alveoli*. In the front part of the under jaw, where the first teeth appear, the cavity is narrower and deeper, and the alveolar partitions better defined than in the posterior portions, where teeth are not formed until a much later period.

For some months after birth, as during the foetal state, the blood-vessels and nerves belonging to the teeth, run along at the bottom of the maxillary cavity, in a slight groove, immediately below the pulps of the teeth ; but afterward this groove becomes a complete and regular bony canal, through which they pass, sending off branches to each particular tooth. From an early period of their foetal formation, the alveoli grow much faster than the teeth themselves, which are consequently contained in them but loosely ; and they have enlarged so much at the time of birth, that they almost cover the teeth ; thus affording the latter good security from compression and injury in their plastic state, and

enabling the infant to make adequate pressure in sucking, and even in biting upon elastic substances, to force them through the gums. Almost equally early does ossification begin in the teeth also, its first appearance being on the tips of the incisors. In a foetus of about five or six months, it is apparent on the pulps of the incisors and cuspids, and on the points of the molars. It thence gradually descends over the pulp, down to the neck of the tooth, from the cutting edges of the highest points, where it began. With regard to the precise time at which the temporary teeth at first and successively appear, there is so much uncertainty that it can only be stated in average periods of several months, as in the preceding table ; and even these are not sufficiently extended to include a multitude of exceptions of frequent occurrence. In many instances no tooth whatever cuts the gum before the child is twelve or fourteen months' old ; while in others, several exhibit themselves precociously, at the time of birth. These strange diversities probably depend upon the various health and vigor of different children, as derived from their pre-congenital constitutions.

CHAPTER III.

THE PHYSIOLOGICAL HISTORY CONTINUED.

The Period of Second Dentition—Corrected Table of its Medium Sub-periods.—Phenomena of Irregular Dentition.

THE period of Second Dentition is computed by *years*, and is much more determinate, in all its stages, than that of the first or temporary dentition. During this period, not only have all the teeth of the first dentition to be expelled and renewed, but *twelve* additional ones created where none were produced before. It must be admitted, however, on the authority of many eminent anatomists, both ancient and modern, that the germinal sacs of some of these last mentioned permanent teeth are discoverable, in the posterior portion of the jaws of the foetus, several months before the regular period of birth, as well as the rudiments of those which are to take the place of the temporary teeth, as direct successors. So that there are, in reality, the germs of two sets of teeth, those of the second as well as of the first dentition, in the mouth of the foetus, at the same time.

When the rudiments of the first or temporary teeth become so far advanced as to be well defined in form, the membranous sac of each sends forth a new sac, like a minute bud by its side. These new little sacs, are the germs of the permanent teeth which are to succeed the temporary ones, just as new buds succeed the old leaves of a deciduous foliage. And as these sacs increase in size, the sockets of the temporary ones become enlarged, and small niches, or recesses, are formed in the internal plates or partitions forming the sockets before described. These niches increase in capacity in proportion with the growth of the new sacs of the permanent teeth, until they gradually form new sockets, within the old ones, around them all. There is, however, an orifice left between the sockets, through which the membranes of both sets of teeth continue to be connected, and which are supplied by the nerves and vessels, common to both, running through the canal beneath them. But there is much reason to suppose that the new teeth flourish, by means of this connection, at the eventual expense of the old ones, for after the latter have fulfilled their temporary functions, their membranes, and even their very roots, have wasted away, and

indeed, entirely disappeared, in so mysterious a manner as to excite a very natural suspicion that the new comers are somewhat obnoxious to a charge of embezzlement.

The period at which these changes appear to be proceeding upon the largest scale, is between the fourth and the fifth year. At this age, the bodies of the many undeveloped permanent teeth have greatly advanced in osseous solidity ; it has even commenced on the bicuspid ; all the points of ossification on the middle grinders have become united, and the membranes of the last grinders, including the wisdom-teeth, are forming. There is, indeed, a remarkable uniformity in the number of teeth which are formed and forming in children at this age ; and it may be confidently said to be greater than at any other period of life, there being not less than twenty-six in each jaw, or twenty more than the permanent number ; for it must be remembered that none of the twenty temporary teeth have as yet been shed.

Children, in general, begin to shed their teeth when about six or seven years of age, and the permanent teeth appear in nearly the following order : “ First, the middle incisors of the under jaw ; soon afterward, those of the upper ; then

the lateral incisors of the under, and nearly at the same time the anterior grinders ; then the lateral incisors of the upper jaw, though some time elapses between their appearance and that of the former. The anterior bicuspid appears about the ninth year ; the posterior about the tenth or eleventh, and the cuspids and middle grinders about the twelfth or fourteenth year. Finally, the last grinders or wisdom-teeth appear between the seventeenth and twenty-fifth year."

According to the eminent anatomist, Bell, the following table exhibits these medium periods of the second dentition, at one view, somewhat corrected, however, by later authorities :—

First Molars,	between the	6th and 7th	year.
Central Incisors,	" "	7th and 8th	"
Lateral Incisors,	" "	8th and 9th	"
First Bicuspid,	" "	9th and 10th	"
Second Bicuspid,	" "	10th and 11th	"
Cuspids (Canines)	" "	11th and 12th	"
Second Molars,	" "	12th and 13th	"
Third Molars, (wisdom teeth,)		20th and 30th	"

The numerous deviations from this generally uniform law, which are greatly exaggerated by many unphilosophical writers, by no means impair its predominant stability, and appear much

more numerous when counted apart than when viewed in comparison. In fact, the reliable statistics upon the subject, are strangely more meagre and inadequate, considering the abundant data for them which it furnishes, than upon almost any other branch of physiological science. So far as accuracy of observation and record are required, and that, too, upon an extensive scale, these statistics have been neglected alike by parents, physicians, and dentists. From the remarkable numerical analogy which is apparent, even from such imperfect data as casual observation has furnished, between the months of the first dentition and the years of the second, there are reasons to anticipate that a more widely extended and systematic course of inquiry would establish a coincidence and harmony in these periods, indicating a natural law of exceeding beauty and value. But the recorded exceptions to this presumptive law, are of sufficient interest and importance to claim a passing recognition.

IRREGULAR DENTITION is replete with many remarkable phenomena, of unquestionable authenticity, independently of those of an apocryphal character. The anterior permanent molars sometimes appear before any of the temporary

teeth are shed ; instances are known in which the infant teeth have been retained to the fifteenth, twentieth, twenty-fifth, and even thirtieth year ; and others are mentioned in which all the permanent teeth have protruded to their full height and size, behind the temporary ones, without displacing them, thus endowing their privileged possessor with two entire sets at the same time. Presenting a pretty strong contrast to such exuberant cases, there are others in which persons have never had any teeth at all ; and there are yet others in which none have appeared until a very advanced age. But the most extraordinary and seemingly incredible cases, are those of a *third dentition*, at periods of life far beyond the usual extreme limits of human longevity. Instances in which individuals are said to have acquired teeth, by a third dentition, between the seventieth and hundredth year, are pretty well attested, although some doubt still remains as to whether these teeth were not, in reality, some of the second dentition which had providently remained in obscurity until their importance should become enhanced by the absence of all others. But Lord Bacon asserts that the Countess of Desmond, with whom he was intimate, and of whom Moore says, she

“ Lived to a hundred and ten,
And was killed by a fall from a cherry-tree then,”

but who, in fact, lived 35 years beyond that frolicsome age, and died at 145—renewed her teeth three times ! A similar marvel is related of Thomas Parr, who lived to 152 ; of Henry Jenkins, aged 169 ; of Peter Torten, aged 185 ; and of several other individuals who lived to an antediluvian age. But that a third dentition is not an ordinary privilege of persons possessing even such resources of vitality as these, is evident from Haller's list of more than a thousand supercentenarians, among whom no examples but those we have referred to are adduced. Indeed, such extra achievements of nature must spring from a rare combination of causes to which the general principles of physiology afford no clue, and resemble those preternatural efforts of the vegetable world in which fruit-trees yield successive crops in a single season, and exhibit both fruits and flowers in ungenial months.

CHAPTER IV.

DENTAL PHYSIOLOGY CONCLUDED.

The Composition and Structure of the Teeth.

Although, in this country, more subject to disease than any other organ of the body, the teeth, both in their composition and structure, are naturally the hardest and most durable. The hardest bones in the frame cannot compare with them in the former quality, and the latter is attested by the fact, that they are frequently found, in perfect preservation, in places of ancient sepulture, where every other fragment of the osseous fabric has mouldered into dust.

Their greater durability, under such circumstances, is dependent upon a distinctive material in their construction, which is employed in the formation, or for the protection, of no other bone—indeed, in no other part of the whole body. This substance is their *enamel*, or *cortex striatus*, which covers every part of a tooth that is naturally exposed to the action of the air, to the corro-

sive action of the saliva, and those articles of food which contain acids—or whose neglected particles, remaining between the teeth, beget acids, by acetous fermentation—and to the ordinary attrition of mastication. That portion of the tooth which, protected by the socket and surrounding gum is not exposed to these corroding agents, is not provided with this extra panoply, but is left in the same ordinary security as any other bone. The special wants of the exposed portion were specially provided for by anticipation, and no part of the wonderful mechanism of the human frame presents a more palpable and perfect adaptation of means to ends than the enamel of the teeth.

There is one important fact, however, in consecutive connection with this admirable provision, which strongly appeals at once to the practical intelligence and the moral habits of mankind, to sustain nature in her beneficent design—*the enamel of the teeth once destroyed can never be restored*. Nature has made no provision for its reparation or renewal, leaving it, in this respect, unlike many other functional parts, less entrusted or accessible to personal care. For it should be remembered that the precious enamel of the teeth, is seldom destroyed

but by neglect of cleanliness, or by employing corrosive substances to clean them. Deposits from our multifarious food, like all other organic matter in a state of decay, under the agency of heat and moisture, pass through acetous fermentation and to putrescence, until even a pure inorganic substance, like gold, can scarce withstand the corrosive action of the fluids which are formed.

The enamel of the teeth is a vitriform compound, very similar in its composition to an improved material recently produced, by chemical combination, for filling decayed teeth. Indeed, the former may have suggested the latter. The enamel is sufficiently hard to strike fire with steel ; its surface is smooth and polished, and it forms a thicker layer on the crown of the tooth, and at the parts where the teeth come in contact, than toward the cervix or neck. Its crystalline fibres, as seen through a microscope, are transverse to the perpendicular surface of the teeth, and seem to protrude from the ivory beneath, in innumerable filiform points, giving to the more translucent medium which they thus penetrate and pervade, a beautiful velvety appearance. It is supposed, however, that the enamel has neither blood-vessels nor

nerves, in its matured and completed state, and that its formation and its sensitiveness to touch, are dependent upon the vascular and nervous structure of the interior osseous portion of the tooth, with which it communicates by pressure, or transferred motion, as does the free and, in itself, insensible part of a finger-nail, with its exquisitely sensitive and vascular roots.

The following analysis of both of these parts of human teeth, exhibiting the elementary proportions of those of men and women, is by the accurate chemist, Von Bibra ; and being a comparative analysis, possesses a much higher interest than that of Berzelius, heretofore exclusively cited upon this subject. It is here copied from *Simon's Chemistry of Man*, p. 607 :

MOLAR TOOTH OF AN ADULT MAN.

	Enamel.	Osseous portion.
Phosphate of lime, with a little fluoride of calcium,	89.82	66.72
Carbonate of lime, . . .	4.37	3.36
Phosphate of magnesia, . . .	1.34	1.08
Salts, (sod and its muriate),	0.88	0.83
Cartilage,	3.39	27.61
Fat,	0.20	0.40
	100.00	100.00

This analysis shows that the chief elementary

difference between the enamel and the osseous portion of a tooth, is that the former contains 23.10 per cent. more phosphate of lime and fluoride of calcium than the latter ; and it is well known to chemists that this combination constitutes one of the hardest and most indestructible substances in nature. When found in a mineral state, it will indent the hardest steel, and sustain a white heat without being decomposed. It is, however, rapidly dissolved by several of the acids, and more slowly by many. The next analysis is of the tooth of a woman, and it should be carefully compared with the above :—

MOLAR TOOTH OF A WOMAN 25 YEARS OF AGE.

	Enamel.	Osseous portion.
Phosphate of lime with a little fluoride of calcium,	81.63	67.54
Carbonate of lime,	8.88	7.97
Phosphate of magnesia,	2.55	2.49
Salts, (soda and its muriate,)	0.97	1.00
Cartilage,	5.97	20.42
Fat,	a trace	0.58
	100.00	100.00

This analysis presents the remarkable result that the enamel of a woman's tooth contains but 14.09 per cent. more phosphate of lime and

fluoride of calcium than its osseous portion ; while that of a man's tooth, as we have seen above, contains 23.10 per cent more ; being a difference of 9.01 per cent. It will be perceived, however, that the enamel of a woman's tooth contains 4.51 per cent. more carbonate of lime than that of a man's, and 1.21 per cent. more phosphate of magnesia. But while this greater amount of lime and magnesia, in the enamel of a woman's teeth, may enhance their whiteness and brilliancy, it may be a questionable compensation for their chemically inferior durability. The true compensation is probably to be found in those higher instincts of beauty and delicacy which prompt the female sex to a greater care of their teeth than is generally evinced by men ; but whenever these instincts are neglected, both theory and experience contribute to prove, that the teeth of females, however beautiful in early womanhood, are the most susceptible of insidious denudation and unsightly decay. In their union of greater beauty and fragility, however, they are probably but in consonance with the general organization of the fairer and weaker sex.

The internal structure of the teeth is not less entitled to consideration than the external,

especially in relation to their diseases and their uses. A tooth, with the exception, perhaps, of its fangs, grows from the outside inwardly, like plants of the *endogenous* division, as contrasted with the *exogens*, in which the wood increases by annular additions to the outside. It is, therefore, composed of concentric circles, or layers, which, like those of the *endogens* grow by internal secretion, from a membranous cavity in the centre, the oldest and hardest layer being on the outside, covered with a silicious enamel like a cane, or corn-stalk. And this is the reason why teeth do not enlarge by growth, in proportion to the jaws, which grow in a different manner. It would be impossible, indeed, without an inversion of the laws of nature, for teeth to become hard enough, on the outside, to answer the purpose for which they are intended, if they grew like *exogenous* stems ; because, in these, the last, or outside layer, must necessarily be the softest. But as the laws of nature are not to be inverted, and the children of men require hard teeth from an early age, therefore it is that they are supplied with a second set, better proportioned than the first to the increased dimensions of their jaws and their greater demand for food. And "here is wisdom."

