

The Case of the Invisible Toothbrush: Why Some People Can Brush Less

E. Cheraskin, M.D., D.M.D.¹

Abstract

A long time ago, President Harry S. Truman was asked the question, "What's new?" His response, "If you never heard it before, regardless of how old it is, it's new!" Utilizing the Truman benchmark, several points are obvious. First, the present notion that dental accumulations contribute to dental diseases and that these collections can be mechanically removed is not only old but generally conceded. What is also not new, as far as the published literature is concerned, is that there are nonmechanical contributions to the common dental diseases. Many of the reports are 30 to 40 years old. Some of them are quite recent, particularly the innovative discussions by Nigel Clarke and his associate in Australia. However, what is really new and emphasized in this report, is that the accumulations in themselves may be due to the absence of an invisible toothbrush. The whodunit may well be hypoascorbemia! Obviously, this is a relatively new thought and requires further study. And, by the way, vitamin C serves many functions. It is well-documented as an electron donor, impressive scavenger, important in capillary fragility and permeability, extraordinary for wound healing, and much, much more. So, providing the ascorbates may add a bonus to improved oral health ... by contributing to general well-being!

Introduction

Apropos, there are three inescapable facts:

- The principal site for chronic disease is the mouth ... even in this day an age, 95% of the civilized population suffers with tooth decay and/or periodontal disease.

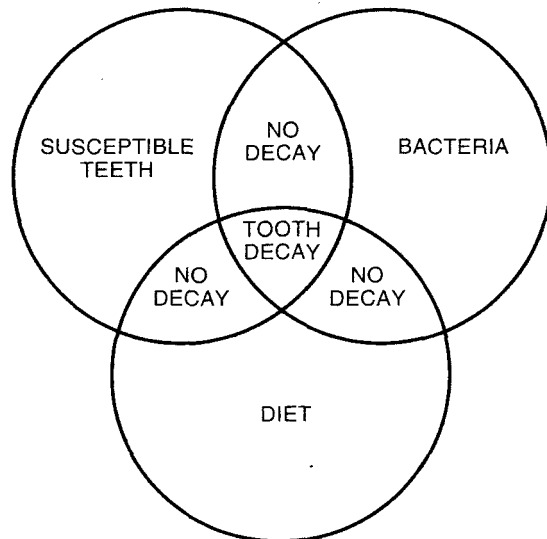
- Judged by our current successes/failures, the present explanations and solutions are filled with contradictions (i.e. more brushing/ flossing doesn't necessarily guarantee less disease).

1. Park Tower 904/906, 2717 Highland Avenue South, Birmingham, AL 35205-1725.

- Maybe ... just maybe ... this is all because we haven't heeded the counsel of the experts.

The National Institutes of Health (NIH)¹ and other authorities, as we shall learn, argue that oral pathosis is a multifactorial problem. They identify three essential ingredients: (1) a critical microbial population, (2) an appropriate diet, and (3) a susceptible state (Figure 1). (Incidentally, other buzzwords are avail-

Figure 1.
tooth decay = susceptible tooth
+ bacteria + sugar



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able such as resistance, tissue tolerance, internal milieu, coping systems, immunity, and homeostasis). And, by the way, this same chart is just as applicable to the periodontal tissues by simply substituting "periodontal disease" for "tooth decay". More importantly, in their pictorial portrayal, they underline the *product* relationship. If any of these three variables is absent, then oral disease does not occur. Parenthetically, this has not been translated into their arithmetic formula which suggests that the phenomenon is *additive*!

Be that as it may, principal attention has been devoted to the role of diet and microor-

ganisms; only scant attention has been accorded the resistance/susceptibility factor. And, when it is considered, susceptibility and genetics become synonyms.

This report is one in a series on Medical Ignorance: Myths and Magics in Modern Medicine. It will remind us of the role and emphasize the measurability of tissue tolerance in oral pathosis. Specifically, we shall devote our attention to the question, "Can you get away with brushing your teeth less?"

A Different Look at Mr. and Mrs. America

Two hundred presumably healthy middle income Caucasians (with the usual mouth problems of dental caries and/or periodontal disease) participated in this study.² To quantitate tooth cleansing, we choose the most simple measurable system. Each subject was questioned regarding the frequency of toothbrushing. It was convenient to divide the group into those with less than twice (n= 71), the 95 who brushed twice per day, and the 34 more than two times daily. To assess tooth cleanliness, a simple, popular, and easy grading of foreign material, the debris score, was utilized. Finally, as one measure of susceptibility, the fasting plasma ascorbic acid concentration was obtained in each of the subjects.

