

Population study showing that without tooth brushing, but with hard biting into food, there is very minimal gum disease.

THE ORIGIN AND CAUSES OF DENTAL CARIES AND PERIODONTAL DISEASE

Dental caries and periodontal disease probably stem basically from the advent of "civilization" with its change in dietary habits.

We know for example, (from any standard textbook¹) that dental caries today affects both deciduous and permanent dentitions. It is also found in all strata of society regardless of economic background. We also know that dental caries varies greatly with age – 4-6 years being that of greatest prevalence for the deciduous dentition, and the adolescent years for the permanent dentition, – and we believe that somatic disease per se has little influence upon caries production in the permanent dentition – except as it may influence oral hygiene or cause extreme acid conditions. Early diabetes for example, often appears to be associated with dental caries and has been attributed to the increased carbohydrate content of the saliva. However basically, dental caries incidence today is believed to be due to five somewhat overlapping main causes. These are (1) increased carbohydrate consumption, (2) increase in number of, or action of, acid producing bacteria such as lactobacillus acidolplus, (3) change in quantity of or PH of saliva, (4) dento-bacterial plaque formation or (5) neglect of oral health, partly because the modern diet does not

¹ Schaefer W, Hine, H.K. and Levy, B. Oral Pathology Text. (or any other Oral Pathology Text)

provide the necessary “cleansing action”². The cause of periodontal disease on the other hand has been shifted constantly through the years, from one factor to another. Today, however its advent is attributed largely and simply to the existence of plaque and/or neglect of oral care³.

Let us examine each of these areas briefly to see just how important they are and attempt to determine what might be an even more important, basic, overriding causative factor in the development of both dental caries and periodontal disease; viz. a change in dietary habits including not only composition of food stuffs but also the amount of chewing necessary to consume these materials.

Dental caries is described as a progressive demineralization and destruction of teeth which today is ascribed to local fermentation of retained food sugars by bacterial plaque. Because it stops as an active process with death, skeletal remains provide an accurate record of its incidence through the ages. Caries were noted in some skulls from South Africa from 500,000 - 1,000,000 years ago in Homoerectus and occasionally in Neanderthal man. However they were found in no more than 2-4% of all teeth examined. During the Iron Age and through the Roman period there was an increase to approximately 10% of teeth examined. English data (which are most complete) show about the same level to remain relatively constant thru Anglo-Saxon and medieval periods. However, dramatic increase occurred toward the end of the 17th Century and increase has continued in all western countries until today except during WWII when there was a sizeable decrease in the European population.

² Manhold, J. I Dental Clinics of North America 1960.

³ Glickman Periodontology (or any other text on periodontology)

Before the 17th Century, the cemento-enamel junction was the most frequent site of caries and between the teeth usually. This same type is seen today in older persons (root caries). These usually developed only after occlusal wear and where gingival recession along with loss of boney support allowed food impaction.

In the 17th Century there not only was increased incidence, but a change in location as well – occlusal and interproximal surfaces were those affected and these are the same as today.

Epidemiologic studies further show a worldwide pattern that reflects anthropological and historical findings; i.e., incidence was extremely low in 1950's and 60's in underdeveloped countries but a rapid increase occurred with industrialization and (they say) exposure to modern western diet. Also in the U.S. there seemed to be a change as a result of a shift from rural to urban type of diet.

Whether diet or not what is the exact etiology? There are actually 3 main caries theories - acidogenic, proteolytic and proteolysis-chelation and one accepted theory for periodontal disease. However, both disease conditions are believed to result basically from the build-up of dental plaque, although trauma often is admitted to be an initiating factor in periodontal disease and neglect of oral health a perpetuating factor in both.

Since the advent of dental caries and periodontal disease both are attributed to the build-up of dental plaque and/or neglect of oral health, let us look a little more closely at the literature.

