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SOME IMPORTANT DEVELOPMENTS
PRESENTLY INFLUENCING DENTAL
HEALTH IN AMERICA*

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Several things have occurred in the past which adversely influence, in one way or another, the dental health and welfare of the American people at the present time; and will continue to do so in the nearby future. I wish to direct attention to four separate developments that have taken place during the past forty years which will have to be discredited and discontinued, and their misleading influences will have to be overcome for people to en-

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joy the highest degree of oral cleanliness and dental health. They are:

1. Improper methods (Charters, Stillman, others) of brushing the teeth;
2. Placing undue emphasis upon brushing the teeth immediately after each meal;
3. Artificial fluoridation of communal water supplies;
4. Topical application of fluorides.

1. IMPROPER METHODS (CHARTERS, STILLMAN, OTHERS) OF BRUSHING THE TEETH

During the first quarter of the present century much attention was directed to methods of brushing the teeth, with the idea of massaging the gums at the same time. Alfred Fones was a pioneer in the field of oral hygiene, and especially in training and in promoting the work of the dental hygienist. He established the first school^{1, 2} for their training. He also published detailed instructions³ for the home care of the mouth, and got out several promotional pamphlets and a textbook intended especially for dental hygienists. A reprint of the fourth edition of this book,⁴ in 1942, describes the same method of brushing the teeth as he first described.³ It has been referred to as the "big circle" method and consists particularly of brushing the buccal and labial sides of the teeth, held in occlusion, with a wide circular movement to include also the gums high and low over the teeth. A large soft brush was used with the idea of massaging but not injuring the gums. To his credit Fones advocated vigorous scrubbing of the occlusal surfaces of the teeth and, as a part of his mouth hygiene, he also included cleaning of the proximal surfaces about the contact areas with dental floss.

In the Charters method^{5, 6} the bristles are directed into the embrasures between the teeth, pointed somewhat occlusalward, the sides and not the ends resting upon the gums. Short rotary movement of the brush is supposed to clean the teeth within the sulci and at the same time to produce "an ideal massage of the gums" by pressure with the sides of the bristles. He warns especially "do not allow the points of the bristles to rest upon the gums".

In the Stillman method⁷⁻⁹ the bristles are placed obliquely to the long axis of the teeth or at an angle to the gingival surface and directed apically, the bristle ends resting partly on the gingivae and partly on the cervical portion of the teeth. "The bristles should never be pointed at right angles to the surface of the gingivae, for in this position they may cause puncture. Pressure on the gingivae is desired with the least amount of friction or injury." "This act is repeated several times and the handle is given a slight rotary motion but not enough to cause the bristle ends to move from the positions in which they were first placed".

Numerous modifications, especially of the Stillman method, have been advocated and taught. The chief of these provides that the sides and ends of the bristles be applied in a sweeping movement towards the occlusal, from above downward for the uppers and from below upward for the lowers. Many dentists believe and insist that this method must be followed.

In a book of more than 700 pages on the use and abuse of the toothbrush Hirshfeld¹⁰ inclines to prefer the Charters method which differs from the Stillman method essentially in the direction of the bristle ends—in the former they point occlusally, in the latter apically. He says these two methods are superior to others generally in that the stroke used is shorter and less forceful, thus minimizing the "tendency to gingival traumatization and tooth abrasion". Throughout his discussion, the idea prevails of taking care not to puncture or injure the gums with the ends of the bristles. He urges especially to avoid "penetration of the gingival crevices by the bristle ends". It should be noted that this is exactly the opposite of what is absolutely necessary. The tooth must be cleaned within the gingival crevice. This can be done, to the extent it can be done with the brush, only by applying the ends of the bristles of the right kind of brush¹¹ to the areas on the tooth within the crevice to be cleaned.

These improper methods or modifica-

ons of them have been advocated by leading authorities and taught in dental schools so long and so positively until they have become firmly established in dental practice. The dentist who advises his patients in this regard recommends the particular method or modification which he accepts as the best.

In papers or in discussions wherein the method of brushing is given the Charters or Stillman method or a modified Charters or Stillman method is usually specified. Often the speaker refrains from being specific and calls it "an approved method" or "an accepted method", neither of which means anything definite.

One does not find in the writings of the originators and promoters of these methods of brushing the teeth any indication that their opinions in this regard were based upon accurate personal knowledge and experience as to the local microscopic etiological and pathological conditions in the two principal diseases affecting the teeth—caries and periodontoclasia. These diseases are caused by microscopic organisms, the lesions at first are microscopic in extent, they advance microscopically, the tissues involved are composed of microscopic elements, and the destructive processes are microchemical. Therefore, one can know of his own knowledge and understand these conditions upon which effective prevention must be based, only through microscopic studies and experience.

