The Boston Medical and Surgical Journal

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April 29, 1920

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Original Articles.

THE RELATION OF TEETH TO GENERAL HEALTH.

BY CHARLES H. LAWRENCE, M.D., BOSTON.

UNTIL recently, the physician regarded the teeth as the dentist's responsibility, and looked upon their function as a purely mechanical one, beneficial indeed, but not absolutely essential. The effect of general diseases such as syphilis upon the teeth was recognized, but regarded as of importance largely as a diagnostic sign of disease, and the loss of an efficient mechanism for mastication was of importance mainly from a cosmetic point of view. True, medical literature since the time of Hippocrates contains occasional observations concerning the effect of the teeth on general health, but these are usually concerned with their influence upon the development of the jaws and facial bones. As portals of entry for infection, the tonsils enjoyed unchallenged popularity, and the systemic degenerative diseases were usually ascribed to the effects of heredity, exposure, alcohol, diathesis, or autointoxication.

Gradually, however, by scattered reports of relief from so-called incurable conditions fol-

lowing the extraction of carious or abscessed teeth, attention was turned toward them as possible etiological factors in organic disease. And when, in 1914, Rosenow¹ reported that organisms of the streptococcus-pneumococcus group could gain entrance to the body through the teeth, and thence hie themselves to its uttermost parts, changing their appearance as they went, the medical profession enthusiastically accepted diseases of the teeth as the roots of all the evil which had not previously been assigned to some other cause.

Pyorrhea was suspected of causing many of the diseases of the digestive tract, and when periodontal and apical abscesses were found co-existing with nearly all chronic organic disease, it seemed logical to many minds to establish a causal relation between the former and the latter. The result thus far has been an awakened appreciation of the importance of the care of the mouth, which is undoubtedly beneficial, and the extraction of thousands of teeth, the beneficial effects of which are in many cases open to doubt.

A review of the literature brings to light a vast deal of theory upon the relation of dental conditions to general health. It is theory only, and while it is valuable in stimulating research, it does not form a sound basis for treatment

of patients. It is important, from the practising physician's point of view, to separate theory from proven facts, and to use the former as a guide in his examination of problems, the latter as the criteria of his procedure.

What are the facts concerning the first, or temporary teeth? That their eruption may cause loss of appetite, depression of the digestive function and nervous irritability in a child seems proven by clinical experience. It was long believed that "cutting teeth" was an adequate explanation of convulsions in infants. I cannot find satisfactory proof of this theory, and I believe that it is dangerous to accept it without reservation. There have been instances in which no other cause for convulsions was found by most thorough examination, but they are rare. Eruption of a tooth should never be accepted as the cause of convulsions until most painstaking examination has eliminated all other possible causes.

Malocclusion of the temporary teeth has been satisfactorily proven to cause improper development of the palatal arch and facial bones, with resulting nasal obstruction and its results. And there is no doubt that a high percentage of children with badly decayed teeth show other physical defects: Adenopathies, anemias, iritis, nasal obstruction, otitis, and rachitis. Odenthal,² for example, found glandular swellings in 99% of children having badly decayed teeth, against 49% of those having no caries. Dr. Wright of the Harvard Dental School has shown that contagious diseases are more frequent in children with carious teeth than in those whose teeth are sound. But does the co-existence of carious teeth and systemic disease prove that the former cause the latter? Or is the reverse true in some cases? or may both be due to improper diet and malnutrition? It must be borne in mind that carious primary teeth usually mean a neglected child, and that other factors, such as improper diet, or obstructed breathing, are probably present.

These conditions must be eliminated before a coincident anemia or infection can fairly be ascribed to the dental caries. The general health will, of course, always be benefited by the proper treatment of the diseased teeth, but caution must be exercised in accepting them as the cause of systemic disease, in order that less easily demonstrated but more important factors be not overlooked.

More important than the temporary teeth as

factors in general health is the second or so-called permanent denture. Persisting much longer, it is by that very fact more subject to diseases. These occur most frequently after the middle of the third decade, and are thus contemporaneous with the degenerative systemic diseases. Research upon the causes of these conditions has disclosed the fact that infection in and around the teeth commonly coexists with many pathological conditions of obscure origin, and that in certain instances, improvement in general health follows the elimination of the dental sepsis.

