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COMMUNICATIONS

ORAL SEPSIS IN RELATION TO OPHTHALMOLOGY*

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Introduction

THIS lecture was founded in 1888 by Richard Middlemore to be given annually on some subject connected with ophthalmic science and practice; it is doubtful if at that time oral sepsis would have been considered such a subject, although Middlemore was a man of such wide knowledge and liberal views that he was probably aware of its importance, and the following opinion of approximately the same date as the foundation of the lecture is interesting. Dennant (1891): "They knew that the teeth affected the eyes, the ears, the throat and the nerve centres generally; therefore more good would come, both to the public and the medical practitioner, if they had more frequent communion and consultation."

Early mention of the subject was by T. Harrison Butler (1911) when he said "I am of opinion that a large proportion of the 'doubtful' cases of iritis are really due to dental sepsis."

Previous Middlemore lecturers have been well aware of the importance of oral sepsis in connection with ophthalmology as

* The Richard Middlemore Post-Graduate Lecture, 1941, given at Birmingham and Midland Eye Hospital, December 12, 1941.

at least a dozen times in the past twenty or so lectures the subject has been mentioned at length.

In view of the seriousness of eye disease it is well that oral sepsis be considered and looked for in all ocular conditions however apparently trivial they may be, for example when the eye or its adjacent structures are the subject of trauma, septic foci which have appeared quiescent hitherto have an opportunity of giving trouble; bodily resistance can, for example, face a 20 per cent. load of sepsis, but when local resistance is diminished bacteria or toxins which have been circulating without apparent ill-effect have an opportunity of establishing a colony from which they are not easily dislodged.

Practice and literature show in dramatic fashion the close association of eyes and oral sepsis, but the more humdrum routine treatment also shows the value and importance of a full investigation of the mouth.

Rehabilitation is much to the fore just now and whatever can be said about preserving occupational skill, earning power and early return to work in connection with limbs and hands, applies, with at least equal force, to the "industrial eye."

"Badness" of teeth may be present in spite of dental treatment and it is a matter of carefully balanced judgment to decide how the teeth may have even a remote effect upon the eye lesion present.

"Trouble" with teeth frequently means "pain," in the minds of patients and consultants alike, but sepsis is often without pain.

Our own teeth are more efficient than the finest dentures, and we are all anxious to escape them as long as possible, thus we are apt to preserve units which have long been no more than masses of filling material, useful for mastication, but sometimes highly dangerous, as carefully preserved teeth are frequent causes of trouble.

Common Aims

The interests of medical and dental science are inseparable, and close co-operation between doctors and dentists in the conditions in which oral sepsis is causal or contributory, cannot be over-emphasised.

The great majority of dentists are not doctors, though some medical training forms part of their curriculum. On the other hand, in the case of the medical student, the teeth and their diseases are almost entirely ignored. The services rendered by dentists are as valuable as those given by medical practitioners, even if they are not so dramatically urgent, and their part in the preservation of health is as great as that of doctors.

Different points of view.—Oculists, like dental surgeons, are specialised, but as their training and associations are essentially

medical, they never lose touch with their original background and are a part of the general medical body. Dental surgeons are trained separately, are not part of the general medical body, and unfortunately they have no common medical meeting ground such as exists for ophthalmologists and *all* other branches of medicine, and there are very few journals which cater for both.

As to outlook, the medico looks on the teeth, at times, as culprits standing between his patient and health, the dental surgeon regards them as objects of utility on which he has spent skill and care, and is naturally loth to sacrifice them; and contrary to medical opinion there is a strong feeling among dentists that teeth can be root-filled and yet remain sterile.

The practice of dentistry is at least dual:—

(a) The maintenance of appearance and mastication (put in this order deliberately).

(b) The elimination of sepsis.

Medical men will realise that these two functions of dentistry may be mutually opposed, and in (a), teeth may be treated and retained when condition (b) would urgently indicate their removal.

Until all concerned (the laity especially, and women mostly) can be convinced *beyond any shadow of doubt* that oral sepsis is really a menace to health, comfort and happiness, there will be little enthusiasm for what is at least a mutilating operation, and at best a psychological disturbance.

Consultations.—There should be more contact between consultant and dental surgeon, as then each practitioner would appreciate the special points necessary in treatment.