Less than 25 per cent of the loss of teeth in this country results from caries; more than 75 per cent from periodontoclasia. Periodontoclasia begins in childhood and is a universal disease of man. Everyone, at anytime, has lesions of some stage of activity and advancement, and these can be demonstrated by proper microscopic examination of suitable material from the locations concerned. Practically all people sooner or later lose their teeth from this disease, if they live long enough. It prevails among people of all races and in all levels of civilization, the rate of progress being influenced by the oral hy-

giene habits and methods of the individual. It affects the most cultured and intellectual people of the world and even more severely, the primitive races,¹²⁻¹⁴ including the African bushman¹⁵ whose habits and characteristics, in many respects, are more like those of lower animals than of man.

Caries is limited to people whose diet contains the necessary fermentable (mostly refined) carbohydrates. The initiation and progress of the lesions of this disease also are influenced largely by the effectiveness of the personal oral hygiene habits of the individual. At the present time very few people know and accurately follow, or have any way to learn the exact method which must be followed to prevent caries. Consequently, almost all people in this country have more or less caries lesions, and most of these tend to progress in time, even though they receive the best treatment and restorations that can be given. Many of the teeth in which caries lesions originated in childhood are ultimately lost, however good the dental service may be. This can be prevented only by preventing the lesions before they start.

The purpose of personal oral hygiene is maintenance of oral cleanliness and prevention of both caries and periodontoclasia, and their consequences. The purpose is accomplished however only to the extent the method or technic, of which proper use of an appropriate toothbrush is an important part, removes and prevents reaccumulation of harmful amounts of the essential etiological material at the locations where the lesions of these diseases originate and advance.

The confusion and inadequacy of information regarding these two principal diseases is indicated in testimony¹⁶ given by Dr. Harry Lyons on February 29, 1956 before a subcommittee of the U. S. Senate. He called attention to the vast and complex problems of tooth decay and its infectious sequelae, and stated that "the so-called gum diseases are essentially complete mysteries as far as their causes and prevention are concerned". He was spee

ing as president-elect of the American Dental Association, as dean of the School of Dentistry of the Medical College of Virginia, and as a member of the National Advisory Dental Research Council for the National Institute of Dental Research.

Caries lesions originate only at locations where heavy bacterial film (plaque material) is continuously present. To prevent initiation and advancement of such lesions it is necessary to prevent or minimize the accumulation and retention of this material which is composed largely of filamentous types of micro-organisms having one end attached to the tooth surface and the other extending outward towards the surface of the film mass. This characteristic has been illustrated^{17, 18} and has been adequately documented¹⁸ by references to numerous other specific illustrations in the literature. These fundamental facts can be confirmed by microscopic examination of plaque material removed from extracted tooth specimens or of sections of enamel cuticle removed with plaque attached.

Removal of this material with the toothbrush from the locations to which the ends of the bristles can be applied, is only partial at best. There are many organisms left and these tend to grow and reaccumulate, thus renewing the film pad or plaque. By repeating the cleaning at suitable intervals harmful reaccumulation and caries producing conditions at the particular locations are prevented.

Almost all caries lesions in young people (under adult age) originate either in the pit and fissure depressions on the occlusal surfaces or on the proximal surfaces around the contact area. The vulnerable areas on the occlusal surfaces can be cleaned well by vigorous application of the ends of the bristles of the toothbrush. It is physically impossible to clean the proximal surfaces where caries lesions originate by any method of brushing with any kind of brush. These areas can be cleaned adequately only by passing the right kind of dental floss¹⁹ through the contact area between the teeth and back

out, thereby removing most of the material which is essential for caries activity.

The next most frequent location for caries lesions to originate is in the cervical region at the cemento-enamel junction. Normally this junction line is covered by the epithelial attachment²⁰ and is not exposed to the necessary conditions (bacterial plaque) for caries. After the gum recedes sufficiently (usually not before adult age) to expose this line at any place caries lesions may begin, if the location is not kept sufficiently clean. This can be done by the use of the toothbrush only to the extent the ends of the bristles of suitable characteristics are vigorously applied to the areas to be cleaned. Please note that this is exactly the opposite of the improper methods of brushing referred to above.

The bristles of the brush cannot reach and clean the interproximal cervical region. This can be done only by proper application of the right kind of dental floss¹⁹ to the particular location.

