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MECHANICAL METHODS FOR INDIVIDUAL REMOVAL OF DENTAL PLAQUE FROM THE TEETH

ARNI D. SOENTOKO, drg.

UNIVERSITAS GADJAH MADA

INDONESIA

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SUMMARY

The prevention of dental caries and periodontal disease assumes great importance because of its world wide distribution and high prevalence, plus the inadequate dental resources available.

Prevention is the only hope for bringing these diseases under control. A high correlation between dental plaque and both diseases, is an encouragement to warrant devoting attention to an oral hygiene procedure, i.e. mechanical methods, as a major approach in prevention.

For this purpose, the toothbrush has been used for centuries. A review of the literature, in this thesis, indicates that it has been developing in type, and enriched by the relatively recent introduction of the electrical toothbrush. However, no difference in plaque removal ability was noted between the manual (hand) and electrical toothbrush.

The brushing method of choice for adults is the scrub brush method. Also, children could be made familiar with this method (using a small toothbrush), at an early age when they first learn to brush their teeth. Some dental professionals do have fears that this method might cause abrasion of the teeth and gingival recession. Thus, a further study to find out a better method with no disadvantages, would be necessary in order to achieve all the truly preventive goals in an oral health programme.

For some individuals, a special method may be needed. The particular method recommended to a patient should be selected only after a thorough analysis of the dentition and the patient, i.e., the recommended method should suit the patient. A patient with periodontitis, for instance, can be taught Stillman's method in conjunction with the roll method.

The frequency of brushing is also discussed. In as much as very few people brush thoroughly when they do brush, and brushing to excess is not a problem to be concerned with in the majority of the public, many dental professions recommend their patients

brush their teeth after meals and at bedtime.

However, it can be emphasized that the thoroughness of brushing is more important than the frequency of brushing per day. Brushing thoroughly once a day, at night, is the most important and practical one.

The toothbrush, at its best, is not adequate for removing all of the dental plaque, especially from the interproximal surfaces. Therefore, many materials and devices have been developed for use as aids in maintaining interproximal hygiene.

Dental floss is the most commonly recommended by dental professionals. Toothpicks are sometimes recommended as cleaning aids when there are overlapping teeth, open interdental embrasures or fixed appliances which cannot be properly cleansed by the toothbrush and dental floss.

Water irrigation devices and some other cleaning aids are also discussed in this thesis. It usually is recommended also that when a person cannot brush immediately after eating, he should rinse with water. It is possible that this practice removes some of the recently acquired food debris, but is ineffective in dislodging material that has had time to become more firmly attached to the teeth.

A diet low in fermentable carbohydrates and enriched in hard fibrous foods such as apples, vegetables, and grains is often recommended by clinicians. Although this is sensible advice in terms of reducing the intake of carbohydrates and of helping the patient avoid caries and such systemic problems as obesity, these so-called "detergent foods" are not truly dental detergents.

It is most important to realize that in man,, self-cleansing of teeth by food does not play a meaningful role as does mechanical dental plaque removal.

The consensus on dentifrices with some abrasivity quality, appears to be that they are useful in conjunction with the

toothbrush for cleansing the teeth. However, even without dentifrices, a proper and thorough toothbrushing can achieve an excellent result.

The use of disclosing agents, of course, will be very helpful to visualize the existency of dental plaque. These agents do enable the individual to judge his own brushing efficiency.

1 INTRODUCTION

Dental plaque may be defined as "bacterial aggregations upon the teeth and other solid structures inserted in the oral cavity" (Theilade 1977).

According to Bergenholtz (1972), Mandel in 1966 defined it as "the acquired, gel-like mass closely attached to the tooth and restoration and consists of cuticle, microbial mass and inter microbial content".

Newbrun (1978) noted that a more formal definition has been formulated by Löe: "Plaque is the soft, non-mineralised, bacterial deposit which forms on teeth (and dental prostheses) that are not adequately cleaned." In this thesis we will only discuss the dental plaque formed on teeth.

The presence of dental plaque on the teeth and oral tissues is recognised as being a requirement for the initiation of (both) periodontal disease and dental caries. These diseases are predominant causes of tooth loss. These diseases afflict practically all dentulous individuals of all populations throughout the world.

