by the fact that his procedure was to tie the inferior thyroids close to or within the capsule of the gland. In 22 cases in which De Quervain tied the trunks of all four arteries no sign of tetany occurred subsequently.

At a later date it is hoped to supplement this paper with a detailed record of cases, but the object here has been to draw attention to the benefit of quadruple ligation in certain bad cases of exophthalmic goitre, and to put forward one or two points in technique with the hope that they may prove useful.

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DENTAL SEPSIS AND SEPTICAEMIA.*

BY

E. M. BROCKBANK, M.D., F.R.C.P.,

HONORARY CONSULTING PHYSICIAN, ROYAL INFIRMARY, MANCHESTER.

ILLNESSES secondary to foci of infection situated about the roots of the teeth are known to be very common, but are apt to be overlooked. The infection may arise from: (1) An abscess at the roots of crowned or filled teeth which apparently are perfectly sound and causing no trouble whatever. (2) Nodular collections of organisms on the roots of the teeth. (3) Absorption of the alveolar process of the jaws, generally associated with more or less visible pyorrhoea, which leads to retraction of the gums and greater or less exposure of the roots of the teeth. (4) Tartar on the teeth.

Whenever a person is suffering from some illness of painful, debilitating, or infective nature for which no other cause can be found the teeth should be carefully examined. Visible pyorrhoea in small or profuse amount may be present, and swelling and inflammation of the gums and interdental papillae; or retraction of the gums may be very obvious. On the other hand, the teeth may be a picture of excellent crowning, bridging, or conservative filling work with healthy gums and yet harbour septic organisms.

It is therefore advisable to have all filled and crowned teeth or protruding teeth examined by x rays, because frequently it is by this means alone that serious septic lesions can be found. The films must be taken by an expert dentist or x-ray specialist used to dental film work; otherwise it is difficult to interpret the results accurately and unnecessary extraction may be done. Ill informed and inexperienced interpretation of x-ray films is responsible for much unnecessary extraction of teeth and disappointing after-results on the one hand, and for the overlooking of septic foci on the other.

The results of absorption of poison from infective teeth vary in an extraordinary way, and are in no way related to the extent of the dental sepsis. Some of the worst cases arise from small foci revealed only by x-ray examination; on the other hand, a marked degree of chronic purulent inflammation of the alveolar process of the jaws may be present, with visible pyorrhoea, teeth covered with tartar, and with foul breath, and yet the subjects enjoy rude health. Either these people's powers of resistance are perfect or the absorption of toxins is not so great where there is free escape of pus.

When septic absorption takes place the metastatic infection, whatever its nature, may run a definite course for a week or a few weeks and then clear up, Nature having produced efficient antibodies to neutralize the invading

toxins. There may be no return of bodily trouble for months or years. Then another outbreak of similar or different nature may occur. For instance, in one patient there was a violent painful inflammation of the tonsil like diphtheria which lasted ten days. Recovery took place, but in a year or so a severe acute painful neuritis and cramp affecting the nerves and muscles of the legs, especially of the feet, developed and lasted three weeks. X-ray examination showed extensive infection of the roots of the teeth, and wholesale removal has resulted in good health.

It is because of the use of x rays in investigating the condition of the teeth that more attention is being paid to general illnesses which can arise from dental sepsis than was paid ten years ago. I remember patients in private practice in my past experience, who had acute illnesses or who died, and in whom no satisfactory explanation of the toxic process was ever given. I often think of one man especially who had a virulent infection with a rash, which I took a fever specialist to see, and which was not scarlet fever. He died. I do remember that he had very bad teeth, but it was many years before the days of dental x-ray work. I do not refer to hospital cases in this paper.

There are two broad types of affections caused by sepsis of the teeth: one unaccompanied, and one accompanied by a rise of temperature.

