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NOTES OF LECTURE I.

"TOOTHACHE."

INTRODUCTION.

IN studying the causes of toothache, it is necessary to bear in mind the various structures of which a tooth is constituted, and the surrounding tissues with which it is in intimate relation.

For this purpose a tooth may be regarded as a hard unyielding box, enclosing a highly sensitive and vascular pulp or "nerve" as it is popularly termed. The portion of tooth which is implanted in the jaw, is more or less conical in shape, and closely surrounded by its bony socket, which is, therefore, a hollow cone.

Between the root and socket is a fibrous membrane called the periosteum, in which a capillary network of vessels ramifies for the nourishment of the socket and external surface of the root, and through this membrane pass the blood-vessels that enter the pulp.

Irritation applied to any vascular tissue produces

hyperæmia—congestion—which may be but transitory, or pass into a condition known as inflammation, if the irritant be not speedily removed.

It is important to distinguish *two different sources of the pain* of toothache, according as the pulp or the periosteum is the part primarily affected; for on the correctness of diagnosis will depend the chance of successful treatment.

In Inflammation of the Pulp so much extra blood is driven to the nerve that swelling is produced, causing a shooting, darting, or throbbing pain, from the resistance offered by its unyielding case of dentine. Heat, or a lowered position of the head, intensifies the throbbing, since either will increase still further the congestion. On the other hand, cold often relieves the pain. As the periosteum is not involved, no pain is felt on the tooth being pressed, or bitten, into its socket.

Inflammation of the Periosteum.—This membrane, on being inflamed, becomes thickened from swelling, and therefore raises the tooth in its socket; hence it appears lengthened, and is bitten on before its neighbours when the jaws are closed, pain being produced from the periosteum being squeezed between the two hard surfaces of the root and its socket. The pain is of a dull, heavy,—not throbbing—character, not worse at night, and often relieved by heat. The tooth is tender to the slightest touch, and the gum surrounding it is swollen, red, and feels velvety to the finger.

Toothache may arise from an unhealthy condition of any of the dental tissues, thus we may have :—

(a) Of the pulp—

(1)—Irritation.

(2)—(a) Acute inflammation.

(b) Chronic inflammation.

(b) Of the periosteum—

(1)—(a) Acute inflammation.

(b) Chronic inflammation.

(2)—(a) Alveolar abscess.

(b) Diffuse cellulitis.

(c) Of the cementum—

(1)—Irritation.

(2)—Exostosis.

Irritation of the Dental Pulp.—The irritation may be either protective or destructive, according to its nature and intensity, resulting in increased calcification in one case, or inflammation in the other. The susceptibility of the pulp to irritation varies greatly in different individuals, but usually decreases as age advances. It may arise from caries, the pressure of a filling on a floor of softened dentine, thermal changes conducted by a metallic filling, exposure of dentine from attrition or erosion, fracture, &c.

Protective.—If the irritation be long continued but slight in intensity, a protective formation of secondary dentine may occur.

Secondary dentine may be found as :—

(a) *Nodules or pulp stones* ; these little bodies are, however, often present in pulps where no history of

antecedent irritation can be obtained, and may frequently be found in the teeth of quite young people. They are, therefore, not necessarily indicative of previous irritation.

(b) *A patch of dentine* on the wall of the pulp cavity, a calcified prolongation of those dentinal fibrils which have been especially subject to irritation, and which have raised this barrier, or shield, to protect the pulp from further irritation.

(c) *Intrinsic calcification of the pulp*.—The root canal being almost obliterated from the greater part of the pulp being converted into secondary dentine.

Destructive.—The pain is usually of a shooting or darting character, and occurring at irregular intervals; sometimes brought on by heat or cold—especially the latter—or by sweet, salt, or acid substances.

The above-mentioned causes may suggest the appropriate treatment, but the irritation is usually best treated by the use of *sedatives*, such as oil of cloves, strong solutions of cocaine, and in children a little carbonate of soda placed in a cavity in the tooth will often afford relief; or *escharotics*, of which strong carbolic acid, chloride of zinc, potassa cum calcæ, and nitrate of silver may be employed in adults. Nitrate of silver, which is the most efficacious, blackens the dentine with which it comes in contact, and must therefore be avoided near the front of the mouth.

If the attacks of pain are frequently repeated they ultimately result in most cases, in acute inflammation and death of the pulp.

Acute Inflammation of the Pulp is generally the result of its proximate or absolute exposure by the advance of caries; it may, however, be traumatic in its origin, the result of a blow fracturing the crown of a tooth, &c.

Symptoms. — Pain of a throbbing character, brought on by food pressing against the exposed surface, or by the application of heat or cold, especially the former. The pain is worse at night when the patient lies down and becomes warm in bed. Increased congestion being thus produced, the pulp is squeezed against the hard unyielding walls of the pulp cavity. The pain may, or may not, be referred by the patient to the tooth really affected; a lower tooth even being indicated as the one in fault when the real source of pain is an upper one, and *vice versâ*; or pain may be felt in both jaws on the affected side at the same time. But the pain *never crosses the middle line*. Pain referred to the ear is generally connected with a lower tooth.

Pressing the tooth into its socket causes no pain, and the gum is neither swollen nor tender.

Should the tooth be extracted and broken open, a large portion or the whole pulp will appear congested, and of a deep red colour, instead of pale pink as it would be in its normal condition.

Course.—If the disease be allowed to run its course untreated, the pulp usually becomes strangulated, and death results. This may not, however, take place until a second, or succeeding attack.

Treatment.—If pain of a severe throbbing charac-

ter has once occurred, destruction of the pulp should generally be decided on. This is effected by the application of arsenious acid, or a substance called "nerve devitalizing fibre," after the pulp has been exposed as fully as possible, the escharotic being carefully sealed in by means of temporary gutta-percha, osteo, or wool and mastich, &c. Great care must be exercised that the pulp is not pressed on by the dressing; arsenic increases the already existing inflammation, and therefore produces greater congestion, and if the dressing presses on the pulp the pain will be needlessly intensified.

The usual quantity of arsenious acid employed is $\frac{1}{16}$ to $\frac{1}{8}$ grain, and it will frequently destroy the pulp in from twenty-four to forty-eight hours. One of the actions of arsenic is to liquefy the surface with which it is in contact, therefore, unless the arsenic is absolutely sealed up in the tooth, some of it will escape on to the gum, and cause sloughing, and necrosis of the alveolus.

Some few persons are acutely sensitive to the action of arsenic, the smallest quantity in them acting as a systemic poison, producing a burning sensation in the throat, diarrhoea, cutaneous eruption, &c. In such cases the drug should always be avoided.

In consequence of the relatively large size of the pulp in temporary teeth, and the probable shortening of the roots by absorption, the use of arsenic in milk teeth is peculiarly unsafe, since absorption of the drug so readily occurs.

Where the symptoms of inflammation have been

less severe, it may be advisable—in young and healthy subjects—to endeavour to soothe the pain with oil of cloves or weak carbolic acid, and then to attempt the operation of “capping”; it is seldom, however, in my opinion, that this operation is permanently successful.

Chronic Inflammation of the Pulp may arise independently of caries, as from intrinsic calcification, attrition, &c.; usually, however, the pulp is exposed by caries.

The **Symptoms** are, pain of a less intense character than in the acute variety, and coming on at irregular intervals, sometimes of a wandering, neuralgic character, which the patient may not attribute to a tooth at all. A paroxysm is often brought on by the sudden application of heat or cold, or sweet or salt substances, or by the exhaustion of the air from a cavity when the tooth is sucked, the pain lasting from a few minutes to several hours. No discomfort is experienced on closing the teeth on one another, and the gum is not swollen or tender.

Pain may, however, be absent altogether, the pulp gradually dying without the patient experiencing any disagreeable sensation whatever.

If the carious cavity be carefully dried and then wiped with a piece of wool, a characteristic *phosphatic odour* will be observed if the pulp is exposed.

The exposed portion of the pulp secretes a serous or purulent fluid, and if this is allowed to drain away, it may continue for an indefinite time without causing trouble; if sealed up, however, the secretion is unable

to escape, and an alveolar abscess results from conveyance of the septic material by the pulp to the surrounding periosteum, *viâ* the apical foramen.

If a tooth in which the pulp is chronically inflamed be extracted and broken open, the chief part of the pulp will usually appear of a normal healthy colour, a limited portion only, near the seat of the exposure, being deeply congested and of a dark red colour.

Polypus of the Pulp.—Sprouting granulation of the exposed surface of a chronically inflamed pulp may take place, the granulations growing till the carious cavity is completely filled by them, constituting what is known as *polypus of the pulp*.

Treatment.—Destruction of the pulp by means of arsenious acid.

A pulp having been destroyed, must be removed by means of suitable nerve extractors, the canals being enlarged for that purpose if necessary.

In using a drill with this object, great care must be taken that the natural canal is not quitted or a false passage may be formed, when there is great danger of an alveolar abscess being produced, from the irritation of foreign bodies such as instruments, pieces of stopping, &c., being forced through the artificial opening.

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NOTES OF LECTURE II.

“PERIOSTITIS, EXOSTOSIS, AND FALSE GEMMATION.”

PERIOSTITIS.

INFLAMMATION of the fibrous and vascular membrane, which lines the socket of a tooth, and covers and nourishes the cementum, is called periostitis.

It may be general, involving the periosteum of a large portion of the maxilla and several teeth; or local, being confined to the socket of one tooth only.

Like inflammation in other parts, it may be either acute or chronic.

General Inflammation of the Periosteum is dependent on some constitutional condition, such as rheumatism, struma, salivation by mercury, syphilis, the inhalation of the fumes of phosphorus, &c.

Local Periostitis may be acute, frequently running on to alveolar abscess, or chronic, in which suppura-

tion either does not occur at all, or is restricted to the portion of periosteum near the margin of the socket.

Acute Local Periostitis may be the result of:—

(a) Inflammation spreading from a living inflamed pulp, through the apical foramen to the periosteum immediately surrounding it.

(b) The direct absorption by the periosteum, of septic material from a putrefying pulp.

(c) Sealing a root canal which contains a portion of putrefying pulp, from which the liquid or gaseous products of decomposition are thereby unable to escape, except through the apical foramen.

(d) Forcing septic substances through the apical foramen, in attempting to clear out or enlarge a root canal.

(e) Injury, either *direct*, where a blow has been received by a tooth and the periosteum damaged; or *indirect*, the blow having caused death of the pulp, its subsequent decomposition producing periostitis.

(f) The passage of foreign bodies, such as drills, nerve extractors, pieces of india-rubber, splinters of wood, &c., through the apex of the fang.

(g) India-rubber bands slipping under the gum and so stripping the periosteum from the root.

(h) The absorption of arsenic, either through the apical foramen, or an abnormal canal in the root, or by the edge of the gum, in consequence of the dressing being insecurely sealed.

(i) Gout.

Symptoms.—In periostitis the affected teeth feel tender, and yet there is an uncontrollable desire to

grind them together, as this at first affords a momentary relief; soon, however, this becomes unbearable, the periosteum being so swollen that the teeth are raised in their sockets, loose and exquisitely sensitive to pressure.

The gums participate in the inflammation (since the periosteum is reflected outwards at the margin of the alveolus), and become swollen and deeply congested, conveying a velvety feeling to the finger when passed lightly over the surface, the outline of the roots of the teeth involved becoming more or less obliterated.

Sudden changes of temperature will often bring on—or increase an already existing attack of—periostitis.

Should the disease be *rheumatic* in its origin it is usually worse in cold damp weather, and during the prevalence of easterly wind. Suppuration is rare in such cases, but when present it is usually confined to the necks of the teeth, and does not arise at the apex of the tooth as in alveolar abscess. In periostitis in *strumous* subjects, on the other hand, profuse suppuration very readily occurs.

When the affection is due to *salivation by mercury* there is extreme congestion of the periosteum and gums, which become spongy and readily bleed, the breath being very foul. If the drug is still continued, sloughing of the gum and necrosis of the jaw will probably take place. As with arsenic, so with mercury. There are some people to whom the drug acts as a poison in the smallest doses, and in these cases the symptoms of ptyalism are produced on the slightest provocation.

General Treatment.—In general periostitis an attempt must be made to improve the constitutional condition, and any special cause of the disease be treated accordingly. Thus in *rheumatic periostitis*, the salicylate of soda, gr. x.—gr. xxx., three times a day, will often prove of value ; while in *salivation from mercury*, the drug should be discontinued, and a mouth wash of some disinfectant—such as permanganate of potash—be frequently employed to overcome the intense foetor of the breath, while opium and chlorate of potash given internally are often of great assistance.

In periostitis having a *strumous origin*, the general health of the patient must be improved as far as possible, fresh air being most necessary, while cod-liver oil and the syrup of the phosphate of iron, ʒ—ʒij., twice a day, are of the greatest value.

In *syphilitic periostitis* treatment must be directed to eradication of the original disease from the system, iodide of potassium, gr. iii.—gr. v. three times a day, tonics and a generous diet being indicated.

If the bowels are confined, a brisk purgative, *e.g.*, mag. sulph. ʒj.—ʒss., or pulv. jalapæ co. gr. 60, administered at the commencement of the attack, will often prove of great advantage.

Local Treatment may consist in counter irritation, painting the gum with equal parts of liniment of iodine and Flemming's tincture of aconite ; or the application of a capsicum plaster to the gum.

Local blood-letting, by means of a leech applied as near the apex of the root as possible, or scarification

of the gum in the region of the inflammation, sometimes proves of service.

An attempt may be made to reduce the inflammation by means of hot water or hot poppy fomentations held *inside* the mouth; or a pad of blotting paper soaked in a 10 per cent. solution of hydrochlorate of cocaine, and held against the inflamed gum, will, after the interval of five or six minutes, paralyse sensation in the tender periosteum, and cause contraction of its dilated capillaries.

The strong solutions of cocaine quickly decompose; it is, therefore, a useful precaution to add some antiseptic, such as a little saccharine, when it is intended to keep such solutions for any length of time; saccharine also possesses the advantage that its sweet taste overcomes the unpleasant flavour of cocaine. A useful formula consists of:—

Cocaine Hydrochlor.	...	...	gr. 24
Sol. Saccharin. (5%)	...	...	℥ 100
Aq. dest. ad.	...	...	ʒiv.

A poultice should *never* be applied *outside* the face.

Chronic Local Periostitis will often be met with in those cases in which the membrane is subjected to slight but long-continued irritation; as from the small hard nodules of tartar frequently met with in the—so-called—Rigg's disease; the undue occlusion of front teeth when the molars have been lost; the constant habit of biting off the ends of cotton sometimes produces this condition in needlewomen; or the band of an artificial plate, if carried too near the margin of the gum, may also occasion it.

Chronic periostitis, in very many cases, has its origin in an inflamed or dead pulp, the inflammation spreading from the apex of the root to the contiguous membrane. There are cases, however, in which the converse train of symptoms may be met with. In these, the periosteum becomes inflamed at the neck of the tooth and eventually is destroyed; this process gradually extending up the socket, at last reaches the apex, and by cutting off the blood supply to the pulp, destroys it.

Chronic periostitis, as a rule, affects the entire circumference of the root; in certain cases, however, the disease occurs on one aspect only; thus it is not uncommon to find the gum has receded for a considerable distance, from the anterior surface only of one or two lower incisors, to be puffy at the edge, and for the subjacent bone to have disappeared, a mass of tartar occupying the situation which was originally covered by the gum.

The Symptoms are similar to those already described, though more limited in extent and less intense in character. The gum appears red and thickened at its margin round the affected tooth, shrunk from its attachment, and the alveolus beneath absorbed, so that the tooth will gradually loosen and fall out.

In persons who have reached or passed middle life, there is a great tendency for one tooth after another to become victims to this condition.