They are essentially bacterial diseases, although their complex nature is realised. The bacteria responsible for the initiation of these dental diseases are located in the dental plaque. All tooth surfaces are covered by an acquired pellicle originating from salivary proteins.

The initial plaque formation comprises the colonization of this pellicle by certain indigineus oral bacteria. On tooth surface areas which are shielded from the abrasive action of foods and adjacent tissues or not kept clean by the patient, the bacteria will multiply and form a thick plaque.

This maturation of the plaque involves qualitative and quantitative shifts among its bacterial population resulting in the plaque becoming pathogenic.

Frandsen (1976) noted that "dental caries is localized, progressive decay of the tooth." The process is initiated by demineralization of the tooth surface by organic acids. These acids result from fermentation of dietary carbohydrates by plaque bacteria.

As tooth mineral is lost, secondary destruction of tooth protein, also due to plaque bacteria, contributes to cavity formation. If uncontrolled, cavity formation extends and destroys large parts of the crown of tooth, eventually involving the pulp and resulting in infection which may spread to the periapical tissues.

"Chronic inflammatory destructive periodontitis is a disease of the connective tissues supporting the tooth: gingiva, periodontal membrane, alveolar bone and root cementum." (Frandsen 1976). It is initiated by cytotoxins, enzymes and antigens which originate in the bacterial plaque and which elicit an inflammatory reaction in the supporting tissues. Products of tissue breakdown may further enhance the inflammatory reaction.

The incipient tissue changes occur in the gingival margin which is in direct contact with the bacterial plaque. The intercellular substance of the epithelium and the structures which provide the connection between sulcus epithelium and tooth surface are lost or changed. This opens the way for penetration of bacterial products into the subjacent connective tissue and for downgrowth of the bacterial plaque into the gingival sulcus.

The connective tissue changes comprise the typical inflammatory reactions including collagenolysis. The destruction of the anchoring collagen fibers at the cemento-enamel junction is associated with epithelial downgrowth along the cementum, which becomes necrotic. Thus a periodontal pocket is formed. At the same time, resorption of the alveolar bone takes place. If uncontrolled, the lesion will progress in an apical direction, eventually destroying all supporting tissue and terminating in the loss of the tooth.

It is evident that the bacterial dental plaque plays

a paramount role in the development and progression of the two major dental diseases. It follows that these diseases may be prevented if plaque formation is impeded or the development of its pathogenic properties suppressed.

We must also examine the pathogenicity of plaque as a whole. A simplistic model is that bacteria form plaque (fig. 1).