The manner in which teeth grow is, therefore, as follows: the pulpy sac of the foetal tooth, already described, is composed of two membranes, an inside and an outside one, the pulp being between them, and leaving a cavity in the centre. Ossification commences from the interior side of the outer membrane, and from the proximate side of the inner; and as it goes on, converting the pulp into bone, in layers, as aforesaid, the interior membrane contracts, until the solid portion of the tooth is formed, when it constitutes what is termed the nerve of the tooth, lining the cavity, and connecting itself with the maxillary nerves and vessels, already mentioned, through a small hole, or *foramen*, as it is called, at the point of the fang or fangs. This interior membrane, though thus contracted, is not diminished in quantity, for it now nearly fills the cavity, is decidedly pulpy in appearance, highly vascular, and exquisitely sensitive.

But while the main body or bony substance of the tooth is thus formed, under the mutual and reciprocal action of its interior and exterior membranes—which, it is now pretty well ascertained, are relatively negative and positive, and deposit their osseous concretion by an action precisely similar to that of galvanic plates

upon metallic solutions—the outer surface of the exterior membrane is *excreting* the *cortex striatus*, or enamel, upon the bone. It commences this new action as soon as a shell of bone has been formed on the interior pulp, and continues it until the whole is ossified, when itself becomes either absorbed or transformed into the substance of the enamel. The latter result is, perhaps, the more probable, for this substance, as examined by good microscopes, is less truly crystalline than is commonly supposed, betraying fibres suspiciously organic and tubular in their origin, though vitriform in their morpholysis. It must be admitted, however, that there are many examples of imperfect crystallization, exhibiting a fibrous structure, where no organic matter can be suspected. But in this case of dental enamel, the fibres appear to shoot out, as it were, horizontally from the surface of the ivory beneath, or at a right angle with its perpendicular plane, and as though they grew from it.

The name of *ivory* is here retained for the bony stratum next beneath the enamel, because it resembles that fine, compact variety of bone, not merely in appearance, but in structure and chemical composition. It contains a much

larger proportion of phosphate of lime than any other kind, and stands, in this respect, second only to the enamel itself. Its technical name, however, is *dentine*. Much elaborate research has been bestowed on this substance, by Retzius, Muller, Malpighi, Nasmyth, Owen, and others, who agree that it consists of tubular fibres, containing organic deposits of calcareous salts : and of intertubular substance in which are observed corpuscles, or osseous cells, called by Professor Owen *calcigerous cells*, which also contain earthy salts.

At the part where the enamel terminates at the neck of the tooth, another substance, called *crusta petrosa*, *cementum*, and *cortical substance*, commences, in a very thin stratum, at first, and gradually thickens toward the extremity of the fang. (There is much reason for supposing that this substance differs from the rest of the tooth in having an *exogenous* growth.) Parkinje and Frankel supposed that it also lined the *cavitas pulpæ*, or cavity of the pulp, in adults, and gave it the name of *substantiæ ostoidea*, while Malpighi called it the *materia tartarea*. But it has since been found that the substance deposited on the inner surface of the dentine, at the age of twenty and upwards, and which

encroaches on the cavity, has a distinct structure from the *crusta petrosa*, or cement, which covers the fangs, as it partly resembles dentine and partly bone. Hence Owen, with his usual precision of expression, calls it *osteodentine*, which is preferable, in this respect, to the "secondary dentine" of Tomes, although the latter would answer very well as its ordinary synonyme.

As a tooth, therefore, is divisible into four sections, or parts, namely, the *corona*, or crown ; the *cervix*, or neck ; the *radix*, or root ; and the *cavitas pulpæ*, or cavity ; so also is it divisible into four component substances, namely, the *certex striatus*, or enamel ; the *substantia ossea*, dentine or ivory ; the *crusta petrosa*, stony crust or cement, covering the root ; and the *osteodentine*, or secondary dentine, lining the cavity.

To this account of the structure and composition of the teeth, which embraces the latest scientific results upon the subject, and is more complete, perhaps, than can be found in any other single treatise of this kind, it is only necessary to add a few remarks.

The organization of the teeth, as thus described, is much more imperfect in some indi-

viduals and families than in others. The enamel, especially, sometimes in successive generations of families, appears to be defective in some of the constituents of its composition, being hereditarily yellow ; in others, it is so friable as to crumble off in spots, and at length leave the teeth denuded to the ivory, dirtily discolored, and subject to speedy decay. There are many other instances in which children exhibiting this defect in the first dentition, recover from it in the second. But the converse of this is rare, if not altogether unknown ; for those who inherit a good enamel on their first teeth, invariably acquire it on the second, unless some special malady supervene.

This fact may be regarded as but one, among a multitude of others, showing the great dependence of the normal condition of the teeth upon the natural constitution, as derived from the foetal stage of existence, and perhaps from one or both of the parents. But there would be little practical benefit in arriving at this sad and seemingly hopeless conclusion, if there were not another fact, of the same class, equally well established, and of the most momentous admonitory importance, clearly demonstrating that mothers, at least, under the circumstances I am

about to state, have it in their power to prevent the transmission of their own dental diseases to their offspring. That the children of mothers whose teeth are diseased are more peculiarly liable than others to dental maladies, with all their agonies, deprivations, and other deplorable consequences, is too universally known to be disputed ; but it is equally well known to all dentists who, like the writer, have had an extensive practice for more than a quarter of a century, that *children of the same mothers, born one year or more after those teeth have been extracted, are entirely exempt from the dental diseases which afflict their elder brothers and sisters*, and arrive at an adult age without any indication of the painful inheritance.

That the same happy results would follow, in all cases, it might be deemed unwarrantable to affirm ; but having fully verified the fact in my own practice, as a rule to which I have known no exceptions, when the necessary conditions as to time have been fulfilled, I deem it one which it would involve no slight degree of maternal culpability to neglect.

Very forcible corroborations and interesting elucidations of this important fact, derived from pathological considerations, might readily be

adduced, did the scope of this work permit ; but they may occur to many maternal readers without farther suggestion. The peculiar and excessive sensibility of the teeth which prevails during the gestatory period, more than any other, might itself suggest some instructive reflections upon this subject, although it by no means follows that all or any of the teeth which suffer from the functional sympathies of maternity at this period, require extraction or any kind of professional aid. There are, however, good reasons for concluding that impressions, to say the least, transferred from diseased teeth, at this period of special sympathy with these organs, may affect those of the offspring to the end of life.

CHAPTER V.

IRREGULARITIES OF THE TEETH AND THEIR CAUSES.

With the exception only of the subject presented at the close of the preceding chapter, there is no branch of dental economy which appeals more urgently to the vigilance and care of parents and guardians, than irregularities of the teeth, during the process of second dentition. It is not merely that irregularities, then occurring, become established deformities for life, if neglected when timely reparation might be effected, but there is the higher consideration that such abnormities are, almost invariably, predisposing causes of disease. The extreme difficulty, if not impossibility, of keeping irregular teeth thoroughly clean, together with their necessarily greater liability to accumulate those acidifying deposits of food which prey at once upon their enamel, and the contiguous edges of the gum, would alone suffice to produce

this result, independently of the usually concomitant defects in their internal structure.

There is scarcely a stronger evidence of a debased and wretched state of society, producing abandoned parentalism and neglected childhood, than prevalent deformities of the teeth. In this country, as a matter of course, they are chiefly found among that class of our foreign population who, in their native land, rank the lowest in physical comfort, as well as in cultivated intelligence, of any in the civilized world. It is not altogether uncommon to find, even among the prolific mothers of this hereditarily isolated and misgoverned race, teeth so far protruded from the jaws as to admit of no covering whatever from the lips, which, in fact, they frequently displace by their extreme projection. Canine teeth, which, properly adjusted about the twelfth or thirteenth year of childhood, would not have exceeded ordinary dimensions, are to be seen uplifting or growing literally outside the upper lip, like those of some carnivorous animal in advanced age. And there is little doubt, from the perpetuation of such deformities in particular families, that a primarily neglected irregularity has acquired the force of a determinate hereditary tendency.—

This, of course, can only be arrested by skillful and frequent attention to new cases, as soon as the tendency becomes developed.

But the most general cause of the more prevalent irregularities of the teeth, is a disunity of action between the decadence of the temporary ones and the growth of the permanent. The former are not ready to take their departure before the latter want to make their appearance ; and thus, like some clumsy soliloquists who have to succeed each other on the stage, they are often thrown into ludicrous positions. In other words, the fang of the first tooth not being sufficiently absorbed to enable the child to remove it with the fingers, before the second is ready to take its place, the latter is deflected from its proper direction, and usually, though not always, appears on the inside.

It is still one of the most mischievous errors of empirical dentists and other injudicious persons, to anticipate this misdirection, and remove its cause at too early a period. Many suppose that they can loosen and extract the temporary teeth with impunity, almost whenever they think proper ; and parents, brothers, sisters, aunts and servants, often undertake the super-serviceable task with an amateur gusto, appalling to

think of. But when we reflect, as every dentist, at least, should be expected to do, that there is a vital connexion between the temporary and the permanent teeth, by means of a vascular cord, passing from the neck of the former to the sac of the latter, as stated in a previous page, and which will be prematurely severed if the temporary tooth is extracted before the sac of the permanent one is properly ossified, it is evident that none but a dentist of sound professional knowledge and experience, should be entrusted with the operation, until nature is ready to perform it for herself. Far better it is to allow the new tooth to yield to its necessity for a while, and correct its aberration afterward, than to risk its interior completion and ensure its premature decay. There can be no reasonable doubt that the osseous deposit in the sacs of the new teeth is derived, in no small degree, by absorption from the fangs, at least, of the old ones ; for the mysterious disappearance of the latter, as before stated, admits of no other explanation. .

It is even contended, by some writers on this subject, that the premature extraction of the temporary teeth frequently involves such a contraction of the alveolar groove of the jaw as to

obstruct the upward passage of the new ones, and thus occasion the very irregularities which the operation was ignorantly designed to prevent. The eminent physiologist, Bell, adduces the case of "a fine healthy boy, whose maxillary arch was perfectly well formed, being taken to a dentist, who, with great dexterity, removed eight primary teeth at once, all of which were firm in their sockets. The consequence was that the permanent teeth grew so irregularly, for want of room, from the contraction of the maxillary arch, that it became necessary to extract four permanent *bicuspid*s, to remedy the effects of the malpractice. And thus, in all probability, four important teeth were sacrificed at the shrine of ignorance ; for all the other members of the family had regular teeth, though left entirely to nature."

Another judicious writer observes, in relation to the molars, that "if the posterior temporary molar teeth be extracted, the first four permanent molars, which the child usually gets at six or seven years of age, will be very apt to press forward, so as to partially occupy their places, and thus produce an irreparable irregularity. For there will not be room, anterior to the permanent molars, for the permanent teeth suc-

ceeding the temporary incisors, cuspids and bicuspid ; and as the incisors and bicuspid come in before the cuspids, the irregularity will be very apt to extend to the latter also, the only remedy for which will be the sacrifice of the four permanent posterior bicuspid.

When, however, from a crowded state of the teeth, by whatever cause produced, great irregularity appears to be absolutely inevitable in after life, the sacrifice of these posterior bicuspid, at a proper period of childhood, is to be recommended, as the only effectual preventive at once of deformity and disease. Repulsive as the alternative may be, it is the only one ; and if adopted at this period, it will cause much less pain and inconvenience to the child than parents generally suppose. For the fangs are then scarcely half formed, and yield freely ; the anterior teeth will fall back, and the molars will come forward ; good room will soon be acquired for the rectification of every irregularity, and to obviate those diseases and sufferings which must otherwise ensue.

The only exception to the expediency of this practice, under the urgent conditions upon which alone it is predicated, is when the first two molars are very defective in structure, or

exhibit unequivocal indications of premature decay. In this case they should undoubtedly be sacrificed in preference to the bicuspid, but under no other circumstances ; for when sound and well formed, they are more valuable teeth than the latter, and should be proportionably prized. It unfortunately happens, however, that these first molars sometimes decay so early and so rapidly that it is not possible to preserve them, when, of course, they should be extracted, whether the anterior teeth are crowded or not. Experienced dentists alone are competent judges, in any of the cases here presented, and to such only should parents and guardians entrust their children, during the critical and momentous period of second dentition.

But the greatest liability to the formation of irregular teeth, at this period, arises from parental inattention to its indications, and their consequent neglect of timely professional advice. When parents, themselves, have sound and regular teeth, without the aid of art, there is comparatively little ground for anxiety concerning those of their children. Nor when they observe that the temporary teeth, prior to the period of second dentition, stand a little asunder, after having been more crowded at an ear-

lier age, is there much cause for apprehension ; for this is an evidence that the expansion of the maxillary arch, in its gradual elongation to a more elliptical form, has provided adequate space for their larger successors. But when this is not the case, or when there is a firm prominence in the gum behind a temporary tooth, more or less irregularity may be reasonably feared ; for such a prominence indicates either a permanent tooth, growing out of its proper place, or a *supernumerary tooth*, still more unsightly and troublesome. In the latter case, which an experienced dentist alone can determine, the intruder should be extirpated as soon as it fairly cuts the gum ; in the former he will merely be required to decide upon the proper time for extracting the first tooth without injuring the second. Some irregularities, occurring at this period, may require mechanical contrivances, for gradual pressure, while others can only be arrested by abscission.

If the unfortunate owners and exhibitors of shockingly irregular teeth felt as much annoyed with their unenviable property as the generality of dental writers appear to be, they would not be very ambitious to bequeath it to their descendants. One of these writers insists that

“great deformity of the teeth is invariably associated in our minds with the idea of mental perversion.” Another, a German author, says, “it always produces, however gradually, that expression of countenance which partakes at once of the ludicrous and the ferocious, and sometimes of the horrible and diabolical.”—While a writer, in the French Dictionary of Medical Science, enhances those sensitive severities by declaring, with equal warmth, that “good teeth are an ornament equally attractive in both sexes ; distinguishing the elegant from the slovenly gentleman, and diffusing amiability over the countenance, by softening the features. But it is more especially to woman that fine teeth are necessary, since it is her province first to gratify the eye, before she touches the soul and captivates the heart.” It would assuredly be supererogatory to add a syllable to appeals like these !