Treatment.—All sources of irritation must be carefully removed, and the case treated in a similar

manner to that previously described, astringents, such as tannin or sulphate of copper, being sometimes of use as a subsequent application. If there is undue antagonism with an opposing tooth, this should be rectified with the burring engine, or by other means. Teeth which are very loose, and around which the alveolus is obviously much absorbed, should be extracted; and it will frequently be found that the roots are exostosed; in other cases, however, the end of the root may be extensively absorbed. Where the periostitis is due to syphilis, there is so poor a chance of the teeth again becoming firm, that they should generally be removed.

After the extraction, especially in cases of exostosis, the socket will often be intensely painful, and for several days present a sloughy appearance; when this is the case, relief may almost immediately be obtained by touching the whole of the exposed alveolus, periosteum and lacerated gum, with solid nitrate of silver. In other instances repeated applications of cocaine prove very valuable.

EXOSTOSIS.

THE root of a tooth is, at times, the seat of a local hypertrophy named *exostosis*. In this condition the dentine takes no active share, the cementum and periosteum alone being involved. Usually the lower

end of the fang is the part affected, though any portion of a root may become exostosed.

If a longitudinal section is made through the root of an exostosed tooth, the cementum will be seen to increase in thickness as the hypertrophied tissue is reached ; usually this is gradual, though sometimes the increase is quite sudden. The lacunæ become very numerous, the canaliculi from the various lacunæ freely communicating with one another, and here and there with the terminations of the dentinal fibrils. Now and then, a vascular canal may be seen in the thickened tissue, but, unlike the vascular canals in bone, the lacunæ are not arranged concentrically around the vessels to form "Haversian systems." The lacunæ are more irregularly scattered through the cementum than they are in bone, though they are arranged concentrically round the root, producing a laminated appearance. Although in some respects resembling bone of the skeleton, the cementum is much denser, and more compact, no matter how thick it may be.

In teeth with more than one root, the cementum is often very thick in the angle formed by the division of the fangs, and this is especially noticeable in molars. In this thickened mass of cementum, one or more vascular canals are frequently met with, unaccompanied by any sign of exostosis ; the presence of such vascular canals, in thickened cementum near the end of the roots, is therefore, in itself, no evidence of exostosis.

Occasionally canals are seen to traverse one side of

the root in a more or less transverse direction, from the pulp cavity through the dentine to the cementum, and to communicate with one or more lacunæ, and so indirectly with the periosteum. A case is figured and described by Mr. Salter, in which a canal traversing the dentine from the pulp cavity to the periosteum is occupied by true bone.

With the increased deposit of cementum at certain parts, we commonly find absorption going on in other portions, and are usually able to trace the alternations; the margin of the absorbed area being festooned, as though it had been gnawed, this absorbed portion in turn being filled up again by new cementum. The cells concerned in the absorption are large and polynucleated, and named *osteoclasts*, while the cells causing the deposit, which are similar in appearance, are named *osteoblasts*. Whether these cells are identical, or whether different cells are concerned in absorption and deposition, is a point on which opinions vary, though probably the same cells are concerned in the double function.

While these changes are taking place in the cementum, the periosteum becomes thickened, very tough and vascular, and frequently the pulp cavity of the tooth is filled up by secondary dentine.

Sometimes the absorption goes on to such an extent, that the whole thickness of cementum is removed at one spot, and the subjacent dentine eaten into, the absorbed dentine being subsequently replaced by cementum. This has been described under the name of *Inostosis*.

Symptoms.—These are usually of a vague and intermittent character, the tooth affected being subject to attacks of sub-acute periostitis; the patient usually describing them as “neuralgic.” The pain increasing in severity, and the intervals shortening, the tooth is at last extracted, and after an interval—for the extraction itself often occasions a severe paroxysm, the severity of which usually depends on the previous length of the disease—the patient obtains relief. It is, however, very usual for teeth in succession to be attacked, and it is only after all the teeth have been removed, that the patient obtains permanent relief.

Treatment.—This is eminently unsatisfactory. Iodide of potassium, gr. v., three times a day, is occasionally of assistance; and strong solutions of cocaine, 10 to 20 per cent., applied to the gum may temporarily afford relief; but as the case progresses, a time at last arrives when the pain is so continuous, and so severe, that extraction becomes inevitable.

FALSE GEMMATION.

OCCASIONALLY the cementum of two adjoining teeth increases so greatly, that the alveolus between them entirely disappears, being removed to make way for the new deposit, their roots then become firmly united by cementum to form one mass, constituting what is known as “false gemmation.”

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NOTES OF LECTURE III.

"ALVEOLAR ABSCESS."

INTRODUCTION

MICRO-ORGANISMS—or germs—are of two classes, one being harmless and the other pathogenic or disease producing.

If a vascular tissue, such as the periosteum, be sufficiently irritated, a passage of leucocytes through the walls of the capillaries takes place, by a process known as *diapedesis*. If the irritation is not continued too long, or is not too violent in character, the transuded leucocytes may be carried off by the lymphatics and the inflammation end by *resolution*.

But if at the time of the irritation, the vitality of the tissue is lowered, it becomes the prey of an attack of pathogenic micro-organisms, and a contest takes place between the transuded white blood cells and the organisms, the leucocytes attempting to devour—and so destroy—the germs, and are then

known as *phagocytes*. In this contest some of the leucocytes perish, and are called pus cells, a pus cell being merely a dead leucocyte.

The micro-organisms, on the other hand, attempt to defend themselves, and either they or the poisons they secrete—known as *ptomaines*—produce a peptonising or digesting action on the leucocytes and neighbouring tissue, causing a softening and liquefaction, the resulting fluid being called *pus*, or *matter*. This process is known as SUPPURATION, and if the area of liquefaction be circumscribed and away from the surface, it is called an abscess; while if it be superficial it is named an ulcer. In the meantime the capillaries surrounding the spot where the battle is taking place, become distended and pour forth fresh leucocytes to replace those which have perished in the fray; this inflamed outer area which has not yet broken down forming what is spoken of as the “abscess wall” or “sac.”

An abscess arising from a tooth is known as an *alveolar abscess*, or *gum boil*, and in the majority of cases is situated at the end of the fang, being the result of :—

(a) Septic infection of the periosteum at the end of the root, from :

- (1) Direct absorption of septic material from a decomposing pulp.
- (2) The passage of decomposing fluid, or gas, through the apical foramen, in consequence of sealing up a septic root canal.
- (3) Forcing septic substances through the foramen at the apex, in attempts to clear out or enlarge a pulp canal.

- (b) The passages of foreign bodies, such as nerve bristles, drills, splinters of wood, &c., through the apex, and their retention in this situation.

The abscess may, however, be situated at some other part than the apex, in consequence of local inflammation of the periosteum ; instances of this nature are comparatively rare, though they do occur now and then. Such an abscess may arise in consequence of the formation of a false passage through the side of a root, or in the fork between the fangs, in an ill-directed attempt to open up a pulp canal.

Symptoms.—In *acute alveolar abscess* the symptoms are similar to those of acute periostitis, though much intensified. Thus the tooth will be raised in its socket, loose, and exquisitely sensitive to pressure ; the gum around it swollen, deeply congested, and soft, or even “ boggy ” to the touch if pus has infiltrated the surrounding tissue, while the shape of the socket can no longer be distinguished. The sulcus between the cheek and the gum, instead of being concave, is pushed up so as to become convex. In other cases the swelling is less diffused, and the gum over the apex becomes globular in shape. Sometimes diffuse cellulitis of the face occurs, the whole cheek being swollen, tense, shining, and very painful, and the eye closed if an upper tooth is the source of trouble.

Pus always tends to spread and escape—or “ point ” as it is called—in the direction of least resistance ; this may be towards the cavity of the mouth, or the surface of the face. The cancellated bone becomes rapidly absorbed, though the dense outer plate is penetrated less easily.

The pus from an upper tooth may burrow into the antrum, or be directed backwards to the palate, either between the periosteum and the bone—when great pain will be occasioned, and necrosis probably occur—or between the periosteum and the mucous membrane. In the latter case large quantities of pus are often formed with but very little pain, since the tissue is sufficiently lax to be easily distended. *Abscesses in the palate* nearly always arise from lateral incisors.

When an abscess is situated at the root of a lower molar, particularly a lower wisdom, the jaws may be firmly closed, constituting what is known as *trismus*, Trismus may arise from two causes: tonic *spasm of the masseter*—in which case the jaws may be readily forced open when the patient is under the influence of an anæsthetic—or *inflammatory infiltration of the masseter*—when the closure will be equally obstinate, whether an anæsthetic be administered or not.

An abscess from a lower wisdom sometimes points beneath the angle of the jaw, and an abscess connected with any lower tooth may burst either through the cheek or beneath the margin of the mandible.

When an alveolar abscess continues for a lengthened period the bone in its immediate neighbourhood may become so much absorbed as to, in some cases, form a large osseous cavity. In other instances the periosteum is destroyed over a large area, and produces necrosis. In the lower animals these complications are very liable to occur, from the nature of their surroundings rendering relief impossible. Septic pneumonia, caused by the discharge trickling into the

air passages during sleep, is frequently the means of terminating fatally such cases.

Pus occasionally travels along the sheaths of the vessels or nerves to remote regions, giving rise to septicæmia. As a rule, however, the constitutional disturbance, even in a severe case of alveolar abscess, is surprisingly slight.

The submaxillary lymphatic glands sometimes become infected, when they will be enlarged, tender, and the skin over them red and adherent; but where these glands are enlarged from purely constitutional causes, as is frequently the case in strumous subjects, there will be no tenderness about the teeth, swelling of the gum, or other obvious connection with the glandular enlargement.

The submaxillary lymphatic glands in children are sometimes infected with tubercle, said to have been conveyed to the glands by carious teeth with exposed pulps. In any case of suspicious enlargement of these glands in children, therefore, the teeth should be most carefully examined, with the view to treatment if this be found necessary.

Alveolar abscesses in connection with the temporary teeth are more common with the second molars than with any others.

Whether pus burrows to the surface of the face, or bursts in the mouth, will in many instances, be determined by the relative length of the roots and the depth of the sulcus between the cheek and gum; thus, if the roots are long and the sulcus shallow, the pus is very liable to point on the surface of the face; and

conversely, if the roots are short and the sulcus deep, the chance of pus finding its way to the cavity of the mouth is very much more probable.

Pus, especially when arising from a chronic abscess, may separate the periosteum from one side of the fang, and welling up beside the root, escape at the margin of the gum.

Course.—In the majority of cases the pus finds an exit for itself; the symptoms may then entirely pass away, or a discharge continue through a narrow channel called a fistula, and the case degenerates into a chronic abscess. The opening of this fistula is, in some instances, situated at a considerable distance from the affected tooth, though usually it will be in the neighbourhood of its apex. Sometimes the gum at the mouth of the fistula becomes distended into a little papilla, through which the discharge may be seen to escape.

Occasionally the inflammatory symptoms disappear, the abscess ceases to secrete, its walls become greatly thickened, tough, and fibrous, being converted into what is known as a pus cyst. Eventually it may quite solidify from calcification of its contents. Sometimes the abscess becomes converted into a serous cyst, the alveolus considerably thinned and distended around a cavity which is lined by serous membrane, the cyst being filled with a limpid fluid, crowded with the yellow scales of cholesterin. This is spoken of as a *dental cyst*, and must not be confused with a dento-gerous cyst.

Treatment.—This must be directed to *removing*

the cause of suppuration and giving exit to the pus. Where a pulp has died without exposure but beneath a layer of carious dentine, relief will often be at once obtained by opening into the pulp cavity, and so allowing the pus or gas to escape. If death of the pulp has taken place beneath a filling, as it often does some few months after the operation of "capping" has been performed, the removal of the filling and enlargement of the opening into the root canal, will afford the necessary relief. The removal of the filling may be rendered less painful if a 10 per cent. solution of cocaine is applied to the gum during the operation, and for three or four minutes previously.

At the first, or a subsequent visit, the root canal must be thoroughly cleared of all traces of the pulp, and enlarged for this purpose if necessary; an antiseptic dressing of carbolic acid, perchloride of mercury, or iodoform and eucalyptus oil, &c., being introduced into the root canal and the cavity lightly sealed. It is a usual practice to pump peroxide of hydrogen or peroxide of sodium through the canal up to the abscess, before introducing the dressing. Some practitioners place great faith in what is spoken of as "immediate root filling," after syringing with peroxide of hydrogen until bubbles of gas cease to escape.

Where a fistula exists in the gum, the antiseptic should be pumped through the root and out at the mouth of this fistula.

When the root canal is extremely narrow or tortuous, it is often very difficult to remove all traces of the pulp, or cause ordinary dressings to reach the

abscess; in such cases iodoform and eucalyptus are of extreme value, since their volatile nature enables them to reach positions inaccessible to drugs which do not readily evaporate.

As an alternative treatment, which is, however, intended only as a palliative and not a cure, the operation of *rhizodontrophy* may be resorted to. This consists in drilling a small hole through the root, just at the neck of the tooth, through which any discharge of pus or gas may continue to escape; and if the pulp cavity be filled with crystals of thymol—which are strongly antiseptic and dissolve very slowly—before the tooth is finally stopped, comfort for a long time is often assured, and the tooth kept tolerably sweet.

The pulp occasionally suppurates in a tooth which is free from decay, and the operation of rhizodontrophy offers a ready exit for the pus, which—in such cases—is often of extreme value.

When it is not feasible to reach the pulp chamber, and the tissues are much distended, the abscess should be opened *in the mouth* by a knife; and when cellulitis is present a deep incision will often give immediate relief, even if pus does not escape at once, as this may follow some few hours afterwards, especially if hot fomentations are employed meanwhile.

Where, from burrowing of pus, it is feared that the abscess will burst on the surface of the face, it is often advisable, in addition to making an incision in the mouth, to support the skin by means of a pad of teased-out cotton wool soaked in flexible collodion. In the case of lower molars, however, gravitation of

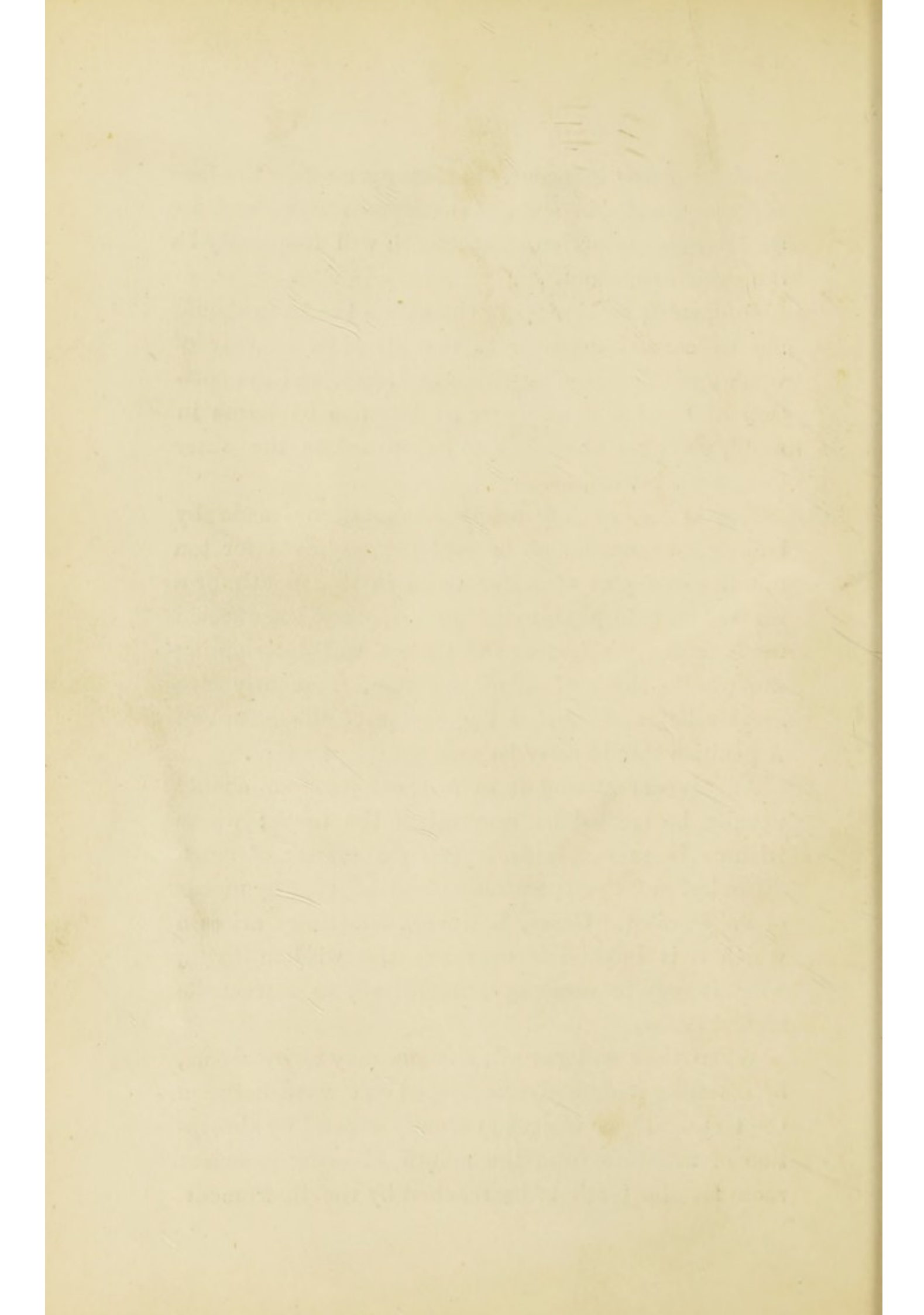
pus is so liable to occur, that an opening on the face will often result, in spite of these precautions, and for this reason extraction of the tooth will frequently be the safest treatment.