Verbal messages should never be sent via the patient, otherwise serious misunderstanding may arise, and has in fact frequently occurred; an early dental opinion should be sought more frequently; often a dental opinion is asked for, after months of ordinary treatment; and while oral sepsis is not the be-all and end-all of eye treatment surely the oculist's work is facilitated if one potent source of sepsis, at any rate, is eliminated.

What is Oral Sepsis?

Hunter originated the term and thus described it (1930): “ ‘ Dental Sepsis ’ seemed to me to place the whole responsibility of dealing with the subject upon the dental surgeon, whereas my whole thesis was that the first responsibility for recognising and appraising the possible importance of the sepsis presented in the mouths of his patients, rested, in the first instance, upon the doctor in charge of the case. It was to emphasise this fact that I devised the alternative name of ‘ oral sepsis ’.”

The degree of oral sepsis cannot be expressed in terms of

"infected teeth" only; it must have regard to all the other conditions present, such as gingivitis, tartar deposit, ulceration and pocketing, pyorrhoea, periodontitis and osteitis shown by recession of gums or looseness of teeth, or by thickening of alveolar margins, and conditions revealed by radiographs of apical abscesses and granulomata, buried roots, or impacted or unerupted teeth.

Oral sepsis far exceeds that of any other form of focal infection, and the amount and character of the systemic effects which may be produced by any particular degree of dental sepsis depend upon the character and virulence of the particular infection that happens to be present, and also upon the degree of resistance the individual patient may be capable of offering.

GENERAL.—Oral sepsis may be "open" and recognisable, or by contrast "closed" and concealed, and yet causing severe systemic effects; "open" is for some reason considered less dangerous than "closed" because, perhaps, much of the inflammatory discharge is received into the mouth and swallowed, but the important aspect of septic absorption *at the site* of the inflammation must not be ignored; the amount of toxic absorption from the gum margins in a case of definite pyorrhoea is much greater than that from a few apical granulomata, as in addition to discharge into the mouth, they are also absorbed over an area much wider than the apex of a tooth.

In acute conditions organisms are violently introduced into the tissues, while in the chronic form they are successfully confined to a necrotic nidus and the reaction is due to the absorption of their toxic products.

Transmission may be by:—

- (a) Direct extension.
- (b) Lymphatic and venous extension.
- (c) The general blood supply.
- (d) Swallowing pus, and its effect when absorbed from the bowel.
- (e) Neuropathic transmission of antidromic impulses as a result of septic irritation of nerve endings.

Although there is a considerable body of opinion that oral sepsis is an important factor in disease, there is also a feeling that the focal infection theory has failed because of the absence of statistical evidence, *i.e.*, Koch's postulates are not satisfied, but when removal of affected teeth is carried out with little or no relief to the patient, secondary foci have probably become established.

OPEN.—There are two varieties of pyorrhoea, "dry" and "moist"; in the former the gums retain much of their normal healthy appearance, and there is no flow of pus, but radiographs show that the alveolus has been considerably absorbed.

"Pocket" formation is one of the most important characteristics of pyorrhoea, as pockets are seats of chronic inflammation.

Several of the manifestations of pyorrhoea remain after vigorous local treatment such as :—

Absorption of the alveolus around the body of the tooth, or at its apex;

absorption of the apex itself;

"festering" of food and other debris within the alveolar "pockets";

"valve action" between adjacent teeth, slightly loose, which allows food to pack between the teeth, and remain trapped.

The size of the absorptive area of a severe pyorrhetic lesion of only one average tooth may be nearly as large as a postage stamp.

"Gum boil" is open drainage of an apical infection, and should not be disregarded.

Ill-fitting crowns and bridge work causing stress on the teeth or gums, ill-fitting dentures and dentures which have outlived their allotted time are also causes of sepsis; vulcanite, naturally porous, becomes in time the seat of bacterial activity, causing inflammation of the mucous membrane of the mouth, formerly called "denture sore mouth," and the septic material is "sucked" across the palate by capillary attraction and to other teeth not previously affected.

Dentures are often worn too long, causing first a mucous membrane which is chronically inflamed, and a ready means of absorption of toxic products, and secondly "buccal" ulcers, so slow and chronic that often the patient is unaware of their presence, which are most resistant to treatment.

The "pumping action" of dentures and loose teeth causes infected lymph from the mucous or periodontal membranes to be forced into the blood-stream, resulting in transient bacteraemia at each meal-time.

Dentures worn for too long, cause alterations within the temporomandibular joint often followed by pain of "trigeminal" type.