CHAPTER VI.

DENTAL DISEASES AND THEIR CAUSES.

External and Internal Caries—Periostitis and Odontitis.

The most prevalent of all diseases of the teeth—probably because it is one in which nearly all others terminate—is *Caries*, so called, perhaps, from *careo*, to want, because it is always characterised by a deficiency or loss of substance in the tooth or bone which it attacks. It is a mortification of the osseous portion of the tooth, and doubtless passes through the regular stages of inflammation, ulceration, gangrene and desquamation. It is usually divided into the two varieties of external and internal caries, which is a distinction rather of the parts of the tooth at which it commences than of diversities in the disease itself, although they undoubtedly exist. For the external caries necessarily advances toward the interior of the tooth, and becomes internal ; and the latter

works its way outward and becomes external. Each of these modes of action, however, has causes and effects peculiar to itself; and both admit of a more discriminative diagnosis than those distinctive terms imply.

It may be questioned whether external caries ever commences without some previous abrasion of the enamel—that is to say, it probably never begins on the outer surface of the dentine, next beneath the enamel, until the latter has become impaired from some other cause. Hence the external variety usually begins either on the upper part of the crown, or horizontal surface of the tooth, where the enamel is most subject to abrasion from attrition, or at the neck, where it terminates, and where it is most exposed to the corrosion of acidifying matter and tartaric accretions. Indeed, the enamel next to the gum, is invariably found to be discolored and rough, and therefore, at least partially decomposed, whenever the tartar has been suffered to remain upon it even but a few months. The colored spots which are frequently seen upon the dentine, beneath the enamel, while the latter retains its whiteness, transparency, and polished texture, as yet unimpaired, are attributable to

internal caries, produced by other causes, which will presently be explained.

It may be asserted, as a generally correct line of distinction between external and internal caries, that each begins where the other ends, not so much in relation to the opposite parts of the tooth, which they first respectively attack, as to the inverse order of their pathological actions, symptoms and effects. Thus, unless the laws of chemistry are to be deemed suspended, in order to accommodate an adverse theory, external caries must commence with chemical decomposition of the exterior of the tooth, and proceed until it produces inflammation and suppuration of the interior vascular portions; while, on the other hand, internal caries commences with inflammation of these interior portions and proceeds through the gangrenous stage to the destruction of the exterior walls.

The only apparent exception to this rule is in the case of colored spots, beneath a perfect enamel, when few or no traces of decay appear much further in the interior. But it may be confidently asserted, whenever this combination of circumstances is really detected, that it will be found in explanatory harmony with the

two following pathological laws of the illustrious John Hunter :—

1st. *Those parts of the human body which are the most vascular, and possess the greatest amount of vitality, are the most susceptible of inflammation, but when attacked by it bear it the best.*

2nd. *Those parts which are the least vascular and vital, are the least susceptible of inflammation, but when attacked by it bear it the worst.*

The latter of these laws is, of course, a corollary from the former, and, as laws of pathological dynamics, they are probably of universal applicability. They are, in fact, dynamically identical with those of the mechanical powers, in which the gain of time is in inverse ratio with that of power ; and like those of plasto-elastic substances, in which the most susceptible of impressions are the soonest to recover from them, and the reverse. And they are illustrated upon the broadest scale, in the comparative susceptibilities and tenacities of youth and age, which are also in an inverse ratio. But in nothing are they exemplified more beautifully than in the pathology of internal caries of the teeth.

It is admitted by all who concede vascularity

to these organs, that the interior, or most vascular and nervous portion of their structure, is the most subject to the temporary inflammation and pain. Yet it is also true that this very portion is the last and least subject to permanent disease. A febrile state of the system in general, or of adjacent parts, frequently suffices to produce inflammation and pain in the teeth, without leaving a trace of permanent disease or implying its previous existence. Other excitations or irritations of the system will often produce the same effects, and many females are subject to tooth-ache periodically, while in other persons it often accompanies ordinary cold, damp feet, or sudden depression of temperature. When this inflammation, however, is of a more violent character, or too frequently repeated, it produces a permanent lesion, not in the most vascular and nervous part of the tooth, as a person ignorant of the above laws would suppose, but, invariably, in the least vascular and the least sensitive; namely, in some upper section or other of the crown, and not unfrequently immediately beneath the enamel.

Here it is that such inflammations inflict their only irreparable injuries; here it is that

internal caries works out its greatest excavations, while the natural cavity of the tooth—the seat of the pulpy plexus of vessels and nerves which give it vitality—remains, as yet, uninvaded by decay, and preserves its lining membrane in its normal condition. And hence, too, it is, that an excavating caries may be busily at work for a long time, like “a worm i’ the bud,” without exciting pain or suspicion, except, perhaps, by the original inflammation which superinduced it. For this part of the tooth, including nearly all between the natural cavity and the enamel, is almost, if not entirely, devoid of nerves of sensation, however endowed with those of motor communication, as is proved by the daily practice of scraping out and filling in its carious recesses, without inflicting pain, unless the nerve-cavity be too closely approached.

As this work is designed for intelligent parents and families rather than for the profession, it would scarcely enhance either its interest or its value, in the domestic circle, to dilate it with the discussions, concerning internal and external caries and their causes, which have amounted to a perpetual controversy between dental authors of the highest science and cele-

brity for many years. It may be enough to state that while one class of these writers contends that caries of every kind arises from external causes exclusively, another insists that it invariably springs from internal inflammation alone. The present author adheres to neither of these ultra sects, but has long since adopted a medium ground of conclusion which he thinks might reasonably reconcile both.

His conclusions are, 1st, that external caries always begins externally and from external causes, sometimes with inflammation and at others without, but most generally with the mere chemical decomposition of the phosphate of lime in the tooth; and always terminates in internal inflammation and caries, unless arrested by the skill of the dentist. 2nd. That internal caries is always caused by inflammation, sometimes produced by external causes, and at others not, but always propagated through the nerve-cavity in the first instance, and terminating in the external destruction of the tooth, unless arrested by proper means.

The intricate obliquity of this controversy appears to have arisen from an oversight of the very evident fact that both of these kinds of caries may really originate in the same part of

the tooth, at the same time, and from the same cause. Thus although external caries always begins externally, commencing either with the enamel, or the *crusta petrosa* of the root, next to the neck of the tooth, or with both, yet the inflammation from which internal caries springs, frequently begins at the same external part, namely, in the *periosteum*, or vascular coat of the fangs, where it is termed *periostitis*. Having more or less rapidly affected this membrane down to the point of the fang, where it enters the foramen, or nerve-hole, in complication with the other nerves and vessels of the tooth, and whence it ascends and spreads with them into the *cavitas pulpæ*, the inflammation, now become *odontitis*, distends the whole mass of tissues within the cavity, whose space, being too confined for its dilated contents, becomes a furnace of intolerable suffering, reverberating the fiery force back through the foramen again, until it, not unfrequently, flashes like electricity through almost every other branch of the fifth pair of nerves; affecting those branches which belong to other teeth and gums, such as the posterior and superior dental; the anterior dental; the *infra-orbital*, running to the upper lip, cheek, and nose; and, through the inferior

maxillary branch, the *buccal*, connected with the inner surface of the cheek ; and the *auricular*, extending from the ear to the forehead ; until the whole encephalous region throbs in agony. In other instances, the inflammation producing internal caries, may spring altogether from internal causes, such as a febrile diathesis or hereditary predisposition. Nowhere is internal caries so prevalent as in those districts which most abound with intermittent and remittent fevers.

The progress of this variety of caries, after inflammation has decidedly implanted it in the solid substance of the tooth, differs remarkably, both in intensity and extent, in different persons. In some, it is almost imperceptible for many weeks or months ; in others, eight or ten of the molars are attacked almost simultaneously, and their crowns actually burst open by internal suppuration, within a much shorter period. Indeed such rapid action is necessarily of brief duration, and it is often difficult to dissuade patients from having many valuable teeth extracted at once, instead of waiting until the caries admits of an opening by which the diseased portion may be removed, the excavations filled, and the teeth preserved perhaps to the end of life.

Thousands of perfectly sound teeth are often sacrificed to impatience under the pain of the first or inflammatory stage, before any caries whatever has been established, under the impression that they must be greatly decayed, and in ignorance of the fact that the progress of actual decay is usually attended with comparatively little pain, or none whatever, until the enamel becomes ruptured, so as to admit the air.

If these paroxysms of inflammation were treated, not with external nostrums, but with cooling laxatives, most of such teeth might be saved, not, perhaps, by preventing caries, but by allowing it to proceed, as it generally would, without pain, until certain discolorations of the dentine, under the enamel, enabled the judicious dentist to determine the proper period for opening, cleaning, and filling the excavation. In very extreme paroxysms of pain, it is true, the temptation to use external palliatives becomes irresistible, as the only alternative to immediate extraction; but their effect is probably much less permanent than that of saline or other aperient remedies, reducing the febrile irritation of the system in general.

Opiates and narcotics, used internally, un-

doubtedly act as anodynes in *odontitis*, as in other local inflammations ; but they only do so by temporarily diminishing the sensibility of the brain, the seat of all sensation, without mitigating the irritation which causes the pain. Local stimulants, such as brandy, camphor, and the pungent spices, sometimes operate as anodynes, by producing counter-irritation and excoriation in the adjacent gums and cheeks ; but they more frequently aggravate the pain by reaching the periosteum of the fang, and increasing its inflammation even in the nerve-cavity of the tooth. Yet it must be conceded that the worst of these remedies, if it but afford relief, is better than the extraction of sound teeth, for the worst could not so entirely destroy them.

External caries is never produced by inflammation, unless it begin at that part of the tooth, below the neck, which is covered by the *periosteum* ; when, as we have seen, both varieties of the disease are liable to set in at the same time. This membrane is united to the fang by small fibrous prolongations, and innumerable minute vessels, which penetrate its substance ; and whether this tissue be inflamed in the interior or on the exterior of the tooth, its action, in inducing caries, is the same.

In the former case, it is traced, on bisecting a diseased tooth, by a small brown streak, shooting from the nerve-cavity towards the crown, where the careous action is greatest. In the latter case, it is often traced by a similar mark, extending from the external caries inwardly. In all other instances, external caries commences with an abrasion of the enamel, and, of course, without inflammation, because there is no tissue to be inflamed.

An abrasion of this glassy substance may be effected by various causes. Excessively hot or cold liquids or solids, are very likely to superinduce it, by cracking the enamel into a multitude of vitriform fissures, often too microscopic to be discerned without a magnifying lens. Some drinkers of tea and coffee swallow these accustomed beverages at a temperature which would crack a tumbler, without seriously affecting the mucous membrane of the mouth and tongue ; and others will dexterously cool hot solids between their teeth that would blister either. This can never be done with impunity to the enamel. The mastication of ice, is scarcely less imprudent, not to mention hickory nuts, fruit stones, pins, needles, and suspicious coin. In addition to severe pressures of this

kind, we may mention that of the points of contact, in irregular or overcrowded teeth, which are generally the first attacked by external caries.

But the most predominant cause of abrasion is chemical decomposition, which, not ceasing with the enamel, acts still more vigorously upon the softer dentine beneath it. These substances being chiefly composed of phosphate of lime, some writers, whose knowledge of chemistry seems to be limited to the smaller text-books of the science, have denied that this compound can be decomposed by any acids generated in the mouth, or ordinarily brought into it, because the phosphoric acid has a stronger affinity for the lime than any but the most powerful mineral acids. Such objectors incur the obligation of admitting an undeniable effect while they reject the only adequate cause. Their objection, however, arises from an oversight of the chemical fact that the *quantity* of an inferior decomposing agent may be equivalent to the intensity of a superior one ; and that, when aided by the additional element *time*, the feeblest may perform the work of the strongest. Thus bones, which retain their phosphate of lime intact, though calcined at a white heat, and which require,

even then, nine-tenths, by weight, of sulphuric acid to decompose them, will be decomposed, in time, by the gentle action of the oxygen of the air ; and the mildest of the vegetable acids, continually applied, suffices to decompose them within a comparatively short period. A tooth will entirely dissolve, in good vinegar, with great rapidity.

The acid which principally acts upon the teeth is the *acetous*, generated in the mouth by the fermentation of the alimentary deposits, chiefly vegetable, which are constantly renewed between the teeth and around their necks, on and within the edges of the gums, through neglect in cleaning them. With the heat, moisture, and abundant access of oxygen, in the incessant course of respiration, this sedimentary matter, always more or less saccharine in its elements, passes into acetous fermentation in a few hours, especially if the natural temperature of the mouth be raised by a feverish condition. When not displaced by cleaning and rinsing, or, less effectually, by new matter from another meal, these deposits soon pass from the acetous to the putrescent stage ; and hence it is, without relation to the stomach, that the breath of

persons during a fast, or other abstinence from food, is more offensive than at other times.

The natural acids of fruits used as food—such as the *tartaric* and *racemic* of grapes; the *citric* of oranges, lemons, gooseberries and currants; the *malic* of apples and many other fruits—are probably quite harmless to the teeth, in their usual transitory action, and frequently highly beneficial as antiscorbutics. The teeth of some persons, however, are so sensitive even to these acids as to demand that they should be sparingly indulged in, not on account of their exerting any corrosive action upon the enamel, or of their affecting the nerve by penetrating through the substance of the tooth, which they certainly do not; but because from so readily reaching the periosteum of the fang, when in an irritable state, they affect the nerve of the interior cavity by sympathy, as in the case of *odontitis*, before described. The liability to such disagreeable sensations from the use of these otherwise agreeable acids, can only be determined by experience or premonitory apprehension, as it varies greatly in the same individual at different times. A very similar but more transient degree of sensitiveness in the dental nerves is excited, through the auricular

branch of the fifth pair, by piercing, acerbitous sounds, such as those of saw-setting, slate-pencil-scratching, or Hotspur's "dry wheel grating on an axle tree," which he declared did not set *his* "teeth on edge" half so much as Glendower's "mincing poetry."