1. *Apyrexial Affections*.—The common illnesses arising in this way are generally painful, such as myositis, fibrositis, neuritis, arthritis, or phlebitis. Affections of the stomach simulating ulceration and malignancy may, in my opinion, be caused by dental sepsis, and probably biliary infections as well. I always have the teeth of cases of indefinite gastric nature examined, and in many instances removal of septic teeth has relieved the complaint of the patient. A common type of apyrexial complication is an adult of 40 or more who has attacks of rheumatism or neuritis which affect any part of the body, come on at any time without exposure to wet or cold, but especially if the person is run down or overworked. The pain and stiffness may be very great, allowing lying down in only one stiff position to avoid pressure on the affected muscle or nerve, and causing a very crippled gait. Sleep without anodynes is impossible. If such a person has any septic teeth they are almost certain to be the cause of the trouble, and their removal will result in cessation of the pains, though, it may be, only after some months in long-standing cases. One interesting case I am watching now is a young gentleman farmer, aged 25, who has had three attacks of painful myositis, etc., affecting the neck and back, for which there was no cause like exposure to weather. He had an excellent set of his own teeth with only one filled molar. This we had x-rayed. The roots were not clear like those of the other teeth, and as it was a dead tooth it was removed, and definite evidence of sepsis about the roots was found. It is at present too early to say whether we have removed the cause of the "rheumatism."

2. *Pyrexial Affections*.—Among affections accompanied by a rise of temperature are inflammation of the throat, acute tonsillitis, arthritis, phlebitis, bronchopneumonia, and septicaemic conditions generally, including septic endocarditis. The temperature varies from a simple septic evening rise and morning fall lasting weeks or months to daily rigors of severe type lasting days or weeks or longer. In one case I will refer to it was more like rat-bite fever than any other condition I know of. In some cases it simulates that of irregular typhoid or paratyphoid infection, and Widal tests should be done to check diagnosis. Death has occurred in two cases in private practice under my observation.

PHYSICAL SIGNS AND SYMPTOMS.

Myasthenia Cordis.—One of the most important and commonest symptoms of dental toxæmia even in apyrexial cases is shortness of breath on slight effort—what I may call myasthenia cordis. This was the only complaint of one patient, and it had troubled him for many months. It may persist for several months after the offending teeth have been removed and the acute symptoms have passed off. There may be no evidence of dilated heart in these cases unless there is some associated anaemia; merely some inability on the part of the heart muscle to carry on the

* A paper read in opening a discussion on focal sepsis at the Manchester Pathological Society, December 9th, 1925.

circulation, and possibly the right side of the heart is more affected than the left because there is no oedema of the legs.

Lungs.—When the lungs are involved the condition is apparently a more or less extensive moistness or oedema not restricted to one part, with general crepitations varying in character and amount, and worse at the base. There is not much sputum. If the septic poisoning is extensive a widespread septic bronchopneumonia develops in one or both lungs, and death will probably result unless the teeth be removed.

Oral sepsis is one cause of delayed resolution in lobar pneumonia, and it may affect the course of the disease.

Nephritis in two of my cases began as albuminuria, followed by haematuria.

Phlebitis was a prominent complication in two of my cases, and directed my attention to the mouth. In one instance the man died of septic pneumonia; in the other the woman had a bronchopneumonia, which was a long time in clearing up.

An erythematous rash was a persistent complication in Miss Q.'s case; and it was present in the case I have already referred to which simulated scarlet fever. I have seen extensive erythema nodosum on legs and arms when the teeth were very septic.

Throat Affections.—Dental sepsis is a very common starting point for acute throat infections. Whenever there is a septic inflammation of the tonsils or pharynx which is not true diphtheria the condition of the teeth must be looked to. This is especially important in people who are subject to recurring throat trouble. Not only may there be a tonsillitis, but a profuse pharyngitis is common in dental sepsis.

Anaemia is sometimes a marked consequence of dental sepsis. The patient may look as if he were suffering from pernicious anaemia, but the anaemia is of the secondary type, with low colour index. I have never found extraction of teeth relieve true pernicious anaemia. Not uncommonly the teeth and gums are in a bad state in this disease, and removal is necessary as part treatment, but cure does not follow. I have not been able to get proper blood or bacteriological examination done in my cases. Many of them were seen in their own homes, and remote from such facilities. When I have had blood smears to examine there has been no definite departure from the normal in the number or characters of the leucocytes.