Periodontoclasia (gingivitis, "pyorrhoea alveolaris", "periodontal disease") is a purely local, continuous, inflammatory disease resulting from local etiological conditions. At anytime after a tooth has erupted and attained its occlusal level, suitable material from the gingival crevices, especially the interproximal crevices, always contains from a few to many pus cells; and sections of tissue from this location show more or less inflammation upon microscopic examination. The intensity or activity of this early stage inflammation (gingivitis) varies greatly in different people and in different locations in the same mouth, influenced largely by the oral hygiene conditions present. This early unrecognized and usually symptomless gingivitis constitutes the early stage of a progressive pathological process which continues to advance and never ends until the involved tooth is finally lost (extracted or exfoliated), usually after middle life, sometimes earlier. Much confusion has resulted from failure to recognize the early stage of this disease.

Kronfeld²¹ says "the presence of a small number of inflammatory cells in the sub-epithelial tissues can be considered as indicating a gingivitis; but if it is, almost every human gingival crevice would have to be considered pathological which would only cause confusion".

All periodontoclasia lesions begin at the gingival margin where bacterial material (plaque) is continuously produced and is retained on the tooth at the entrance to the gingival crevice. The bacterial mass tends to advance (grow) into the crevice and cause irritation and microscopic inflammation (gingivitis) of the crevicular epithelial tissue resting against it. In time concretions (mostly calculus) form on the surface of the tooth in the deeper part of the bacterial mass. This is composed largely of filamentous types of micro-organisms attached to the tooth. The foreign material on the tooth and extending into the crevice now consists of the hard concretion overlaid by the film of growing bacterial material, and this is mechanically more irritating to the gingival tissue resting against it. The inflammation and suppuration resulting from the advancement of this foreign material on the surface of the tooth within the crevice (now a "pyorrhoea" lesion) continues (usually over long periods of time) and the attachment of the gum on the tooth recedes.²⁰ As the process advances inflammation and resorption of the supporting tissues—periodontal tissue and alveolar bone—ensue and progress as long as each particular tooth is retained.

At all times this foreign material is found present on the surface of the tooth within the crevice, thus making the tooth itself, in effect, a foreign body extending into the chronically inflamed and suppurating surrounding tissue. This fundamental fact has been illustrated^{17, 18} and has been adequately documented¹⁸ by references to numerous other specific illustrations in the literature. It can be confirmed by microscopic examination, also with the dissecting microscope, of specimens of extracted teeth suitably stained

to bring out the landmark²² which indicate the location of the outer border of the epithelial attachment. This locates the very bottom of the lesion when the tooth was in the mouth. The bacterial film always extends to this line²³ and the underlying subgingival calculus extends²⁴ almost to it.

The only way by which the early stages of this disease and further advancement of existing lesions can be prevented is by cleaning the teeth within the gingival crevices sufficiently frequently to prevent reaccumulation of the etiological foreign material. This can be done with the tooth-brush only to the extent the bristles of appropriate dimensions¹¹ are directed into the crevices and reach the material to be removed. This is exactly the opposite of the improper methods of brushing referred to above.

The bristles can be directed into the exposed crevices in the sulci between the teeth but they cannot be applied to material in the deeper part of the interproximal crevices. This can be removed by the use of the right kind of dental floss²⁵ carried to the very bottom of the crevice, but in no other way now known.

Scales of calculus must be removed by a dentist who understands the conditions that exist. Although calculus does not reform in locations that are cleaned daily, occasional cleaning and rechecking by the dentist is needed to discover any locations that may have been missed by the daily routine.

A method of personal oral hygiene based upon the above indicated fundamental facts has been designed, by which the highest degree of oral cleanliness and dental health can be maintained. Both caries and periodontoclasia are practically prevented and further advancement of existing lesions, especially early stage lesions, is substantially retarded or prevented. I have referred to this method as "the necessary method of personal oral hygiene",¹⁷ "the right method of personal oral hygiene", "an effective method of personal oral hygiene".¹⁸ In speaking to

dentists who have learned and are teaching it to their patients or to people who know and follow it, I usually refer to it as "our method of personal oral hygiene".

Anyone who knows of his own knowledge and understands the local microscopic etiological and pathological conditions in the two principal diseases already knows in advance that approximately this exact method is necessary and that any neglect or deviation from it would be less effective to the extent of such neglect or deviation.

Improper methods of brushing the teeth not only are not effective but teaching and promoting them misleads people and detracts from their learning and following the method of personal oral hygiene which is absolutely necessary.

2. PLACING UNDUE EMPHASIS UPON BRUSHING THE TEETH IMMEDIATELY AFTER EACH MEAL

In 1938 Stephan²⁶ designed a microcolorimetric technic for determining the pH of plaque material removed from the surfaces of teeth, and of debris from cavities. In 1940,²⁷ employing a delicate antimony electrode, he measured the pH of plaques and cavities in situ. He found that the lowering of the pH of the plaque reaches its greatest intensity during the first thirty minutes after a glucose rinse and that little or none of the effect remains after two or three hours. Fosdick and associates,^{28, 29} testing plaque material from teeth for pH with a microglass electrode, found similar rapid reduction after ingestion of carbohydrates.