Billings³ has shown clinically that infection of the teeth is common in patients with chronic arthritis, and that elimination of such infection often has a beneficial effect upon the joint condition. Cultures of the streptococci obtained from apical abscesses have caused arthritis when injected into rabbits. Gilmer⁴ has found pyorrhea or apical abscesses in the majority of patients seen by him for iritis and allied ocular diseases. Miller⁵ has isolated 58 varieties of organisms from the mouth, "many of which were pathogenic or under certain conditions might become so." Hartzell and Henriel⁶ were able to demonstrate the streptococcus viridans almost invariably among other organisms in cultures taken from apical abscesses, and even in cultures from the roots of healthy teeth. Thoma⁷ has shown that maxillary sinusitis is often secondary to apical abscess, and has called attention to its relation to other diseases of the nose and throat.

The situation is summed up by Barker,⁷ who in 1918 stated that arthritis, osteitis, osteomyelitis, periostitis, myositis, embolic pneumonia, pleuritis, nephritis, ureteritis, myocarditis, endocarditis, pericarditis, lymphadenitis, neuritis, neuralgia, iritis, anemia, septicemia, and pyemia, may in certain cases have their origin in oral sepsis, and that there is a growing tendency to look upon the same etiological factor as contributory in many instances to chronic degenerative diseases like arteriosclerosis and hypertension. He further enumerates the following disturbances of the digestive tract as the most common ones associated with oral sepsis: Gastritis, gastroenteritis, achylia gastrica, pylorospasm, toxic hepatopathies, and probably some cases of gastric and duodenal ulcer.

It would seem that the quantity of evidence against the teeth was overwhelming. But a

careful analysis of its quality makes conviction less certain. The majority of the articles are statements that infected teeth were found in the mouths of those suffering from a given disease, or assertions that oral sepsis *may* in certain cases, cause pathological conditions. Granting the possibility, is there any available evidence as to how often they do?

Hammond, analyzing forty cases of arthritis, found that in only twelve were the teeth alone diseased. After treatment, one case showed striking and immediate improvement, one improved after subsequent use of vaccine, three cases showed "some improvement," two were unimproved after extraction and one after pyorrhea treatment, one improved without dental treatment, and one could not be traced.

At the Robert Brigham Hospital, examination and treatment of the teeth of all patients was carried out systematically. Dr. Thoma, who had charge of the work, found that in a series of eighty-one patients, seventy-two had dental abscesses, and that in order to put their mouths in proper condition it was necessary to extract three hundred and thirty-four teeth. These patients were suffering from chronic disease, in the majority of cases arthritis of long duration. In very few was there definite improvement following the extractions. This does not prove that the local infection, if that be the cause of arthritis, did not originally gain entrance through the teeth. If so, it had become firmly established in the joints, and late extraction could do no good. It must be remembered, however, that many sound bacteriologists have been unable to confirm Rosenow's finding of streptococci in the majority of arthritic joints, so that the assumption that the teeth are portals of entry for infecting organisms in arthritis is as yet not firmly established. The fact that streptococci cultivated from the teeth cause arthritis in rabbits loses much of its significance in the light of Billings' statement that "streptococci from any source may produce acute joint lesions in inoculated animals, especially rabbits."

Almost every physician, however, has seen cases of chronic disease which improved remarkably after the elimination of dental sepsis. It is not to be denied that infected teeth cause disease elsewhere in the body, but I can find no convincing evidence that they are usually responsible for the many diverse conditions ascribed to them. Black³ reports a series of ro-