TREATMENT

When obvious dental sepsis with inflamed and even bleeding gums is present in a case of septicaemia; and for which no other cause can be proved, the teeth should be extracted. Generally there is only a reduced number of teeth present, and they can all be extracted with safety: Bleeding is not likely to be as troublesome when many teeth are removed as it is for a single tooth or two teeth, the shock to the peripheral vasomotor system being so great that the arteries contract. The shock of extraction in all my cases has been very little; what bleeding has taken place has done good, and the temperature has soon come down to normal. I have had several infected teeth removed when there has been bronchopneumonia present. A skilled dentist will take only a few minutes to remove many teeth, and the anaesthetic for this time has so far done no harm to my cases with pulmonary complications. If most of the teeth are still in the mouth the worst half could be removed at one time and the rest cleaned with

carbolized dental pumice-stone powder and the gums painted with half-strength tincture of iodine daily. This cleans up a mouth very much, but will not remove the deep-seated sepsis.

Cases with No Visible Sepsis.

CASE I.

Mr. X., aged 40, in September, 1923, had a rigor followed by acute proctocolitis of septic bronchopneumonia type. Empyema developed from a virulent streptococcal infection. One week after the empyema operation he had nausea, his feet swelled, and the urine contained albumin and blood with streptococci and *Bacillus coli*. The nephritis lasted until Christmas, 1923, when he got up for the first time. Before getting up the temperature was normal; but his pulse rate kept at 120, rarely below 100. In May, 1924,

His pulse was still fast and he was easily short of breath, but he felt better and resumed work in June. For seven weeks he felt comparatively well, then he began to suffer from appalling headaches and had to go to bed. The temperature was only 99° . Then intense soreness and swelling at the head of the radius bone came on rapidly like an acute inflammation of a joint. His temperature was then rising to 102° at night; he also had pains in his back and right shoulder, which lasted three days and kept him on his back. The elbow-joint pain passed off without any pus forming.

Widal test negative. In October, 1924, x-ray examinations showed that there was no collection of pus in the chest. I found, however, that he had two old filled left molar teeth which had never given him any trouble. X-ray examinations showed abscesses at three of the four roots. The teeth were extracted and there was a reaction of temperature in twenty-four hours to 102°, and other slight reactions until a spicule of necrosed bone came away from the seat of extraction. The temperature then settled down and he gradually got back to his former health, but only after a period of eight months.

CASE II.

Miss Q., aged 28, was seen in March, 1925. For weeks before she had had severe pains all over, and in most of the joints, especially in the knees and ankles. There were daily rigors with temperature of 105°. She had an erythematous rash over the body as well. There was no obvious cause of the rigors, but the mouth was full of crowned teeth. These teeth were removed and the subsequent history is very striking. Her doctor writes:

"Miss Q. made a good recovery, though only after seven months' illness. For a month after the teeth were extracted she continued to have a daily rigor and high temperature, usually 105° or thereabout. On one occasion it reached 107° (taken by her mother).

After a more severe attack

of headache and sickness than usual the attacks came every second day, the temperature reaching between 103° and 104° , with very little headache and great improvement in the general state. This periodicity lasted about eight weeks. Then the attacks came every day (temperature about 102°) for six weeks up to the end of August. During September the attacks came mostly every second day (occasionally on the third). In the early part of October they came every third day. In the second week of October she had a very severe attack with violent headache, sickness, and prostration, the temperature reaching 104° ; the next day she was fairly well, and on the day following that a

slight attack—temperature 101°. Since then (the middle of October) there has been no fever and she has felt quite well. With every febrile attack she had a renewal of erythema, chiefly blotches; sometimes nodes on the arms, and pains in the joints, chiefly the ankles. Her mother and herself are quite certain that she had attacks of the same kind as in this illness, though much slighter, at intervals during the last two years. During this time they recollect her having red blotches on the lower part of the neck."