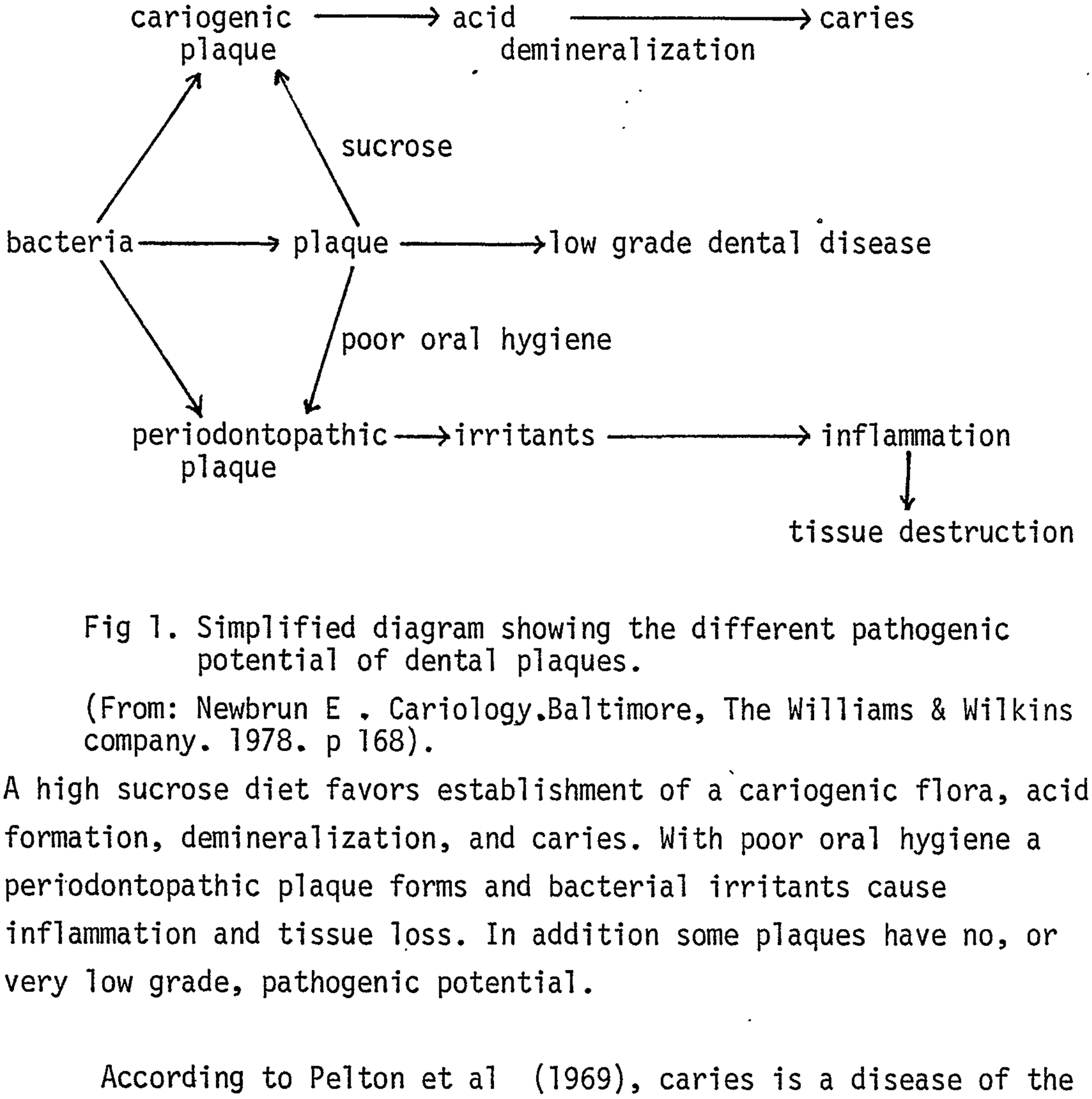

Fig 1. Simplified diagram showing the different pathogenic potential of dental plaques.

(From: Newbrun E . Cariology.Baltimore, The Williams & Wilkins company. 1978. p 168).

A high sucrose diet favors establishment of a cariogenic flora, acid formation, demineralization, and caries. With poor oral hygiene a periodontopathic plaque forms and bacterial irritants cause inflammation and tissue loss. In addition some plaques have no, or very low grade, pathogenic potential.

According to Pelton et al (1969), caries is a disease of the young, and sex differences also are typical (females tend to have a somewhat higher DMF experience than males). Race, probably as a result of socioeconomic differences, finds whites in the USA with more caries than Negroes. There is a great variation in caries experience among different places, and the urban residents tend to have more caries than rural-living persons.

Of the countries for which studies were selected and reported,

those of North Africa tend to have the lower DMF, those of South America have intermediate experiences, while those of England, New Zealand, Scandinavia, and North America have the highest rates.

According to Barmes (1979), there is usually a high to very high prevalence of the disease in highly industrialized populations, such as Japan, French Polynesia, Italy (Urban), Norway, France (Urban), Canada. In developing countries such as Ethiopia, Kenya, Nigeria, the prevalence is usually very low to low. Virtually universal increases in caries prevalence in developing countries ranging from small early increases to rapid changes approaching the highest levels (the latter are most often associated with urbanization).

Lehner (1980) stated that"periodontitis is a disease of the old". According to Pelton et al (1969), the highest PI values by age were recorded among the Hill Tribesmen of South Vietnam. The lowest scores were recorded in the United States. On the basis of studies by the Interdepartmental Committee on Nutrition for National Defence reports , the countries with the least favorable dentist/ population ratios have the highest prevalence of periodontal disease.

The National Health Survey and an independent study in Baltimore illustrate that periodontal disease attack in the United States is greatest in the Negro race. Russell's study indicates that educational level and socioeconomoic classification are more likely the influencing factors. Periodontal Scores are consistently higher for males than for females. Periodontal disease is more prevalent among lower socioeconomic populations and among people with poor oral hygiene scores.