entgenograms of all the teeth of three hundred individuals. They were selected irrespective of medical and dental histories, and examined for the existence of oral and systemic disease. There were eighty patients under twenty-five years of age so examined. Forty-eight, or 60%, showed x-ray evidence of peridental or apical abscesses, or both. Sixty-nine, or 86%, were classified as negative as regards systemic disease; six, or 7.5%, complained of occasional muscular or joint pain, and five, or 6%, gave a story of well defined systemic disease. There were fifty-one patients between the ages of twenty-five and twenty-nine. Thirty-eight, or 71%, had dental sepsis, and three, or 5%, had systemic disease. Between thirty and thirty-nine years of age, 87% of patients showed oral sepsis, with 9% of organic disease; between forty and forty-nine years, 89% had abscessed teeth and 20% had systemic disease, while after fifty years of age tooth infection was present in 100%, and 32% had organic pathology. It will be noted that there was a sharp rise in systemic disease incidence between 40 and 49, though there was only a 2% increase in dental sepsis as compared with the preceding decade. The figures for the entire series showed that 77% of all the patients had dental abscesses, and 77% were free from organic disease, 23% giving systemic pathology. The presence or absence of other possible causes of the systemic diseases was not noted by Black, nor is there a comparison, as regards general health, with a series in which he found no sepsis. It cannot be said, therefore, how much the incidence of organic disease was increased by the oral sepsis, but there is no indication that dental infection was a fertile cause of pathological conditions. Hammond² states that in the majority of cases the dental lesion is so thoroughly walled off that many deny the possibility of this condition becoming a focus of infection except in rare instances.

However thoroughly the septic process may be walled off, it is conceivable that it may cause systemic degenerative changes by acting as a source from which continued absorption of small amounts of protein takes place. These small continued doses of poison may act directly on the various tissues, or may sensitize the body to a whole group of proteins which would then act as toxic agents. It has been shown by Miller that protein sensitization is not specific, and the work of Walker demonstrates

that a patient sensitized to one protein is usually sensitized to several. The beneficial results in arthritis, obtained by intravenous injections of suspensions of dead typhoid bacilli also suggest that arthritis may be due to protein poisoning.

The great objection to this theory lies in the fact that it has never been demonstrated, in a sufficient number of instances of coexisting dental and systemic disease, which existed first. Cardiac disease, nephritis, arteriosclerosis, anemia, indeed all chronic diseases have a depressing effect upon the general health, which may conceivably allow previously sound teeth to become infected. That pathogenic organisms do exist in the roots of healthy teeth has been shown by Hartzell and Henrici, and the injurious effect of chronic disease upon the nutrition of the teeth has long been known. It therefore seems as logical to suppose that an anemia or a nephritis may depress the local resistance and allow active dental infection to occur as that the reverse is the case. Carbuncles and diabetes frequently co-exist, and proper treatment of the carbuncle usually improves the diabetic's condition, but it is not argued that carbuncles cause diabetes. In regard to oral sepsis in this disease, Joslin¹⁰ says, "It is my impression that the changes in the teeth are subsequent to the onset of the diabetes, but I am open to conviction on this point." At present, who can say more, as regards any chronic disease, on either side of the case, if individual instances are excepted?

Because of these individual instances, in which the elimination of dental sepsis gives brilliant results, there is a tendency to regard any tooth which shows an abnormal shadow on the x-ray film as the cause of almost any co-existing disease of obscure origin. As is usually the case when a new discovery is made, there has been too much enthusiasm concerning the possibilities of dental infection, too much generalization, and too little careful, critical investigation. Many ingenious theories have been advanced, and a few facts established. It may be regarded as proved that in certain instances dental sepsis does cause systemic disease. Therefore a careful examination of the teeth should always be made, and the patient should be questioned concerning dental symptoms. It should be remembered that the absence of pain does not exclude abscesses at the roots, and that if no other foci are found, and the systemic

disease suggests focal infection as an etiological factor, dental consultation and x-ray examination of the teeth should be made. Infected teeth which serve no useful purpose should always be extracted. But if the x-ray findings alone are positive, extraction of useful teeth should be reluctantly performed, since results show that benefit is obtained in only a small number of cases and the extracted tooth is not always as bad as the x-ray indicated. No promises of cure should be made, and the patient should clearly understand that the operation is in the nature of an experiment. Even though dental infection be present a careful search should be made for other foci. Absorption from tonsils, pharynx, sinuses, pulmonary infections, digestive and genitourinary tracts should be eliminated before the teeth are held accountable. It must be remembered that caecal stasis, a diseased gall bladder, or an infected prostate may be the cause of systemic disease, and foci which can be eliminated without the loss of useful organs should be treated before suspected teeth are extracted. Oral sepsis which can be successfully treated without sacrificing the efficiency of mastication should be eliminated in every case. It should not be forgotten, however, that mastication is an important part of digestion, and that disorder of nutrition may arise from lack of teeth. In his work on disease of the heart, MacKenzie¹¹ says, "The great importance of oral digestion is not sufficiently appreciated. Not only does the process of mastication in several subtle ways stimulate the digestive glands of other organs, but the juices from the mouth which are mixed with the food not only assist digestion but prevent the flatulence which is so often a troublesome feature in the weakened digestion of heart failure." This statement applies with equal force to a large number of chronic diseases, the treatment of which is greatly complicated by an ill behaving stomach or a foul mouth due to lack of sufficient teeth for chewing. Anemia and disorders of the digestion may be due in some cases to dental sepsis—in others they are as surely caused by too radical extraction in its treatment.