In opening an abscess in the palate the knife should not be carried too near to the alveolus, for fear of wounding the posterior palatine artery, and the position of the facial artery must likewise be borne in mind, when an abscess is to be opened on the outer side of the lower jaw.

Hot water, or hot poppy fomentation—made by boiling two ounces of bruised poppy heads for ten minutes in a pint of water—held in the mouth, or a roasted fig held against the gum opposite the affected tooth, will, by softening the tissues and determining the pus to the surface of the gum, frequently give great relief and shorten the course of the affection. A poultice should *never* be used *outside* the face.

An abscess arising from a lower wisdom should usually be treated by removal of the tooth; where trismus is present this is often a matter of much difficulty, and the operation is best affected by means of an elevator. Cases, however, sometimes arise in which it is impossible to reach the wisdom tooth, when it may be necessary, first of all, to extract the second molar.

When time will permit, trismus may be overcome, by inserting wedges of compressed soft wood between the teeth. These wedges gradually expand by absorption of moisture from the mouth, allowing sufficient room for the tooth to be reached by the instrument.



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NOTES OF LECTURE IV.

"DENTAL CARIES."

INTRODUCTION.

THE process of tooth destruction known as "Dental Caries," though involving certain complex phenomena, resolves itself essentially into *an acid fermentation*, whereby the lime salts of a tooth are first dissolved, and the animal portion subsequently broken up by means of micro-organisms.

It is not in reality a disease (though the expression is convenient, and therefore employed in these lectures), for every appearance, and stage of natural caries, may be exactly reproduced outside the mouth.

Caries invariably originates *on the surface* of a tooth, and progresses inwards towards the pulp; the "*caries interna*," described by Hunter and others, being entirely a misconception.

The most common situations for caries to originate in, are the pits and fissures on the masticating surfaces of molars, at the points of contact of any of the upper

teeth; and between the molars and bicuspid in the lower jaw, the teeth anterior to these being but very rarely affected. Crowding of the teeth together in any part of the mouth, renders them more liable to caries, from offering facilities for the lodgment and subsequent decomposition of food.

Caries in Enamel.—The earliest stage of caries in the enamel is best observed in a freshly extracted tooth, in which the disease has just commenced on one of its approximal surfaces. The enamel having lost its brilliant polish, a white chalky spot is noticed, the surface of which is more or less rough, and which, as time goes on, becomes sufficiently softened to allow a sharp instrument to penetrate it. If the disease be permitted to continue, a corresponding spot on the contiguous tooth appears at the point where the two teeth touch; this spot, however, in many cases, being brown or black at first instead of white, as indeed may be, though more rarely, the original starting point of disease in the first tooth.

Secondary Decay in Enamel.—Having penetrated the entire thickness of the enamel, the disease may spread laterally, undermining this tissue to a considerable distance; the inner portion being of a white powdery, or even cheesy consistence, while the outer still remains sufficiently hard to afford it protection.

Examined microscopically the transverse striation

of the enamel prisms is found unduly distinct and pigmented; the prisms less closely coherent than in the healthy tissue, and in the internal, softened—so-called *secondary* decay—to have fallen apart and to be more or less disintegrated. Mixed with these loosened and broken-down enamel prisms are masses of bacteria, which are often seen forcing their way *between the different prisms*. The loosening of the prisms appears to be due to lactic acid, from fermentation of food, &c.

Mr. Tomes, however, states that the *axial portions of the enamel prisms are attacked before their peripheries* are affected.

Dr. Abbot describes the enamel fibres as united to one another by delicate threads, and when carious, to be not only decalcified, but to show certain protoplasmic bodies re-asserting their individuality; while to most other observers these so-called protoplasmic bodies are nothing more than masses of micro-organisms.

Caries in Dentine.—The enamel being penetrated, decalcification commences in the dentine, and spreads in all directions with nearly equal rapidity; this tissue, therefore, also becomes softened from removal of its lime salts, and a microscopic section shows the tubes to be crowded by micro-organisms. These organisms are enabled to find their way more easily along the tubes than across them, therefore a longitudinal section in an early stage of caries, shows the organisms intruded to a greater distance along the tubes than laterally, where the dentine though

obviously softened, may not show the slightest trace of them.

Though the majority of the tubes may be filled by organisms to a corresponding depth, it will generally be seen that they have gone much further in some tubes than in others.

Having gained admission to the tubes these canals gradually enlarge, and along their course show numerous dark, round or oval bodies, which are due to their lumen being suddenly and irregularly increased; the spaces being choked by closely packed masses of micro-organisms. These round or oval masses, named "liquefaction foci" by Dr. Miller, correspond to the "varicosities and globular swellings" in the dentine, described by Mr. Tomes. The enlargement of the tubes continuing, their walls eventually disappear, cavities being formed by the fusion of adjacent smaller tubes. Thus a space or cavern forms by the enlargement of individual, and the fusion of contiguous, spaces; the dentine becomes more and more cavernous in its character, and so gradually broken up, the *débris* being washed away by the fluids of the mouth.

The animal basis of the dentine from being highly insoluble, is converted into a soluble material by means of peptonising bacteria, just as leucocytes, connective tissue, bone, &c., are peptonised during the process of suppuration.

The organisms concerned in the destructive process are micrococci, rod-shaped bacilli, and leptothrix; micrococci are by far the most numerous, and

with the bacilli penetrate farthest into the tubes, the leptothrix being usually found near the surface of decay. It is said that both micrococci and bacilli may occupy the same tube, though usually but one form of organism is found in each. Both coloured and colourless bacteria are found in the human mouth; as a rule, however, the colourless ones largely predominate.

The diameter of bacteria of the mouth is considerably less than the average diameter of the dentinal tube, hence one might expect that some of the organisms would penetrate beyond the region of decay, into the healthy dentine. The vast majority of these bodies, however, do not penetrate as far as the normal dentine, much less enter it, since they are only able to obtain access to the dentine after it has been decalcified by acids.

Pipe stem appearance.—Owing to the enlargement of the dentinal tubes from decalcification, in an early stage of caries, the dentine appears as though made up of structures resembling numbers of tobacco-pipe stems united by an intertubular substance. Mr. Tomes suggests that “the diseased condition has, perhaps, undone the work of development,” for “the tissue is to a certain extent broken up into its histological elements.” Dr. Miller attempts to account for the appearance “by the pressure of the fungal masses in the tubules, by which a compression of the walls is caused.” (?)

The appearances are obviously not due to any vital process, since similar characteristics have been noticed

by Messrs. Leber and Rottenstein, in teeth made of hippopotamus ivory and worn in the mouth as artificial substitutes, and by them and others also in human teeth worn on plates, and which had become carious in the mouth. In specimens of decay artificially produced, the appearances are so exactly similar that it is impossible to distinguish one from the other.

Rod-shaped elements or fragments in the tubuli of carious dentine were first noticed by Sir John Tomes, and are not uncommonly met with; by him they were accounted for as "portions of consolidated dentinal fibrils," or as "bits of the sheaths of Neumann," or as "casts of the enlarged tubules."

Dr. Miller states that "these rods disappear often completely as soon as they are brought into contact with dilute sulphuric acid," and he therefore considers it not improbable that they are lime formations, but "more like cylindrical casts of the dentinal tubules than calcified fibrils." They are also frequently seen in artificial caries.

Rows of shining irregular grains in the tubules may often be noticed in early caries, both in living and dead teeth; Messrs. Tomes, Magitot, &c., describe them as lime-granules, while others regard them as fat. Dr. Miller states that "by crushing the above-mentioned casts, grains are also produced in the tubules which bear considerable resemblance to those which occur naturally." It seems, therefore, not improbable, that the granular bodies have the same origin as the rod-shaped.

Translucent Zone.—An area of increased translucency, in that part of the dentine which is situated between the advancing caries and the healthy tissue, may frequently be met with. In consequence of the convergence of the dentinal tubes towards the pulp cavity, the translucent zone will often appear in longitudinal sections as conical in shape, the base being directed outwards towards the surface of the tooth, and its apex pointing towards the pulp cavity. It may, however, present the character of hyaline stripes or spots; and is apparently due to the closer approximation of the index of refraction of the dentinal tubes and their contents, in this situation, than in that of the surrounding dentine.

By reflected light the zone has a horny look, closely resembling that which is often seen in senile roots. The appearance has been variously ascribed:—

(a) To the calcification of the dentinal fibril. —Wedl, however, caused dried sections of the horny roots of senile teeth to imbibe carmine, showing that the dentinal tubes instead of being solidified were still patent. Messrs. Leber and Rottenstein state that the translucent zone is softer than the surrounding dentine, and obviously, therefore, not due to increased calcification, and they attributed it to

(b) A partial decalcification of the dentine. This is in some instances no doubt true, for the “pipe-stem” appearance is sometimes well marked in this area.

(c) The obliteration of the dentinal tubes by swelling of the matrix.

Miller regards it as a partial conversion of fibrils into normal dentine, not necessarily caused by calcification.

The appearance is exactly the same whether met with in a carious tooth with a living pulp, or in a human tooth which has become carious while worn on an artificial plate.

It probably bears no direct relation to decay, inasmuch as it frequently occurs in a marked degree, and in typical forms, in places where there is not a trace of caries.

Pigmentation.—One of the early phenomena of caries usually spoken of, is that of pigmentation of the enamel and dentine. Pigmentation or discolouration is not a necessary accompaniment of decay, though it is usually so described. The absence of discolouration is especially noticeable in the secondary caries of enamel, which is white, and in very rapid decay we are accustomed to speak of “rapid white caries.” The carious tissue may be artificially stained by tobacco smoke, &c., just as may exposed dentine which is not carious at all. Dr. Miller considers it “exactly the same as that of the discolouration of any other organic substance which is decomposed by micro-organisms.”

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NOTES OF LECTURE V.

"DENTAL CARIES."—II.

The Chief Predisposing Causes of Caries usually described are :—

(a) **Structural Defects.**—Imperfectly developed, soft, honey-combed teeth, and those with large, interglobular spaces, deep fissures, and pits on the surface.

It has lately been shown, however, by Dr. Black, that there is but very little difference in the density of teeth, whether of the apparently hard and healthy variety, or of those we have been in the habit of describing as soft and very liable to caries, and which, if once attacked, rapidly go on to complete destruction.

(b) **Crowding and Irregular Situation**, from the lodgment of food, and the nidus for fermentation their position affords. For the same reason, a recession of the gums between contiguous teeth is by many assigned as a predisposing cause.

(c) **Pregnancy.**

(d) **Inherited Tendency.**

(e) **Certain General Diseases**, *e.g.*, gout, rheumatism, struma, &c.

Various Theories have been advanced in explanation of the phenomena of dental caries. They may be briefly enumerated as:—

(a) **Inflammatory.**

(b) **Chemical.**

(c) **Parasitic.**

(d) **Chemico-parasitic.**

Inflammatory Theory.—It is a significant fact that there are no blood vessels in human dentine or enamel, whether these tissues are in a healthy condition or diseased; inflammatory changes in them therefore are impossible. Gun-shot wounds, and other injuries to the tusks of elephants, show no trace of inflammation in the ivory which has been damaged, though the pulp in immediate proximity may have been acutely inflamed, and an abscess have formed in its substance. The incisors of rodents are liable to fracture, and several cases of reunion are recorded, but no sign of inflamed dentine has ever been detected in them. The same may be said with respect to the cases of fractured and re-united human teeth, which have been reported. When examined microscopically, a similar absence of vessels, or of any signs of inflammation of the injured dentine, has been noticed.

Caries may continue in dead teeth as well as in living ones, and the process appears identical in human or ivory teeth, worn on plates as artificial substitutes.

The every-day operations of preparing cavities in

teeth, and subsequently filling them with metal, often involving considerable pressure and percussion, would inevitably set up inflammation in a vascular tissue, such as bone, and so render these operations impossible.

The inflammatory theory of decay has in recent years been chiefly supported by Messrs. Abbott, Heitzmann and Boedecker, but their investigations have received no support from other observers. Certain "cellular elements, clusters of protoplasm, medullary elements," on which they lay great stress, have either not been seen, or have been differently interpreted by other investigators; Messrs. Milles and Underwood regard them as masses of organisms, and Dr. Miller very confidently states that they are "masses of micro-organisms mixed with the *débris* of the decomposing dentine."

Mr. Tomes, in a recent and very careful chemical analysis, has shown that there is not a trace of organic material between the prisms of adult enamel.

Chemical Theory.—In support of the view that caries is entirely chemical in its origin, the following statements are usually relied on. Caries always starts from the surface, and never from a portion of the tooth entirely unexposed to external influences. Litmus paper placed in a carious cavity will show an acid reaction, as will the mucous membrane in the neighbourhood, and the secretions of the mouth in many cases where caries is progressing. Most dilute acids, organic or inorganic, when brought in contact with enamel and dentine, are found to dis-

solve them. The secretion from the mucous membrane of the mouth is generally slightly acid, and markedly so in certain conditions of health. The stringy viscid mucus, often seen in young people in whom caries is rapidly advancing, is distinctly acid, and in certain dyspeptic conditions an acid state of the oral fluids may be frequently observed.

When natural teeth, or teeth made of ivory, are worn as artificial substitutes, they are liable to decay, and when so attacked present all the appearances—such as the translucent zone? tobacco-pipe stem, beading of the dentinal tubes, &c.—observed in caries occurring in teeth with living pulps. On the other hand, it has, so far, been impossible to reproduce artificially all these appearances by means of acids alone.

Dr. Magitot has produced cavities resembling those of caries, in both enamel and dentine, by the action of sugar and various acids; when, however, precautions were taken to prevent fermentation, such as the addition of creosote to the solutions, or boiling the solutions in tubes and hermetically sealing them while boiling, a solution of the enamel only occurred. Pigmentation does not occur in those cases in which the dental tissues have been artificially exposed to the action of acids only.