The dentist reported that there was some pus in the pulp cavity of one or two of the teeth; only in one tooth was there any trouble at the apex, and that only beginning.

CASE III.

Mr. E., aged 26, was well until three years ago. He had diphtheria in 1924. In June, 1925, he had swelling and pain in the glands in the neck below and behind the right ear. Temperature 102°. As the pain and swelling persisted the glands were opened; no pus came away, but only a brown thin discharge. Two days afterwards marked albuminuria developed, and in another day haematuria. Temperature of septic type with evening

Type of temperature. Widal test negative.

Type of temperature for weeks.

rise to 101.5° or 102° continued. I saw him six weeks after the onset of the adenitis. On examination it was found that he had five or six molar and bicuspid teeth which had been filled for five years, and when asked if they had caused trouble, said "No, except that two of them became tender on the day of the operation." The teeth were examined by x rays and absorption of the roots of those which had caused pain at the time of the operation was found. The other teeth were indistinct and suggested absorption. All doubtful ones were extracted and the patient has improved steadily since. The diphtheria may have been a septic condition secondary to focal sepsis.

Cases with Visible Sepsis.

CASE IV.

Mr. F., aged 45, for three weeks in 1923 had felt very ill and unable to carry out his work as a baker, although he did not go to bed. His temperature was rising to 101° and 103° at night; he had incontinence twice, and on one occasion had a kind of fit. The mouth was very foul, the gums being inflamed and bleeding easily. Although seriously ill (it was felt that he was dying) all the teeth were extracted. He recovered after this and has been quite well since. He was said to have had a similar illness sixteen or seventeen years ago, from which he recovered. This I believe to have been a slighter attack arising from similar though less virulent dental sepsis.

CASE V.

Mrs. O., aged 67, had pneumonia in March, 1924; it was apparently lobar pneumonia of the left base. This cleared up very slowly and three months later she developed oedema of the left leg. The temperature had been normal for a few weeks, but began to rise again three weeks before I saw her the second time. The mouth was very foul with septic incisors and canines. She had not visited a dentist for twenty years. The teeth were dealt with as soon as possible and she gradually got back her usual health.

CASE VI.

Mr. J., aged 49, was seen in November, 1925. In July he had an attack of "influenza" with high temperature but with no physical signs. Since then he was constantly short of breath, which varied in degree, and he found all stairs trying. A few days before I saw him he had a similar attack of feverishness. His temperature rose to 102° in the evening; the spleen was palpable, the Widal test negative. A few moist sounds were heard over the bases of the lungs, especially the left lung. He had had a cough in recent winters. There were no teeth in the upper jaw, but eight or ten in the lower jaw were in a very septic state and he had pharyngitis. He was too ill to do anything, and he died in a few days of septic intoxication and bronchopneumonia.

CASE VII.

Mr. E., aged 47. This man's illness began with phlebitis and oedema in the left leg, which lasted ten days and was clearing up when the right leg became involved. I saw him at this time, and, looking for a cause, found a very offensive condition of the mouth, pus exuding from round all the teeth and stumps and spongy inflamed gums. The man was so ill that immediate treatment was thought necessary, and he was removed to hospital for it. He died, however, of septic pneumonia in thirty-six hours, and before the teeth could be dealt with.

CASE VIII.

Mr. K., aged 34, felt so debilitated that it was feared that he might have pulmonary tuberculosis, which was in the family. I could find no sign of organic disease anywhere. In the mouth he had five very fine specimens of crowned teeth which had been there for five years and had caused no trouble. X-ray examination showed seven teeth to be diseased at the roots. They were removed, and progress to usual health followed—slowly, as it does in most cases of dental sepsis.

CASE IX.

Mr. A., aged 54, complained of palpitation and shortness of breath on very slight effort and of easily getting tired. He was definitely anaemic and a blood count showed red blood cells nearly normal (4,700,000), colour index 0.6 only; no special changes in the white cells. He had some slight dilatation of the heart. His teeth looked very suspicious; there was a protrusion from the gums, but there was no marked pyorrhoea. X-ray examinations showed that there was a great deal of deep-seated sepsis. After necessary extractions by his dentist he began to feel better and soon got perfectly well.