Much has been said of sugar and sweet confections, as accelerators of dental decay; and they are entitled to this character precisely in proportion as they are permitted to remain within the interstices of the teeth and upon the edges of the gums, as the readiest of all materials for acetous fermentation. Sugar, though in itself, and, when applied in large quantities, one of the best preservatives of animal substances, is of all others the most susceptible of conversion into acetic acid when brought in contact with vegetable matter containing albumen, or already in a state of incipient fermentation; and its change is so rapid that the usual intermediate stages of the process are imperceptible. Eaten frequently and abundantly, fresh from the cane, as it is said to be by the negroes of the South, it may have an opposite effect, and become rather detergent than otherwise. But when deposited between the teeth with other food, it cannot be neglected

with impunity, and in some persons it almost immediately excites the sensations produced by vegetable acids.

Some writers have imagined that the natural saliva of the mouth, even in its ordinary healthful condition, has a corrosive effect upon the teeth ; but this is impossible, as it is then found, by the most delicate tests, to contain no free acid whatever. It is the natural detergent fluid of the mouth, supplied from glands which should be regarded as perpetual fountains of cleansing streams. But for their copious aid, the teeth and gums would become laden with accumulated particles of food, imbedded in mucus ; and the acid generated from them would be the powerful *acetic*, instead of being diluted, as it now is, with the milder *acetous*. That the saliva may become what is termed "vitiated," in common with other fluids of the system, and thus become a vehicle not only of poisons introduced into the circulation, as in the case of mercurial salivation, but also of acids morbidly engendered, such as the *uric* acid of gouty subjects, is highly probable. Both in this respect, and as a possible though doubtful source of what is unscientifically called the "tartar" of the teeth, it will be briefly con-

sidered in a future page. But even if it be a source of this concretim, it should be remembered that nature has made no provision for the *neglected* instincts or intelligence of her creatures, and that dirty teeth are no more entitled to such a provision than dirty faces.

In conclusion, we may regard external caries as the result of a decomposing acid, more or less constantly created and renewed in the mouth, from alimentary sediment, left around the teeth by a semi-barbarous and degrading negligence. To this may be added, as a casual cause, the pernicious agents which are sometimes employed to remove, while they really aggravate, the evil. Not merely sharp abrading substances are often used as dentifrices, but too energetic acids, both vegetable and mineral. To restore the whiteness of discolored teeth, some dentifrices contain pulverized alum, which is a sulphate of alumina and potassa, and acts chiefly by its sulphuric acid; cleaning the teeth, certainly, and temporarily exhibiting them beautifully white, but, like the oxalic acid, sometimes introduced for the same purpose, rapidly destructive to the enamel, and speedily fatal at once to their beauty and their durability.

CHAPTER VII.

THE DENTAL CONCRETION, OR TARTAROID OF THE TEETH, ITS CAUSES AND CONSEQUENCES.

Analysis of the Concretion—Analysis of the Saliva—Phosphate of Lime, as a deposit from farinaceous food—An old hypothesis modified—Tartaroid as a prolific cause of dental and stomal diseases—Scurvy of the gums.

Solid compounds of earthy and organic matter, termed concretions, are found in various parts of the animal system, as results of deranged action. They are all more or less calcareous or constituted of lime, in combination with an acid, whether they occur as biliary or urinary calculi, as ossific matter in the sputum of consumptive subjects, as chalk stones of the gouty, or as tartar on the teeth. This last concretim has received the name of tartar, from its fancied resemblance to the *bitartrate of potassa*, or crude cream of tartar, deposited in casks from the acetous fermentation of wines, although the

two substances contain scarcely a single ingredient in common. It would therefore, be less unscientific to term it a *tartaroid*, i. e. "like tartar." The dental concretion, as analysed by Dr. S Wright, from a quantity collected from the teeth of various persons and thoroughly dried, is constituted as follows :—

Phosphate of lime,	65.82
Acetate of lime,	5.35
Carbonate of lime,	1.43
Urate of sodium and potassium,	14.27
Sulphate of do. do.	3.24
Phosphate of magnesia,	1.76
Albuminate of soda,	2.23
Mucin and alkaline lactates,	2.79
Undetermined salts,	0.74
Animal matter and extractive,	2.37
	100.00

It having, heretofore, been assumed by dental writers and physiologists in general, that this concretion is deposited from the saliva exclusively, the following analysis of this fluid, compared with the preceding, by the same chemist (*Chem. Gaz.* IV. 242) will aid the reader in judging of the probability of the hypothesis. In 1000 parts of healthy saliva :—

Water,	988.10
Ptyalin,	1.80
Fatty acid (sebaic ?)	0.50
Chlorides of sodium and potassium,	1.40
Albumen with soda,	0.90
Phosphate of lime,	0.60
Albuminate of soda,	0.80
Lactates of potassa and soda,	0.70
Sulphocyanide of potassium,	0.90
Soda,	0.50
Mucus with ptyalin,	2.60
Loss,	1.20
	1000.00.

It is thus seen that, in about 0.12 of solid matter contained in saliva, only 0.00 is phosphate of lime, while the dental concretion contains 65.82 of that substance, or nearly as much as is contained in the osseous portion of the tooth itself, (see chap. IV, p. 29). It will also be observed that the principal solid ingredient in saliva is *ptyalin*, a brittle, transparent, colorless substance, when dry, of which no trace has been found in the supposed deposit. On the other hand, dental tartaroid contains several substances in large quantities, not found in saliva, namely, acetate of lime 5.35, urate of sodium and potassium 14.27, sulphates of the same 3.24, besides carbonate of lime, phosphate of magnesia, albuminate of soda, and *mucin*; the last

being an ingredient of mucus, supposed to be identical with the *pyin* of pus, soluble in free alkalies, but forming an insoluble precipitate with acetic and other acids.

It is evident, therefore, especially from the presence of such large proportions of *urates*, that while the tartaroid of the teeth can never be deposited by healthy saliva, it may be an abundant product of a morbid diathesis similar to that which generates the concretions of urate of sodium, called chalk-stones; the osseous matter found in the liver, lungs, and intestines, and the urinary calculi of the bladder. The saliva, moreover, being a secretion at once copious and constant, from the parotid, submaxillary, and sublingual glands, conveyed into the mouth by various ducts, a comparatively slight derangement of the glandular system might suffice to render it a medium of such gradual deposits on the teeth. But it is too much to assume that it is the only medium of such morbid secretions and deposits, for the buccal or cheek mucus, with which it is always mixed, is another source, both plenteous and perpetual, to which the mucin, at least, of the dental tartaroid, may be rationally attributed.

There is yet another probable source of this

concretion, independent both of saliva and mucus, and of any morbid condition whatever. We have already seen that it contains nearly 66 per cent. or about two thirds, of phosphate of lime. Now whence comes the phosphoric acid which, either free or combined, plays so important a part in the animal economy, diffusing itself through all the nerves and muscular tissues, impregnating every secretion, and absolutely creating, by chemical affinity, the whole osseous fabric? It is not derived from respiration, for the air does not contain it ; and yet it is continually passing off, in the urinary secretion, in large quantities, as well as in the perspiration. The answer is that, as an oxide of phosphorus, one of the most universally distributed of all the elementary bodies, and a component of all organized matter, it is supplied to our system in every particle of our food. Indeed, phosphate of lime constitutes at least one-third of our best farinaceous food ; and the ashes of wheat flour, as analysed by Schmidt, contain not less than 60.39 per cent. of phosphoric acid. When, therefore, we reflect that the whole of our food has to pass through the mouth, in contact with the teeth, where much of it is held in solution by the saliva and

other fluids, whence the phosphate of lime is readily precipitated by saline agents, it would be a remarkable exception to the well known chemical law of homogeneous attraction and cohesion, if it did not become deposited on the teeth, as its natural nucleus. Indeed, this *must* be a source of tartaroid, on the teeth of every person, whether old or young, by whom the practice of frequently cleaning them is neglected, however pure and unvitiated the saliva may be.

The principal argument in support of the assumed origin of tartaroid in saliva, is the undisputed fact that it is found the most frequently, and in the greatest quantity, on those teeth and their parts which are nearest to the salivary ducts, such as the inner side of the incisors, near the sublingual ; and the outer side of the upper molars, near the parotid ; while the lower molars are less directly exposed to the ducts of the remoter maxillary glands. But since the same local results would follow from the evident fact that these ducts would be the main points of solution and precipitation, provided the deposited phosphate be chiefly derived from our food, the assumption which ascribes it exclusively to vitiated saliva, becomes a doubtful dogma,

divested of much of its plausibility. My own conclusion is that the concretion is derived from both sources ; but that its chief component, the phosphate of lime, is almost entirely precipitated from our farinaceous food. Hence, while it is never found on the teeth of carnivorous animals, nor of savages who live by the chase, it is exceedingly prevalent in countries where the agricultural classes feed principally on oat meal and salt meat, the large proportion of phosphate in the former being freely precipitated by the chloride of sodium in the latter. Hence, also, its universality among sailors, who subsist, during long voyages, on similar diet. But, whatever be its origin, there is but little excuse for its formation on the teeth, and still less for its destructive continuance and growth.

In its first sedimentary state, the tartaroid is of a soft and slimy consistence, precisely similar to the variety of phosphate of lime known to chemists as the "one-third basic," which is prepared by dissolving bone-ash in chloro-hydric acid, boiling to remove carbonic acid, and precipitating by an alkali ; when it appears like a gelatinous sediment, which gradually condenses into a hard, white, granular mass. The viscid, mucous matter which most persons

may observe on their teeth when they awake in the morning, and which is increased by a disturbed and feverish sleep, contains the same constituent, and becomes a similar substance. Much of it, of course, is removed by mastication during the morning meal, but much of it also remains in the interstices and around the necks of the teeth, to add, by accretion, to previous deposits. When this process is permitted to continue for a course of years, the concretion, augmenting, as it does, in an accelerating ratio, becomes a more prolific cause of dental and stomal disease than any other known to the profession. There are numerous instances in which it has been suffered to accumulate until it has choked up one or more of the salivary ducts, and until the molars were not only encrusted with an undistinguishable mass, but with large lumps, which projected the cheeks like tumors; and one of our most respected dental authorities states that he has seen a lump of this kind at least half as large as a hen's egg, of the ordinary size.

One of its first effects, after it has formed between the teeth and around their necks, is to separate the gum from the tooth by gradual insinuation. This enables it to proceed downward

from the cervix to the fang, and thence to the alveolar processes or sockets, which it also separates, and eventually absorbs and destroys. In the meantime, the gums become inflamed, ulcerous, and desquamous, so as to bleed under the slightest pressure ; and when the yellow, pasty sediment, which is the most recent superstratum of the deposit, is removed from their detached edges, upon which it rests as upon a shelf, they often excite a painful surprise by the depth to which they have shrunk.

But it is not merely the gums which suffer pain and dilapidation from this stealthy enemy. The periosteum of the fang, whose vessels and nerves, in its upper portion, are united with the gum, becomes inflamed, and extending its malady as already described, produces odontitis, with all its agonies, and finally internal caries : not to mention the tumors and suppurations, both of the gums and the cheeks, and the intolerable foetor of breath, which generally accompany its progress. And there are no diseases of the teeth and gums, except the few peculiar ones which claim a brief notice in the next chapter, that may not be produced by this cause.

It is now generally conceded by medical

writers, of all classes, that the deplorable disease called *scurvy of the gums*, from its supposed resemblance to *sea-scurvy*, has its origin more frequently in this than in any other source. In fact, the former disease principally differs from the latter in being in a local rather than a general affection; and there is much ground for the opinion that the latter, variously named by nosologists, *scorbutus*, *purpura*, and *porphyra*, is a mere extension of the former, as a general infection, under a predisposing diathesis, from a local seat of the disease. Certain it is, at least, that a scorbutic cachexy almost invariably makes its earliest and most active lesions upon the gums, before it marks its progress upon the skin and the mucous surfaces of the system.

The local variety, commences in an inflammation and ulceration of that part of the gum which is most adjacent to the necks and fangs of the teeth, where also the tartaroid concretion most abounds; and it more frequently accompanies than precedes the growth of this formation on the fangs and sockets, exuding purulent matter from deeper ulcerations as it descends. The gums become turgid, spongy and painful; bleeding at the slightest touch and acquiring a purple hue. A deposition of the osseous matter

takes place at the bottom of the sockets, gradually lifting and loosening the teeth, until they actually fall out, one after another, and the whole are lost, though most or all of them may be perfectly sound. If the disease be not now arrested, the alveolar processes become absorbed, and a terrible ulceration and caries of the maxillary bones is liable to ensue.

The prevention of this disease, is simply the prevention of tartaroid ; for most dentists concur with the eminent Koecker in declaring that it never occurs when this cause is not present, to a greater or less extent. Its remedy and cure is the removal of the cause, together with such decayed teeth and stumps as may unite in generating the morbid virus and aggravating its action. It is true that, in deplorably neglected cases of long standing, and in others of virulent rapidity, temporary palliatives may be required, even to enable the necessary operations to be performed ; and these preparatory medicaments, consisting principally of cleansing and antiseptic washes, followed by gentle astringents, it is the operator's business to apply. But no branch of dental surgery requires greater maturity of judgment, or more careful manual skill. When

such abilities are engaged, all but the very worst cases of this disease are easily cured, to the unimaginable delight of its desponding patients, and their probable exemption from its recurrence to the end of life.

CHAPTER VIII.

ON THE RARER DENTAL DISEASES AND THEIR CAUSES.

Exostosis, or post-mature enlargement of the fangs—Its mystery elucidated. *Necrosis*, or death of the teeth.

The most remarkable and painful of the rarer diseases of the teeth, is *Exostosis*, which consists in a preternatural enlargement of their fangs, while every other portion may remain perfectly natural and sound, and even the contiguous gums be free from inflammation. It is regarded as the most mysterious of all dental affections, and no satisfactory elucidation of it has hitherto been published, if discovered. Its mystery consists in the fact that, while the enlargement is necessarily effected by external accumulation, as the term *exostosis* implies, there is not, as in the case of tartaroid, any indication of osseous deposition, exterior to the periosteum ; but on the contrary, a perfectly homo-

geneous incrementation of the natural substance of the fang, within that membrane, which is proportionably distended to inclose it.