Dr. Miller states most positively that “the enlargement of the dentinal tubules, the liquefaction of the basic substances, the confluence of the canals, and the formation of cavities in the dentine are absolutely inexplicable by the action of acids in such a dilute state as they occur in the mouth.”

*Miller denies
translucent zone in dead
teeth.*

Parasitic Theory. — Various writers have attributed caries to the action of different parasites, thus *Protococcus dentalis* — an organism inhabiting the human mouth, has been credited with the power of “liquefying dentine and enamel.”

Messrs. Leber and Rottenstein regard the earliest stage of caries as purely chemical, but once decalcification in the dentine has commenced, they consider it is continued by the elements of the fungus *Lep-tothrix buccalis* penetrating and enlarging the dental tubes, and thereby rendering easy the access of acids to the deeper parts.

Messrs. Milles and Underwood consider that “two factors have always been in operation : (1) the action of acids, and (2) the action of germs.” Their theory, which they call the “septic,” “is rather an amplification of the chemical theory than a contradiction of it. Most probably the work of decalcification is entirely performed by the action of acids, but these acids are, we think, secreted by the germs themselves, and the organic fibrils upon which the organisms feed, and in which they multiply, are the scene of the manufacture of their characteristic acids, which in turn decalcify the matrix and discolour the whole mass.”—*Transactions International Medical Congress*, 1881.



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NOTES OF LECTURE VI.

"DENTAL CARIES."—III.

Chemico - parasitic Theory of Decay.—Dr. Miller well summarises the results of his investigations as follows :-- "Dental decay is a chemico-parasitical process consisting of two distinctly marked stages : decalcification, or softening of the tissue, and dissolution of the softened residue. In the case of enamel, however, the second stage is practically wanting, the decalcification of the enamel practically signifying its total destruction."

The Source of the Acids he considers to be chiefly the fermentation of amylaceous and saccharine substances which lodge in and between the teeth, and "inasmuch as the fermentation of carbo-hydrates gives rise to the production chiefly of lactic acid, and since lactic acid, even in dilute form, speedily acts upon tooth-tissue (decalcifies it), there can be very little doubt that the acid reaction and the decalcification of the dentine are produced in a great part by this acid."

The fermentation of starchy substances produces acids, which are found quite as injuriously to affect the teeth, as the acids derived from the fermentation of sugar; and the fermentation of saliva containing bread or potatoes, not only more quickly yields an acid reaction than a similar mixture of saliva and sugar, but it will yield a greater quantity of acid, in a given time, than the mixture of saliva and sugar would.

Sugar, being highly soluble, is readily carried away by the saliva, whereas starchy substances, being more sticky and more insoluble, remain longer in contact with the teeth, and so exert their injurious influence during a more lengthened period. Starch, therefore, appears to be more injurious to the teeth than sugar. When, on the other hand, albuminous substances and saliva are mixed and allowed to ferment, but a small quantity of acid develops, and this soon disappears, giving place to an alkaline reaction. From the knowledge of this circumstance, Dr. Miller draws the conclusion that such substances "are not injurious to the teeth, even though retained for some length of time; they may even retard the progress of decay by neutralising the acid through their alkaline products." Mr. Tomes, however, considers that albumen may injuriously affect the teeth, by giving rise to such fermentation products as valeric and butyric acids: "No proof, however, has ever been adduced for the statement that butyric acid is formed in the oral cavity, and no organism has been discovered in the mouth which gives rise to this fermentation. Free

access of air is unfavourable to its development" (Miller). Mr. Tomes further states that when cotton is pressed between teeth, and allowed to remain in contact with the gum for three or four days, the gum becomes irritated and the "mucous membrane throws out a secretion capable of injuring susceptible teeth." Dr. Miller, however, points out that decay but seldom occurs in cases of pyorrhœa alveolaris, in which the gums are in a state of constant irritation for months together; and adds, "whenever decay does accompany inflamed gums, we invariably find pockets or spaces which, by retaining food particles, serve as centres of fermentation and consequent decay."

The second stage of Caries, the dissolution of the decalcified dentine, appears to result from the action of micro-organisms, in peptonising—or converting into a soluble form—the previously insoluble animal basis of the dentine; this may, therefore, be designated the *digestive* stage.

Bacteria can nourish themselves only by substances in a state of solution, and if solid substances are presented to them, the bacteria must liquefy them before they are capable of being utilised as articles of their diet. "Upon this power of bacteria to liquefy substances of an albuminous nature depends the destruction of the softened dentine—in other words, the second stage of dental decay" (Miller).

The rapidity of the destructive process is directly proportional to the intensity of the fermentation, and inversely proportional to the density of the tooth substance; therefore honey-combed and rocky teeth, and

those containing numerous interglobular spaces, fall most easily a prey to the disintegrating process.

The softened layer of dentine is said to be much thinner, dryer, and blacker in dead than in living teeth. The alkaline substances yielded by a putrefying pulp, or by suppuration in the surrounding gum, will neutralise the acids formed in the dentine by fermentation; decalcification must, therefore, be slower in progress or cease altogether while the previously softened dentine is removed by dissolution. Naturally, therefore, the decalcified layer is thinner under such circumstances.

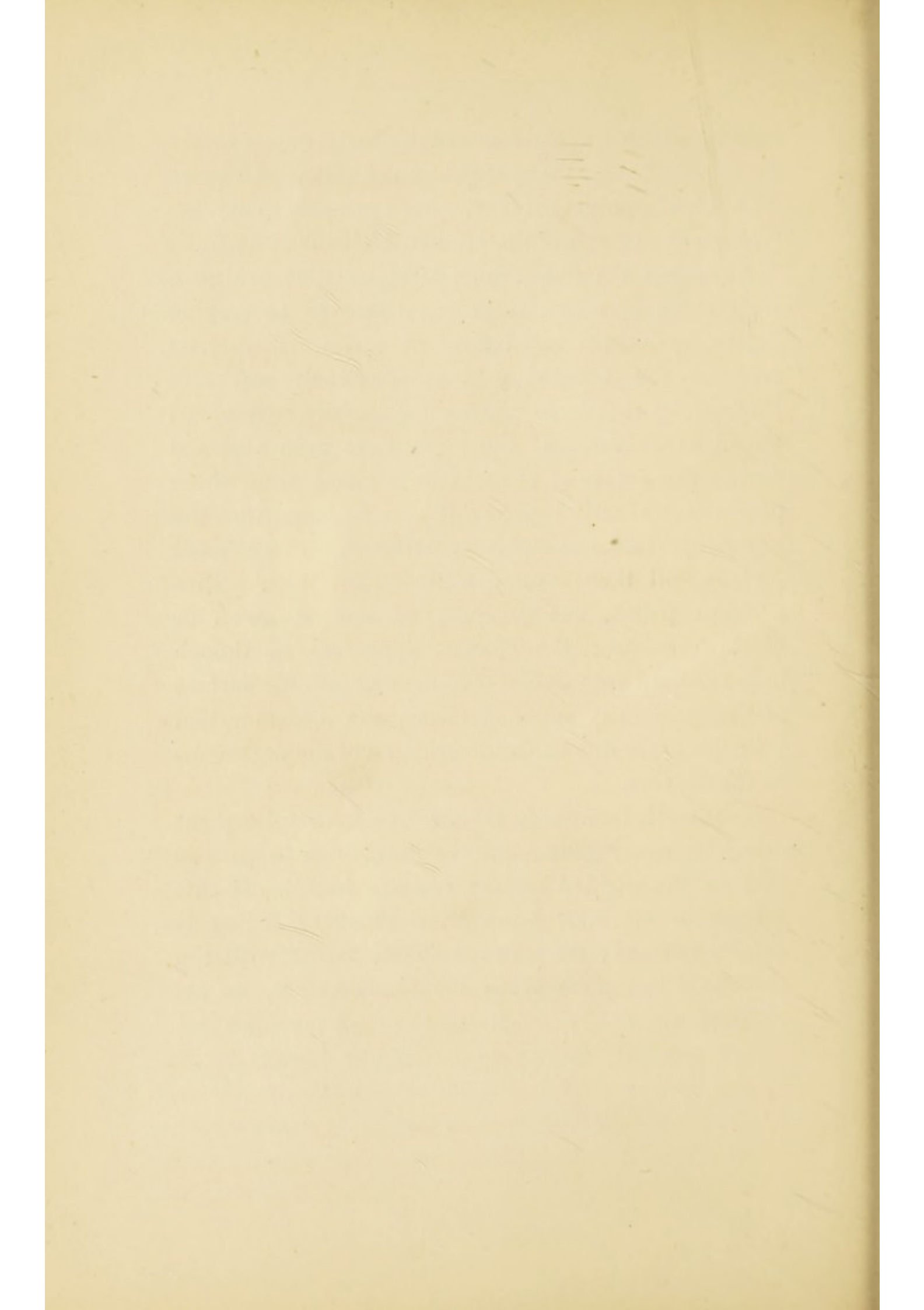
If teeth are placed in a mixture of saliva and any carbo-hydrate, such as bread, starch, &c., and then kept in an incubator at 98.5° F. for several days, the mixture being renewed from time to time, the teeth will very shortly be softened to various depths, depending on the length of time the experiments have been kept up; and on examination *will exhibit all the phenomena of natural caries*.

The Micro-organism of Dental Caries.—On this subject Dr. Miller writes: “All micro-organisms of the human mouth which possess the power of exciting an acid fermentation of foods may, and do, take part in producing the first stage of caries; and all possessing a peptonising or digestive action upon albuminous substances may take part in the second stage; and those possessing both properties at the same time may take part in the production of both stages. But whether there is any one bacterium which may always be found in decayed dentine, and which might, there-

fore, be entitled to the name of the bacterium of tooth-decay, or whether there are various kinds which occur with considerable constancy, we are not able to say."—
“Micro-Organisms of the Human Mouth.”

Arrested Caries.—From time to time we meet with cases in which teeth are destroyed to varying depths by a very rapid form of caries. During its progress the affected part is extremely soft and leathery, so that large masses may readily be removed by an excavator. If the teeth have been attacked during the course of some acute ailment from which the patient shortly recovers, it may be found that the advancing caries is suddenly arrested. The affected surface will then assume a glassy hardness, with a brilliant polish, but generally of a dark brown or blackish colour; the change appearing as though lime salts had been suddenly infiltrated into the surface of the previously softened tissue, the discolouration being probably due to the destruction of the organisms in the dentine.

Such teeth frequently remain free from subsequent decay for many years, and are insensitive to pain so long as the vitrified surface remains intact. If this surface is cut into, however, a sensitive region is quickly reached; no attempt at excavation with the view to filling such teeth should, therefore, be attempted.



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NOTES OF LECTURE VII.

“ EROSION : TREATMENT OF CARIES.”

Erosion, or “Decay by Denudation,” as it was described by Hunter, is a condition in which teeth become eaten away at certain parts, without, however, presenting the usual appearances of caries. The cavities so produced generally present either saucer-shaped, or narrow grooves; the labial surface of the tooth near the neck being their most favourite situation. This is, however, by no means the only position in which they are met with, the lingual surface being sometimes attacked, and now and then, the groove will be entirely confined to one side of the tooth.

In some cases the groove appears as though produced by a file passing horizontally along contiguous teeth, involving several in its destructive passage.

Occasionally the edges of enamel overhang the groove, producing an undercut; and it may extend from the buccal surface laterally, so as to partially encircle the tooth.

Sometimes, instead of a groove, a shallow saucer-shaped depression will be noticed, as though a piece of soft enamel had been scooped out from the buccal surface of the tooth.

The disease usually commences in the enamel, and involves the dentine secondarily, continuing its advance to the pulp cavity itself. But before this is reached the pulp has generally become solidified from intrinsic calcification, the cavity thus being effectually sealed by secondary dentine. The enamel and dentine are brilliantly polished, and the latter tissue is generally very hard. Though the condition usually starts at one spot in the enamel, occasionally several different points are separately attacked.

The upper teeth are more commonly affected than the lower, and the disease seems especially to affect persons of a strongly marked gouty or rheumatic diathesis. It is stated that erosion only attacks teeth with living pulps, though more than one case has lately been recorded in which the condition was noticed in teeth mounted on artificial plates.

For a long while it was a matter of dispute whether these grooves were correctly attributed to erosion, or were in reality the result of attrition from the tooth-brush, the band of an artificial plate, &c. Cases of erosion are, however, frequently met with in the mouths of persons who never use a tooth-brush, and

who do not wear plates at all ; the cavities are also encountered in positions inaccessible to a tooth-brush, and the saucer-shaped scooped out depressions could be hardly so produced ; and, lastly, the same appearances have been met with in the teeth of seals, and in other lower animals.

Mr. Arthur Underwood has described the enamel prisms in eroded teeth as unusually granular, and the interspaces as abnormally large ; and inclines to the belief that this arrangement of the prisms renders the enamel especially liable to be attacked by erosion.

The cavities of erosion are sometimes quite painless ; on the other hand they are often extremely sensitive to heat and cold, or to sweet or salt substances, and particularly resent the irritation caused by a tooth-brush. In such cases, the sensitiveness may be most effectually removed by nitrate of silver. Since, however, nitrate of silver stains dentine black, chloride of zinc, or potassa cum calcæ may be substituted, when the affected part is likely to be observed. While the cavities are but yet superficial, their deepening may be retarded by daily painting with sal volatile or eau de Cologne. When the cavities are sufficiently deep, it may be necessary to fill them, and for this purpose gutta-percha answers admirably ; it will, however, usually be found that but a small amount of excavation is possible, since the dentine immediately beneath the surface is intolerably sensitive when cut into. In such cases, palladium amalgam is often of great value if its superficial blackness is not a matter of importance.

Treatment of Caries.—This may be divided into general and local.

General Treatment consists in strict attention to the hygienic conditions of the mouth, by the use of antiseptic mouth-washes, such as Condly's ozonized water, Listerin, Sanitas, &c., after each meal, so as to prevent particles of food remaining between the teeth, and by fermenting, starting, or keeping up decay. This being supplemented by frequent applications of the tooth brush, which should always be used at night as well as in the morning, and in a direction upwards and downwards, instead of across the teeth as it is usually employed. Tobacco smoking appears to retard the progress of decay; from the germicidal properties of tobacco, though the dentine if exposed is liable to be stained by it.

Local Treatment.—Where sharp or overhanging edges are present about the teeth they should be smoothed off, so as to afford a less easy lodgement for food. When carious cavities actually exist, they should usually be "filled" by some material which not only prevents the ingress of food, but by hermetically sealing the cavity, excludes both air and moisture, and so renders impossible the continued vitality of the germs.

Should the dentine be thin and soft immediately over the pulp it is better to leave a portion of it rather than risk the pulp becoming exposed. Providing the edges of the cavity are sound it need not be feared that caries will progress beneath the filling.

Of the filling materials at our disposal, gold is the

most permanent and suitable in many cases; but where the dentine is soft, and but a thin layer remains to protect the pulp, the pressure needed to insert the filling, and the high thermal conductivity of gold render its employment inappropriate. In large interstitial cavities in molars and bicuspid's where the decay extends as far as the gum, it is often a very useful practice to fill the part near the cervical wall with tin, and then complete the stopping with cohesive gold.

Where the cavity is very sensitive to changes of temperature, a non-conductor of heat, such as a gutta percha or an osteo-filling, is most suitable. Gutta-percha is extremely valuable in cavities which extend to—or actually beneath—the gum, but is not suitable where it is subject to mastication. In such cases it is readily worn away, and is liable to be forcibly squeezed into the cavity causing pressure on the soft dentine beneath, or even splitting of the tooth if its walls are thin.

Osteo, on the other hand, resists mastication well for periods usually ranging from one to two years, by which time it generally begins to dissolve away. Its solution is much more rapid in cavities at, or beneath the gum line, and in such situations is most untrustworthy.