Stephan³⁰ also found that there is a quantitative difference in the intensity and duration of the acidity produced by carbohydrates on the teeth of caries-free and caries-active individuals, the pH drop being greatest in cases with extensive caries activity.

With the idea of making practical application of the above information, dentists and dental authorities have advocated brushing the teeth immediately after each ingestion of sugar-containing food.³¹ The American Dental Association got out a pamphlet³² advocating the procedure.

Commercial interests, taking advantage

of this information and especially the later clinical report of Fosdick,³³ have extensively and continuously advertised the idea that the teeth must be brushed immediately after each meal. This is done in connection with appealing, extravagant and misleading advertising for the purpose of promoting the sale of their "superior dentifrices". For several years anyone who reads current periodical literature, listens to the radio or watches T.V. programs has been repeatedly advised to brush his teeth promptly after each meal.

In 1950, Fosdick published³³ the results of an extensive study carried out over a two year period by a group of 10 dentists on a total of 946 (423 controls, 523 test subjects) college students in 7 institutions. The test subjects were required to brush their teeth after each meal. The controls were allowed to follow their usual procedure. Both clinical and x-ray examinations were employed. Statistical methods were employed in analyzing the data. The results varied considerably when different methods of estimating them were used but a reduction in the neighborhood of 50 to 60 per cent in the average number of new carious surfaces over the two year period was indicated.

The test subjects were instructed to rinse the dentifrice from the mouth after each brushing and when brushing was impossible to rinse the mouth thoroughly with water. The author³³ recognized that the rinsing and not the brushing may play a large part in the results. "It is obvious that the toothbrush or the abrasive cannot physically reach the inner portions of the proximal areas. Hence it is to be expected that the forcible dilution of the material in these areas might account for the results. There is considerable evidence to substantiate this possibility". Thorough rinsing of the mouth soon after each meal not only dilutes but it washes away much of the soluble material, in addition to particles of food material on the teeth.

Brushing the teeth immediately after meals, if properly done with the right kind of toothbrush, probably does no di-

rect harm, but emphasizing and promoting it tends to encourage placing undue reliance upon it and to detract from the essential and entirely effective cleaning of the teeth at night before retiring. It only promises some preventive effect against caries. Rinsing vigorously without the brushing or dentifrice does about as much good.

Brushing alone, in the usual way, could have little or no preventive effect upon the other more important disease, periodontoclasia, for the reason that it does not clean the proximal surfaces within the gingival crevice where the etiological material (bacterial film and calculus) accumulates.

Since the teeth must be cleaned effectively (by the proper use of the right kind of both toothbrush and dental floss) every night before retiring, and they should also be brushed upon arising in the morning, brushing also after each meal, making a total of 5 times a day, would increase any harm that may result from over-vigorous use of current harsh inappropriate brushes. "Nothing has been so destructive of tooth structure or has caused so much recession of the investing tissue as the use of stiff, ill-shaped brushes." Most people who have habitually brushed their teeth for several years with the usually employed brushes have worn back the edges of their gums over the high places to some extent.

Brushing the teeth immediately after each meal is not convenient or practical and will not be carried out by many people. Since, it is not necessary, and of itself, is not of any considerable benefit, placing undue emphasis upon it tends to mislead and confuse the public and thereby to unfavorably influence dental health.

3. ARTIFICIAL FLUORIDATION OF COMMUNAL WATER SUPPLIES

Previous observations relative to "mottled enamel"³⁴⁻³⁸ led to the discovery by Churchill,³⁹ in 1931, that this condition was caused by the fluoride ion in the water supply. Dean and Everage⁴⁰ concluded that 1 ppm fluoride in drinking water was not harmful and therefore "has

no public health significance". Dean⁴¹ in 1942, announced that caries incidence in children was about 60 per cent less in areas where the fluoride was at or above 1 ppm, as compared with nonfluoride areas.

This and much other confirmatory evidence of substantial reduction in caries damage from naturally fluoridated water provided a logical and supposedly sound basis for artificially adding fluorides to communal water supplies, up to what was considered to be the optimum level of 1 ppm. The catch was, and still is, the unwarranted assumption that this powerful chemical, in such small doses, has no harmful effect upon other organs and tissues of the body; while at the same time it is capable of profoundly affecting the teeth, and in some unknown but supposedly harmless way, of significantly reducing the incidence and retarding the pathological process of caries. Just why fluoride selects only the teeth to thus favorably affect or how this beneficial action by it is brought about have remained confused or unrecognized. The general belief is that such teeth, which contain somewhat more fluorine are therefore more resistant to caries activity.