CASE X.

Mr. M., aged 40, underwent operation for gall stones in November, 1925. Three weeks later double quinsy developed, with thirst, polyuria, and glycosuria; insulin was given. On December 7th bronchopneumonia affecting the bases of both lungs supervened, with pink sputum, a temperature rising to 103.5°, and an occasional rigor; he was very delirious at night. The teeth and gums were very septic; removal of the teeth was advised, and done the next day (December 12th), though he was extremely ill. Improvement followed almost at once, and recovery in a few weeks with no glycosuria.

I could give notes of other similar cases in private work and many from hospital practice.

DENTAL CONDITIONS LIKELY TO FORM SOURCES OF INFECTION.*

BY

BARRON J. RODWAY, O.B.E., L.D.S.R.C.S.Eng.,
HONORARY DENTAL SURGEON, ROYAL INFIRMARY, MANCHESTER.

WHEN discussing dental disease as a factor in the causation of general disease, it is difficult for a dentist to be definite in his statements. He frequently sees a patient who has been under medical treatment for an ailment for some time without sufficiently good results following, and he finds a condition of oral sepsis present. He treats this, the patient begins to improve, and he rather naturally is inclined to conclude that the removal of the oral sepsis has been the dominating factor in the successful treatment of the case. He also wonders if the oral condition was not also the dominating factor in the causation of the disease. As the patient in all these cases has been receiving medical treatment at the same time, he can only wonder—he cannot definitely claim that the treatment of the oral condition cured the general condition. But when he sees this happen time after time he necessarily concludes that there must be a probability that oral sepsis is a common predisposing cause of many ailments.

As I am therefore not able to make any definite statements as to the relationship between oral sepsis and the many diseases which may be influenced by it, I will confine myself to a description of the dental conditions which are most likely to influence the general health, and will indicate how x-ray examination of the teeth helps in the estimation of the likelihood of the teeth, in individual cases, forming foci of infection.

It appears to me that there are three broad classes of oral conditions which may result in general septic infection. In the recent discussion at Bath there seemed to be a disposition to regard only two classes—an open and a closed form; the open form being harmful from the effect of the swallowing of the organisms and their toxins, and the closed form from the absorption of the toxins through the blood stream via the bone. To me this seems a little misleading, as the condition of pyorrhoea is almost surely a combination of the two forms; hence my description of three types.

The first type is that in which sepsis is solely the result of neglect and lack of use of the teeth, where the teeth, at their gingival margins, are covered with deposits of salivary tartar and debris. There is generally a gingivitis present resulting entirely from the presence of these deposits, but the gums do not present, except just at the gingival margins, the congested appearance which is characteristic of pyorrhoea. This condition can generally be rapidly cleared up by careful attention to scaling and cleaning of the teeth. In this class of case, although there may be a certain amount of infection through the capillaries from the gingivitis, the chief ill effect is caused by the constant swallowing, both in the saliva and in the contaminated food, of the organisms and their products. The appearance of the mouth (in this type of unhealthy mouth) is often more striking than that of either of the other two types, but the condition is not nearly so harmful as regards infection.

The second type is that in which there are non-vital teeth present—that is, teeth whose pulps have been destroyed either in the process of preservation of the teeth, or through the progress of caries. Although very many teeth are successfully treated by devitalization of the pulp, with its subsequent removal and replacement by filling material, there are unfortunately many teeth whose pulp canals are beyond the skill of the average dentist to fill completely. In these latter cases, and in cases where the pulp has become necrotic as the result of caries extending to the pulp chamber, there is a possibility of the sepsis present extending through the foramen in the apex of the root, and causing an area of necrosis to develop in the vicinity. These areas are shown in x-ray films of the teeth as dark shadows round the apices of the roots of the

* A contribution to a discussion on focal sepsis at the Manchester Pathological Society, December 9th, 1925.