A knowledge of the relative merits and weaknesses of these two fillings, enables us to combine them in such cavities as extend from the gum to the masticating surface, as in the proximal cavities in molars and bicuspid's. Here it is a useful practice to pack

gutta-percha at the cervical edge, and then fill the remainder of the cavity with an osteo.

Osteos are usually composed of oxychloride or oxyphosphate of zinc. Though the former are more lasting, they are apt to cause so much pain in sensitive cavities, that acute inflammation and death of the pulp has occurred in many cases, the use of oxychloride of zinc is now, therefore, almost entirely abandoned. Oxyphosphates, though probably not so permanent, are far less irritating, hence their employment has become almost universal where osteos are needed.

Of the remaining materials employed for filling teeth, amalgams only need here be mentioned; of these the chief are palladium, Sullivan's and Flagg's submarine.

Palladium expands slightly on setting, making an absolutely water-tight filling, and one that is most useful in shallow cavities in which but a slight hold can be obtained, as in erosion grooves on the buccal surface of molars, where the extreme sensitiveness renders thorough excavation difficult. Though in such cases the expansion of palladium is an advantage, it becomes a source of danger if employed to fill large cavities, as the tooth is liable to be split during the expansion of setting. Palladium amalgam sets extremely rapidly, consequently great rapidity in its manipulation is imperative.

Palladium turns absolutely black on the surface after it has been in the mouth for a few days, it is therefore unsuitable for use in such positions as are

visible; it does not, however, stain the tooth in the slightest degree, and therefore may be safely employed if it be not actually in sight.

Sullivan's amalgam is a most valuable filling in the case of frail or soft teeth, which it will often preserve for many years in a most wonderful manner, and is especially valuable for the preservation of the first permanent molars of children. It has, however, the disadvantage of itself turning quite black, and of staining the dentine to a considerable depth, so that even if the filling be out of sight, the discoloured tooth may still attract unenviable attention. A modern preparation, known as Stewart's amalgam, which is similar to Sullivan's in many of its preserving qualities, does not stain the substance of the tooth, and in many mouths will retain a grey colour; in others, however, it becomes superficially blackened.

Flagg's submarine amalgam is an extremely valuable filling material, which with many patients retains its colour perfectly; but owing to a small quantity of copper entering into its composition, it does superficially blacken with some people. It makes a very close-fitting filling, which hardens rapidly, so that it can be polished within a few minutes of being inserted.

Most, if not all amalgams change their shape while hardening; the most valuable amalgam, therefore, will be one that sets rapidly, so that it may be burished before the patient leaves the chair. For this purpose excess of mercury may readily be removed by rubbing on the filling successive portions of tin foil.

If the instruments for inserting the filling are heated during use, a dryer amalgam may be employed than would otherwise be safe, and the hardening of the filling is expedited

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NOTES OF LECTURE VIII.

"SALIVARY CALCULUS AND PYORRHŒA ALVEOLARIS."

Salivary Calculus, or *tartar*, is a calcareous substance (composed of the triple phosphate of ammonia, lime and magnesia, with epithelium, *débris* of food, &c.), which has a tendency to deposit on the teeth, especially at the back of the lower incisors and on the buccal surface of the upper molars. When rapidly formed it is comparatively soft and readily broken; but when more slowly deposited it is exceedingly hard and difficult to remove. The lime salts are normally present in saliva in a state of solution, but the cause of their deposit in the form of tartar has hitherto been little understood. Lately, however, Mr. H. Robinson, of Downing College, Cambridge, has shown that certain micro-organisms found in the mouth when cultivated on agar-agar, possess the power of producing crystals of the double ammonium-mag-

nesium phosphate, identical in form with the mineral called struvite. He considers that the organisms produce ammonia from the nitrogenous organic matter in which they are growing, which then combines with the magnesium phosphate in the agar-agar to form the double salt. Magnesium and calcium phosphates being present in solution in the saliva, only require ammonia to cause the formation of ammonium-magnesium phosphate, and to throw out of solution the calcium phosphate, these salts both being constituents of tartar.

During the formation of these crystals Mr. Robinson also noticed the production of a green colour, and this may possibly explain the formation of a "green stain," as it is described by Mr. Tomes, or "green tartar," by Mr. Salter, and which is so frequently met with on the buccal surface of the permanent teeth soon after their eruption.

Tartar is normally white or pale yellow in colour, but may be stained brown, green or black from decomposition in the mouth, or from the use of tobacco, port wine, &c. Tartar deposited from the parotid gland is usually of the soft variety, while that from the sub-maxillary and sub-lingual glands is harder.

When suppuration has long continued around the neck of a tooth, or along its alveolar socket, grains or small nodules of hard discoloured tartar are frequently present, the result of the constantly alkaline condition of the parts, from being habitually bathed in pus, or more directly from the action of micro-organisms, as previously suggested.

Occasionally tartar is found deposited in narrow, hard, dark rings, just beneath the free margin of the gum; it may occur on any teeth, but is most commonly found encircling the necks of the upper incisors.

Loose teeth are frequently encased in a complete sheath of tartar, and in some cases this acts as a splint, binding the teeth firmly together, and affording them considerable support. Salivary calculus is also found to deposit on artificial plates which are not duly cleansed.

Tartar is usually deposited in a wedge shape with the base towards the gum, on which it acts as an irritant, causing its gradual shrinkage from the neck of the tooth, the alveolus also being absorbed before the ever-advancing irritation. The root of a tooth may thus be laid bare almost to its apex, causing death of the pulp from its blood supply being cut off. If the tartar is carefully removed, the gum beneath will be seen congested and covered with an unusually thin layer of epithelium, so that bleeding is readily produced.

Tartar is deposited in large masses as the result of the disuse of certain teeth, as when—in consequence of an exposed pulp—mastication is carried on entirely on the opposite side of the mouth; or where, from the loss of one or more teeth, the remainder have no antagonists.

Treatment consists in the thorough removal of the salivary deposit by means of suitable instruments called scalers, care being taken to injure the gum as little as possible. If the back teeth are first treated,

the hæmorrhage which is so readily produced will impede the operator to a less extent than if treatment is carried on from before backwards. After all traces of the tartar have been removed the teeth should be thoroughly polished with fine powder, so as to leave no spot as a nucleus for the deposit to recommence upon; and the patient should be directed to be most assiduous in the use of his tooth-brush night and morning; and to use it up and down, and not across the teeth, as it is generally employed.

If the gums are very congested, it is useful to rub powdered tannin, or some other astringent on them, and the use of a germicide, such as carbolic acid, in the tooth powder or mouth wash will probably retard or prevent the deposit, by destroying the germs concerned in its formation.

Pyorrhœa Alveolaris, False Scurvy, or Rigg's Disease, is a condition in which the gum in the neighbourhood of one or more teeth is chronically inflamed, deeply congested, therefore, readily bleeds, and is rather tender to the touch. A slight thick creamy discharge is continually poured out from the alveolar socket, as may readily be noticed by gently pressing the finger over the gum, from the sulcus towards the neck of the tooth. By absorption of the margin of the alveolus and recession of the gum, spaces are left between the exposed necks of the teeth, and pockets also form beneath the gum, into which food and other foreign bodies collect and

decompose. The condition may affect the neighbourhood of one or two teeth only, and very frequently the socket of one lower incisor; it has, however, a tendency to spread, and thus, if neglected, to involve a considerable portion of the mouth.

Within the margin of the gum, nodules of hard tartar are usually noticed, or the calculus may be found as a hard narrow ring; as the disease advances the gum is peeled from off the affected root, the alveolus being likewise absorbed so that the tooth loosens and finally comes out. The alveolus is often absorbed in a characteristic manner, a saucer-shaped hollow surrounding the affected tooth, as though a round-ended instrument had been forced between the root and its socket, thinning the bone and bulging it away from the tooth. In other instances the alveolar margin is merely thinned, very porous from chronic inflammation, and absorbed to a greater or less extent. At the same time that absorption is going on, there may be a fresh deposit of bone at the outer or inner edge of the alveolus, causing a prominent ridge beneath the gum, which may readily be felt by the finger.

Causes.—Various causes are assigned for the disease, none of which are wholly satisfactory; thus by some it is stated to be bony in its origin, Dr. Riggs considering it to be similar to caries in other bones. This, however, seems unlikely from the fact of the disease disappearing on the removal of the affected tooth or teeth. Others consider it due to the deposit of tartar; a perfectly clean and smooth surface of

tooth, an eighth to a quarter of an inch in extent, is, however, generally present between the tartar and the bone, showing that the tartar is secondary to the absorption.

Some observers attribute it to a constitutional origin, and in many cases it is noticed in people who have reached or passed middle life, and whose health is below the normal ; on the other hand, it is also seen to attack the mouths of persons whose health is otherwise perfectly good.

Naturally, a parasitic origin is suggested as the cause, but although germs are present in abundance, no characteristic organism has so far been isolated ; it is, however, by no means improbable that, could we find a suitable habitat for its cultivation, some special organism might be discovered, and the experiments of Mr. Robinson seem to make this view more likely.

All things considered, a periosteal origin seems more probable than any other. The spongy and inflamed gum, discharge from the socket, loosening of the tooth, absorption of alveolus, with occasional marginal deposition of new bone, are more readily understood if the periosteum is primarily at fault than if any other tissue is the original seat of mischief.

The tenderness of the teeth causes imperfect mastication, and dyspeptic symptoms are, therefore, liable to follow its long continuance, added to which the constant secretion of pus is exceedingly injurious, both from being swallowed, and from tainting the air which is inspired. Many of the lower animals, especially when in captivity, suffer from extensive destruction

of alveolus and the deposit of immense masses of tartar.

Treatment can scarcely be considered satisfactory, for though the disease may be brought into abeyance it is very liable to return.

It consists in the thorough removal of every trace of tartar from the pockets formed between the gum and teeth, several visits being usually required for the purpose, astringents and antiseptics at the same time being employed. Sulphate of copper packed into the pockets every day for about ten days, the freshly displayed tartar being on each occasion removed before a renewed application of the drug, seems to have yielded better results than are otherwise obtained. Sulphate of copper is a very powerful astringent, and next to the salts of mercury is one of the most potent germicides we possess ; it dissolves but slowly, and this serves to keep up its action on the affected tissue for several hours at a time—a condition which is not possible with a more soluble salt. Its taste is, however, exceedingly disagreeable, and it requires much resolution on the patient's part to enable him to persevere with the treatment for the allotted time.

Perchloride of mercury, either alone or in combination with peroxide of hydrogen, aromatic sulphuric acid, &c., have also been used with varying success ; a compound called phenol camphor—composed of crystals of carbolic acid 25 parts, camphor 75 parts—is also useful, especially in the later stages of treatment, the carbolic acid acting as an antiseptic, and the camphor seeming to dry up the gums in a remark-

able manner. Formaldehyde or formaline, in 2 to 4 per cent. solution is a powerful antiseptic, and has lately been employed in pyorrhœa alveolaris with more or less success. Its actual value in such cases has, however, yet to be established.

Dr. Riggs, in addition to removal of the tartar, advises chipping away the edge of the alveolar margin, for the same reason that gouging away the diseased bone is resorted to in the treatment of osseous caries elsewhere.

Constitutional Syphilis when present in a patient suffering from Riggs' disease, may cause extensive ulceration to spread from the margins of the inflamed gum into the neighbouring lips and cheek. This is best treated by scraping away the ulcerated surface, and giving iodide of potassium internally.

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NOTES OF LECTURE IX.

“Certain Inflammatory Conditions of the Mucous Membrane of the Mouth.”

Introduction.

THE mouth may be regarded as an incubation chamber, to which various organisms, pathogenic as well as harmless, have free access. Some of these are mutually antagonistic and destructive, while others thrive and multiply under conditions which are not thoroughly understood. Many of the necessary adjuncts such as warmth, air and moisture are liberally provided, and it needs but a suitable medium whereon the germs may feed, for a colony of parasites to flourish, destroying the host which thus maintains them.

These germs being almost universal, the mystery is rather that we are ever well than that we are ever ill ;

and the question of "immunity" has lately received much attention at the hands of bacteriologists, among whom very diverse opinions are held. All seem agreed, however, that anything which lowers the vitality of a tissue renders it less capable of resisting the destructive action of bacteria. Insanitary surroundings of any kind, dirt, food, light and air of insufficient quality or quantity, &c., by depriving the body of an essential element of health, make it a more easy victim to the attack of micro-organisms.

It need, then, be no matter for surprise that the mouth is at times the seat of unhealthy inflammation. This, when confined to the gums, is termed "gingivitis," but when the neighbouring parts are also involved, is called "stomatitis."

In some instances, the inflammation is quite superficial (aphthous or follicular stomatitis), in others, the deeper tissues are invaded, resulting in well-marked ulceration (ulcerative stomatitis), while in a third variety (noma), the virus is so potent that destruction of all the soft tissues of the face, the jaws themselves, and the base of the skull, may be produced.

Stomatitis, though by no means confined to children, is much more frequently met with among them, and in those who are poor, dirty and ill-fed; the resisting power among such people being usually but very feeble.

Thrush is a contagious disease, which first appears as scattered white dots of the size of millet seeds, on

the inflamed mucous membrane of the mouth. These dots by enlarging peripherally gradually coalesce, producing a membranous structure which is closely adherent to the subjacent mucous membrane, but which peels off at the end of a few days and is constantly renewed. The disease was formerly ascribed to the growth of the mycelium of a mould fungus—the *Oidium albicans*; later observations, however, point to its being probably due to the fermentation of a yeast fungus—the *Saccharomyces albicans*. This may either be derived from the air, or—as suggested by Dr. Miller—may be due “to unclean sucking-bottles, sucking-bags, sugar-teats, &c., which, particularly when the contents are undergoing fermentation, furnish most excellent nutrient media for bud-fungi!”

Treatment.—Good air and food, with careful cleansing of the mouth, and all bottles, &c., which may contain food, or be brought in any way into contact with the mouth, so as to prevent fermentation. The use of alkaline carbonates as mouth washes, or borax and honey, frequently rubbed over the affected tissues, will often be of great assistance. Those parts which are most severely attacked may be touched with nitrate of silver. Sulphurous acid (ʒss.—ʒj. ad aqua ʒviij.), which is so destructive to low forms of parasitic life, often proves of great assistance in the treatment of thrush.

Aphthous or Follicular Stomatitis. — The mucous follicles become inflamed, either singly or in groups, rapidly melting into sharply defined painful ulcers, which may remain isolated or rapidly spread.

Their usual seat is in the sulcus between the lips and gum, the frænum of the lips, or beneath the tongue.

Ulcerative Stomatitis generally commences at the margin of the gum, which at first is deeply congested and readily bleeds, the tissue rapidly breaking down into a dirty, ragged, painful ulcer. It is more common in the lower than the upper jaw, and frequently starts in the neighbourhood of the canine tooth; it tends rather to extend forward than backward, but is generally confined to one side of the mouth, though it may spread to a considerable distance either way. The parts which are brought in contact with the ulcerated surface frequently participate, so that the lips and cheek, or more rarely the tongue, may become secondarily involved, leading to cicatrization between the cheek and gum when the tissues are healing, unless due care is taken to keep the ulcerated surfaces separated. The mouth becomes excessively painful and the breath extremely foul. If neglected, the gum will slough, and the sockets of the teeth, being laid bare, become necrosed.

A very similar form of contagious ulceration of the mouths of sheep frequently occurs in the autumn; and the affected tissues have been found by Dr. Klein to be deeply penetrated by dense masses of bacilli, which he considers to be the cause of the ulceration. It is quite possible, that to a similar micro-organism may ultimately be traced the source of ulcerated stomatitis in the human subject.

Treatment.—This consists in attending to hygienic conditions, a tonic treatment being often ad-

visible. In follicular stomatitis the local application of sulphate of copper will often be all that is necessary. In ulcerative stomatitis the chief reliance is generally placed on chlorate of potash given internally, in doses varying with the age of the patient—for a child, from three to five grains, three times a day, or for an adult from ten to fifteen, being an average dose. At the same time the bowels, if confined, should be freely opened by an aperient—five to fifteen grains of sulphate of magnesia for a child, or a drachm to half an ounce for an adult—often proving very useful in such cases. If the ulcer is very painful it may, with advantage, be touched with nitrate of silver.