In respectfully submitting my own explanation of this phenomenon, I rather invite investigation than expect gratuitous concurrence. On referring to chap. iv. p. 33, it will be seen that the fangs of the teeth, within the periosteum, are covered with a peculiar strong crust called *crusta petrosa*, or *cementum*, which greatly differs in structure, if not in material, from the osseous nucleus or centre, and, indeed, from every other part of the tooth. And I there parenthetically intimate the opinion that it also differs from every other part in having an *exogenous* instead of *endogenous* growth. This is proved by the transverse and longitudinal sections of the fang, in which the precise resemblance of its structure to that of all organisms of the exogenous class is distinctly evident; and by the fact that, like all organic structures of this class, it is provided with a secreting membrane or corticle, while the rest of the teeth is not. *Exostosis*, then, appears to be a morbid augmentation of the *crusta petrosa*, after its mature formation, by the continuance or renewal of the secretory action of the peri-

osteum. The material of the augmentation is to be found, of course, in the phosphate of lime, both in saliva and in deposition from food, as in the case of tartaroid. The cause is, probably, a low chronic inflammation of the membrane, unattended with pain, until the enlargement is such as to compress it severely against the walls of the alveoli, when any casual accession of periostitis produces intolerable suffering.

It is usually characterised, however, by an indolent, but constant and depressing pain, exceedingly exhausting to the nervous energy, and very similar to that of rheumatic toothache, for which it is frequently mistaken. It often affects both sides of the jaw at the same time, and occasionally causes partial blindness, tetanus and delirium. Mastication eventually becomes impossible, and as all opiates and other medicaments necessarily fail to afford permanent relief, the patient resorts to extraction as the last remedy instead of adopting it as the first. It is a disease which probably admits of no other, unless a longitudinal incision in the periosteum might prove effectual in arresting it before it has become too far advanced. On the other hand, rheumatic odontalgia is so often mistaken for it as to induce the sacrifice of sound

teeth, devoid of every appearance of exostosis or decay. It is, therefore, a dental malady which, above all others, requires the discriminating judgment of a competent practitioner.

NECROSIS.

Another of the rare dental diseases, is known as *Necrosis*, or the death of the tooth, usually commencing at the point of the fang, severing its vital connexion with the nerves and vessels of the maxillary channel and alveoli, and thus leaving it an extraneous body, to decay by exfoliation and irritate by contact. It is usually caused by paralysis of the periosteum, without pain, or by so sudden and extreme an inflammation of it as to produce the same result, without having had time to implant internal caries. Hence *necrosis* usually occurs in sound teeth, which, however, soon become discolored and *dead-looking*, while the fangs, on extraction, are often found to have acquired a rough surface, and a deep green, or brown, or black color. It is scarcely necessary to state that, in this case also, extraction is the only course to be adopted.

When such teeth are permitted to remain, they produce an inflamed, suppurated condition

of the sockets and gums, very similar to that of scurvy, superinduced by tartaroid, with the difference that the purulent matter is discharged through the gums, from two or three orifices, so low down as to be about opposite the points of the fangs, or at least, the middle portion; but before so extensive a caries of the alveoli as this implies has occurred, the discharge is effected between the tooth and the gum, at the cervix. Scarification and lancing are sometimes employed to allay the livid and painful swellings, but with little effect, except as preparatives for extraction. As in necrosis of the bones, so in this of the teeth, no cure can be effected but by the removal of the dead part from the living.

VENTOSIS.

Ventosis, is the name that has been applied to a disease in the cavity of the tooth, from its resemblance to *spina ventosa*, a species of tumor in several bones, arising from an abscess formed in the centre and discharging itself outside. It is caused by a peculiar inflammation of the membrane lining the *cavitas pulpæ*, causing an absorption of the contiguous surfaces, and an enlargement of the foramen of the fang,

through which the pustular matter is discharged into the bottom of the alveolar cup, and thence works its way through the gum, by one or more openings, as in the case of neglected necrosis, last described. As in that disease also, the gums become livid, spongy, and sensitive beyond endurance; the exuding matter, usually more copious and foetid than in necrosis, is revolting both to the smell and taste; and so rapid is its infective action upon the sockets that, unless the tooth be soon extracted, they become extensively dilapidated, and endanger those of adjacent teeth, which suffer in consequence. The first acute action of the disease, in the nervous center of the tooth, probably inflicts as much pain as human nature is ever called to endure; but it is so obscure and equivocal, at this period, as to be frequently confounded with acute odontalgia from other causes, and demands a corresponding degree of discriminating inquiry, which the patient, or rather impatient, is seldom in a mood to meet. It has, however, distinctive symptoms which, admitting of no alleviation, dictate extraction as the only resource.

DENUDATION.

Denudation, is a constitutional affection of the teeth, primarily confined to the enamel, and doubtless arising from a natural defect or frailty in its composition. It is a gradual but general solution of all the enamel of the teeth, generally beginning on the crown where there is the greatest attrition, and proceeding downward to the cervix, until all the exposed surfaces are left naked. It has already been mentioned that some persons and families are hereditarily devoid of enamel on their teeth; and denudation reduces others to the same deprivation, by causes equally constitutional, inscrutable, and irremediable.

As the denuding process advances, the teeth change their color, becoming yellower as the dentine is more exposed. At length the latter, when not corroded by acids nor attacked by caries, becomes of a brown hue, highly polished, and apparently durable. It is more frequently its misfortune, however, to become very sensitive both to the mildest vegetable acids and changes of temperature, and to fall into premature decay. This result may be protracted, if not obviated, by a careful abstinence from acids of all kinds, and a daily use of dentifrices, pre-

pared chiefly from impalpable chalk, which absorbs the acids generated in the mouth. By this means the color of the dentine may be restored, so as to nearly equal that of good ivory, even after it has been lost ; and a polish also may be acquired, the maintenance of which may be regarded as a standard test of exemption from erosive disease.

ABRASION OR TRUNCATION.

These are terms applied to the gradual wasting of teeth on the grinding surface, by attrition in mastication, which is so great in many instances, and in teeth, like the bicuspid and incisors, so little subjected to this action, as to demonstrate a constitutional or radical defect in their whole composition, instead of the more limited imperfection exemplified in the denudation of the enamel. In some examples, all the front teeth are worn down nearly to the edge of the gum, while the molars are reduced but slightly, thus leaving a space through which the tongue may be partially protruded, while the other teeth are in contact. In other but rarer cases, all the teeth have suffered an equal reduction, and the face exhibits the collapsed expression of utter toothlessness. The most

remarkable peculiarity of this disease is that it is generally unaccompanied by any other, even the worn down stumps exhibiting an immunity from caries, apparently because so complete a demolition admits of no aggravation. Even the sensibility to acids and cold air, which is painfully experienced during the first stages of abrasion, soon subsides ; the nerve-cavity itself becomes filled with ossific matter as fast as it is invaded, until it is entirely obliterated.

It is not to be supposed, however, that such stumps of teeth, insensible though they be, can be permitted to remain in the jaw without mischievous consequences. The gum gradually grows over them, it is true, and a fancied security from future disease may be cherished for some time ; but internal abscesses and gangrene, of the most virulent character, ultimately ensue, in a majority of cases, endangering even the maxillary bones to a greater extent than any other cause. The only expedient, in such cases, is self-evidently extraction, which can generally be accomplished with much less pain and difficulty than in many others ; and the gums soon become prepared for artificial teeth, attached by atmospheric pressure.

DENTAL FRACTURES.

Abruption, or sudden fracture of the teeth, is to be regarded, in most instances, as an accident rather than a disease ; but it is so frequently liable to occur to teeth of frail or impaired stamina, even in their ordinary use, as to be entitled to consideration. When they break off at the neck or nearly level with the gum, it is usually an evidence of external caries, surrounding the part. Other fractures occur from other causes ; a small fruit stone, piece of bone, or shot in game, sometimes produces a fracture extending far beyond the point of contact ; for the muscular force unconsciously exerted by the jaws, in ordinary mastication, is altogether beyond conception, until proved by a casualty of this kind, or a still more unwelcome test upon an unfortunate finger. When the fracture is small, the application of a fine file to its sharp points or edges may be the only attention required ; but when it extends to the cavity, and exposes the nervous membrane to the irritating action of the air, not to mention liquids, extraction or abscission is the only alternative to painful disease.

When, by some violent collision, teeth become completely dislodged from their sockets, or so

dislocated as to require removal, they may frequently be replaced, so as to remain useful for years, provided the operation be promptly and properly performed. But it is seldom that amateur surgery can be relied on in such a case, as there is generally something to be done besides merely restoring the tooth to its place, which would, in fact, be useless, without an adjustment of the alveolar processes, wherever they have participated in the injury.

It remains only to advert to those injuries of the teeth which are incident to certain trades, medications, and personal habits. Among the most remarkable though least mentioned of these is—

PHOSPHOEROSIS,

A dental and maxillary disease, incident to the manufacture and use of phosphorus, and especially to its employment in the manufacture of matches, now extensively pursued in all parts of the world. In Germany, where this disease first attracted medical and scientific attention, it has been well studied. In France, it has lately been made the subject of a prize, from the Academy, to Drs. Von Bibra (whose comparative analysis of the teeth has been seen in a pre-

vious chapter) and Ghoist, of Nuremburg, for a report of great interest. They state that it affects the teeth and maxillary bones of a large portion of the persons employed in the business ; that females are more subject to it than males, and young women more than those advanced in age. They report that it prevails wherever the manufacture is conducted, causing the loss of the affected teeth and bones, even when it does not endanger life. Their explanation of its causes and effects, is both simple and scientific. "The phosphate of lime as it exists in the teeth and bones, is insoluble in water, but by the arrival of an additional quantity of phosphoric acid, which being present in the air, is absorbed and penetrates into the bones, the basic phosphate of which they are composed is converted into an acid phosphate, (bi-phosphate) which is very soluble in water, and even deliquescent in the air. In this way the bone loses its consistency, becomes inflamed, suppurates, and falls into a state of *necrosis*. As the disease always commences where there are carious teeth, the transformation takes place directly ; the vapors coming in contact with these teeth first affect them, and then the jaw with which they are in connection."

The only apparent preventive, or rather procrastinative of this affection, in persons engaged in this pernicious employment, is suggested in the last part of the statement, namely, the removal of all teeth in which decay has been superinduced by other causes. As the manufacture and packing of phosphorous matches now engages a large number of persons in this country, most of whom are women and children, more susceptible, it is said, than those of the other sex, or the more advanced in age, to its destructive influence, and who are almost certain to become unhappy agents in transmitting its evils to their offspring, it is already an object worthy of philanthropic consideration whether some means cannot be devised for obviating so immeasurably extensible a calamity. Nor is it improbable that strong currents of air for carrying off the phosphoric exhalations as fast as they arise in the factories, or the introduction of some neutralizing vapor, may be adopted as, at least, an alleviative expedient.

Other manufactures in which powerful acids are freely evolved into the air, such as that of sulphur, the sublimed vapor of which, combining with the oxygen of the atmosphere, forms sulphuric acid, must necessarily have a perni-

cious effect upon the teeth ; but the statistics of this fact are probably too vague, at present, to be of much practical value.

MERCURIALYSIS.

Of all the extraneous causes of dental injury and dilapidation, the excessive administration of mercury is probably the most potent and prevalent. Happily, the great diminution in the quantity of nearly all medicines now prescribed by the more reflecting members of the medical profession, has probably a tendency to reduce that of mercury in a similar proportion. It is, at least, pretty evident that the desperate practice of salivation is less recklessly resorted to than at a former period, because fewer cases of dental mercurialysis are presented for reparation. One of the most approved old criteria of an efficient medication by this subtile metal, even in liver complaints, was the loosening of the teeth, in connection with soreness of the mouth, and an intense stimulation of the salivary glands. This effect on the teeth is produced by an extraordinary thickening of the periosteum of the fangs, which lifts them out of their place, it being the peculiar action of mercury to distend its vessels. And although

the teeth generally recover their firmness as that action subsides, yet the *reaction*, upon the absorbent vessels, is but too obvious and permanent in its effects.

It is not too much to assert that the teeth of such persons never fully recover their previous appearance and stability. They are to be known from the teeth of all other persons, at a momentary glance. While, as in some kinds of consumptive marasmus, the edges of the alveoli, and therefore of the gums, gradually sink down by absorption, leaving the teeth tall and skull-like in aspect, they are further distinguished by a turbid, mercurialized tinge, as those of consumptive patients are for their peculiar brilliancy. In many instances, a majority of the teeth soon fall from the jaw, leaving but some two or three to linger as ghastly and useless relics of the general wreck. The removal of these unsightly incumbrances, and the substitution of a good set of the artificial indestructibles, is a duty which the victims of such malpractice owe alike to themselves and the circles in which they move ; and it is to be regretted that the authors of the mischief cannot be compelled to make at least this small amount of restitution.

MEDICINAL ACIDS.

Much has been written upon the real or supposed effects of other medicines, in impairing the teeth ; and there is little doubt that those which abound with mineral acids, such as sulphate of quinine, taken, as it usually is, and ought to be, in solution, with an additional quantity of the acid, have this tendency, when frequently repeated and long continued. But as these are usually administered as remedies in febrile maladies which, if neglected, would injure the teeth still more, besides undermining the whole constitution, the choice of evils, which such cases present, admits of no hesitation.

THE EFFECTS OF TOBACCO.

Most writers on the subject concur in condemning the use of this popular sedative as injurious alike to the teeth and the nervous system at large, in whatever form it may be used. And so far as the teeth may participate in a general nervous derangement, there is little doubt of the reasonableness of this conclusion. But that the habit of chewing tobacco, however objectionable and injurious it may be in other respects, has a directly destructive effect upon the teeth, is apparently true only of those con-

stitutionally predisposed to *necrosis*. That it often precipitates and confirms this tendency, there is no doubt whatever ; and that tobacco fibres, permitted to remain between the teeth, will generate erosive acids, like all other vegetable matter, is equally indisputable. It is evident, nevertheless, that the practice of chewing, uncleanly as it is, in every other particular, has a detergent effect upon the teeth, in removing other sedimentary matter, whatever may be the effect of its own. It is seldom that a tobacco chewer is disposed to admit its ill effects upon organs so important to its use, though he cheerfully concedes that it may be eminently destructive to them when used in smoking. And thus it is that men in general—

Compound for sins they are inclined to,
By damning those they have no mind to.