Several separate study projects were set up for testing artificial fluoridation as compared with little or no fluoride in the water. Progress reports⁴²⁻⁵² from time to time, and now some final reports after ten years⁵³⁻⁵⁶ all confirm the earlier observations that caries damage is significantly reduced in areas of naturally fluoridated water and about as much where water is artificially fluoridated to 1 ppm. or more. A liberal over-all estimate from such of these reports as I have seen would be an average of about 50 per cent reduction in the caries rate in children. Some of the more favorable age groups show somewhat greater effect.

These results would be well worthwhile if they were secured without harmful effect, either to children who receive the most caries retarding benefit or to older people who benefit less or not at all. They

are not. The reduction in the incidence of cavities in teeth (the advanced stage of caries) from fluoridated water results entirely from the contemporary increase in periodontoclasia (gingivitis) activity. This has not been recognized by the originators, promoters, and advocates of artificial fluoridation. However, it is a fact, nevertheless. The incidence and progress of caries lesions are reduced in the same way by increased gingivitis activity from any other cause, such for instance as Vincent's disease, numerous systemic diseases and conditions, certain vitamin deficiencies and certain other chemical poisons.

In order to understand the relationship between caries and periodontoclasia and the influence of ingestion of fluorides, it is necessary to be clear on certain fundamental facts relative to the nature of the pathological process, the prevalence of the early stage lesions of these diseases and how they advance.

Enamel caries lesions originate at certain locations where fermentable carbohydrates are retained and minute quantities of acids are produced by bacterial action. Caries does not occur without carbohydrates or without bacteria. Traces of acids produced at frequent intervals, or continuously, partially decalcify the enamel giving rise to a chalky white condition in which the enamel at the particular location is softer ("chalky enamel") and can be dug into with a sharp instrument. If the etiological conditions continue, the partial decalcification advances into the enamel and sooner or later may reach the dentin. Disintegration of chalky enamel may result in a break in the surface producing a depression or cavity, small and shallow at first, which continues to enlarge or advance. After cavity formation, and sometimes before, the caries lesion at accessible locations usually may be recognized and diagnosed. This should be considered the advanced stage caries lesion. There was a considerable period of time however, from the normal unaffected condition at the particular location, to this

clinically diagnosable caries lesion. During this entire period the early unrecognized caries lesion at first is microscopic, but it usually progressively increases in size and in depth. The rate at which the process in each lesion progresses is determined by several variable factors, some of which may accelerate, others may retard it.

The most important factor in retarding proximal lesions is interproximal gingivitis (early stage periodontoclasia). This is always present to variable extent and in variable degrees of activity, from microscopic lesions only to active visibly inflamed lesions which bleed easily on pressure. Inflammatory exudate, which contains more or less blood serum and therefore has approximately the same pH as blood,⁵⁷ tends to neutralize or counteract acids produced in the environment and thereby retard the caries process. If gingivitis is sufficiently active the caries process is slowed down or may be prevented from reaching the stage for clinical diagnosis. Many such retarded early stage lesions remain inactive indefinitely, others may progress slowly and break down in later life, leading to the impression that new caries lesions have developed. Actually practically all enamel caries lesions originate within the first year or two after the eruption of any given tooth.

The prevalence of early stage proximal caries lesions, either active, retarded, or inactive, in any given population can be learned only by examination by proper technic of a considerable number of extracted tooth specimens. Good technic for this purpose is to dip the specimen in 5 to 10 per cent HCl for less than thirty seconds to release the enamel cuticle, dip in water followed by 0.25 per cent acid fuchsin to improve contrasts and differentiate other tissues from enamel, and then examine under the dissecting microscope. The depth to which such early stage lesions extend can be satisfactorily observed if the specimen is split through the lesion with a double side flat separat-

ing disc or other suitable instrument.

I have examined many hundreds of specimens in this way. Lower incisors seldom decay. If these are omitted I have found proximal caries lesions in from 75 to more than 90 per cent of the specimens in the different collections examined. Many of them, even in those from older people, are still in the chalky enamel stage and have not reached the cavity stage. Their advancement has been retarded or prevented for many years. It is not unusual to find some such lesions with more or less calculus over them, indicating that there was no acid action at the particular location, at the time it was deposited, or since that time.

Reports have shown that the caries preventive effect of fluoride ingestion is remarkably selective⁵⁸⁻⁶³ relative to location of lesions. The greatest benefit applies to proximal lesions, much less to occlusal or other lesions. Now the Newburgh-Kingston reports^{56, 64} confirm this pronounced selective effect, even where there is only about 1 ppm fluoride in the water. The antacid effect of inflammatory exudate applies especially to the interproximal region and thereby retards proximal caries. Any increase in gingivitis activity, however slight, increases the amount of exudate and correspondingly retards caries activity. The increase from as little as 1 ppm. of fluoride in the water is sufficient to substantially retard proximal caries but it has much less effect upon caries at other locations.