Constitutional Syphilis will sometimes produce ulcers resembling those of ulcerative stomatitis. They are, however, much less painful to the touch, more indolent in their course, and will only yield to anti-syphilitic treatment. This consists in the administration of iodide of potassium in three- to ten-grain doses, three times a day, with the use of antiseptic mouth washes; scraping the ulcerated surface sometimes proves of much additional assistance.

Gangrenous Stomatitis, Cancrum oris, Noma, Phagedæna oris.—These are names given to a very malignant form of stomatitis, in unhealthy and neglected children, in which most frightful destruction of tissue goes on quite unchecked, except by the employment of the most powerful caustics. It is almost painless during its whole course, and usually

first attracts attention by the foulness of the patient's breath. It begins by a swelling in the cheek, and the formation of a hard, shining, red, central spot; inside the mouth, corresponding to this spot, is an irregular, painless ulcer. The red spot soon becomes gangrenous, turning black, lays open the mouth and exposes the bones of the face, and sometimes even the back part of the orbit and base of the skull. Meanwhile there is intense salivation and very fetid breath. It is extraordinary how little the appetite is affected during the whole course of the disease.

A special rod-shaped bacillus has been isolated and cultivated by Dr. Miller, which he considers characteristic of Noma.

Treatment. — This consists in the use of the strongest caustics, such as fuming nitric acid or acid nitrate of mercury to the affected surface, in order to arrest the extension of the disease, the most scrupulous attention being given to frequent cleansing of the mouth with antiseptics. The strength must meanwhile be kept up by means of tonics, such as iron and quinine, port wine, &c., with plenty of nourishing food.

Actinomycosis is a parasitic disease which occasionally attacks the mouths of human beings, but is much more commonly found in those of cattle. It is characterised by the formation of hard indolent swellings, which eventually ulcerate on the surface, and breaking down, discharge a thick creamy substance resembling pus, but which under the microscope is found to be largely made up of the parasites—the

actinomyces. These objects, when stained, exhibit oval or circular tufts, composed of characteristic club-shaped bodies (the actinomyces) of a violet colour, the centre of the space between the apices of the clubs in the human subject being occupied by threads which are stained in a similar manner. In cattle, however, the space within the circle left by the clubs is stated by Professor Crookshank to contain no threads, and to be thus distinguished. The parasites are said to gain access to the tissues of the jaws through the medium of carious teeth. The disease in man is probably less rare than is supposed, though it has been so lately described that it is at present but comparatively little known.

Acute general inflammation may be due to salivation by mercury, to scurvy or to purpura, or to corrosive liquids—such as carbolic acid—taken into the mouth, by accident or design.

Ptyalism, or salivation by mercury, causes inflammation of the whole mucous membrane of the mouth and tongue, with profuse flow of saliva from the inflammation spreading to the salivary glands. The breath becomes intensely fetid, the tongue so swollen as to be indented by the teeth, and if the condition remains unrelieved, sloughing of the gums and necrosis of the jaws may supervene.

Treatment consists in stopping the exhibition of the drug, and using antiseptic mouth washes, with the internal administration of chlorate of potash and of opium.

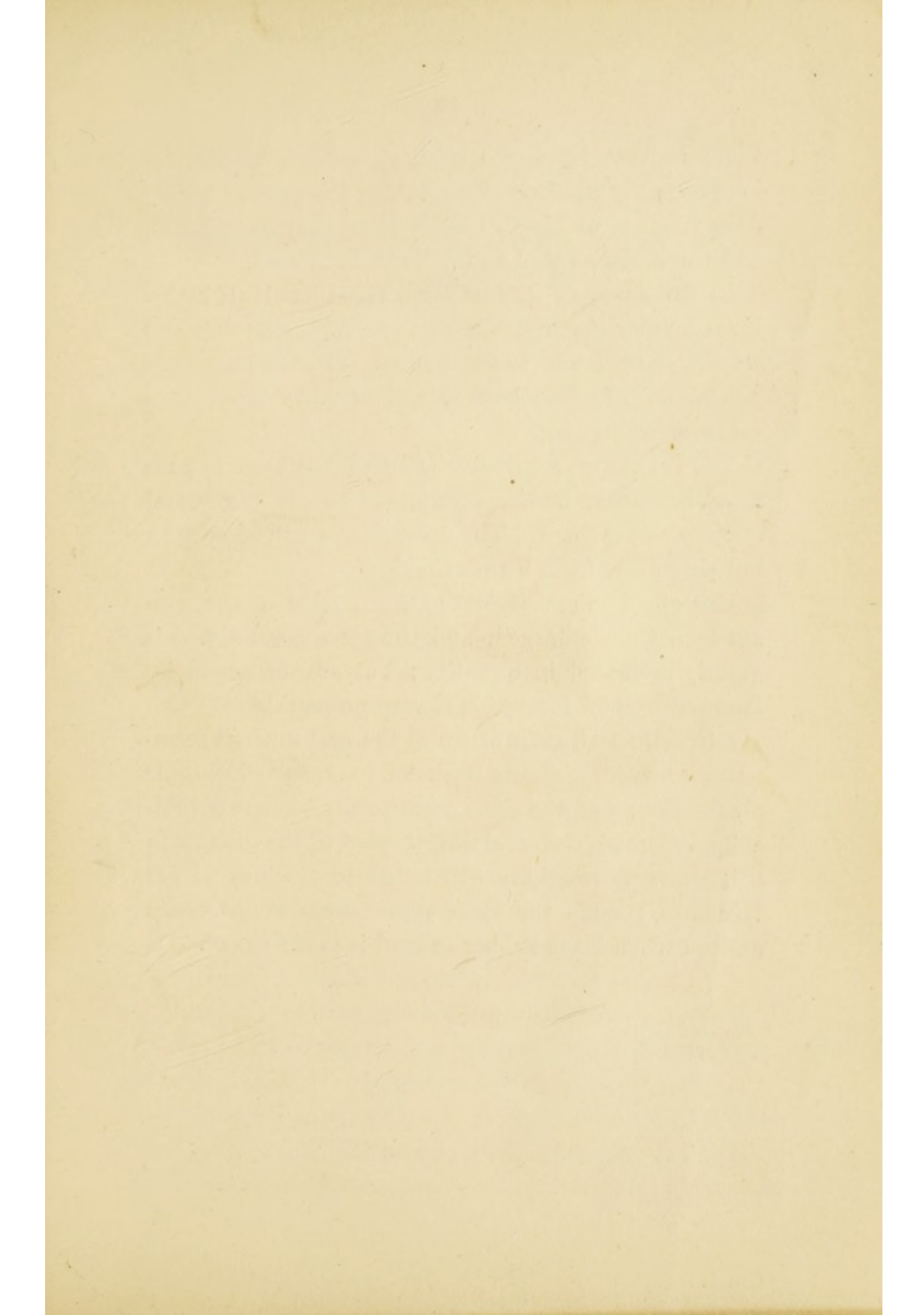
Scurvy, a condition but rarely seen in the present day, causes the gums to become deeply injected, bleeding at the slightest touch, or the oozing may occur of its own accord, and the hæmorrhage be very difficult to arrest; the lips and tongue present an anæmic appearance, in marked contrast to the gums. The teeth become loosened in their sockets, and finally drop out; if allowed to run its course, the gums may slough and necrosis of the jaw occur.

Treatment.—This consists in a plentiful supply of fresh fruit and vegetables, astringent and antiseptic mouth washes at the same time being employed. Loose teeth should be retained if possible, as they usually become firm again when the gums are restored to a healthy condition.

Purpura resembles scurvy in a minor degree, but we do not find the same distinction in appearance between the gums and the lip and tongue, nor are the immediate consequences so serious. The treatment consists in the use of constitutional remedies, with antiseptic and astringent mouth washes.

The burns of carbolic acid should at once be treated by rubbing in sweet oil, in which the acid is readily dissolved.

Lampas.—A rapid, soft and painless enlargement of the gums is now and then met with in human beings. The teeth may become entirely hidden by the overgrowth, very loose in their sockets, though unattended by pain or suppuration. The growth is very soft and may be readily peeled from the teeth as far as the necks, but not further. Though deeply red in colour



there is scarcely any tendency to hæmorrhage, for inadvertently pricking or scratching the growth hardly draws a drop of blood. Both jaws may be affected, and the labial as well as the lingual surfaces.

In the cases so far met with there has been a previous history of purpura in some form. Both men and women seem liable to the disease. It has long been known as affecting horses, and is quite familiar to veterinary surgeons.

The treatment hitherto adopted has been to pare away the superabundant gum, and to use the actual cautery to the base. The operation is attended with but singularly little hæmorrhage.

Examined microscopically, the papillæ of the gum are seen to be enlarged, and the submucous tissue is greatly increased in quantity; but an absence of inflammatory new formation is very noticeable.

Chronic Inflammation of the oral mucous membrane sometimes shows itself as the result of chronic alcoholism; and the gums occasionally become chronically inflamed under artificial plates, the condition being often wrongfully attributed to the use of red vulcanite, though the same appearances are at times noticed when black rubber or gold is made use of.

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NOTES OF LECTURE X.

NECROSIS OF THE JAWS.

INTRODUCTION.

WHEN, from any reason, the vascular circulation in a bone is arrested, its death or necrosis takes place. This may be the result of injury, destroying the nutrient artery or stripping the periosteum from the subjacent bone; or it may arise from inflammation (osteitis), the congested capillaries becoming strangulated from the pressure upon them of the surrounding osseous tissue. The circulation in the outer portion of the bone may likewise be cut off by effusion of pus between it and the periosteum, when this membrane is inflamed (suppurative periostitis).

Death of any portion of a bone having occurred, granulations are formed in the living part which is in contact with it. The necrosed portion is severed from the living by a process of ulceration, absorbing or eating away this living line of demarcation. Separation being completed, the dead bone is floated on the

layer of granulations ready to be cast off. During these changes the leucocytes are continually poured out from the capillary loops of the granulations, to do combat with the micro-organisms which swarm wherever dead bone exists. Vast numbers of them perish, and decomposing, form the foul pus which is constantly escaping through the cloacæ, or holes left in the new bone for this purpose.

In bones developed in cartilage, as soon as pus has separated the periosteum from the dead bone, plastic lymph is poured out, and converted first into cartilage and then into bone, a shell of new bone, called a "vaginal sheath," thus being formed around and enclosing the dead. This necrosed bone within a new shell is called a "sequestrum."

In bones developed in membrane no vaginal sheath is produced, and therefore the dead portion is spoken of as an "exfoliation."

Necrosis is more common in the lower than the upper jaw, for two reasons :—

- (a) Because strangulation is more easily induced in compact than in cancellous bone ; and
- (b) Because of the scanty arterial supply of the lower jaw, mainly derived as it is from the two inferior dental arteries, which do not anastomose ; whereas the upper jaw is supplied by numerous branches of the internal maxillary artery, which freely inosculate.

The *outer surface* of the bone, at least in the lower jaw, is *usually first attacked*, and if, by means of free

incisions, an early exit is given to the pus, mere superficial exfoliation of the bone may occur; or the disease may involve the whole alveolar portion of the jaw, leaving the base uninjured. On the other hand the entire maxilla, including the rami, condyles and coronoid processes, may be destroyed. Necrosis in the upper jaw is met with now and then, but it is rare.

Etiology.—Any inflammatory affection of the mouth may, by involving the periosteum, lead to necrosis of the jaws, the specific causes being:—

- (a) Alveolar abscess.
- (b) Arsenic escaping from a dressing in a tooth on to the gum.
- (c) Syphilis, tertiary stage.
- (d) The inhalation of the fumes of phosphorus or mercury.
- (e) Salivation by mercury administered internally.
- (f) Scurvy.
- (g) Stomatitis.
- (h) The exanthematous fevers (scarlatina, small-pox and measles).

Symptoms.—The symptoms of any form of necrosis of the jaws are those of severe periostitis; at first the pain is intermittent, but later it becomes constant. The teeth in the affected part are raised in their sockets, loose and very tender when bitten on; the gums are swollen and extremely painful, peeling from the alveolus beneath, and a constant discharge of very fetid pus is poured into the mouth. At the same time the face becomes swollen, and the skin tense

and shining, the phosphorous variety of necrosis producing the swelling in the most marked degree. Meanwhile the general health suffers severely from the constant and long continued pain, the inability to take food, and from the poisonous effects of the pus which is swallowed. Pus also finds its way into the trachea during sleep, causing septic pneumonia in some instances, especially among the lower animals. The inspired air, of course, readily becomes contaminated by the foul discharge.

In bad cases of phosphorous necrosis, gangrene of the lips and cheek will sometimes supervene.

The pus tends to gravitate, therefore in the upper jaw it usually escapes into the mouth, and rarely on the surface of the face ; for a similar reason, however, when the lower jaw is affected, numerous sinuses may form along its lower border or outer side, or openings may even occur low down in the neck.

Treatment.—The exciting cause must be got rid of if possible, and for this reason all loose stumps, which may be keeping up irritation, should be extracted. In the early stage the gum may be scarified and leeches applied to relieve congestion, while hot poppy fomentations held in the mouth will often soothe the pain, and opium may be given internally with this object ; the bowels, if confined, being freely opened. By this means we may hope to arrest the disease before it has passed beyond the stage of periostitis, and a free incision through the periosteum is often of great assistance for this purpose. If pus has already formed, it must, of course, be let out as

soon as possible. At the same time, tonics, and as nutritious a diet of soup, beef-tea, eggs, &c., as possible, are imperative.

Meanwhile the strictest cleanliness of the mouth must be observed, the sinuses being frequently syringed with antiseptics, such as chloride of zinc, perchloride of mercury, 1—1000, peroxide of hydrogen, or formalin 2 per cent. to 4 per cent., &c.

As soon as the sequestrum is loose—but not before—it must be removed, and it may be necessary to divide it in two before extraction is attempted. Foreign surgeons advise sub-periosteal resection, but it does not appear to present any especial advantage.

In the majority of cases of necrosis, the teeth drop out or are extracted in consequence of the pain they occasion. In children the germs of the unerupted permanent teeth, as well as the erupted temporary ones, are frequently destroyed, in consequence of the destructive process involving the crypts of the developing teeth. If, however, the crypts are not affected, the teeth may still be developed and erupt in due course. It is, therefore, most important in children, not to remove the sequestrum until it is quite loose, and to effect its removal with as little injury as possible to the subjacent bone and soft parts, so that the inflammation may not be extended to the crypts of the developing teeth.

Process of Repair.—In the *upper jaw*, after the dead bone has separated and been removed, in young subjects a process of repair may be effected by means of fibrous tissue which ultimately becomes ossified ;

in adults, however, no attempt at production of new osseous tissue ever takes place at all. In the lower jaw, on the contrary, new bone is very freely formed.

In the *lower jaw*, a more or less perfect shell of new bone is formed around the dead. Through the cloacæ the sequestrum may be felt bare and rough when a probe is introduced. As soon as it is found to be loose and the new shell of bone is sufficiently strong, it should be removed, when the space is quickly filled by the granulations which become converted into fibrous tissue, and subsequently into bone. An entirely new jaw may thus be reproduced.

The new bone is derived chiefly from the periosteum; a case is, however, on record, where the new bone was reproduced from the tissue of the gum, entirely *anterior to the dead bone and periosteum*.

Result.—The newly formed bone is very vascular, the Haversian canals being extremely large and parallel to the long axis of the bone (except in the case of phosphorous necrosis), near together, and anastomosing freely, the lacunæ are large, numerous and irregular, and the canaliculi few in number. The new bone in some cases evidently arises from the fibrous structure of the gum and *not* from the osseous surface of the periosteum at all.