Our reason for using the ascorbates is based on the observation that in some subsets of the general population Suboptimal vitamin C state is as high as 100%.³ Additionally, we have studied vitamin C deficiency in dental patients and discovered that up to 72% may be hypoascorbemic.⁴ By this trinity of information, it was then possible to construct, and hopefully respond, to three questions.

The Traditional Confirmation

The most often asked question is, "How effective is toothbrushing?" In other words, "What's the connection between debris (oral cleanliness) and toothbrushing habits?"

Figure 2 shows the frequency of daily toothbrushing on the horizontal axis and the mean debris scores on the vertical. Three points warrant special emphasis. First, those brushing least (black column) represent the greatest accumulations. Second, in the group with the most toothbrushing (white column), there is the least amount of debris. Finally, while the correlation coefficient is statistically significant (r = -0.265, p < 0.01), it is not perfect. This suggests the possibility that other factors may be operative.

Hence, in answer to the first question, there

Figure 2. Relationship of daily toothbrushing frequency and debris index

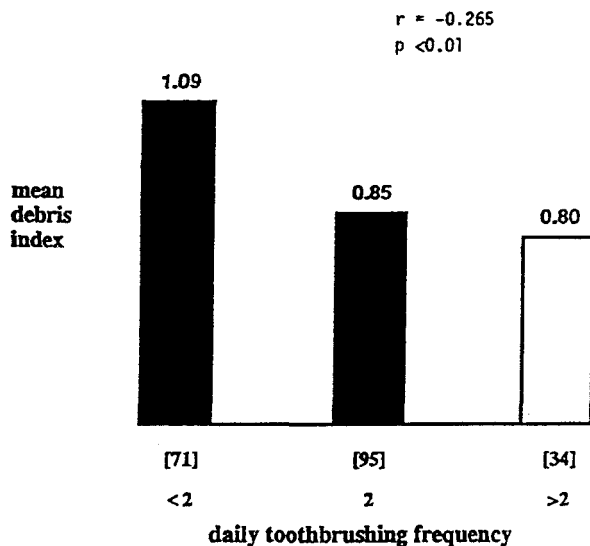
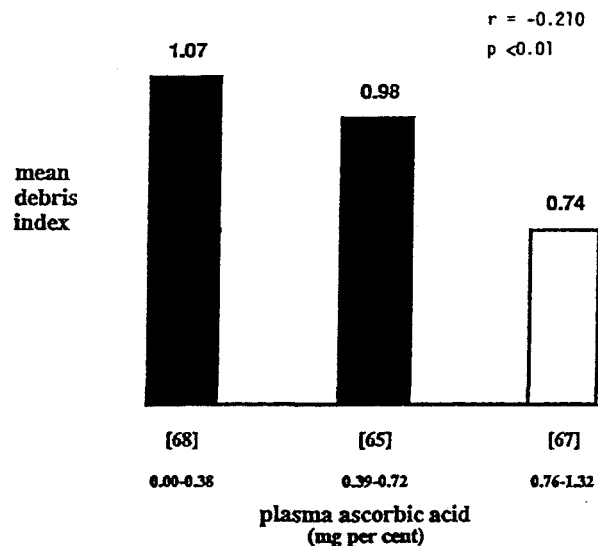


Figure 3. Relationship of plasma ascorbic acid and debris index



does indeed appear to be a convincing relationship between tooth cleansing (tooth-brushing frequency) and tooth cleanliness (debris score). These observations are not surprising and support the current dental philosophy of the importance of local and mechanical factors in periodontal health and sickness.

A Second Opinion

Turn on the television and we will guarantee within minutes news about a new-fangled vitamin-stuffed cereal. Tune in the radio and discover that we now have fiber in finger foods. All of this stems from the well-established fact that vitamins and minerals influence every cell, tissue, organ and site in the human system. It figures, therefore, that the mouth should also be part of the story. What is the connection between diet/nutrition and susceptibility to oral disease?

In other words, the query now to be posed is, "Can we alter oral debris by changing vitamin state?" Our personal experience has been quite extensive with ascorbic acid (AA).⁵⁻⁷ So, for purposes of this experiment, "What is the correlation of the ascorbates and oral cleanliness without altering the usual oral cleansing habits?"

