

# THE SYSTEMIC CAUSES OF DENTAL CARIES

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The factors governing the decay of teeth have always been the subject of much speculation by dentists. The theory accepted in recent years is that the immediate cause of the tissue destruction in this case is lactic acid, produced at the point of decay by micro-organisms, which are protected in the initial stages of the process by a gelatinous plaque attached to the teeth. It has also been observed that some persons are immune to caries, and that the susceptibility to caries varies with the same individual at different times, being greatest in childhood. As it has been shown that the most careful prophylactic measures will not entirely prevent caries in susceptible persons, it is the purpose of this paper to describe the cause of the systemic conditions that are predisposing factors in the case of dental caries.

Fones says regarding the cause of tooth decay: "The only logical result of the interesting researches of Pickerill is that, in tribes and races where dental caries is the great exception and not the rule, the diet consists of unrefined and natural foods, while the peoples in whom dental caries is most prevalent are consumers of refined or civilized foods."

Howe, after extended clinical observation on children, states that caries is a result of vitamin deficiency in the food. He was able to produce in guinea pigs caries, bleeding gums, resorption of alveolar process, and soft tissues, and even necrosis of cranial bones by feeding a diet deficient in vitamins, in this case oatmeal and fat-free milk. He says "The softening and carious dental effect was distinct and unmistakable." By careful feeding of proper foods Howe was able to arrest the carious processes, and again cause their recurrence by a return of the vitamin deficient diet. He states that he was unable to say which of the three vitamins was responsible for the effect, that very likely all three were of importance in this respect. He also states that it makes no difference whether these disturbances are the result of irregular calcium metabolism or the result of infection, the control (or predisposing cause) lies in the diet.

Prinz, from a long series of experimental studies states that he has almost arrived at the conclusion that the etiology of dental caries rests with the constituents of the salivary fluids.

Howe, in later experiments on the effect of diet upon the teeth, gives the different effects of the three known vitamins which are as follows: first, known as fat soluble A, found in fish oils such as cod liver oil, in animal fats, yellow grains, bananas, green vegetables. Second, water soluble B, found in milk, germ of seeds, eggs, yeast, raw vegetables. It is destroyed by a temperature of 150 degrees Fahrenheit, so it is not present in pasteurized milk nor in cooked foods. Third, water soluble C, found in orange and lemon juice, cabbage, raw tomatoes green vegetables. It is destroyed by boiling. Howe found that as a result of these experiments upon guinea pigs and rabbits that the vitamins B and C are the most important in the production of immunity to caries. This is significant in that these two vitamins are not found in cooked foods.

Pollina, after clinical observation and study of family, personal and mouth history of six thousand Boston school children, found that

eleven per cent who had been totally free from infectious disease, had normal dental arches with no dental caries, well balanced in nutrition, body and mental age. He says: "Many observations have enabled me to compare, reflect and record the above data with such definiteness as to evolve the following axiom: That dental caries is the result of infectious diseases of childhood, acting on the organs internal secretion." Pollina claims that from clinical records he can show a history of measles, chicken pox, mumps, scarlet fever, diphtheria, etc., in every case of dental caries in children.

Here we have an apparent difference of opinion among authorities. Some believe that dental caries is the result of a vitamin deficient diet. Others think it is due to a derangement of the endocrine glands, or the organs of internal secretion. Another says it is due to the composition of the salivary fluid. Again that it is due to a diet of denatured or civilized food. The above causes, however, are really one and the same. A diet of the refined civilized foods is invariably lacking in vitamins B and C. As Sajous has demonstrated that vitamin C is always present in normal saliva where it "sustains the defensive oxidation which renders bacteriolytic and anti-toxic enzymes effective," we find that these scientists have been approaching the solution of the same problem from different angles, and that dental caries may be due to a vitamin deficient diet, thus starving the endocrines, or that the endocrines may be debilitated through disease, in either case the saliva is deprived of its normal bactericidal properties. Also, Howe says that lack of vitamin B causes atrophy of the parathyroids. Sajous states the parathyroids are important in the promotion of calcium and phosphorus metabolism, and as these elements form the mineral elements of the teeth, one can see that lack of vitamin B during the development of the teeth will certainly interfere with proper calcification. Thus, vitamin B is responsible for the proper development of calcification of the teeth while vitamin C promotes the bactericidal properties of the saliva and is responsible for the subsequent preservation of the teeth. And as both of these vitamins are destroyed by the cooking of food and the pasteurization of milk, one wonders how the human body is able to function at all on the minute amounts of these essential food elements found in the average diet. The deficiency of these vitamins produce many other pathological symptoms aside from the dental aspect. For instance Howe says regarding his experiments with guinea pigs: "The nervous condition of the animals was very marked, and on handling showed signs of tetany, these are attributed to deficiency of water soluble vitamins (B and C)."