During the past fifteen years I have examined more than a thousand persons, mostly university personnel, more than half of them medical students. These people have been from different parts of the country, mostly from the gulf and other southern states, a good many of them from areas having naturally fluoridated water. On an average, those from known fluoridated areas have sustained less damage from caries than the others. On the other hand, they have sustained more damage from periodontoclasia and often still have more gingivitis. Several

of them stated that although their relatives and acquaintances in their communities did not have much trouble from caries, some of them had more trouble from "gum disease" and sometimes already were wearing dentures at relatively early ages.

People who have naturally fluoridated or artificially fluoridated water will continue to experience less caries and more periodontoclasia damage. Their total dental health, therefore, will be unfavorably influenced as long as these harmful conditions continue.

4. TOPICAL APPLICATION OF FLUORIDES

The idea that resistance to dental decay from ingestion of fluorides may result from incorporation of fluorine in the tooth substance led to topical application of fluorides for prevention of caries. Numerous experiences have been reported,⁶⁵⁻⁷⁷ the results varying from none^{65, 77-80} up to as much as 50 per cent reduction³³ in the caries increment. Most of the observations have been on children. Some reports indicate some slight caries preventive effects in adults^{72, 73} others none.^{77, 79}

At least several separate treatments are considered to be necessary^{81, 82} to secure any marked reduction, 7 to 15 applications⁶⁹ yielding the best results. The preventive effect has been found to subside or to disappear⁸³⁻⁸⁵ following interruption or discontinuance of the treatment.

More recently topical stannous fluoride has been reported⁸⁶ to more effectively prevent caries than sodium fluoride; also to be effective in a toothpaste⁸⁷ although sodium fluoride is not. It has been found experimentally to be markedly superior to sodium fluoride⁸⁸ in protecting powdered enamel from the action of acids. The anti-enzyme effect of stannous fluoride has been shown to be a function of the tin content⁸⁹⁻⁹¹ and not of the fluorine.

In carrying out the topical fluoride treatment a "thorough prophylaxis", which increases the uptake of fluoride,⁹² at one or more of the several treatments in the series is considered to be necessary. Elimination of this reduces the caries preven-

tive effect by one half.^{82, 93} This means that in the most over-optimistic claim of 40 per cent prevention 20 per cent results from the prophylaxis and not more than 20 per cent can be attributed to the fluoride.

In the Shaw publication in 1954, Bibby and Brudevold⁹⁴ tabulated the caries control reported by 16 different authors in 31 separate studies of topical application of sodium fluoride and by 7 authors using other fluorides. In the light of the information in their two tables and of much other information in the literature, and considering that at least 20 per cent reduction results from the prophylaxis and perhaps other influences associated with the treatment, it is evident that topical application of fluorides has little or no specific caries preventive effect.

In 1948, Congress, influenced largely by the urgent request, advice and recommendation of representatives of the U. S. Public Health Service and of organized dentistry, appropriated \$1,000,000 for a nation-wide demonstration and promotion of topical application of 2 per cent sodium fluoride.^{95, 96} The stated purpose was to set up (roughly) one "field demonstration mobile unit for each state; to demonstrate to dentists, dental hygienists, state and local health department personnel, et cetera, the correct technic of making sodium fluoride application to the teeth; and generally to publicize and promote interest in the procedure".

The program was hastily inaugurated in 1948 and vigorously pursued. By October 1950, demonstrations had been conducted by the demonstration teams in 658 communities;⁹⁷ and in many more since that time, all over the country.

This procedure, which has little or no specific caries preventive effect, has been promoted, more or less, also in many other countries. Dean⁹⁸ quotes H. J. Schmidt, secretary general, European Organization for Research on Fluorine and Dental Caries Prophylaxis, as stating that it has been utilized extensively in recent years in Denmark, England, Finland, Ger-

many, Holland, Hungary, Italy, Sweden, Switzerland and Yugoslavia.

Even now this procedure is being extensively publicized and promoted by the American Dental Association, especially through a leaflet⁹⁹ printed and supplied for wide distribution, mainly through dentists in their offices. In this leaflet the Council on Dental Health of the American Dental Association recommends fluoridation of communal water supplies. They also recommend topical application of fluorides for children who do not have fluoridated water; and for those who do, unless they were born in a fluoridated area. They recommend a series of four separate applications at intervals of two to seven days, a course of such treatment to be given preferably at the ages of 3, 7, 10, and 13. They claim that this "will reduce the occurrence of dental decay by an average of 40 per cent".