Figure 3 pictorially portrays the plasma ascorbic acid levels on the x-axis. The 200 subjects were divided into three near equal subsets. There were 68 with the poorest ascorbate levels (black column) ranging from 0.0 to 0.4. Sixty-seven showed the best (white column) vitamin C levels (0.8 to 1.3). The average debris scores are shown on the ordinate. Three items deserve special note. First, those with the poorest AA demonstrate the most debris (black column). Second, the group with the best ascorbate level (white column) is characterized by the least accumulations. Finally, the correlation is statistically significant ($r = -0.210$, $p < 0.01$), very much like that shown in Figure 2 and also not perfect.

Therefore, within the limits of these data, there appears to be a very real correlation between vitamin C state (as a possible nonmechanical contributor) and debris irrespective of tooth cleansing habits.

The Current Ecologic Thinking

What we have witnessed thus far (Figures 2

and 3) is actually an analysis of a series of surreal events. In the real world, people who do or don't clean their mouth also do or don't ingest ascorbates. And so, are the accumulations totally the result of how much one brushes or how much vitamin C is ingested?

Figure 4 depicts the frequency of daily toothbrushing on the abscissa and the average debris scores on the y-axis. Additionally, the 200 subjects were divided into two equal subgroups. The 100 with the relatively poorer plasma ascorbic acid levels (less than 0.6 mg%) are shown by the black columns; the other 100 with the better vitamin C state (0.6+ mg%) by the white columns. Several points warrant elaboration. In those showing the lower (poorer) plasma ascorbic acid scores, there's an obvious inverse relationship. In other words, and not surprisingly, the greater the toothbrushing frequency, the less the debris (0.87). This has already been demonstrated (Figure 2). It is also statistically confirmed ($r = -0.337$, $p < 0.01$). On the other hand, it is interesting that the data suggest that in those with relatively good AA state (the white columns), it is not too critical how frequently one brushes one's teeth. This is underscored by the lack of statistical significance ($r = -0.164$, $p > 0.05$).

Here is probably part of the explanation for the well-known fact why some of us need brush our teeth less than others.

Comments

Surely by act if not by word, the centerpiece for stomatology is cleanness. And so, we are told that good oral hygiene (cleansing habits) will cause good oral hygiene (cleanliness); bad oral hygiene (poor cleansing) will net poor cleanliness.

It is evident that plaque material may be removed from the tooth surface with effective mechanical cleansing techniques as shown in the literature⁸ and earlier in this report (Figure 2). Hence, this interface structure may, with proper instruction, be altered through a change in the external world (toothbrushing, flossing irrigation).

Much less clearly understood is the importance of the inner world (gingival tissue metabolism) to foreign and external accumulations. In the past, plaque has been regarded as inert matter. Now it is recognized that this so-called debris is a microcosm containing myriads of living neutrophils and other formed

elements. Its environs are remarkably similar to human blood and tissue fluid.⁹ As such, it should reflect metabolic changes within the host tissues.

Viewed in this perspective, the role of the organism's metabolic status as a possible contributor to plaque formation becomes more understandable. The findings of this investigation, as represented in Figure 3, suggest that plaque is indeed also related to the internal milieu as judged by vitamin C metabolism. In other words, this can be viewed as a demonstration of nonmechanical brushing.

These findings are consistent with other published reports of nutrient-debris (plaque) relationships. For example, Coven¹⁰ has reported a significant connection between gingival AA and debris score in children. Another study¹¹ found marked differences in foreign accumulations between Adventist and nonAdventist teenagers. The authors concluded that they were related to diet and not to differences in brushing frequency. It has also been confirmed by Mandel that the plaque represents the initial phase in calculus formation.¹²