There has been a mass of investigative material gathered through the years on aboriginal peoples and by studying the skulls of the ancients. If these data are examined, it would

seem that although the problem today may be plaque and/or neglect of oral health, the basic, underlying problem or causative factor is specifically a lack of need for proper mastication of food caused by, no doubt, the advent of increasing quantities of food which do not require this mastication.

For example, Palomino⁴ studied the Aymara of Western Bolivia in 1978 which is a population who are descendants of the formidable Tiahnanean civilization. These people eat practically no refined foods of any type. Their staple diet is raw vegetables, and dried or fresh meat. They do chew coca leaves which have a vasoconstrictor effect on the oral tissue.

The caries rate was very low in general and 31.7% of the population exhibited no carious lesions whatsoever. Gingivitis and periodontal disease was found almost exclusively in the older population who showed extensive attrition resulting in traumatic occlusion. In some, the masticatory forces were so severe as to produce complete crown abrasion and accompanying bone and tooth root atrophy.

In 1979 Zitrow⁵ reviewed the Eskimo dietary/oral condition and reported that in the past the Eskimo diet was almost exclusively fat and protein from mammals and for all practical purposes was devoid of any form of plant life (the word Eskimo is derived from the Indian word loosely interpreted to mean eater of raw flesh.) The meat was eaten raw and more often than not frozen and raw. He reported that this still is the case with many of the older Eskimo in more distant areas and there is little periodontal pathology and/or

⁴ Palomino, H.: The Aymara of Western Bolivia: III. Occlusion, Pathology and Characteristics of the dentition *J. Dent. Res.* 57:457, 1978.

⁵ Zitrow, R.e.: The relationships of diet and dental caries in the Alaskan Eskimo population. *Alaskan Med.* 21,10, 1979.

caries. In the past the Eskimo was believed literally to be the population which had the lowest caries rate in the world, and early investigators like Waugh, Leigh and Ted Rosebury became well-known for their treks to study Eskimo oral conditions and their reports of entire caries free villages and as little as 4 cavities in 395 Eskimo skulls examined and other “startling” discoveries, and Bang and Kristofferson⁶, as well as numerous other followers demonstrated a tremendous increase in dental caries in these populations when dietary changes resulted.

Also with respect to caries, Weintraub⁷ reported that Indians of upper eastern U.S. and Canada showed only 0.2 cavities per skull in those of Indians of the region more than 400 years old. This was before the advent of the maple tree. Apparently some ecological change evolved at this time allowing maple trees to develop. When these trees grew and maple sugar was available, the 400 and less year old skulls showed a caries incidence of 3.1 per skull.

Pedersen⁸ also reported the rapid change in caries by examining skulls. He examined those of Eskimo with contrast to the white population. He found on examination of 5,606 permanent teeth and 146 primary in 525 Greenland Eskimo skulls only 2 teeth with caries found in the adult and none in the primary.

⁶ Dang, G. and Kristoffersen, T: Dental caries and diet in an Alaskan Eskimo population. Scand. J. Dent. Res 80, 440, 1972.

⁷ Weintraub, J.A.: Remains of Ancient tribes tell the tale of dental disease. Dent. Stud 56:58, 1978.

⁸ Pedersen, P.O.: Dental caries in Greenland 1935-1969. Pre-war Greenland and its population. Dtsch-Zahnarztl-Z. 26:1023,1971.

Similar reports of changing caries activity with changing diet come from Australia. (See additional references.) Donnelly et al⁹ in 1977 found in Venezuelan Indians plaque accumulation to be great along with a complete lack of oral hygiene. In spite of this, the existence of gingivitis was variable. And no pockets appeared before 30 years of age and when occurring they still were observed in only 1/3 of the population after this age. Also of great significance was the fact that no teeth needed to be scored as markedly mobile with loss of masticatory function.

Now besides the study of Palomino mentioned earlier, what else do we have on periodontal disease? Actually, here also there have been a sizeable number of investigations.