For this reason, when extraction is necessary, care should be taken that the patient is not left with an insufficient masticating mechanism. The extraction of the diseased teeth is often only half the battle—substitutes must be furnished. The method of doing this is of course

a question for the dentist to decide, but I believe that from the standpoint of cleanliness, artificial teeth should not be permanently fixed in the mouth. From the medical point of view, permanent bridge work and similar devices are not desirable.

Such, I believe, are the facts concerning the relation of the teeth to general health. They should not be confused with the theories. The latter are interesting, and will in the future answer questions which are at present vexatious—but they do not form a basis for the intelligent treatment of the individual problem.

The need at present is a method of determining whether the teeth are the cause of the organic disease. So far, this test consists in extracting the teeth and awaiting the result. A test which can be used before extraction would render such a method unnecessary. Cotton¹² has employed the complement fixation test, and finds it valuable in doubtful cases. Unfortunately the technical difficulties of the test greatly limit its use. In conjunction with Thoma, I am at present using the skin reaction to bacterial proteins in a series of cases to ascertain its usefulness in determining the part played by oral sepsis in any individual instance. Our series is not yet large enough to draw deductions from, but if the test proves reliable, its simplicity will make it available in all cases. Thus far, the results obtained by the skin reaction have coincided with the bacteriological findings. A full report will be made when sufficient evidence has been obtained.

Until more clinical facts are available, caution should be used in promising results from the extraction of diseased teeth. Even though extraction is necessary from the point of view of mouth cleanliness, it may not cause improvement in a long established disease process. Unjustifiable enthusiasm is sure to cause reaction, and bring ill repute upon a theory, which though not yet properly tested, offers real hope in the solving of many difficult problems in medicine.

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THE MILK SITUATION.

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FOR the last twenty-five years, here in Massachusetts, there have been sporadic attempts to clean up the milk situation. The diseases that are transmitted through milk that are of any great danger to man are diphtheria, typhoid fever, scarlet fever, foot and mouth disease, septic sore throat, and tuberculosis. The first four are now well regulated; in the United States we are free from foot and mouth disease, and the first three, being acute infectious diseases, are watched carefully. Septic sore throat breaks out occasionally, but it is not so very prevalent, while tuberculosis, a slow insidious disease, chronic in nature, is an enemy that should be considered seriously.

There are three types of tuberculous organisms,—avian, human, and bovine. The avian does little damage, although it is a menace to poultry men. The human type may be transmitted through milk as typhoid, diphtheria and scarlet fever are, but that is more or less a simple thing to control. The bovine type is larger than the human or avian and more virulent in that it kills both rabbits and guinea pigs, while the human kills guinea pigs only and the avian kills rabbits only. The much discussed question immediately comes up as to whether the bovine type affects humans. 'Robert Koch, the scientist who discovered the bacillus, said in an address before the Tuberculosis Congress of London in 1901, that bovine and human tuberculosis were different diseases; that the human disease was not transferable to cattle, and that it was not necessary to protect a man from pearl disease or bovine tuberculosis. This statement is right in that human tuberculosis does not materially affect cattle, but bovine tuberculosis does materially affect man, as has been shown by many investigators. It has been found that: "Intravenous injections of tubercle bacilli from human sources, non-virulent for cattle, are capable of conferring an immunity against tuberculosis sufficient to withstand natural infection by association." But the report goes on to say, "Until further knowl-