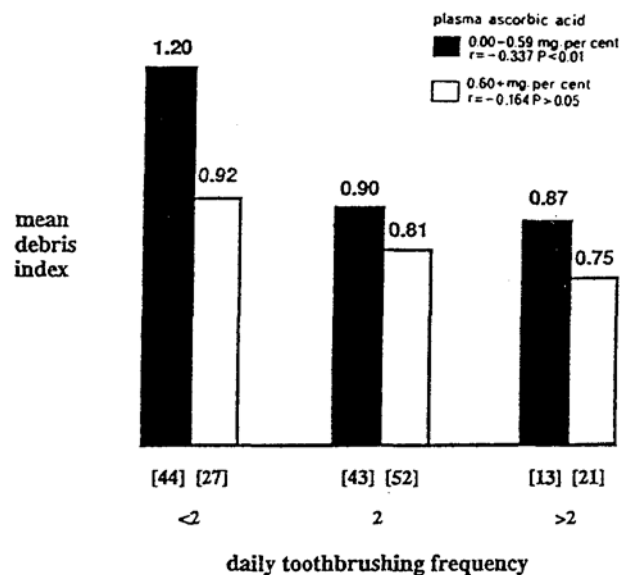
Obviously, cause and effect can be more convincingly imputed from clinical trials. One such study¹³ reported a resolution of materia alba, calculus, and stain when 500 mg of ascorbic acid was daily administered for 90 days to 35 mentally retarded boys. Duster-winkel et al¹⁴ and Lane and his associates¹⁵ reported reducing debris scores significantly with multivitamin and mineral supplementation.

Notwithstanding, even in this day and age, it is still generally held that the only way plaque can be prevented from causing damage to the periodontium is to remove it mechanically.^{16,17} If nutrients are determinants of plaque, as the present investigation and other studies suggest, this concept may be incomplete. The need for further investigation of nutritional approaches to oral hygiene (tooth cleanliness) would thus seem to be appropriate.

A second implication arises when an attempt is made to study the role of nutrients in the genesis of periodontal pathosis. It is customary in evaluating nutrients as potential etiologic factors to do so only in subgroups having the same oral hygiene (tooth cleanliness) and age.¹⁸ Obviously, if oral hygiene

(cleanliness) is to some extent a function of diet, it should not be held constant when evaluating a nutrient as a potential etiologic factor.

Figure 4. Relationship of debris index, plasma vitamin C and toothbrushing



Viewing brushing frequency-debris score relationships as influenced by ascorbic acid status (Figure 4) provides additional insights into plaque prevention and control. At all levels of brushing frequency, those with the better plasma AA levels exhibit cleaner teeth. In fact, the average debris score (0.92) for those who brush less than twice daily but have better vitamin C levels compares favorably with that of the poorer C subjects who brush twice or more daily (0.90 and 0.87).

The key fact underscored in this investigation is not the existence of a particular nutrient-plaque relationship, but the need to completely reevaluate existing concepts of oral hygiene (tooth cleanliness).

The philosophic considerations and the practical implications of the ecology of oral health and sickness not only continues but seems to intensify. This is superbly borne out in the citations by Nigel Clarke and his co-worker.¹⁹

"... Some individuals experience severe inflammation to minimal plaque, whereas others have minimal inflammation to heavy plaque ... Whether these variations occur as a

result of differences in host response or in virulence of the microbes is undetermined; however, the probabilities point to host factors rather than to microbes ... Periodontal disease has long been recognized as a chronic disease, but the literature describes a disease that is derived entirely from the effects of a microbial colonization of the gingival crevice. If this were so, it would mean that periodontal disease is unique among chronic diseases, all of which represent the long-term cumulative effects of interaction between a host biologic system and the surrounding environment ... Perhaps dentistry has lost the perspective between the oral tissues and the entire organism ..."

Additionally, we note from the work of these Australian investigators of their interest in the relationship of ecologic principles to the specifics of oral disease. This is emphasized in the following quotation:

"... (There is a possible) causal role for the host factors and (there is the suggestion) that the type and severity of periodontal disease(s) are reflections of the competence of the host defense rather than of the virulence of commensal oral organisms ... (It can be) postulated that chronic periodontal disease results when environmental factors, specifically those that compromise the peripheral blood supply, disturb the delicate balance between host and parasite in favor of the parasite ..." Finally, the importance of ascorbates is also emphasized as one of a number of contributing factors to the genesis of periodontal pathosis.

"... It has been established that 20% of gingival collagen is turned over daily ... Fibroblasts require ascorbate to produce collagen. Hence, the high turnover of gingival collagen probably renders gingival remodeling and repair particularly vulnerable to ascorbate deficiency. Vitamin C is also required by polymorphs in their vital defense role. The phagocytic and chemotactic functions of the white cells require vitamin C concentration within the cell ... Although debate continues concerning the required plasma ascorbate levels, it appears likely that the demand for ascorbates and essential metabolites for defense and repair of gingival tissue may be met in the presence of chronic inflammation, smoking, stress, inadequate diet, aging, or any other vaso-constrictive factors ..."

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