The first application of fluoride in the series is supposed to be preceded by a thorough cleaning of the teeth, the others not. Any reduction in the occurrence of dental decay from this treatment results largely, if not entirely from the prophylaxis and is small compared with practically 100 per cent prevention which results from the right method of personal oral hygiene. Even if it is believed that there is a specific effect, which there is not, amounting to as much as 20 per cent caries reduction from the fluoride, there is still no need for it.

Continued promotion of topical application of fluorides tends to perpetuate the existing confused information relative to caries and to further postpone the time when those who wish information can learn the fact that prevention of caries depends essentially upon effective personal oral hygiene plus occasional cleaning of the teeth by the dentist, and not upon any kind of medical treatment.

Topical fluoride could not have any preventive effect upon the much more important disease—periodontoclasia—which is always present, more or less, as gingivitis in childhood, and continues to ad-

vance from that time onward. On the other hand, the right method of personal oral hygiene, regularly followed, prevents or controls this disease and at the same time prevents caries and maintains a high state of oral cleanliness.

COMMENT

Many variable factors and conditions contribute more or less to the origin and advancement of the lesions of both caries and periodontoclasia. It is not necessary to know, understand, or control each one of them in order to prevent these diseases. It is only necessary to know and to prevent or minimize the essential local etiological conditions — conditions without which the lesions do not occur. These consist of accumulation and retention of foreign material, composed primarily of bacteria, at the particular locations where the lesions originate. The necessary physical removal of this material at appropriate intervals (at night before retiring) can be accomplished only by the right method of personal oral hygiene. In the light of all presently known facts and experience any neglect of, or deviation from this method reduces the benefits in proportion to such neglect or deviation.

Personal oral hygiene is an individual and a personal matter. Each person must know and accurately follow an effective method. Such a method will be taught only by dentists (or others) who know and follow it themselves. Those who have the information and experience know that the highest degree of oral cleanliness and dental health results.

Any institution, agency, organization, or group concerned with promotion of dental health, not interested in looking into or confirming the fundamental facts upon which effective personal oral hygiene must be based, but wishing only to know the clinical observations of dentists who have had the necessary experience, now have the opportunity. Names can be furnished of dentists of the highest professional standing in their respective communities in 17 different states who have learned this effective method and have been en-

thusiastically teaching it to their suitable patients, some for several years. Their experiences and results surely would be interesting and enlightening to others who have not had such experiences. These dentists could be contacted in any practical way, or better still, they could be brought together in groups (a dozen or several times that many if wanted) for conferences and discussions.

Any one of these dentists could call in numerous patients for illustration of results, who have been following this effective method for several years. Individuals can be presented, of all ages up to past 80, who follow this method and are maintaining practically complete dental health thereby.

Improper and unnecessary brushing discussed under 1 and 2 above tend to correct themselves. The harmful influence of their promotion should gradually decline as more dentists learn and teach, as they surely will do sooner or later, effective personal oral hygiene.

Artificial fluoridation of communal water supplies is rapidly expanding. It has been advocated and promoted originally and continuously by the U. S. Public Health Service and by the American Dental Association. It has been officially endorsed and approved by several of the foremost national (and many regional) scientific organizations, including the American Medical Association¹⁰⁰ and the American Association for the Advancement of Science,¹⁰¹ said to be the largest body of scientists in the world. Recently a group of more than a hundred prominent citizens and leading authorities in their respective fields, many of them physicians, organized a strong endorsement and recommendation¹⁰² of fluoridation, especially for the city of New York.

Under these circumstances of overwhelming authoritative and influential support, artificial fluoridation has been adopted in several hundred communities¹⁰³ in this country. The trend is gaining momentum and promoters of it are meeting with greater success all the time.

A large number of reports of observations in naturally fluoridated districts and now in artificially fluoridated communities all show that the incidence of the advanced stage of caries—cavities and extracted teeth—in young people is reduced by fluoridation. This is accompanied by and results from the contemporary increase in periodontoclasia activity. It only increases the activity of this disease, which all people have from early childhood onward. It does not make sense to fluoridate the water, thereby increasing the activity of this more important disease, in order to lessen the caries activity.

Whenever the relationship between the early stages of the caries process and the early stages of periodontoclasia is better understood and the harmful effect of fluorides in this regard, is recognized and can become known, as surely will occur sooner or later, artificial fluoridation of public water supplies will have to be discontinued. Until that time its unfavorable influence upon dental health will continue wherever it has been adopted.

