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AETIOLOGY OF DENTAL CARIES

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Hippocrates already in 466 before our era formulated his theory to the effect that dental caries, in the same way as other general diseases, was due to a disturbance of the four principal humours of the body. For many centuries this conception was prevailing, even until the middle ages, when it was held that cavities in teeth set in by worms. Manyfold were the theories subsequently drawn up, in order to explain dental diseases coming up for study.

The inflammation theory (Galen, Hunter, Fox, Abbott), the electrical theory (Bridgeman), the chemical theory (Robertson, Magitôt, J. Tomes), the parasite theory (Fleischmann, Baumgartner) and the endocrine theory are the principal theories described since, each of which had a greater or smaller number of adherents.

However, in 1885 Miller formulated his chemico parasitic theory by which the complicated problem of aetiology of dental caries appreciably grew clearer. Until to-day his conception of the phenomenon is almost unanimously adhered to.

The principal features of Miller's theory as Pickerill outlined them, are the following:

1. That the organisms of the mouth, by the secretion of an enzyme (or by their own metabolism), so act upon carbohydrate food material as to form acids by a process of fermentation. The chief acid formed is lactic, but butyric, acetic, formic, succinic and other acids may also be formed.

2. Carbohydrate food material lodging between or on the teeth is the source of acid, which attacks the lime salts of the enamel, dissolving the interprismatic cement substance. Thus by the action of the acid and by the force of mastication the enamel is destroyed or weakened, and removed mechanically.

3. The action of the micro-organisms of the mouth upon protein material is to form an excess of alkaline substances that have no action upon the enamel other than a beneficial one.

4. The enamel being penetrated, the solution of the lime salts of the dentin is brought about in the same manner, the organisms penetrating along the dentinal tubules.

5. The further stages of caries of dentin is brought about by another set of organisms which secrete a proteolytic enzyme. This dissolves the collagen of the dentin matrix, thus forming a cavity.

Those five items of Miller's theory, summarized by Pickerill, and on several occasions defended by Miller personally, are generally adopted for the explanation of aetiology of caries.

The bacterial fermentation of carbohydrate food particles remaining upon the teeth, thus forming acids which attack the mineral constituents of the teeth, while the organic basis substance is destroyed by another type of bacteria, is the actual substance of Miller's theory.

Still this explanation does not suffice in general. There are certain conditions that may immediately serve to counterdict and which, at the first appearance, would seem to be so as to interfere with Miller's theory. If, in reality, the fermentation of carbohydrates is assumed to be the direct causative agent to caries, the question arises why this affection does not become manifest in all dentures in which retained food débris are lodging in constant contact with the teeth, and still more, why

some teeth are affected by caries, whereas others in the same mouth are not susceptible.

In order to reply to questions of this character the word "immunity" has been introduced. Black particularly attempted along this line to clear many inexplicable phenomena. Therefore it is essential to discriminate between such individuals as may be classified as being immune to caries and such others as are susceptible. Thus one and the same mouth might show one tooth immune and another susceptible.

It is regrettable that this concept: immunity from caries has obtained a firm footing in dental science. Certainly this concept in the course of years created confusion and repeatedly brought about wrong comparisons being made between caries and infectious diseases.

I agree to Wild's elaborate publication on this subject and cite the following from his article:

"By immunity is meant the insusceptibility of individuals to infections — assuming a certain infective process — that may affect other individuals of the same sort under similar conditions", as Kolle and Hetsch define immunity in their book entitled: „The Experimental Bacteriology and Infectious Diseases". The principal part in natural immunity is played by endogene protective devices in the human body. Against the penetrating bacteria will act the phagocytes. Except those defensive substances produced, there are still others not yet formed: Buchner's alexines. Those are bactericide substances dissolved in serum. The alexines stimulated by the causative factor of the infection, are segregated from the cells, in which process the movable lymphocytes play a part. On his question whether the enamel possesses immunity in the sence of the immunity doctrine, Wild claims that in view of the immunity principle being based on activity of cells (phagocytosis means the activity of "round cells", whereas alexines are being produced by living cells) the origin of immunity is bound to vitality.

Although the researches by Ch. F. Bödecker and the experi-

ments of Fish convinxcingly have shown that a communication is in existence between the enamel and the pulp through the dentin, and that the enamel itself is supposed to contain humour (dental lymph, Bödecker) that communicates with the pulp along said channels, still there can be no question of a vitality in the sense of Wild, neither in the enamel nor in the cuticula covering this tissue. Hence Wild concludes that „neither in enamel nor in its supporting tissues can be traced such defensive powers as in a biological-bacteriological sense would be considered equal to immunity; he suggests, after v. Beust in vain attempted to formulate the same in 1911, in relation to caries, to replace the concept: "immunity" by "natural resistance".

On behalf of an accurate conception of the origin of dental caries, we must bear in mind that for the occurrence of this affection, the direct causative factor, the aforementioned Miller's theory is of primary importance and besides, indirect causes of a predisposing character which may further this affection to set in, come into account in addition. Moreover certain factors controlling resistance, prevail in the teeth proper.

Pickerill described this as follows:

"The phenomena are profoundly modified by a large variety of factors... And since these conditions vary in different individuals, it is evident that the possible permutations and combinations of the various factors are very numerous and complex... Dental caries is not the "effect" of any single "cause", but it is the resultant of several forces — it may be few or many, and not always similar-acting in one general direction, and which happen for a longer or shorter period to be coincident."

Miller in 1904 personally enumerated certain predisposing factors such as: the selection of diet; a diet of meat and fat prevents dental caries; fresh fruits, also if they contain organic acids, are innoxious, whereas carbohydrates favor caries in proportion to their being soft, pappy and liable to fermentation; irregular position of teeth, and defectively formed interproximal spaces further the occurrence of caries.

From the factors that are said to be responsible for the smal-

lei or greater resistance of teeth to caries, we are conversant of but few.

The classification stipulated by Pickerill in relation to sclerotic and malacotic teeth, the first, comprising that clinically well-known class of teeth which are characterized by their "hardness", and usually yellow-colour, being, very resistant the second group, characterized by their comparative "softness" and whiteness, being very susceptible to caries, has not been adopted unanimously.

Gottlieb established that the degree of keratinizing of the enamel cuticula and of the outer ends of the enamel lamellae, is a factor of primordial importance in respect to the greater or smaller resistance to dental caries.

That the consistency of enamel and consequently its resistance to caries, may be appreciably affected by nutrition, particularly in the fetal stage and during the first years of childhood, has been clearly shown by many researches of recent years, whereby the action of vitamines upon the structure of dental tissues was investigated.

From whatever point of view however, we may consider the problem of dental caries, still the direct causative agent remains fermentation of carbohydrates, originating from food débris lodging around the teeth; accordingly, the proverb, also gradually becoming in vogue in Europe, in this conception finds its support that

A clean tooth will not decay.