Of the latter mode of indulgence, it must be stated that it is rare indeed to find inveterate smokers with good teeth. Eventual discoloration is certain ; and the discoloring matter is a pyronicotic acid which, however anodyne in some kinds of tooth-ache, is an active accelerant of caries, if not a superinducement. But it were probably idle to condemn the use of tobacco, as a source of dental disease, even if the evidences

of the fact were clear and abundant, in general experience, instead of being commonly controverted. It is one of these tenacious habits, originating in experimental imitation and confirmed by nervous appetency, which will probably be perpetuated among mankind for an indefinite period, in defiance of every objection.

It may be worth a passing remark, as a matter of scientific curiosity, that the only two vegetable productions with which such habits, in the civilized world, at least, are universally allied, are those which, above all others, at present known, the most abound in *nitrogen*. At the head of the whole vegetable kingdom, in this element, as in this influence, stands *nicotiana tabacum*; and second only in rank, in both respects, stands *caffea arabica*; the former being as repulsive as the latter is agreeable, both in odor and flavor. The nitrogenous sceptre of King Tobacco and Queen Coffee, is well-comely wielded over a greater multitude of loyal subjects, of all nations and races, than can be claimed by any kingdom or creed. And if Coffee has a rival for the throne in her Chinese cousin Tea, it is because the latter is almost identically her equal in nitrogenity. (*Vide* Mulder's and Peligot's analysis, *Comptes Ren-*

dus, 1843.) It is also a chemical fact that those vegetable products which mankind at large, with 'unintelligent and unconscious unanimity, have selected and retained as their favorite and principal articles of food, are the most affluent in the same constituent. Such facts, in connection with the remarkable influence of several modern compounds of nitrogen upon the nervous sensorium, are certainly highly curious, and might well incite more instructive researches in the philosophy of an element which, though constituting four-fifths of the atmosphere that surrounds our globe, and presumptive by a supporter of all animal and vegetable life, has been the least studied and appreciated of all the great functionaries of nature.

CHAPTER IX.

ON PARENTAL CARE OF THE TEETH OF CHILDREN.

In their laudable zeal to enforce the importance of individual and domestic care of the teeth, several writers, of high rank and repute, have averred the extraordinary opinion that the teeth of all persons, with scarcely an exception, might be preserved through life, from the period of second dentition, to that of extreme age, unless destroyed by injuries purely accidental. They make no exception even for hereditary diseases, nor for those arising from natural malformation and irregularity, insisting that the whole of these might either be obviated by parental precaution, or effectually remedied by timely professional aid. These writers assume the position that the teeth are not naturally more subject to internal disease than any other bones of the system, nor more exposed to external injury in their ordinary use than the nails,

the eyes, or the nose ; and that the sole cause of their greater decay is their greater neglect.

Without countenancing or controverting an opinion so extravagantly extreme, all dentists concur in the conclusion that a very great majority of the dental diseases and instances of disease, now predominant in persons of every age, and in all classes of society, admit either of prevention or remedy, by proper and timely care. The very fact, however, that such care is required, is sufficient proof that these organs are more exposed than most others to disastrous consequences from neglect. No other osseous organ either requires or admits of such care ; the nails are repaired by constant renewal in growth, while the teeth are not ; the eyes are protected and cleansed by the involuntary and ever vigilant action of their lids, which have crystal fountains equally ready with their aid ; and as to the nose, although it is probably in more constant use than any other external organ, it has seldom to encounter a worse enemy than the vital air. The teeth, on the contrary, are subjected to a greater number and variety of pernicious agents, and furnished with fewer natural resources to resist them, than any other

organs of the body ; and hence, are, at once, more liable to injury and more in need of care.

The first care of the teeth, should be bestowed by the mother, *upon her own*, for the sake of her offspring. Emphatically as this duty has been urged, in a previous chapter, on the authority of unquestionable and conclusive facts, its importance may be enhanced by several additional considerations.

It is not merely for the sake of the *teeth* of their children that all women who expect to become wives and mothers should previously secure a complete eradication of the diseases and decayed remains of their own, but for the sake of the general health of their future offspring, as well. That a scorbutic diathesis is engendered in the system by bad teeth, together with all the other maladies and constitutional vitiations, mentioned in the introductory chapter, admits of no doubt ; and it is equally certain that every constitutional taint, from whatever source derived, may be transmitted by parents to their children.

The most important fact of **all**, however, is, that this parental transmission of all diseases arising from bad teeth may be entirely prevented by the timely removal of the cause. No fact

known to the profession is better established than this, and it is consequently one which mothers cannot too soon impress upon the minds of their marriagable daughters and female friends. It is a fact which admits neither of doubt nor of delay, and its due appreciation would not only obviate an incalculable amount of misery and depravation in countless generations of innocent and helpless children, but in their mothers also ; for the precursory period of maternity is, of all others, the most certain and fruitful of personal suffering from decayed teeth.

However inconsiderately the teeth of young females may have been neglected prior to the period at which they intend to incur new obligations and responsibilities of such momentous magnitude, the condition of those organs should then, at least, become a matter of primary solicitude and attention. Every tooth, so far decayed as not to admit of effectual and durable filling, should be removed without hesitation, and replaced by others, pure and indestructible. Every vestige of tartaroid, which, as we have shown, is an inevitable source of disease both to the teeth and gums, should be removed by those improved instruments and skilful hands which are absolutely required for the operation. To

rely upon tooth-brushes, dentifrices, or incompetent dentists, in this case, would be a deplorable mistake. Nothing less than a complete eradication of this morbid concretion from those parts of the teeth in which it is a perpetual cause of irritation to the gums and fangs, should be considered safe and satisfactory. And this operation, once properly performed, will be a source of health and pleasure for a lifetime : for few persons, of that sex, especially, to whom sound teeth and sweet breath are of such inestimable value, both personally and prospectively, will ever permit so pestiferous a nuisance to accumulate again.

The teeth of children demand a mother's care, from the first two or three months of infancy to the twelfth or thirteenth year of second dentition. The first dentition is actually a crisis in human life, and the enormous disproportion of mortality which occurs at this period, above any other, is attributed, by the most eminent medical authorities upon the subject, to the general irritation of the infantile system, produced by "teething." Many of these writers insist that at least one-half, if not two-thirds, of the deaths of infants, under two years of age, originate in this cause alone.

The *dentition diarrhœa* of infants, has a distinct and established place in medical nosology, as one of the most prevalent effects of this cause; and although it must be regarded as an effort of nature to reduce the gastric and general irritation which the painful process of teething induces, yet it frequently amounts to a positive disease, running into *cholera infantum*, which, besides mowing down its daily thousands, reserves its other gentle victims for a fate still more cruel, in becoming chronic, and slowly wasting them away by intestinal ulceration.

The utmost, perhaps, that the most intelligent and attentive mothers can do in such cases, is to firmly refrain from administering those crude and dangerous nostrums, chiefly compounds of opium or laudanum, in its harshest and most aggravating forms, which are in illiterate use and repute for this purpose, merely because they sometimes afford a temporary alleviation of symptoms. Very small doses of *ipêcac*, or *magnesia* and *rhubarb*, or prepared *castor oil*, are better than all the opiates in the world, in every stage of the complaint, though not half so good as the judgment of a judicious physician, in any case in which they fail to afford permanent relief.

But there is a simple and obviously rational operation, too little resorted to even in the worst cases of painful and inflammatory dentition, which generally supercedes all medicines, by arresting every distressing symptom ; and that is, puncturing the gum with the lancet, wherever the local inflammation or tension, from the cutting tooth, appears to demand its aid. The relief is invariable, and the pain and danger none. The few drops of blood which issue from the incision, and which are such a childish terror to mothers, immediately allay the local irritation, and thence the symptomatic ; while the incision itself performs, in a single instant, the painful and tedious task which the duller tooth might not have achieved in several weeks. Thousands of infants needlessly suffer, and as needlessly die, from the prejudiced obliviousness of mothers to this simple and grateful remedy. When infants accomplish their dentition without protracted irritation and its symptomatic consequences, of course, even this valuable expedient is unnecessary ; but whenever the little sufferer turns shrieking from its mother's breast, after repeated attempts to bear even the gentle pressure of the plastic nipple, there is much stronger reason for examining the state of its

gums than for suspecting gripes in its bowels, to which its acute distress is more commonly ascribed.

It should scarcely be necessary to caution either maternal or hired nurses, of ordinary intelligence, against introducing bone, coral, or other hard substances, into the mouths of infants, as instruments to facilitate dentition ; though we still sometimes see these barbarous and dangerous contrivances, in the shape of ivory rings, sticks of coral with silver bells, and other seductive toys, suspended by bright ribbons from the necks of the little victims, as if to enchant them into as much suicidal suffering and injury as possible.

If mothers and nurses do not know that the teeth of babies, at this tender age, are so soft and pulpy, almost immediately beneath the cutting edges, or at least around the necks and fangs, and throughout their interior structure, as to be susceptible of great injury and displacement from the eager pressure of the jaws upon such unyielding substances, it is high time they should learn and reflect upon the fact. Certainly, nothing harder than the nurse's finger, or the most elastic kind of india-rubber rings, should be introduced for this purpose ; and the

instinct of infants to bite upon their own tiny and tender fingers, should suggest the gentlest treatment. That friction, with the fleshy point of a finger, along the ridge of the gum, is often welcome and gratifying, is evident from the avidity with which it is sought and prolonged ; and it were well if the assiduous kindness of nurses were such as to induce them to refrain from substitutions less troublesome to themselves.

Early in the interval between the first and second dentitions, children should be taught the most important lesson that either they or adults ever can be taught, for the preservation of their teeth ; and should be trained in it so thoroughly, at this early period, as to render it as habitual, to the end of life, as that of washing their faces and hands. That lesson is the daily practice of *rinsing the mouth*, in cold water, so as to completely wash out the alimentary deposits, whether fragmentary and fibrous, or merely sedimentary, that would otherwise inevitably remain within the interstices of the teeth and upon the edges of the gums. This eminently salutary but much neglected practice, is more effectual and important, in many respects, than that of the tooth-brush, though it does not

supercede it. It does more than the best brushes can do, however carefully and regularly applied, in cleansing the apertures between the teeth, and the whole extent of their interior surface, in both maxillaries, though less efficient as it regards the outer edges of the gums, opposite the teeth, and in the removal and prevention of incipient tartaroid.

Good *mouth-rinsing*—by which we mean brisk ejections and injections of water, between the teeth, by means of strong and active compressions and agitations of it, within the cheeks and jaws—thoroughly washes away the feculent matter deposited in the interstices and angles of the teeth, which otherwise becomes acid in a few hours and speedily putrescent ; and which is undeniably the predominant cause of almost every disease to which the teeth are liable. The flavor and feter of this daily recurring feculence, sufficiently attest its noxious character ; and it seems marvellous that its voluntary suction upon the palate and transmission to the stomach, should be preferred to its expulsion by ablution, even if the nauseating practice were as efficient as the cleanly.

But it is not solely on account of detergent ablution that the habit of mouth-rinsing is to

be deemed important. Above every other means it tends to fortify the teeth and gums from those effects of severe atmospheric changes, from heat to cold, experienced in inhalation, and frequently productive of inflammation. Accustomed from early life to the temperature of cold water, they would necessarily become insusceptible of injury from such influences.

The importance of preserving the first teeth, for the sake of the second, until by the absorption of their roots, the former naturally give place to the latter, is an established maxim in dental therapeutics, however lightly it may be regarded in the family circle. The premature decay, or unhealthy condition, of the first set, is a very unfavorable omen for the second, which, in absorbing a portion, at least, of their roots, are liable to imbibe their diseases also ; and even if the dependence of the latter upon the former were less direct than this formative and vital connection implies, still the development of the new teeth, in the midst of such unhealthy parts as we frequently see in the mouths of neglected children, can scarcely fail to affect them injuriously, and to speedily blight every hope of their future health and durability.

To prevent such sad and inexcusable conse-

quences, a due attention to the *cleanness* of their children's teeth, on the part of parents or other guardians of childhood on whom the duty may devolve, is as absolutely necessary as that of adults for the preservation of their own. There is a most cruel culpability involved in the neglect to clean the teeth of children for them, when they need it, and are unable to do it for themselves. To this end, in addition to the occasional application of a small soft brush, nothing is required but to habituate them to the mouth-rinsing already so strongly urged—a habit which they soon learn and delight in, and are not likely to abandon to the end of their days—a habit which would be the moral germ of many other habits of cleanliness and care, and which might materially mould the whole future character. The better to facilitate and confirm the practice, and to prevent even its occasional pretermission, it should be insisted upon as a regular and indispensable branch of the morning ablution. Adults may do as they please, in regard to their own teeth, and have bad ones or not, according to preference ; but they have no right to neglect those of their children.

Upon the serious subject of the *premature removal* of deciduous teeth, so detrimental to

the perfect structure and stability of the succeeding ones, enough has been said, in connection with the account of their organization, to excite parental caution and supervision. It may be added, however, that children so frequently extract these teeth themselves, or permit them to be plucked off with threads or other strings, by playmates and school-fellows, whenever *they*, in their surgical wisdom, think them loose enough for the dexterous operation, that the most imperative parental injunctions may be needed to prevent the mischief that might ensue. Irreparable injuries are also often inflicted upon these teeth, and indeed upon the new ones, by the recklessness of children in cracking hard nuts, ice, and candies, against which they should be admonished with equal solicitude.

In relation to the *irregular growth* of the new teeth, so widely out of their proper places as they sometimes appear, together with the frequent necessity of professional aid in such cases, appropriate advice has been given in previous pages ; and nothing remains to be added, upon the whole subject of parental care of children's teeth, but the cordial assurance that such care will ever be rewarded with heartfelt satisfaction and inestimable success.

CHAPTER X.

ON THE DENTAL ECONOMY OF ADULTS.