The prevalence of periodontal disease is higher than that of caries (Barmes 1979). Virtually no populations are free of the disease. There are sharp contrasts in the intensity of the disease with a tendency to lower levels in highly industrialized populations than in the developing countries, though there are many exceptions. Some of low prevalence countries are Canada, USA, Australia, Ethiopia, Israel, and Sudan. Netherlands, Malaysia, Iran, India, are moderate. Some countries with high prevalence are

Solomon Islands, Yemen, Saudi Arabia, and Oman.

The preventive efforts relative to caries involve increasing the acid solubility resistance of the tooth surface (by the use of fluorides), carbohydrate limitation, and plaque reduction, but among the methods of prevention in relation to periodontal disease, there is one measure only which has universal practical application, i.e. plaque removal (Forrest 1981).

It may justly be argued that emphasizing plaque control or oral hygiene procedures is no new message. Man has practised various oral-hygiene procedures since the beginning of history, and the dental literature contains numerous reports stressing the importance of oral hygiene. Regrettably, little appropriate action has been taken. Tooth cleaning plays a humble role in the professional delivery of dental services, and the typical oral-hygiene procedures as carried out by the public are actions of cult rather than cleansing (Frandsen 1976).

Who should be responsible for the implementation of effective oral-hygiene programs? Dentists and dental hygienists can remove plaque and calculus from the teeth. Since, however, there concretions start to reform in a few days, oral-hygiene procedures become a continuous task. It is inconceivable that activities which should be carried out on a daily schedule on a mass basis can be handled by professionals.

Therefore, the maintenance of good oral hygiene becomes the joint responsibility of the dental profession and the individual patient. The profession should provide information on goals, means and methods, remove concretions, and establish dental conditions favorable to plaque control. The maintenance of oral hygiene by a daily home-care routine becomes the responsibility of the patient.

There has been a tremendous effort to find some way of either preventing the formation of plaque or effectively removing it from the surface of teeth. One of the approaches to controlling plaques is mechanical removal of plaque (Newbrun 1978).

Devices have been used for purposes of oral hygiene for several thousand years. According to Newbrun, apes and monkeys use wisps of straw or small twigs to dislodge food debris from between teeth. Primitive man used his fingernails and splinters of wood. The first known formal toothpick, dating back to about 3000 B.C., was Sumerian and was made of gold. The Chinese designed gold and silver toilet sets that included stiletto-like toothpicks.

Greeks, Romans, Hebrews all used toothpicks. In Roman times toothpicks were fashioned from bronze, gold, or silver. Plyni advised against toothpicks cut from vulture feathers, saying they turned the breath sour, but recommended the bones of hares and porcupine quills. Hippocrates (460 B.C.) recommended a ball of wool soaked in honey for cleaning the teeth. Sponges, shredded ends of certain sticks, lint, and fingers all served as early brushing devices.

The origin of the tooth brush is not definitely known. The earliest records of actual toothbrushes are from China and date back to 1498. These toothbrushes had bone or ivory handles with natural bristles perpendicular to the longitudinal axis of the handle. Commercial development of toothbrushes occurred in Europe in the late eighteenth and early nineteenth centuries, and there has been little change in basic design since then.

According to Scutt and Swann (1975), the first mechanical toothbrush might be found in 1885, by Frederick Wilhelm Tornberg, watchmaker, of Stockholm. The invention relates to an improved toothbrush, by means of which the teeth may be cleaned as easily on the inner or back side as on the other side.

Toothbrushes are now accepted all over the world as the main aid to oral hygiene. One relatively recent innovation has been the introduction of electric toothbrushes. Before toothbrushes, chew sticks made of wood were widely used, and still are in parts of Africa and India. The preferred materials are plants of citrus, ebony, and coffee families.

To primitive man, oral hygiene was a toothpick made of bone,

wood, or metal used to poke out bits of fibrous food which were both uncomfortable and socially annoying. To 20th century man, the image of oral hygiene could include all forms of gadgetry, various clean methods, and confusing and contradictory concepts.

Oral hygiene armamentarium may range from a single toothbrush to an oral hygiene centre complete with electric implements, water sprays, special lights and mirrors, and types of disclosing solutions, all designed by manufacturers to stimulate gadget-minded modern man in his increasing awareness of the importance of maintaining clean teeth (Hoskin and Masters 1977).