Sufficient increase in periodontoclasia (gingivitis) activity to retard caries results from 1 ppm fluoride in the water, which is therefore more harmful than beneficial, even to young children. The caries preventive effect is much less in older people but increased periodontoclasia activity results from chronic fluoride intoxication at any age before the teeth are finally lost in later life.

There is considerable difference of opinion as to the influence of association between caries and periodontoclasia.¹⁰⁴⁻¹⁰⁶ Many experienced dental practitioners are of the opinion that there is less caries activity in mouths with the most active periodontoclasia and that the two diseases tend to be mutually exclusive.

There are many reports in the literature relative to the influence of fluoridated water upon periodontoclasia (gingivitis) most of them indicating little or no effect, one way or another. These reports are mostly based upon the PMA index employed by Massler, Schour and associ-

ates.¹⁰⁵⁻¹¹¹ This method attempts to show the incidence of frank overt lesions (the advanced stage of the disease) but does not recognize or throw any light upon the early stage. The method is subject to unintentional and unavoidable bias^{112, 113} and much variation between different examiners.

Most reports of surveys of the caries rate and evaluation of caries control measures are based upon the DMF method of Klein and Palmer.¹¹⁴⁻¹¹⁶ Like the PMA this DMF method attempts to show the incidence of advanced stage lesions and does not recognize or throw any light upon early stage caries. It too is subject to as much as 100 per cent¹¹⁷ examiner bias and variation. It is evident that such methods could be of only limited significance as to the prevalence and the relationship of caries and periodontoclasia, and the effect of control measures.

An impressive report by Russell¹¹⁸ indicates that not only less periodontoclasia but less final loss of teeth was experienced by lifelong residents of Colorado Springs (2.5 ppm fluoride) than was found in a supposedly comparable group at Boulder, Colorado, with fluoride-free water. An example of contrasting report is that of Dale and McCauley¹²⁶ of chronic fluoride intoxication from fumes of hydrofluoric acid. The unexposed control group had an average of 27.4 teeth remaining; whereas those in the exposed group had only 23.3 teeth left, those exposed more than ten years only 21.6.

Greenwood published¹¹⁹ an extensive review of fluoride intoxication up to 1940. There was then abundant evidence (proof) of the serious, irreversible, harmful, systemic effect of fluorine in excessive amounts, and in some not-so-excessive. A large volume of additional information relative to the subject has appeared since that time, mostly supporting the claim that 1 ppm is not harmful and assuming that any harmful effect could be recognized by the methods used.

Mottled enamel occurs in part of the population when there are only 2 or 3 ppm

of fluoride in the water and in almost all when the content is still higher. Long continued intake of increased amounts of fluorine from fluoridated water¹²⁰⁻¹³⁸ or from contaminated air^{120, 139, 140} causes, not only mottled enamel and dental hypoplasia, but also profound changes in the other calcified tissues of the body. These changes include osteosclerosis, thinning of the lamina, increased density, opacity to x-rays, narrowing of the marrow spaces, lack of normal sharpness of the bone outlines, osteophytic formations on various bones, synostosis of various joints, especially of the vertebral column, excessive calcification of tendons, fasciae, ligaments and ligamentous attachments, "bridging" between the vertebral bodies giving rise to stiffness of the back (the so-called poker back), etc. These striking conditions are usually recognizable only after thirty or thirty-five years of exposure but they continue to exist as long as the sufferer lives, and to increase if the exposure continues. Reduction of the bone-marrow spaces, thus impairing and reducing the blood-making tissues of the body not only produces anemia but it also reduces the ability to make back blood in anemia from other causes.

The fact that these severe harmful effects have resulted from 3 times as much, or perhaps 5 to 10 times as much, fluoride in the water as is added in artificial fluoridation leaves room for doubt as to the complete safety and harmlessness of that procedure.

There is much individual variation in susceptibility to the known effects of fluorides, whether it be the beneficial caries retardation in children or the known harmful effects, such as increased periodontoclasia activity, mottled enamel and the cumulative damage to the bones, tendons and ligaments of the body. Citizens, officials, and health authorities of the community have to decide whether to expose the entire population of all ages, and in all conditions of health and vitality, to such possibly harmful effects in order to secure the limited caries preventive effect

of fluoridation of the communal water supply.

The public looks to the U. S. Public Health Service and the dental profession, more than to any other health agency or authority for guidance relative to dental health. As long as they continue to actively advocate and to recommend topical fluoride treatment it will be wanted by many people. Although dentists, after practical experience, may be doubtful of the results they have seen they still will be confronted with the public demand for fluoride applications, as long as the promotional publicity continues.

SUMMARY

Attention has been directed to four separate but somewhat related developments unfavorably influencing dental health, which have taken place during the first half of the present century. Some of the reasons for such influence have been presented.

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