It is estimated, from extensive observation, that not more than two persons out of ten, in the whole community, are in the habit of cleaning their teeth ; and that the remaining eight-tenths are more or less affected with dental diseases. Supposing these estimates to be even proximately correct, the inference is irresistible that the facts which they embrace stand correlatively as cause and effect. Indeed, if the first be but nearly true, we scarcely require any other evidence of the second, which must follow as an inevitable result. We do not mean to insist, with some writers, that there is never any dental disease where cleanliness is habitually maintained, but that disease must sooner or later occur wherever it is not; and that neglect, as before repeatedly stated in these pages, is every where the predominant cause.

But there is a neglect of care as well as of prevention, and, in this two-fold character, it constitutes one of the most extraordinary abnegations of self-preservation to be found amid all the varieties of personal improvidence. None of the ordinary incentives to health, comfort, or comeliness, seem adequate to counteract this inveterate species of negligence; and even among those refined individuals and classes with whom personal cleanliness and punctilious neatness are a scrupulous and elaborate habit, it is often too evident that their teeth receive but a comparatively stinted portion of their attention.

To what can so anomalous a negligence be attributed, in a matter of such paramount importance, unless it be to the inconsiderateness of practical ignorance of the subject?—to the want of such information, in fact, as a little domestic treatise of this kind, so readily imparts, yet is so rarely at hand to supply? It is a subject seldom included in works of domestic medicine or management; rarely thought of by the family physician. And who, among all his choice books on law, physic, divinity, history, science, or general literature, has a practical treatise on the care of the teeth in his library? The reason doubtless is, that works on this sub-

ject are generally written either too exclusively for the profession, or too superficially and quack-doctorly, as mere advertisements of somebody's practice, to be of any practical value, whether for private or domestic reference.

The preventive branch of dental economy, in adults, consists in a proper method of cleaning and preserving the teeth, established as a daily habit. And here everything that has been urged, in the preceding chapter, on the inestimable value of mouth-rinsing, applies with still greater force. It has been shrewdly said that the profession of dentistry has no greater rival than the tooth-brush; but I am of opinion that good morning and evening mouth-rinsing, would soon become entitled to a moiety, at least, of that honor.

As a general rule, moderately soft tooth-brushes, of medium width, are to be preferred to all others. If, however, the teeth have been so much neglected as to be at once discolored and encrusted, a harder brush may be desirable, for a short time, provided it be not too wide; for, under such circumstances, a brush at once wide and hard would lacerate the flaccid gums too much for daily endurance, and the new habit of tooth-cleaning would be in great dan-

ger of abandonment as too painful a reform to be perpetuated. Full soft brushes, on the other hand, soon become both agreeable and refreshing. No others should ever be used, on the front teeth, after they have recovered a degree of whiteness ; for say what we may of the hardness of the enamel, it will wear, like the diamond itself, under the repeated attrition of substances of nearly equal hardness. The chief use of hard brushes is on the molar teeth, when they are encrusted with tartaroid ; but they are less effective than soft ones, in reaching the interstices of the teeth, the inferior pliancy of the former compelling it to pass over those recesses which the latter penetrate and cleanse. Even these may occasionally fail to dislodge concrete and fibrous matter that has become firmly wedged, and a tooth-pick, shaped to the part, may be a necessary as well as generally useful auxiliary.

Unless the practice of using the tooth-brush has been continued from early life, and the teeth are free from discoloration as well as tartaroid, the occasional use of some tooth-powder will be necessary to restore their natural purity and polish, and to preserve their beauty from becoming impaired. Water alone, will not often

suffice for this in persons of mature age ; and proper dentifrices should be applied, as often, at least, as twice or thrice a week.

But here the question arises, what are proper dentifrices ? And it is a question which cannot be answered by a single rule of preference, because different kinds may be equally valuable or objectionable for different purposes. Thus, very finely pulverized pumice stone, is a good tooth-powder, for the side teeth, when covered with tartaroid ; but it would utterly destroy the enamel of the front teeth, if constantly applied. Yet it is not uncommon to find this keenly abrasive powder, made from a volcanic scoria that will dull a diamond, mixed up with chalk and charcoal and sold as the best of all tooth-powders for indiscriminate and continual use ! And, what is still worse, frequently recommended for such use in dentistrical publications !

Pulverized charcoal, from certain mistaken or exaggerated notions of its properties, has probably been more generally recommended than any other substance. Under certain conditions, charcoal, both vegetable and animal, is undoubtedly at once an antiseptic, a disinfectant, and a decolorizer. But these properties are entirely

dependent upon its peculiar power of absorption, which exists chiefly in relation to gases, and not remarkably as it regards fluids. Its absorptive power, is again dependent upon its freedom both from moisture and air ; and its special property of decolorizing certain vegetable solutions, probably depends upon its avidity for oxygen, as contained in the oxyds of which the coloring matter is composed. It is evident, therefore, that even its antiseptic property, so much extolled in reference to the putrescent matter, generated solely through neglect of cleanliness, in the interstices of the teeth, is almost entirely imaginary, in the state of saturation with water, in which it is applied ; and certainly not greater than that of chalk, and several other absorbent powders.

But while it is thus almost negative, in the virtues ascribed to it, there are serious objections to the continued use of charcoal as a dentifrice. It is absolutely insoluble in water ; and the consequence is that, whenever its particles are either forced or attracted between the teeth and the gum, they are very liable to remain there, and become a cause of irritation—even-
tually collecting mucus at least, if not the feculent matter they are inadequate to neutralize.

Another objection to this powder is its highly abrasive action, which is much too great for the enamel of the front teeth, at least. It cuts through hard substances with rapidity, acting both upon gems and metals: and that which no person would think of using a second time as a plate powder, can possibly be fit for continual attrition upon the far more precious enamel of the teeth, which, once injured, can never be repaired or re-polished.

Some respectable authorities have recommended animal charcoal, or bone-black, in preference to the vegetable variety. And certainly it admits of a very fine pulverization, when elaborately prepared; but besides being open to the same objection of insolubility as the other, and being a still greater nuisance on the score of its infinite smuttiness, it possesses chemical components of a very questionable character. Containing, upon an average, about 88 per cent. of phosphate and carbonate of lime, and 2 of carburet or siliciuret of iron, there remains but 10 per cent. of carbonaceous matter (nitrogenous charcoal), in which all its famous antiseptic properties must reside. To render these available, it must be applied perfectly dry, thus making it as seemly and deli-

cate a mouthful, as any lady, examining its progressive condition in a mirror, could seriously desire.

Either of these kinds of charcoal, however, is better than no dentifrice at all, and having thus truly described them both, we leave them to the reader's choice. But it may not be inexcusable to add that, in case any of the particles of either kind should happen to be forced, by a hard tooth-brush, through the skin of the gums, they are pretty sure to remain there, indelibly, like the anchors and mermaids upon the sailor's arm, pierced in with india-ink—a third form of charcoal, not a whit more insoluble than the other two ; and many gums have actually been thus tattooed.

Another extraordinary tooth-powder, indorsed in certain cookery books, and almanacs, and in high repute among those who have never tried it, is the ashes of segars. In explanation of its violent action upon the teeth and gums, and as a matter of general curiosity, we give its analysis:—

Silica.....	15.59
Lime.....	11.60
Magnesia.....	7.75
Potassa.....	7.30
Soda.....	2.50

Chloride of Potassium.....	1.75
Alumnia and oxyd manganese.....	4.50
Carbonic acid.....	19.75
Sulphuric acid.....	12.30
Phosphoric acid.....	14.80
Ammonia.....	2.00
Loss.....	0.16
	100.00

It is thus evident to every chemist, that it would be difficult to form even an artificial compound more destructive to the teeth and corrosive to the gums. Besides its caustic alkalies, it contains over 12 per cent. of sulphuric acid, and nearly 15 per cent. of phosphoric acid, which last, as we have already seen, in a previous chapter on dental diseases, produces that malignant variety of caries, both in the teeth and maxillary bones, called *phosphorosis*, even when inhaled by the mouth in a state of vapor. Indeed, the per centage of sulphuric acid, to say nothing of the carbonic, would be quite sufficient to destroy the enamel in a short time. To those who smoke cigars until their teeth look like them, it may be a favorite recompense to use the ashes for the removal of the discoloration, and they will, undoubtedly, have this temporary effect. But unless the laws of chemistry have been repealed by some

recent act of the legislature, the remedy would soon prove much worse than the original mischief. So excessively excoriating, however, are these caustic ashes to the gums and cheeks, that we presume few persons can possibly continue to apply them, except at distant intervals. But, it should be understood that, even when thus moderately used, their destructive effect upon the teeth is both certain and cumulative.

Tooth-powders have been the subject of much dissertation, and many researches and recipes, both in ancient and modern times. They are usually classed as the *mechanical* and the *medicinal*, the latter being mostly astringent. But it is quite usual and not objectionable, to compound mild vegetable astringents, such as orris root, Peruvian bark, and myrrh, with the fine argillaceous earths, such as prepared chalks, Armenian bole, or the impalpably silicious red oxyde of iron, which all act mechanically by friction. Prepared chalk, 4 parts ; fine bright Armenian bole, 2 parts ; fine filings of Castile or (still better) white Windsor soap, 1 part ; powdered orris root, 1 part ; powdered nut-galls, or Peruvian bark, half a part ; and finely crushed white sugar, 1 part ;

the whole perfumed as most agreeable, well dried and intimately mixed—make probably as good a tooth-powder, for habitual use, as can be compounded, it being both innocuous and detergent, and exceedingly pleasant withal, which is no small object.

For occasional use, and specific purposes, various other things are truly valuable. Thus, finely pulverized pumice stone, as a mechanical dentifrice, for the side teeth, under the circumstances already stated, would be very useful. The vegetable acids, lemon or lime juice, or good vinegar, used unfrequently, and principally on the side teeth, by persons of a scorbutic tendency, are well known to be efficacious, not only as anti-scorbutics, but as solvents of tartaroid and discoloring deposits. But, frequently applied, these acids would make the teeth acutely sensitive, and produce an injurious and unsightly contraction of the gums. As an antiseptic solution, for occasionally rinsing the teeth, nothing is better than an ounce of saltpetre dissolved in a quart of warm water, the solution being used, when cool, a wine-glassful at a time, and then rinsed away with pure water.

With regard to other dentifrices and mouth

washes, strictly medicinal, nothing can be recommended in a domestic manual of this kind ; for the conditions under which they ought to be applied vary too much for any general rules, and can be safely determined only by professional judgment or sound private knowledge. Thus oxalic acid, has its valuable, though very limited uses in dentistry ; but being a terrific poison, when received into the stomach, and a strongly corrosive agent when applied to the teeth, it would be altogether unsafe, out of professional hands. So a solution of sulphate of copper, is very efficient in arresting those rapid gangrenous ulcerations which sometimes occur in the mouth ; but being very poisonous, it would be unsafe to entrust it, as a general rule, to domestic administration.

Having thus reached the limits of dental economy in private and domestic practice, we shall proceed to indicate the circumstances under which it should have recourse to professional resources.

CHAPTER XI.

ON THE RESOURCES OF DENTISTRY, SURGICAL AND MECHANICAL.

The profession of Dentistry, as a distinct branch of Surgery, has not been generally established, in this country, much more than half a century, nor in Europe more than a whole one. It is a legitimate scion of that progress in practical science and art which best effects the aggregate improvement of an age by a division of study and labor, and thus achieving the highest proficiency and excellence in the particular departments of which that aggregate is composed.

In France, where the arts most conducive to personal appearance and grace have been longer cultivated than in any other of the modern nations, the distinct profession of dentistry appears to have had a somewhat earlier date ; for Italy herself has not caught the spirit of the classic age, in that respect, with so true an

inspiration. In ancient Greece—as was inevitable among so refined a people—the profession appears to have flourished at least contemporaneously with the purest epoch of sculpture ; and it is remarkable that its practitioners were then designated by precisely the same title, “ Surgeon Dentists,” which they now adopt. Allusions to their art, and to their skill in making imitative teeth, are to be found in many of the classic writers, who frequently refer to the charm imparted by good teeth to the countenance and address, and to the chilling effect of bad ones. Ovid speaks of the latter as the most effectual remedy for the tender passion ; and Palladius maliciously observes, of an antiquated coquette, that for much less than the cost of her beautiful hair and teeth, she might have bought an entire mask !

During the succeeding ages of comparative barbarism, the profession of dentistry, in its distinctive character, at least, became extinct, throughout Europe ; having merged into that of the rude surgery of the dark centuries, when a red-hot iron was deemed the best cautery both for an aching tooth and an amputated limb. It thence descended into the hands of menials and slaves, to the entire loss, of course,

of its scientific and artistic resources ; and, although, with the revival of learning, we find several new treatises on the subject, compiled from the ancient authors, chiefly by French writers, as early as the sixteenth century, yet it was not until the first quarter of the eighteenth, when it was boldly revived by Fouchard, for the benefit of the court of Louis XV. that *Odontotechnie* was restored to its old foundation and respectability, as a special branch of the art of surgery.

Since then, its literature, medical, chemical, and mechanical, has amounted to thousands of volumes ; its colleges, professors and graduates, are already as reputable in this country as in any other ; the American Society of Dental Surgeons, is unsurpassed in professional knowledge and personal respectability ; and it is admitted, by the French themselves, that, in the design and manufacture of artificial teeth, we have become their triumphant rivals.

The greatest obstacle, perhaps, to the beneficent progress of dentistry, in this country, as in others, is the general ignorance, and consequent inappreciation, of the extent and value of its curative and reparative resources. But for this, it would be inconceivable that so large

a number of persons and families, in every community, should supinely submit to the personal disadvantages, discomfort, and actual danger to health and life, which accompany diseased and decayed teeth, when all these evils might be completely corrected, with promptness and facility, for a far less expenditure of time and money than the same persons freely bestow upon objects of comparatively frivolous importance.

Nothing is so commonly heard, in the office of the dentist, as expressions of regret that an earlier resort had not been had to his aid ; and it is one of the richest recompenses of his otherwise troublesome and disagreeable profession, that it is constantly alleviating suffering, arresting disease, and affording its patients an unexpected amount of satisfaction. No other department of medical practice is so invariably successful in these respects, nor at once so prompt and permanent in the benefit it confers.