To prevent caries then, we must begin with the child as early in life as possible and see that the diet contains plenty of vitamins B and C, which means as much uncooked food as possible and non-pasteurized milk. And according to the previously quoted authority Pollina, care must be taken to guard against childhood infective diseases, which debilitate the endocrines, and as Sajous also states, favors the necrotic dental process of caries, by failing to provide nature's germicidal oxidizing agent to the saliva. Sajous, in his celebrated treatise "The Internal Secretions and The Practice of Medicine" elaborates in

detail upon the protective function of the endocrines, not only in respect to caries but in regard to systemic infections such as diphtheria, measles, etc. And as he has shown that the endocrines depend upon the supply of vitamins in the diet to furnish the material for their disease fighting secretions, it is apparent that the degree of resistance to disease possessed by the individual is proportional in considerable measure to the vitamins in his diet. Therefore, the whole question resolves itself into a matter of vitamin sufficiency, and the childhood infective diseases that Pollina considers a cause of caries are really another result of vitamin starvation, if Sajous is correct in his conclusions. In this way the infective disease becomes a secondary predisposing factor favoring caries, and may be many times as effective in this respect as the primary factor, the vitamin insufficiency. Pollina's viewpoint, that caries was due to exhausted endocrines may be fully justified, as he observed the predisposing cause that was most apparent.

Tuberculosis has been observed to predispose to caries, rapid destruction of the teeth taking place in many cases. This is to be expected as susceptibility to tuberculosis is now known to be due to vitamin insufficiency, and the disease has a particularly debilitating effect on the endocrines. We here have a vicious circle, in which the vitamin starvation produces the susceptibility to infectious disease, the overworking of the endocrines to fight the disease increases the need for vitamins, and the exhaustion of the endocrines increases the susceptibility to infection.

When we consider that the vitamins in the food are the materials from which the endocrines secrete their active principles, it is apparent that there are two ways that a glandular insufficiency may take place: 1. There may be a lack of vitamins in the diet. 2. There may be a degeneration or atrophy of the gland, sometimes being an irreparable result of the first situation. Diabetes is a good example of this, the islands of Langerhans undergoing a degeneration, possibly from overwork in attempting to secrete insulin from the blood stream that contains too little of the raw material, the essential vitamin.

It must be remembered that the metabolism of the human body, being an animal function, is a breaking down process of complex compounds that are built up by the synthetic processes of plant metabolism. The animal or human body cannot build up organic compounds, and is wholly dependent upon the vegetable kingdom for organic foods. Vitamins are a class of organic compounds that are probably the most complex of food constituents. As before stated, all of the ductless glands (the thyroid, parathyroid, thymus, pineal body, pituitary, adrenals, gonads, pancreas, islands of Langerhans, spleen,) must have one or more of the three classes of vitamins in order to secrete their vital fluids, and if deprived of the vitamins will atrophy and cease to function. Such cessation of function produces the following results:

1. Lessened resistance to all infectious diseases, including dental caries. This point could be elaborated upon to any length. For instance, Sajous has shown that the opsonin of bacteriology is a secretion of the thyro-parathyroid glands, the spleen and pancreas produce Erlich's complement, while the amboceptor of Erlich is secreted by the adrenals.
2. Disturbances in metabolism, such

as diabetes and rickets. Severe dental caries accompanies rickets, and teeth develop slowly or not at all in children afflicted with this disease. The cause is lack of vitamin C,\* which is found only in raw food, being destroyed by heat. The mysterious fact that rickets occurs oftenest in children in very poor or very wealthy families is explainable in view of these facts. The child in the poor home gets too little of all foods, while the child in the rich family gets only cooked or sterilized foods, and has less access to the kitchen where other children are getting raw foods occasionally at least.

The third result of lessening or cessation of endocrine function is disturbance to organic function, including mental activity. Dr. Berman of Columbia University in his book "A Study of the Glands of Internal Secretion in Relation to the Types of Human Nature" states "The internal secretions constitute and determine much of the inherited powers of the individual and their development. They control physical and mental growth, and all of the metabolic processes of fundamental importance. A derangement of their functions, causing an insufficiency, an excess, or an abnormality, upsets the entire equilibrium of the body, with transforming effects upon the mind and the organs. In short, they control human nature, and whatever controls them, controls human nature". Dr. Berman shows that the temperament of an individual is determined by the relative activity of different glands of internal secretion.

To summarize them, dental caries is due to a vitamin-deficient diet, starving the endocrines which are then unable to secrete sufficient of the germicidal ferments to prevent dental caries or other infectious disease. And the presence of a systemic infection sets up a vicious circle, as the hyperactivity of the endocrines in fighting the disease makes the vitamin starvation more acute, such starvation being the original cause of susceptibility to the infection.

\*Vitamin D was just being established as another factor in rickets when this was written.

## BIBLIOGRAPHY

- Howe, "Dental Caries," Dental Cosmos, August, 1920—Pages 921-929.
- Editorial, Dental Cosmos, August, 1921—Pages 836-839.
- Howe, "Studies on the Effect of a Vitamin Deficient Diet on the Teeth," Dental Cosmos, November, 1921—Pages 1,086-1,092.
- Pollina, "Endocrinodontia," Dental Cosmos, February, 1922—Pages 218-223.
- Sajous, "Endocrine Glands and Dental Nutrition and Caries," Dental Cosmos, July, 1923—Pages 702-713.
- Sajous, "The Internal Secretions and the Practice of Medicine", 4th edition—Pages 696-699. 713-715. (Vol. 1.)
- Talbot, "Late Researches on Interstitial Gingivitis," Dental Cosmos, August, 1921—Pages 795-803.
- Editorial, "Endocrinology", The Dental Digest, March, 1922—Pages 183-184.

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