In the USA (Horowitz et al 1980), mechanical plaque removal is relied upon extensively to remove or control dental plaque, toothbrushes and dental floss are the devices most frequently recommended for this purpose. Although there is evidence to show that the mechanical removal of plaque with toothbrush and dental floss can reduced gingival inflammation, its effect against dental caries is equivocal.

Nevertheless, state-wide programs have been implemented in schools and clinicians have initiated programs in their offices and clinics designed to convince children and adults to practise daily mechanical plaque removal. Moreover, entrepreneurs have developed assorted commercial products designed to improve the efficiency and thoroughness of plaque removal.

According to Newman (1980), the general opinion remains that of Miller (1890), namely that mechanical methods of plaque control are safer and more effective than continuous antiseptic or antibiotic therapy. Both gingivitis and caries may be controlled by mechanical removal of plaque. Chronic inflammatory periodontal disease may be prevented and caries incidence significantly reduced by adequate toothbrushing and better oral hygiene aids.

In this thesis, dental plaque will be briefly discussed, and mechanical methods for its removal, namely, toothbrushing and the use of dental floss and other cleaning devices, will be evaluated, from the literature.

2 DENTAL PLAQUE

2.1 SALIVA

The most important attributes of the salivary secretions are protective in nature-helping to maintain the integrity of the teeth, tongue, and mucous membranes of the oral and oropharyngeal areas. The critical importance of saliva in this regard becomes most readily apparent when malfunction of the salivary glands results in dry mouth or xerostomia. The mucosa becomes dry, rough, and sticky, it bleeds readily and is subject to infection.

The tongue becomes red, smooth, slimy, and hypersensitive to irritation. In the edentulous patient dentures become extremely difficult to manage. When teeth are present, there is a heavy accumulation of plaque, materia alba, and debris, caries progresses rapidly and extensively, periodontal disease is markedly exacerbated.

According to Grant et al (1972), the flow of the major salivary glands is less than 0.05 ml/minute/gland at rest with no external stimulation and 0.5 ml/ minute/gland (or greater) with stimulation, and it is apparent that 80-90% of the daily production of saliva is the result of stimulation (mainly gustatory and masticatory) associated with eating. During most of the day and all night, salivary flow is minimal. Conditioned reflexes as well as emotional and factors have also been shown to affect salivary flow rate.

Saliva is slightly acidic prior to secretion into the oral cavity, it becomes slightly alkaline on excretion from the gland due to a loss of CO_2 (carbonic acid in solution). Since bicarbonate concentration increases with increasing flow rate, salivary pH becomes elevated at high flow rates.

The physical flow of saliva act as a "backward tide" to remove food and cellular and bacterial debris for elimination via the alimentary tract. The rate of clearance may be an important deterrent against plaque formation and may help to reduce the incidence of caries and inflammatory gingival disease.

Saliva has considerable buffer capacity. This protective function occurs in the plaque, directed against acidogenic microorganisms, and occasionally on the mucous membrane surface, where acids from foods or regurgitations are involved.

Newbrun (1978) noted that Stephan had found as early as 1940, that the pH of plaque falls to a value between 4 and 5 following a rise with a suitable substrate and after a period of time returns to the original "resting" level in the pH range of 6 to 7 (The critical pH for cariogenesis is about 5.2).

In Newbrun's studies on the pH of plaque in hamsters infected with Streptococcus mutans, have provided further insight as to why the pH of plaque returns to resting value. When plaque was exposed to a low concentration of sucrose (2.5%), the pH dropped, and then after a short time began to rise. However, if the plaque and tooth were isolated with a Parafilm cup, the pH of plaque decreased further and remained low.

In view of the prolonged high levels of acid found when the plaque was isolated, it is presumed that normally pH reverts towards neutrality due to the gradual diffusion of saliva into plaque coupled with exhaustion of substrate and diffusion out of acid end products.

Sucrose consumption results in very rapid pH falls in plaque, since sucrose penetrates plaque rapidly and is so readily metabolised. Therefore, according to Newman (1980), to be most effective, buffering systems should be reinforced by plaque removal immediately after meals.