One of the most important operations of dentistry is the filling of decayed teeth, so as to entirely arrest the caries which caused their cavities, and to preserve them in perfect use for many years, and frequently to the end of life. It is an operation which has improved in method, material and efficiency, beyond most

others, with the progress of time and individual experience. The author of these pages, in the course of his long established practice, has himself filled more than *thirty-five thousand* teeth ; and, of this vast number, a very large proportion would have been willingly sacrificed to the promptings of pain, in utter ignorance of the fact that they admitted of immediate cure and permanent preservation.

In the earlier periods of practice, this operation used to be performed by means of cements, or plastic compositions, of various substances, which hardened within the tooth. There are peculiar cases in which the use of cements continues to be indispensable, but with these exceptions they have been abandoned as inferior in durability, comfort, and preservative qualities to pure gold, which is now the universal substitute in all respectable practice. Tin foil, as second only in desirable properties to that indestructible precious metal, continues to be used, as a preparative for the former, in certain cases where the tooth is not ready for the permanent plugging ; and it is sometimes required, when more pecuniarily convenient, by sensible patients who are superior to the false pride which subjects thousands to destruc-

tive delays. It is generally unobjectionable in most of the teeth, except on the score of its inferior durability, which is liable to lead to an eventual recurrence of disease, in the process of unconscious corrosion.

A good tooth-filling cement, combining every desirable quality, is the greatest *desideratum* of the profession ; and has been for many years an object of elaborate inquiry and experiment, both among dentists and professed chemists. Required, as it is, to be insoluble in the natural and acquired fluids, acids, and alkalies of the mouth, and to be devoid of chemical action in itself ; to be so perfectly plastic when applied as to fill every inequality in the cavity, and yet to harden so rapidly as to allow the patient to use his teeth without displacing it ; to harden thus quickly without either contracting or expanding in the cavity, since the former would still leave the tooth subject to disease, and the latter subject it to suffering—are qualities that have not yet been contained in any substance whatever. The alloy of bismuth, lead, and tin, known as the *fusible metal*, because it melts at the temperature of boiling water, is still extensively used in France, and by some practitioners in this country. But it is highly objection-

able, not only on account of the destructive degree of heat at which it is necessarily applied, but of its corrodibility under the action of acids.

Of durable cements, devoid of metals, the most promising as yet discovered, is a recent improvement upon the celebrated one, known as Ostermeyer's, and almost identical in composition with the tooth itself. It *sets* more quickly than the gypsum plaster, and at as low a temperature ; it neither contracts nor expands in a mould, and speedily becomes as hard as the mineral *apatite*, or crystalized and insoluble phosphate of lime, which in fact it is. The author is in possession of its formula ; but as its components require to be mixed the instant it is applied, and still involve a question concerning its chemical effect upon the teeth, it will require to be tested a long time upon extracted ones, and in various corrosive fluids, before it can be confidently announced to the profession. In the meantime, there is nothing equal to refined gold.

The method of filling the teeth, however, is at least as important as the material. The best selection of the latter, is no better than the worst, when it is so applied as merely to *cover up disease*. And in this consists the great

danger both of amateur and charlatan practice. There are many cements, continually advertised, and obtainable of apothecaries, which will fill and remain in the teeth for some time ; and there have been, and probably are practitioners, of a certain class, who will use them with as much dexterity as they would cork a bottle. But it should be the highest concern of every patient, in need of this operation, to apply only to such dentists as are competent and responsible for the removal of every vestige of decayed matter that could extend its ravages beneath the filling. In order to do this completely, much skill and experience are frequently required on the part of the operator, and sometimes no little firmness on that of the patient. But when thus properly performed, the operation is adequate to the preservation of teeth even so far decayed, internally, as to retain but little more than their external form. In cases of less extreme neglect, the teeth may be fully preserved in their original strength, usefulness, and appearance, to the end of life. Nor is it uncommon for dentists, of proper education and established practice, to be visited by patients, whose teeth they had filled twenty or thirty years before, bringing the gratifying testimony

and ocular evidence that the operation had remained successful, during the whole of those long periods, and still needed no amendment.

Much needless and indeed childish apprehension prevails concerning the *pain* which is supposed to attend this and other operations upon the teeth, as if such sufferings were inevitable and irremediable. But whatever ground there may have been for such apprehensions, even a few years ago, it is now rendered comparatively insignificant by improved resources, both instrumental and medicinal, which the profession can now command. And, in saying this, I refer neither to the use of chloroform nor any other agent for producing insensibility to pain which modern science has discovered and the medical world has so generally adopted.

Chloroform and Letheon have, unquestionably, an inestimable value in the more desperate and dangerous operations of dental surgery, and in many other conditions of excessive suffering. They are, doubtless, a beneficent boon to humanity, and the objections to their judicious use may be purely imaginary ; but I refer to those improved methods of performing painful operations in dentistry, and those more efficient topical remedies for the immediate relief of

pain, which are now known to many, and which I have found so efficient in my own practice as, with rare exceptions, to supersede the use of all others.

In the once alarming operation of "killing the nerve" of the tooth, preparatorily to filling excavations in which the nerve is exposed, there now need be no pain whatever. In the most obstinate cases of tooth extraction, it is now but instantaneous, and therefore infinitely less than formerly. In the once formidable process of scaling the teeth, amid acutely sensitive and ulcerated gums, the sensibility of the latter is now reduced to that of mere touch, and even this is generally avoidable by their proper preparation. The processes by which irregular teeth are adjusted to their proper position, and by which deformities are both corrected and prevented, may now be accomplished by methods involving no pain and but little inconvenience.

Nor is there a dental disease, in the whole list described in the preceding pages, which may not either be cured or relieved, with greater certainty, and in a more satisfactory manner than the generality of their victims have ever been led to believe. Even those diseases of the mouth which are incident to those of the teeth,

not to mention others, described in the introductory chapter, which are considered, however erroneously, as more remotely dependent, come fairly within the resources of dentistry, and are more speedily and certainly relieved by them than by any others within the reach of the medical profession at large. What victims of an intolerable fetor of breath, which they have been led to consider constitutional and irremediable, have any idea that it admits of complete and permanent removal by the dentist? Yet, except in those comparatively few cases in which it arises from serious disease of the lungs, or from habitual constipation, it is within *his* province of cure, and that of no other practitioner.

But there is still another comprehensive resource of dentistry, pre eminently peculiar to it, which remains to be described.

CHAPTER XII.

ON ARTIFICIAL TEETH, AND THE SUPREMACY OF
MODERN DENTISTRY, IN THEIR IMITATIVE,
USEFUL, AND INDESTRUCTIBLE CHARACTER.

The first artificial teeth, adopted in France, on the revival of dentistry, were made of ivory, and imported from India. Among the natives of Hindostan, and all others, throughout India, of the Brahminical faith, the preservation and reparation of the teeth is a religious duty ; and the daily practice of cleaning them is rigorously prescribed, in their most ancient Scriptures and codes of laws, by an authority which they deem divine. They use tooth-powders and the fibres of the racemiferous fig-tree, and accompany the act with prayer. The natural and hereditary consequence of this scrupulous cleanliness is, that they have better and more beautiful teeth than any other people in the world. As a high and invincible trait of beauty, this perfection of

teeth is a favorite theme of their poets, one of whom says of those of his mistress,

“The Cunda blossom bows to the whiteness of thy teeth;
They sparkle with kindness and my soul reflects them.”

Such a people would naturally be anxious to supply the place of lost teeth with good artificial ones, and their ivory imitations are admirably executed, tinted, and polished, to resemble the natural specimens of those who procure them. It has been found, however, both in Europe and this country, that neither ivory nor any other animal tusk, including the soundest specimens of extracted human teeth, can resist the rapid decomposition which accrues to all organic substances, devoid of vitality, under the combined action of the heat, moisture, and atmosphere of the mouth. That decomposition, moreover, is scarcely less nauseous in itself and pernicious to contiguous parts, than decayed teeth, besides involving repulsiveness in color and frailty in use.

To obtain, therefore, artificial teeth, exempt from these objections, it became necessary to seek them from inorganic materials ; and chemistry has seldom been applied with greater acumen, labor, and perseverance, than in the pur-

suit of this object. Many large treatises were written upon this subject alone, besides smaller essays, replete with recipes and processes, as appendices to works on dentistry. Compositions of kaolin, silex, alumnia, and unoxydable metals; and again of metallic oxyds, felspar, fluorspar and the infusible earths, followed each other, in endless permutation and profusion, both for stock and enamel. At length, compounds were formed and moulded which, on the score of durability and practical convenience, were perfectly satisfactory, and this result was obtained in Europe and America almost simultaneously.

The chief defect in these teeth has been, until within a very short period, an unnatural degree of beauty and symmetry in their appearance and form, thus rendering them conspicuously artificial, whether employed in complete sets, or inserted among others to fill vacancies. And this objection still lies against most of the porcelain teeth imported from Europe, as well as against many manufactured in this country.

It is now universally conceded, however, that in this country, at least, the objection has been overcome, and that, in this respect, as in all others, *the best artificial teeth in the world, are*

now made in the United States. Among these, it is but just to claim, what public, conventional, and professional opinion have cordially awarded, that the "PREMIUM INCORRUPTIBLE TEETH," made by the author of this work—who participated both in the labor of the researches and the expense of the experiments which have led to so triumphant a result—are unsurpassed in reputation and intrinsic quality by those of any other dentist at home or abroad.

It has been his aim, as it is now his success, to cause the teeth of his manufacture to embrace a wide range of appearance and construction, from the most pearly and symmetrical that ever glistened between the lips of youthful beauty, to those of the more subdued hue of nature, and advanced age; including, in the gradation between these opposite extremes, every intermediate variety, so as to be perfectly adapted and satisfactory to every individual adopting them. In natural tints alone, independently of imitative forms, these embrace at least twenty-five varieties. Their artificiality is thus completely concealed, in every instance in which a judicious taste permits them to be appropriately selected.

An injudiciousness of selection on the part of

the purchaser, is the chief difficulty with which a dentist has to contend in this department of his practice ; and it is also the greatest obstacle to the universal popularity of this valuable invention. Some persons will insist upon having as beautiful a set of teeth as art can produce, whether suited to their age or not, and still expect them to appear so natural that all mankind shall be blind to the incongruity. A more judicious choice would secure a much better set than nature generally bestows upon her most favored children, with a perfection of naturalness, at the same time, which might bid defiance to the most envious suspicion and the closest scrutiny.

An improvement has been effected in the material upon which artificial teeth are mounted and fitted to the mouth, to be retained by the beautiful and efficient principle of atmospheric pressure, not at all inferior to that which has been accomplished in the material of the teeth themselves. Until a few years past, this mould of the gum and basis of the artificial teeth, was carved from bone or ivory, like the teeth themselves, and continued to be used with the improved porcelain ones. Not only were these organic materials subject to the same

objections and disadvantages which applied to the same kind of teeth, but to the additional and fatal one of incomplete and, therefore, insecure adhesion. It was impossible to carve those substances to so absolutely perfect a conformity with the jaws, and the peculiar irregularities of the gums, as the principle of atmospheric pressure requires. In consequence of this insuperable defect, the upper set, especially, would frequently fall out of the mouth by their own weight ; and many a lady and gentleman have beheld, with indescribable consternation, their truant teeth in their dinner plates, among impracticable viands which they were procured to masticate in a more eligible position.

Every liability to such a catastrophe is now obviated, and the author humbly takes to himself some little credit for the illustrious achievement. He conceives himself to be the first dentist, in the United States, that mounted the incorruptible teeth upon the equally incorruptible gold plates, which so infallibly keep them out of those of the dining table. By taking a mould of the jaws and gums, in a plastic substance adapted to the purpose, and thus obtaining a fac-simile model of them in another, the gold plate is made to fit them so perfectly as to

exclude all disengaging air, and thus render the atmospheric pressure as secure as the gums themselves, until voluntarily removed.

By the same method and material, parts of sets, and even single teeth may now be inserted, upon the same substantial principle ; and the previous necessity of inserting them on the old stumps by pivots, is obviated, with all its painful and otherwise unsatisfactory consequences. Thus may artificial teeth, whether many or few, be made to subserve all the useful purposes of real ones ; and although they may be less convenient for crushing steel and adamant, or drawing iron nails and bolts from oak door-posts, there is some compensation in the reflection that they would incur less injury even in such heroic experiments.

Nevertheless, to set these teeth properly, so as to restore or preserve the shape of the face, the natural articulation of the voice, and the full power of alimentary mastication, demands a combination of mechanical and artistic skill rarely found in inexperienced hands, and not always in others. When such advantages, however, are satisfactorily obtained, they may be accounted among the most inestimable retrieve-

ments of personal deprivation of which either art or nature can furnish an example.

In a previous publication upon this subject, the writer has remarked that, "the loss of no portion of the human frame can be so well and effectually supplied as that of the teeth. Artificial legs and arms, are undoubtedly great conveniences, and go far to compensate deplorable deficiencies in personal appearance; while artificial eyes are now made with such admirable imitative skill as frequently to mislead the intensest scrutiny. None of these ingenious contrivances, however, can perform the functions of the natural organs, and but barely retrieve unsightly deprivations. Artificial teeth, therefore, possess an emphatic superiority in both of these essential objects; for while, when properly made and adapted, they cannot possibly be distinguished from good natural ones in appearance, they perfectly well perform all the offices of sound natural teeth, in mastication, speech, and fullness of the mouth and cheeks, without the liability of disease or decay."

The only abatements to these commendations that we have heard suggested, are indicative of their having originated with individuals who have either never fairly tried artificial teeth,

or have been unfortunate in procuring those of imperfect adaptation. The objections are that they involve a disagreeable sensation of artificiality and a serious expense. But this formidable double-headed chimera, is susceptible of a quietus from the single fact that both the disagreeable sensation and the serious expense are temporary, while the advantage is permanent. Both indeed are greatly exaggerated ; the sensation of artificiality is much less and less continuous than that of a pair of spectacles, and habit soon causes it to become extinct ; while the serious expense is much less, both to peace and purse, than diseased teeth, and is now wisely reduced, by most dentists of extensive practice, to the lowest remunerable scale, for the costly materials supplied. It is, in fact, a very minute capital, invested for life, at enormous compound interest, paid in the golden coin of health and comfort.