In some well authenticated instances no new bone whatever has been produced.

After a time the new bone gradually begins to absorb away, as it does in a senile edentulous jaw, and the question has been asked whether artificial teeth might not arrest this absorption, by providing

a function for the new jaw to fill. The answer must, however, I think, be in the negative.

After phosphorous necrosis, a peculiar *pumice-stone* deposit takes place on the dead bone of the lower jaw, but *not on the upper*, and is derived from the periosteum.

This pumice-stone deposit is laminated in structure; the Haversian canals are larger than normal, are *not parallel* with the long axis of the bone, but *at right angles* to it. This pumice-like deposit, in rare cases, occurs in other than phosphorous necrosis.

Syphilitic necrosis usually occurs in the compact portion of the palate or lower jaw, though occasionally the alveolar structure is affected. When it causes necrosis it does so in the tertiary stage, a perforation of the hard palate being almost diagnostic of syphilis. In the treatment of such cases a plate may be made to cover over the perforated spot and protect the passage between the mouth and the nasal cavity from the irritation of food, &c. At no time, however, either during the period of ulceration or subsequently, should the perforation be plugged, since the pressure on the margins of the cavity will inevitably cause absorption, and so an enlargement of the false passage. Enormous openings are sometimes met with from attempts on the part of patients to overcome the discomfort occasioned by such cavities, by themselves stuffing the opening with plugs of cotton-wool, gutta-percha, &c.

Phosphorous Necrosis.—The poison of phosphorous is only able to reach the periosteum when the gum

is ulcerated, or where the bone is already bare from the recent extraction of a tooth, or through the root canal when the pulp of a tooth is exposed. Workers in phosphorous are therefore enabled to withstand its injurious action, so long as the teeth are sound and the gums healthy. Both jaws are subject to the poisonous influence of the phosphorous, though the lower one seems slightly more often affected than the upper.

Rapid Melting of the Alveolar Portion of the Jaws.—A rapid solution of the alveolar portion of the jaw, accompanied by profuse discharge of almost odourless pus, but unaccompanied by pain, now and then occurs. The teeth become so loose as to seem only attached by gum, and many drop out or are extracted, but no *masses* of dead bone are to be seen, such as would be present if the case were one of the ordinary necrosis, the dead portion apparently being washed away in the discharge. The treatment which offers the best hope of success is the frequent syringing the sinuses with peroxide of hydrogen; this renders the parts aseptic, and under its use the discharge may disappear, the gum again become adherent to the teeth, and the teeth themselves firmly attached by what remains of the former bony socket.

Necrosis after the Eruptive Fevers.—After the exanthematous fevers (scarlet fever, measles and small-pox), cases of necrosis of a peculiar character are sometimes met with, the jaws being the only bones which are ever so attacked. The symptoms usually show themselves within four or five weeks

after recovery from one of the above mentioned diseases, and never later than eight or nine weeks. The disease generally occurs about five or six years of age. The severity or the previous attack seems to have no relation to the subsequent exfoliation, and, indeed, the children affected are usually otherwise very healthy. It is but seldom that the necrosis has been preceded by swelling or pain, or accompanied by periosteal abscess.

The necrosis is said usually to attack both sides of the jaw, one side following the other after an interval of a week or so, and occasionally both the upper and lower jaws are attacked; the crypts of the developing teeth are generally involved, and are exfoliated with the rest of the bone affected. No new bone is formed around the dead portion, and therefore no cloacæ are developed. The first symptom which usually attracts attention is the very foul condition of the patient's breath, and the periosteum is then seen to be peeling from the bone beneath, and to be accompanied by a discharge of very fetid pus. The disease generally lasts for about four to six weeks before the dead bone comes away from the living. According to Mr. Salter the disease is *strictly confined to the alveolar portion of the jaw*, and therefore no thickening of the jaw, or attempt at the formation of supplemental bone occurs.

Mr. Salter considers the disease "is the result of the local application of a specific poison to the vascular parts of the teeth," and in support of this view he further says the teeth are "members of the der-

mal system, and as such we should, *a priori*, expect that they would share in the consequences which attend those particular diseases which spend their chief force on the skin."

London School of Dental Surgery.

1896.

NOTES OF LECTURE XI.

"On certain Malformations and Injuries of the Teeth."

SYPHILITIC, HONEY-COMBED, AND
MERCURIAL TEETH.
FRACTURE, AND DILACERATION.

Introduction.

DURING the period of development of enamel, the forming teeth are very sensitive to any lowering systemic influence, and the crowns are apt to be modified in various ways, according to whether the depression is of a permanent or transient character; the former altering the shape of the whole crown, while the latter only affects that portion of it which is at the time undergoing calcification. Once calcification of the enamel is completed, however, no further developmental change in the outward appearance of the crown is possible.

When a constitutional cause produces malformation of the crown, the change is usually symmetrical, and all four corresponding teeth are often affected in a similar manner, and to an equal extent.

Among the causes liable thus to affect the teeth are :—inherited syphilis, rickets, the exanthematous fevers, and the administration of mercury during infancy.

Syphilitic Teeth.—The children of syphilitic parents occasionally have one or two temporary incisors erupted at birth ; the roots are rudimentary or not developed at all, the teeth seeming only to be attached by the gum. These teeth it is usually necessary to extract, though care must be taken to cause as little hæmorrhage as possible, since newly born children bear hæmorrhage so badly.

Mr. Jonathan Hutchinson, many years ago, observed that the permanent incisors of patients suffering from inherited syphilis, were frequently notched at the cutting edges, and presented a stunted, peg, or barrel-shaped appearance ; and further, that such patients very commonly suffered from interstitial keratitis.

The enamel in syphilitic teeth is frequently imperfect, when the dentine will be more or less exposed, imparting a dirty, muddy appearance to them. When, however, the enamel completely covers the crown, no discolouration will be noticed.

The typical shape of incisor teeth, broader at the

cutting edge than at the neck, is reversed in syphilitic teeth, for in them the cutting edge is narrower than the neck, as though the central tubercle had been suppressed, and the outer two had fallen together. In some recently erupted teeth, a narrow central portion of the cutting edge, bounded by a crescentic margin, is devoid of enamel; after the tooth has been in use for a time, this central portion of dentine wears away, leaving a notch extending from front to back, as though it had been cut by a file.

Any of the six front teeth, in either jaw, may be so affected, but the teeth which most frequently present these appearances, and on which Mr. Hutchinson places the greatest reliance for verifying the diagnosis of inherited syphilis—regarding them as the test teeth—are the upper central incisors of the permanent set.

Honey-combed or Rocky Teeth are apt to be the result of any lowering influence during the period in which enamel is being calcified, and if the injurious influence has been temporary, or intermittent, the periods will stamp the time of their existence on the teeth, by marks on those parts which were undergoing calcification at the periods in question. Thus a child which has suffered from rickets may have imperfectly formed enamel in the lower two-thirds of the crowns of the central incisors, and the lower half of the laterals, while only the tip of the canines may be mal-formed, the bicuspid usually escaping the imperfection altogether. The crowns of the six-year-old molars will, however, be very largely malformed.

If, instead of rickets, a child suffers from scarlatina—or any other acute illness—the enamel may be perfectly formed until the time of the attack, and subsequent to the recovery; but during the illness the enamel developed will be faulty, and so present a groove across the teeth, at the situation corresponding to the part undergoing calcification at the time.

The faulty enamel in such cases presents a rocky or worm-eaten appearance, in marked contrast to the smooth, glistening, unbroken surface characteristic of normal enamel. The cusps of the molars in particular have a craggy look, and stand out as almost isolated projections.

The teeth of the permanent series are far more commonly rocky than the temporary ones; but since honey-combed teeth very readily decay, and caries in the milk teeth is so often disregarded, these teeth are frequently left entirely untreated until the crowns are totally disorganised, and so honey-combing in this series is generally overlooked.

The dentine in such teeth usually presents numerous and well-marked inter-globular spaces, showing evidence of imperfect or arrested calcification.

Mercurial Teeth.—When mercury is administered in frequent doses during infancy, whether in the form of teething powders for the prevention of convulsions, or for the treatment of hereditary syphilis, it is said to modify the form of certain permanent teeth, notably the incisors and first molars, in a characteristic manner.

In the case of *incisors*, the three tubercles of which

the cutting edge is composed, and which in a normal tooth are but faintly indicated, are in mercurial teeth greatly exaggerated; so that the edge, instead of being an almost even line, is composed of three tubercles with two shallow antero-posterior grooves separating them, the enamel usually forming a complete covering to the crown, in marked contrast to the syphilitic incisors described by Mr. Hutchinson.

The *first permanent molars* are also peculiar, having the cusps sharp and spikelike, the base from which they spring being extremely rounded, as though the margin—where the grinding and lateral surfaces meet—had been fused by a flame passing round it.

While Mr. Jonathan Hutchinson considers the upper permanent central incisors the test teeth of inherited syphilis, he points to the six-year-old molars as the test mercurial teeth.

FRACTURED TEETH.

FRACTURE of teeth may be either simple or compound, and caused by direct violence (as from blows received in fighting, a fall, &c.); or from indirect violence, as when a blow received under the chin is transmitted to the teeth. Teeth may also be fractured from being bitten upon hard substances mixed with the food, from the tonic spasms of tetanus, or the clonic spasms of epilepsy, and from the insertion of wedges, levers, &c., between teeth in violent attempts to force the jaws apart.

The fracture may be transverse, oblique, or longitudinal, through the crown, or root, or both.

Fractures are occasionally impacted, but this can only happen when the injury extends below the edge of the alveolus; they may then be ultimately united by cementum, or by the formation of osteo-dentine. Cases of this nature have been reported by Messrs. Dunn, of Florence; W. E. Harding; and fourteen by Wedl; and I have myself met with, and reported, one occurring in a Guian tree-porcupine. A case is described by Mr. Sewill, in which an incisor, in a girl aged fourteen, was longitudinally fractured and impacted, but after six months was extracted and found to be ununited, the pulp being bulged between the two fragments and calcified, so that the two halves could not be fitted together.

If the nerve cavity be opened the pulp usually becomes inflamed, and frequently dies; but whatever inflammatory changes this structure undergoes, they never extend to the surrounding dentine.

A case has lately been described by Mr. Tomes, in which a molar was fractured through the crown, freely exposing the pulp, and in which several fragments of the broken dentine were imbedded. The tooth was extracted for neuralgic pain some months afterwards, when the pulp was found to have grown up so as to fill and cover over the broken edges, to have become calcified, and to have entirely enveloped the broken and embedded fragments in the new calcified material. In the lower animals having teeth of persistent growth, the distal portion of the pulp of course is very

large, and the imbedded part of the tooth is widely open at its extremity.

Specimens of such teeth are sometimes met with, showing the results of most remarkable injuries—comminuted fracture, bending and twisting of the tooth, or invagination of one portion within another, in an extraordinary manner. Yet calcification may have gone on, and ultimately healthy dental tissues—enamel, dentine, and cementum—have been produced.

Longitudinal splitting of teeth through the crown and root has been ascribed to the formation of gas in the pulp cavity, which, being unable to escape through the apical foramen, in consequence of its being blocked by secondary dentine, expands with sufficient force to split the root; an explanation, however, which must be received with considerable distrust. Longitudinal splitting usually occurs in persons who have reached or passed middle life, when the teeth contain a relatively smaller proportion of animal matter than at an earlier period; gouty people seeming especially liable to this accident. The condition, when suspected, is best discovered by the point of a fine probe being pressed into any fissure that may be noticed in the tooth, when the two halves readily bulge apart.

A further cause of fracture may be the weakening which results when rhizodontrophy has been performed, especially if the operation has been carried out by two different operators, in two different positions.

Treatment.—Where the fracture is transverse

and the pulp cavity not opened, the surface should be smoothed and polished, the sensitiveness destroyed by means of caustics, nitrate of silver being carefully avoided in front teeth; suppuration of the pulp is, however, the complication most to be dreaded. In children, its destruction nearly always occurs, either at the time of the accident or shortly afterwards.

When a permanent upper central is broken off in childhood, every effort should be made to preserve the root, so that sufficient space may be retained for an artificial tooth of the proper size, to be inserted when adult life is reached.

Split teeth may be bound together with fine gold wire, or by a gold collar, in the hope of union subsequently taking place.

A case is reported by Mr. W. E. Harding, in which an enlarged cingulum at the back of an incisor was broken off, causing exposure of the pulp and an alveolar abscess.

DILACERATION.

Dilaceration, or the forcible bending of the calcified part of a tooth on the still uncalcified portion, is a condition closely related to fracture; but since the violence takes place at a time when the tooth is still partly in a soft condition, the tooth is bent upon itself, instead of being actually broken, the injury being analogous to what is known as "green-stick fracture" in a bone.

Any tooth *may* be so affected, but since violence is

more readily applied to the front of the mouth than to its posterior part, the injury is usually met with in incisors and canines, or bicuspid.

Examined microscopically, the enamel prisms, or dentinal fibres—according to the seat of injury—are seen to be bent upon themselves but not necessarily ruptured, and of course showing no sign of inflammation; the part of the tooth both above and below the seat of injury being normally developed.

Treatment in such cases is out of the question, and the condition is chiefly of importance, since it may seriously interfere with an attempt to rotate, or otherwise move into place, a tooth which has erupted abnormally.

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NOTES OF LECTURE XII.

"Diseases of the Antrum."

THE Antrum of Highmore is an air cavity situated in the upper maxilla, and has been described as a "triangular pyramid, with the base towards the nose, and the apex towards the malar bone." It gradually increases in size till adult life is reached, and often becomes smaller towards very advanced age. It is said usually to be capable of holding about two and a half drachms of fluid, though it varies considerably, a capacity of eight drachms sometimes being reached. It is not always symmetrical, the cavity on one side being frequently very different in size and shape to that on the other. As is seen in dried preparations, the cavity is occasionally divided by more or less perfect transverse septa into two or more loculi, while the folds of mucous membrane covering the bone in the living subject, make these septa even more complete. The antrum is usually larger in men than in women.

Though in dried preparations, where only the bones are present, we see two openings from the antrum into the nose, in the natural condition there is but one, the other being covered over by mucous membrane. The natural one connects the *upper* part of the antrum with the nasal cavity, opening into the *middle* meatus.

The roots of the first and second molars frequently project into the antral cavity, only a very thin layer of bone covering them, and forming the antral floor. The roots of bicuspid and canines, in a similar manner, occasionally project into the antrum.

Now and then the roots of a healthy first molar are seen to project into the cavity, uncovered by bone at all, but merely surrounded by the lining membrane and periosteum. Thus, inflammation around the root of a tooth, may readily spread to the bony floor of the antrum.

The chief diseases to which the antrum is liable are :—

- (1) Empyema.
- (2) Hydrops antri.
- (3) Cystic growths.
- (4) Polypi.

1. Empyema of the Antrum, or pus in the antrum, may be the result of :—

- (a) A blow on the cheek, causing suppuration of its lining membrane.
- (b) Catarrh, or other inflammation of the lining mucous membrane.
- (c) The burrowing of pus from an abscess arising

in some other part of the maxilla, and usually connected with a tooth.

- (*d*) The spread of inflammation from the end of a root, which either penetrates the antrum, or is directly connected with the bone forming its floor.
- (*e*) The entrance of a foreign body from without or within the mouth, such as a piece of tape or a bit of drainage tube. Or a piece of root may be forced into the cavity, in an unsuccessful attempt at extraction.