"Closed" sepsis is principally concerned with death of the pulp as a result of caries, but other conditions, mainly found as a result of radiographic examination, are buried roots, unerupted teeth either of the normal series or supernumerary; buried retained deciduous teeth; sclerosis of the bone surrounding the site of teeth present or missing.

The medical man who lacks dental training should be careful in expressing opinions on tooth conditions; for example, a gold filling may be much better and healthier for the patient than one which matches the tooth, but the former is likely to be criticised and the latter ignored; crowns are of two varieties: the "cap" which merely fits over the reduced crown of a vital tooth or the

" post " crown which is retained by means of a post which replaces the pulp of the tooth.

" Pulpless," " devitalised," " root-filled," " dead " and other such terms are used in connection with " non-vital " teeth ; death of the pulp may occur as a result of caries or trauma, and Manley (1941) has shown that while injury to the dentinal fibrils in cavity preparation is negligible, the chemical composition of many filling materials causes a marked reaction, often leading to sepsis and destruction of the pulp.

The dental surgeon in his desire to preserve the normal appearance and efficiency of the mouth, or to avoid dentures, for example, in the mouth of a young person, may deliberately destroy and remove the pulp ; a partial circulation and some nourishment is maintained by the periodontal membrane, but insufficient to prevent sepsis, and the present tendency is to reserve this method of treatment (sometimes combined with apicectomy) for anterior teeth.

Let it be understood that there is no difference in deadness, between " death of the pulp " as a result of caries, or deliberate devitalisation by the dental surgeon, and nothing can be done to make these teeth aseptic, whatever care may be taken in removing the contents of the root canal and replacing with antiseptic material.

A writer (*Jl. Amer. Med. Assoc.*, March 25, 1933, p. 974) has estimated that 80 per cent. of the adult population of U.S.A. have root-filled teeth positive to cultural examination, but only 70 per cent. show radiographical evidence of apical infection.

NEURO-TOXIC.—Oral sepsis is a cause of eye-symptoms in young women, sometimes diagnosed as early disseminated sclerosis, but the condition disappears after dental treatment. (Lindsay Rea, 1938.)

J. Jameson Evans (1933) says that ophthalmic disease is often confined to the eye which is on the same side as the primary " infective " focus, and ascribes it to a (long axon) reflex commencing in irritation of the nerve-endings of the second or third divisions of the trigeminal, whence it becomes antidromic by crossing to branches of the first division. Antidromic impulses appear to dislocate vascular reflexes and cellular activity, though probably other undetermined factors are also concerned. The short axon-reflex is salutary and protective ; the long axon-reflex, antidromic and noxious, accounts for the incidence of secondary lesions on the same side as the primary lesion.

Reflex neuroses may be sensory, motor or vaso-motor in type, genuine examples of the reflex action of one diseased tissue on another with which it has intimate nervous connection (J. Jameson Evans, 1918).

Such impulses may arise from a constant stream of small oral

irritations, which gradually irritate the Gasserian ganglion; the teeth in a given case may be "sound" but our conception of what constitutes a sound tooth has changed in the last few years, other causes are:—

Irritation of dentures pressing upon the mucous membrane and nerve endings, and stripping the gum from the teeth; adjacent fillings of dissimilar metals; too much mercury in fillings; irritability of teeth due to fillings; traumatic occlusion; pulp stones; strain on the temporo-mandibular joints due to the bite "closing"; obstructed eruption of a "buried" tooth.

The association of "blinking" and blepharospasm as a reflex from dental irritation, even in the mild degrees associated with orthodontics, has been noted; and the onset of concomitant squint is often associated with "teething."

RADIOGRAPHS.—Radiographic examination is essential in assessing oral sepsis, and should be accompanied by the clinical opinion of a dental surgeon. There may be no apparent evidence of definite lesions such as periodontitis or apical infection, or of rarefying or sclerosing osteitis, yet on inspection of the mouth abundant evidence may be present in the form of gingivitis, pocketing, marginal ulceration or other forms of sepsis; so, if the radiographic evidence is "negative" it should be ignored and reliance placed upon the clinical experience of the dental surgeon. On the other hand radiographs may be the only evidence of alveolar absorption, cysts, unerupted teeth, buried roots (examination for these should never be omitted in "edentulous" patients), supernumerary teeth, sclerosis, and residual infection.

ANATOMY.—Anatomical considerations suggest that direct infection arises in the upper jaw alone and affects the same side, whereas indirect infection can originate in either jaw and affect both sides. By blood stream and lymphatic route, both eyes should be affected, but this is not always so, because one eye may have a greater vulnerability from some intrinsic derangement.