Honan¹⁰, for example found that the Australian bushman with his native diet of kangaroo, wallaby, emu, reptilian flesh, seasonal plants, wild fruits and berries, goats milk and occasional honey ants exhibited abundant calculus, plaque and advanced recession but no hypertrophy of gingival tissue, quite contrary to Moody's universal hypertrophy and little calculus. Both found gingival health to be remarkably good, however, even though there was no tooth brushing.

Pereira and Evans¹¹ reported much attrition in primitive Brazilian Indians but complete lack of oral hygiene, yet most teeth were lost due to accidents or use of teeth in daily

⁹ Donnelly, C.J., Thomson, L.A., Stiles, H.M., Brewer, C., Neel, J.V. and Brunelle, J.A.: Plaque, caries, periodontal diseases and accumulations among Yanomano Indians, Venezuela. *Community Dent. Oral Epidemiol.* 530,1977.

¹⁰ Honan, B.T.: Changing periodontal status in a changing environment. *J. Dent. Res Oct.* 56 Spec. No P C46-54, 1977.

¹¹ Pereira, C.B. and Evans, H.: Occlusion and attrition of the primitive Yanomani Indians of Brazil. *Dent. Clin North Am.* 19:485, 1975.

work. There was some unexplained caries loss in older individuals who ate no refined foods and had to chew vigorously.

Mehta and Sensenig¹² studied Arkansas Indian skulls and reported the signs of heavy attrition, few caries and heavy calculus but no effect on the periodontal bone level.

Baelum et al¹³ reported a study of Tanzanians 30-69 years of age with most interesting results. The mean number of teeth present ranged from 23.9 in the oldest to 29.5 in the youngest age group. In all age groups more than 90% of all tooth surfaces exhibited plaque and 50-65% exhibited calculus deposits. Both plaque and calculus deposits were more extensive in the older age groups and gingival bleeding affected 30-40% of the surfaces in all age groups. However, less than 35% of all surfaces exhibited a loss of attachment of 4mm and less than 10% had a loss of attachment exceeding 6mm. Less than 10% demonstrated pockets deeper than 3mm in all surfaces examined. Loss of attachment generally was accompanied by recession of the marginal gingiva.

An interesting finding was that relatively few individuals accounted for most of the loss of attachment and periodontal pockets found in the study. In other words, even though 35% of surfaces examined showed a 4mm loss of attachment, this loss occurred in only a small portion of the population.

Niswander¹⁴, Liu¹⁵, and others (see additional references) have reported similar results.

¹² Mehta, J.D. and Sensenig, E.C.: Some observations on Arkansas Indian skulls. *Aust. Dent. J.* 11:410, 1966.

¹³ Baelum, V., Fejerskov, O., Karring, T.: Oral hygiene, gingivitis and periodontal breakdown in adult Tanzanians. *J. Periodont. Res.* 21:221, 1986.

¹⁴ Niswander, J.D.: Further studies of the Xavante Indians: VII the oral status of the Xavantes of Simoes Lopes. *Human. Gen.* 19:543, 1967.

Volpe and Manhold¹⁶ additionally were able to obtain changes in the periodontal structure of Beagle dogs which were analogous clinically and microscopically to those appearing in the human by providing these animals only with a soft non-chewable diet for a two year period.

Under the circumstances it would appear that although present day thinking with respect to the role of plaque and oral neglect are important factors in both dental decay and periodontal disease, the basic factor either is being overlooked or completely ignored. The basic, underlying cause of these universal disease processes appears to be diet and the lack of proper or required masticatory function.

¹⁵ Liu, K.: Dental condition of two tribes of Taiwan aborigines-Ami and Atayal. J. Dent. Res. 56:117, 1977.

¹⁶ Volpe, A.R., Manhold, J.H., B.S. and Fullmer, J.C.: Gingival tissue oxygenation: the effect of a single application of four commercial preparations. J. Peria. 37,478, 1966.

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