Symptoms.—These are, in many cases, rather vague, the patient complaining of constantly suffering from a cold in the nose, or perhaps of deep-seated pain shooting up the face to the forehead of the affected side, with some tenderness of the cheek, and slight constitutional disturbance; now and then the pain is more acute, and of a sharp, stabbing, or neuralgic character. When pus is first formed, a slight rigor may occur. If the patient lies on his sound side a discharge of offensive pus occurs, from it escaping through the opening into the middle meatus, when the head is inclined towards the unaffected side. This either runs backwards to the throat, or forwards, and drips from the nostril. The foul odour of the pus is noticed by the patient himself, but not by those near him. This is important, since it is a means of diagnosing empyema of the antrum from ozæna. In this latter condition there is a very offensive discharge, which those who are near the patient perceive, but which he is unable to detect, since the perception of

smell is lost by the olfactory nerves; whereas in empyema of the antrum, these nerves are uninjured. When the patient blows his nose a sudden discharge of matter occurs, and sometimes this will be the first symptom which attracts attention, for it may be noticed before any pain is felt at all. While the patient is asleep the pus is apt to trickle down his throat and so get into the stomach, causing an unpleasant taste in the morning, with loss of appetite, dyspeptic symptoms, &c., lumps of inspissated pus often being coughed up when the patient first wakes.

When the diagnosis is uncertain it is sometimes useful to introduce a small electric light into the mouth, in an otherwise darkened room; if the antrum contains fluid or a solid tumour it will be opaque, whereas if the cavity is empty it will be translucent.

Distension of the antrum is but rarely present, since the discharge can escape into the nose unless the natural opening is closed up, and even then absorption frequently produces an adventitious one. When distension of the outer wall does occur, it is usually the result of a cyst in the wall of the antrum, rather than of suppuration in the cavity itself. In rare cases, however, the pus becomes pent up, causes bulging of the cheek and floor of the orbit, when a peculiar crackling from thinning of the bone may be observed. The pus ultimately escapes, either by the side of the teeth, along the floor of the orbit, or through the cheek; in either case necrosis usually occurs. Both antra may be affected, either simultaneously or consecutively. If the eye is pushed up,

either temporary amaurosis or permanent blindness may be produced.

Treatment. — All possible sources of mischief, such as badly decayed teeth or unhealthy roots should be removed, and the antrum opened through one of their sockets ; but if all teeth seem sound, or the gum is edentulous, the cavity should be perforated through the outer alveolar plate. If pus follows the extraction, the opening should be enlarged with a trocar, or a large drill in the burring engine. If any tooth is to be removed, and all are sound, the first molar is to be preferred. Care must be taken that the trocar is not allowed to penetrate far enough to wound the orbital floor. If the puncture is made through the outer alveolar plate, the instrument should not be carried inwards, but rather upwards. The puncture in this situation is less liable to close up, than if it is made by the removal of a tooth, and food is less likely to gain access to the antral cavity ; on the other hand drainage is hardly so perfect as when the opening is made through the socket of a tooth. The antrum must be thoroughly cleansed by syringing with warm antiseptics. For this purpose a glass syringe is far too small. If the mouth is filled with liquid, it can be driven through the opening by forcibly contracting the buccinator muscles. The course of recovery is very slow, often taking many months. If a tooth has been extracted, a plate may be fitted over the hole with a gold or platinum tube passing through it into the cavity, and through which the nozzle of a spring may be introduced, the

tube being corked up in the intervals. Or a small plate may be made of vulcanite with a peg projecting upwards into the antrum, so as to keep the opening patent, and which can be removed each time the syringe is to be employed. It is important that the injection should be varied from time to time, otherwise it soon becomes tolerated by the mucous membrane, and then ceases to be of value. The following formulæ will be useful in the treatment of such cases:

R̄	Zinc. Sulph.	...	...	gr. xvj.
	Aq. Rosæ ad.	...	...	ʒviij.
R̄	Liq. Pot. Permang.	...	...	ʒiv.
	Aq. Dest. ad.	...	...	Oj.
R̄	Zinc. Chlor.	...	...	gr. viij.
	Aq. Rosæ ad.	...	...	ʒviij.
R̄	Acidi Sulphurosi	...	...	ʒj.
	Aq. Rosæ ad.	...	...	ʒviij.

The patient should be taught to use the syringe himself, and be directed to wash out the cavity night and morning.

In extracting a root it may slip from the forceps into the antrum, and in attempting to recover it, the root may be forced over a low septum into another loculus, and great difficulty be experienced in its ultimate removal.

Hydrops Antri, or "dropsy of the antrum."
—This is a disease in which a gradual, painless dilation of the antrum goes on, until its outer wall is thinned to such an extent as to crackle like parchment when pressed upon; fluctuation being readily obtained through the attenuated bone. Occasionally

the floor or inner wall of the antrum also yields, causing flattening of the palate or blocking of the nostril. On opening the antrum through the socket of a tooth, or above the alveolar margin, a discharge of yellow serous fluid, containing scales of cholesterin, escapes. After the fluid has been evacuated, the parts gradually close up, and the symptoms disappear.

It was formerly supposed that a constant secretion of mucus from the lining membrane of the antrum took place during health, and that this was able to drain away by the foramen leading into the nose; but that if the foramen became closed the fluid collected, producing this condition of *hydrops antri*. The opening from the antrum, however, being at the upper part of the inner wall, fluid could only escape when this level was reached, and the cavity would therefore always contain a considerable quantity of liquid, instead of being an air cavity, and normally empty. Mr. Coleman has also pointed out that the fluid in *hydrops antri* is quite unlike mucus, being yellow and serous, and charged with cholesterin.

The disease usually, if not invariably, originates from the growth of a cyst or cysts, either in the antrum itself or in one of its walls, which, growing to a large size, may ultimately be mistaken for the cavity of the antrum.

Cysts of Antrum.—These may be either single or multiple, and are said by M. Giraldès to be due to dilation of the glandular follicles of the mucous membrane. They are slow in growth, and painless until large. The cysts may, of course, suppurate.

Polypi of the Antrum.—These are closely allied to the small cystic growths previously mentioned by Giraldès, being, as they are, hypertrophies of some of the elements of the mucous and submucous tissues. “When the connective or areolar tissue predominates, the fleshy polypus is produced; when the glandular element is especially affected we have the cystic form produced. When the fibrous element is very loose and we have some glandular hypertrophy, the semi-gelatinous polypus is produced, which closely resembles the nasal polypus.”—*Heath*, “Injuries and Diseases of the Jaws.”

Polypi of the antrum are very vascular. In some cases they are the forerunners of malignant disease.

Symptoms show themselves only when the polypi are large enough to cause bulging, and then it is the nasal wall which yields, and they are apt to be mistaken for polypi of the nose.

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NOTES OF LECTURE XIII.

“On Certain Tooth Tumours, Dentigerous Cysts, and Odontomes. Hæmorrhage after Tooth Extraction.”

DENTIGEROUS CYSTS.

CYSTS arise in various parts of the body other than the jaws, in which more or less perfectly formed teeth are developed; in these cases, however, the term **Der-moid cyst** should be employed; the expression **dentigerous cysts** being reserved for those cases in which the swelling occurs within the jaws, in connection with developing or retained teeth.

Dentigerous Cysts (Follicular Cysts—Sutton) arise in connection with teeth which have been retained within the jaws, most commonly with the permanent

ones, rarely with the temporary teeth. The molars are usually the source of mischief, and either upper or lower jaw may be affected; in the former case the antrum is invaded, in the lower jaw the bone is expanded, and considerable deformity is produced, the swelling being mistaken for a solid tumour.

In the simplest variety the wall is composed of fibrous tissue, and contains a glairy fluid, with the crown and partly developed root of a tooth, the tooth itself being often found inverted. This inversion, or other mal-position, suggests a probable reason for the non-eruption of the tooth and its retention in the cyst. It may generally be noticed that there is an unerupted tooth missing from the series.

The swelling arises from a thickening of the capsule and an excessive secretion of a fluid, normally present in minute quantity, between the enamel and the inner wall of the tooth follicle.

The cyst may undergo secondary changes; thus it may calcify—as it frequently does—forming one variety of odontome, or it may suppurate, this, however, being more common in the lower animals than in man.

ODONTOMES.

AN odontome has been defined as “a neoplasm composed of dental tissues (enamel, dentine, and cementum), in varying proportions and different degrees of development, arising from tooth-germs, or teeth still in the process of growth” (Bland Sutton).

Professor Broca classifies odontomes according to the period at which they arise, thus :—

1. Odontome embryoplastique—

Arising before the development of the membrane eboris.

2. Odontome odontoplastique—

Arising shortly before the formation of the cap of dentine.

3. Odontome coronnaire—

Produced during the formation of the crown of a tooth.

4. Odontome radicaire—

Arising after the completion of the crown.

By Mr. Bland Sutton, however, the following classification of odontomes is made :—

A.—Aberrations of the Enamel Organ.

1. Epithelial odontomes.
2. Calcified epithelial odontomes.

B.—Aberrations of the Follicle.

1. Follicular cysts.
2. Fibrous odontomes.
3. Cementomata.
4. Compound follicular odontomes.

C.—Aberrations of the Papilla.

1. Radicular odontomes.
 - a. Dentomata.
 - b. Osteo-dentomata.
 - c. Cementomata.

D.—Aberrations of the whole Tooth-Germ.

1. Composite odontomes.

Aberrations of the Enamel Organs.—In the first class of Professor Broca we have a fibrous tumour, in which no trace of dental tissue is discoverable, growing within the substance of the jaw, and to which it is commonly attached by a pedicle, and which can usually be enucleated from its bony casing by the finger of the operator. This tumour is not likely to be presented to the notice of the dental surgeon for treatment.

(1) *Epithelial Odontomes.*—Under the head of multilocular epithelial tumour, Mr. Eve has described a cystic dilatation of the maxilla, usually in the molar region, and more commonly in the lower, which generally shows itself at about twenty years of age, though it may be met with at any period of life.

The tumour consists of a collection of cysts of various sizes, separated by thin fibrous septa, which occasionally become ossified. The cavities contain a brownish mucoid fluid; and the growing portions of the walls, of a red-brown colour, somewhat resemble a myeloid sarcoma.

The septa are composed of branching and anastomosing rods of epithelium, originating from ingrowths of the oral epithelium; Mr. Eve suggesting that “they are epithelial ingrowths, the sole representatives of teeth long since suppressed in the process of evolution; or from an overgrowth of the normal epithelium of the gum.”

The cells vary in character, the superficial ones being columnar, while the deeper, which appear to have undergone colloid degeneration, form a stellate

reticulum, resembling the *stratum intermedium* of the enamel organ.

(2) *Calcified Epithelial Odontomes*.—If the cysts just described become solidified by calcification, the resulting odontome resembles an infinitely branched, calcified enamel organ.

Aberrations of the Follicle.—In rickety children the wall of the tooth follicle is frequently much thickened; in some cases there is a space between this wall and the root, the space being occupied by fluid, the whole forming the follicular cyst of Mr. Sutton, or a dentigerous cyst as usually described.

On the other hand, the greatly thickened capsular wall may be fibrous in structure, and not enclose any fluid, constituting then the “Fibrous Odontome,” or it may be entirely converted into cementum, constituting a Cementoma. The three varieties, being really but three stages of development, of a so-called dentigerous cyst to a fibrous tumour and from this to an odontome as ordinarily understood, the tumour thus produced corresponding with the “Odontome Coronaire” or “Odontome Radiculaire” of Professor Broca.

The Compound follicular odontome is a follicular (dentigerous) cyst in which several teeth, rudimentary or perfect, are present in the cavity.

In the fibrous odontome the tumour consists of a mass of fibrous layers, and in the Cementoma a similar laminated arrangement of tissue may be noticed.

Aberrations of the Papilla.—Radicular odontomes arise after the crown of the tooth has been completed, but while the roots are in course of formation,

enamel, therefore, never enters into their structure ; they usually consist of hard dentine and osteo-dentine in different proportions.

Radicular Dentomata are rare in man but common in animals, especially in rodents. The Radicular Cementomata are common in ungulates, in which the formation of cementum is normally large, horses being especially liable to them.

Odontomes are usually symmetrical in the lower animals, but not so in man. Human odontomes are said to be more frequently found in the lower than the upper jaw.

Aberrations of the whole Tooth-Germ.—*Composite odontomes* are those hard tooth tumours which bear little or no resemblance to teeth, but occur in the jaws, and consist of a disordered conglomeration of enamel, dentine and cementum. They may be considered to arise from an abnormal growth of all the elements of a tooth-germ—enamel-organ, papilla, and follicle.

Symptoms.—The most prominent in the case of an odontome, are inflammatory changes in the surrounding parts, with profuse suppuration, leading to the belief that the case is one of periostitis, in which necrosis has supervened. Every odontome is surrounded by a capsule on which it depends for its nourishment ; when this sloughs away the capsule becoming destroyed the odontome necroses, causing the symptoms from which the patient seeks relief.

This suggests the idea that the development of an odontome, like that of a tooth, causes little or no dis-

turbance, but that with the onset of eruption—in both cases—the trouble commences.

HÆMORRHAGE AFTER TOOTH EXTRACTION.

THE remedies employed in the treatment of hæmorrhage are divided into *astringents* and *styptics*; the former causing the vessels to contract, while the latter, by combining with the blood, cause coagulation.

Among astringents may be included cold, extreme heat, solutions of iron, alum, tannin, cocaine, &c., while styptics include such substances as collodion, peroxide of hydrogen, Richardson's colloid styptic, &c. Some of these substances, such as iron, alum, and tannin belong to both classes, since they are astringent and styptic as well.

Hæmorrhage after tooth extraction may be due (*a*) to a *constitutional condition* known as *hæmophilia*—such persons being commonly called “bleeders”—in which there is a want of coagulable power in the blood. (*b*) To an *atheromatous condition of the vessels*, often associated with a very thin watery appearance of the blood itself, the condition usually being confined to old people, in whom the gums look pale and waxy, and in whom the hæmorrhage often continues for a considerable time after the extraction of very loose teeth. (*c*) To the rupture, or incomplete severance of a small artery in the alveolus. A case of severe hæmorrhage has been reported which arose from the rupture of an artery which passed transversely through the root of a

tooth near its apex, and which was necessarily torn on the tooth being extracted.

Treatment.—In the case of bleeders extreme care should be exercised in the infliction of any wound, and a tooth should only be extracted when absolutely necessary. When this is the case the internal administration of perchloride of iron or ergot and sulphuric acid—

R	Ext. Ergotæ Liq.	...	...	℥xxx.
	Acid. Sulph. dil.	...	...	℥x.
	Aq. dest. ad...	...	...	℥j.

three times a day for a few days previous to the operation, may prevent the hæmorrhage being unduly severe. In other cases the gradual ulceration produced by wearing an elastic ligature round the root of a tooth for several days, will eventually separate the tooth from its normal surroundings, without the occurrence of any hæmorrhage whatever.

Hæmorrhage may generally be controlled by freely syringing the socket with quite cold water; or by plugging the socket with small balls of cotton wool, soaked either in perchloride of iron or solution of tannin. Under no circumstances, however, should these two drugs be employed in the treatment of the same case, or the iron and tannin will combine to form ink. Mattico leaf, soaked in warm water and rolled into a cone, with the rough side of the leaf outwards, is held in high estimation by some practitioners, while others place their chief reliance on Richardson's "colloid styptic." In some cases of hæmorrhage where other drugs have failed, an injec-

tion of peroxide of hydrogen has been immediately successful.

In addition to these remedies the greatest assistance is often derived from the pressure of a well-fitting plug, and in some instances the tooth which has been extracted will be the best plug that can be found, as it is hard and sure to be well-fitting. It should first be washed clean, disinfected, dipped in some astringent solution, the socket syringed free from partly coagulated blood, and the tooth then pushed firmly into its place. If ligatures have previously been securely tied around the necks of the teeth on either side, the ends brought over the re-inserted one and knotted together over a pad resting on its crown, sufficient pressure may be easily exerted to keep the tooth in its position. If additional pressure is needed, the jaws may be kept firmly closed by means of a four-tailed bandage passing beneath the chin and over the head.



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