The eyes and teeth are connected by bone; the apex of the upper canine tooth is very close to the floor of the orbit, which is the upper part of the maxilla. During development the orbital plate is in close proximity to the developing teeth, and the antrum separates them only as the skull grows. *Fascia*: Orbital fascia is continued from eyeball to sides of cavity and closely connected to the over-lying conjunctiva; forms the upper layer of the infra-orbital canal and passes through the infra-orbital fissure to become continuous with the fascia covering the bones of the infra-temporal region. Direct spread is thus possible along the fascial planes of the buccal sulcus, via the periosteum of the facial bones to the periorbital and through bone to the floor of the orbit.

Actual bone disease of the alveolar process of the maxilla may

extend to the orbital wall. The nerve supply of the upper teeth arises from the infra-orbital canal, and its branches run in the outer wall of the antrum.

The nasal duct is another close association of mouth and eyes as, during development, its anterior end has been traced into the incisive canal.

Lymphatics: Perivascular lymphatics are in direct continuity with the lymph spaces of the eye and the perineural lymphatics of the optic nerve; lymphatics from the upper teeth run into the infra-orbital foramen, and after circulation through the various layers lymph follows the veins into the lymph spaces of the optic nerve. Lymphatics accompany some of the veins through the sphenomaxillary fissure.

Veins.—Alveolar branches of the pterygoid plexus communicate with the ophthalmic veins and cavernous sinus. The angular vein arises from capillaries in the premaxilla and in direct connection with the inferior ophthalmic vein.

Nerves.—Intimacy of the nerve supply of teeth and eyes, and neuritis of nerves in tight canals in the maxilla emphasise the neuro-toxic aspects.

All the above refers mainly to direct spread, indirect depends entirely upon the arterial blood stream conveying toxins and bacteria to predisposed areas.

BACTERIOLOGY.—The streptococcus is constantly present in the necrotic areas found at the apices of pulpless teeth; many teeth, symptom-free and radiographically negative, on being examined after extraction, are found to be infected. Bulleid has shown that many teeth of low vitality are infected with streptococci, and another writer states that out of 278 pulps of vital teeth examined, only 108 were sterile; impacted teeth are usually infected.

Even when actual bacteria cannot be demonstrated, toxins may be present, and allergy cannot be ignored. There is probably some modified form of selection at work—for example, strain, proneness to injury, “seed and soil,” although Rosenow’s hypothesis of selectivity is not completely confirmed.

Sensitisation in the tissues of the eye probably arises from organisms or toxins in the blood stream, and recurrences of inflammation are excited by minute quantities—so minute as to be otherwise ineffective, or by agents which in the normal state would be innocuous.

CLINICAL.—Over twenty years of experience of oral sepsis in ophthalmic conditions strengthens the writer’s opinion that practically all patients are benefited by prompt and early oral treatment, and in this opinion he is supported by his ophthalmological colleagues. The medical literature of the world has contained so many papers confirming this opinion that there is no need to stress

the general aspects; all recent ophthalmological textbooks mention the association, some fully, but others show lack of knowledge as to what constitutes oral sepsis; for example, one standard textbook merely devotes a few sentences to "pyorrhoea." With so much general agreement there is no need to emphasise any particular relationship, nevertheless, all the evidence shows the especial association of oral sepsis with disease of the uveal tract.

The various routes of infection have already been indicated but in regard to glaucoma some special consideration is justified. Helmore (1935) asks: can increase in tension in glaucoma be due to peripheral irritation of the fifth nerve causing an undue increase of fluid excretion from the vessels of the choroid or retina, sufficiently suddenly to block the filtration angle? and is answered by P. Jameson Evans (1939): congestion and inflammation are factors in glaucoma (acute and chronic), and primary glaucoma is essentially a symptom complex of vascular origin, capillary and venous stasis resulting from disturbance of the local circulation.

He emphasises the frequency of glaucoma originating in peripheral irritation in the fifth nerve area; in treatment, he says, "one must consider first the connection of venous and capillary stasis—fortunately to be found in most instances in the neighbouring organs, *e.g.*, nose, sinuses, teeth—elimination of all septic foci and sources of irritation must be ensured." Dysfunction of the sphenopalatine ganglion has been suggested as the cause of glaucoma, and there is evidence that vasotoxic substances liberated by nerve action, and entering the eye by the blood stream, may be causal.

Cavernous sinus thrombosis of dental origin usually arises from upper incisor teeth, but it has arisen from foci so remote as impacted lower third molars.

Cases have occurred in which an opinion has been given of "no oral sepsis," and later, after further investigation, a consultant has found granulomata, dead teeth, buried apex etc., which emphasises the fact that the dental surgeon cannot satisfy himself of the absence of oral sepsis without a complete radiographic and clinical examination (often accompanied by casts of the mouth).

Severe eye conditions may arise from apparently trivial dental lesions; there is no means of measuring the amount or virulence of an infection and where an eye is in jeopardy and search for other causes has failed, a *suspicious* tooth should be extracted without hesitation.

One of the most important clinical aspects of oral sepsis is the importance of ensuring a clean mouth prior to eye operations; if this were a routine measure there would probably be a reduction in the incidence of sympathetic ophthalmia and more acute forms of post-operative sepsis, showing that lymph spread is a possibility

or else that there is something in the elective nature of the bacteria or toxins.

Archer-Hall (1941) says: "sympathetic ophthalmia is a destructive inflammation of the whole uveal tract caused by:

- (a) organisms in blood stream;
- (b) toxins in blood stream;
- (c) allergic phenomena;
- (d) direct spread by lymphatics in the optic nerve of injured eye, optic chiasma, and optic nerve of uninjured eye.

Robust, adult males with sound teeth and healthy accessory sinuses are most resistant to the disease."

This author also says that oral sepsis is important in the aetiology of acute hypopyon ulcer of the cornea, and in numerous papers emphasises the importance of oral sepsis in acute eye conditions.

TREATMENT.—It is important to give very careful thought to extraction of teeth in all eye conditions; in one case, hospital in-patient or nursing home conditions may be better, and many teeth removed at one operation, under proper surgical conditions; but usually, one or two teeth only should be removed at a time, and a suitable interval allowed for recovery, not only orally but of the patient generally, and especially of the eyes.

Extraction of even one tooth may sometimes be followed by an acute exacerbation of the ocular condition; which is an encouraging sign, *but the patient should be warned of this possibility*; and there may be pain in joints or muscles in addition.

When extracting septic teeth, a suitable combination of surgical measures, cutting the gum, drilling away a small piece of bone, and gently lifting out the tooth, will cause much less local trauma and consequent absorption of toxic material into the blood stream from "bouncing" the tooth in its socket.

Special precautions are necessary at the time of extraction if bacteriological investigation or vaccine are desired.

Gaping wounds and sockets, bounded by sharp irregular expanded bone, encourage the harbouring of food and further sepsis, but much of this is avoidable by careful planning of the operation, avoidance of tearing or stretching of the gum, removal of rough bony edges, sutures where necessary, and a gentle pack of B.I.P.P. in the socket for the first few hours after operation.

Curettage of the socket is rarely necessary, and may actually cause the spread of sepsis from an infected apex by opening up further channels of toxic absorption.

As to anaesthesia, in all cases of oral sepsis local submucous injection should be avoided and reliance placed upon general or regional anaesthetics.

Recommendations

Each ophthalmic hospital should have a dental surgeon, who should examine all patients, frequently with full oral radiographs; while desirable, it may be impossible to examine all out-patients but a dental opinion should be obtained in the case of all in-patients at the *earliest possible moment after admission*.

Large hospitals might have one or more visiting honorary dental surgeons experienced in the importance of oral sepsis, to diagnose and suggest treatment which could be carried out by junior dental officers.

Patients are much benefited by a stay in hospital for a night or two after dental operations, some of the more drastic of which should be performed in the recumbent position in a suitable theatre.

The attendance of dental surgeons during the usual visiting periods of other members of the staff, would allow opportunities for co-operation and consultation to the ultimate benefit of patients.

It is only in such a manner that complete statistics can be obtained and a definite appreciation of the ophthalmological importance of oral sepsis worked out; if there is no dental record of the thousands of new patients, it is impossible to assess the results of elimination of oral sepsis in the hundreds who are treated.

Finally, there should be on the staff of every medical and dental school a lecturer with knowledge of medicine and dentistry, to put before a mixed audience of students of both, the various aspects of the subject of oral sepsis and its associations with general conditions, so that students in their formative years will understand each other's work and have, at any rate, a minimum basis of knowledge of the dual nature of some of their work.

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