The relationship between plaque pH and saliva pH is complicated by the likelihood that a more acid food will increase the rate of salivary flow and thus reduce the retention of food in the relationship between plaque pH and food clearance. However, the main influence of food pH was not a direct effect on plaque pH itself, but rather an indirect relationship between food acidity and the rate of removal of food from the mouth (Edgar et al 1975).

2.2 PLAQUE FORMATION

Plaque may attack the teeth supragingivally, or subgingivally in the gingival crevice or in periodontal pockets. Both types of plaque may vary because of the differing intake of substances from the saliva and diet in supragingival plaque, and from gingival exudate, etc., in the subgingival area. In the absence of pockets, the plaque is confined to the enamel surface.

Saliva influences supragingival plaque deposition. According to Grant et al (1972), it is involved in the first step of plaque formation (deposition of a pellicle), which is a four stage process:

1. Bathing of the tooth surfaces by salivary fluids, which contains numerous protein constituents.
2. Selective adsorption of certain glycoproteins including a high molecular weight material called the agglutinating substance.
3. Loss of solubility of the adsorbed proteins by surface denaturation and acid precipitation.
4. Alteration of the glycoproteins by enzymes from bacteria and the oral secretion.

The pellicle then becomes colonized by bacteria, and the true bacterial plaque forms. Saliva continues to provide agglutinating substance and other proteins for bacterial intercellular adhesion to the intercellular matrix. Salivary proteins and carbohydrates serves as a substrate for metabolic activity of the bacteria.

The rate of growth and amount of plaque formed is influenced by physical factors such as uneven tooth surfaces, carious lesions, ill fitting margins of restorations, and irregularities in the positioning of the teeth. However, even in the absence of such conditions plaque will grow on the teeth of individuals who cease using oral hygiene methods.

Based on both morphological and microbiological sequential analysis, Newbrun (1978) described an understanding of the events involved in plaque formation, especially on clear supra gingival enamel surfaces. These events can be considered as 3 phases:

1. Initial colonization.

2. Rapid bacterial growth.
3. Remodeling.

In actuality, though, these are progressive phases gradually changing and not sharply defined.

Initial colonization occurs during the first 8 hours after a tooth surface has been cleaned, and involves the deposition of bacteria derived from the saliva on the buccal and lingual mucous surfaces adjacent to the tooth.

Rapid bacterial growth occurs between 8 hours and 2 days after a prophylaxis. These organisms that have become firmly attached to the pellicle multiply to form local accumulations of several layers of bacteria held together by interbacterial adherence.

The remodeling phase of plaque starts after about 2 days and continues indefinitely, because the bacterial mass is not a static entity. At this stage, the total number of organisms remains relatively constant, but the microbial composition becomes more complex. The general pattern is one of the early dominance by streptococci, followed by a shift towards a more anaerobic and filamentous flora. In the gingival sulcus region, curved and spiral shaped organisms as well as spirochaetes occur one to two weeks after plaque develops.

According to Ericson (1975), for the subsequent growth of the plaque, sucrose also seems to be of special importance. The extracellular polysaccharides formed contribute to the volume and also to the morphology of the colonies growing on the tooth surface.

Littleton et al (1967 a, b) studied the composition and amount of plaque in patients fed via stomach tube for several months. These patients did form dental plaque, but it was smaller in amount and less acidogenic than plaque from persons who ate normally during the same period. The studies also indicated that the plaque flora can establish itself in the absence of carbohydrates, and can grow on dietary proteins and lipids and from the constituents of the oral fluid only.

In the studies of Theilade and Mikkelsen (1972), an acquired pellicle was formed only in 15 minutes on clean tooth surfaces. Theilade and Theilade (1970) found that after 8 to 15 hours, small colonies of bacteria appeared, and after 3 days supragingival plaque formed a more or less continuous band along the gingival margin.

Theilade et al (1966) examined the plaque forming during a period of no oral hygiene. After a healthy gingival was attained through several weeks of meticulous oral hygiene, very few bacteria, practically all of them gram positive cocci and rods, were present on the teeth at the gingival crevice. After one day without oral hygiene the microorganisms had proliferated resulting in plaque formation.

According to Theilade et al (1966), the formation of plaque along the gingival margin produces subclinical inflammation after only one day and mild gingivitis after a few days. If the plaque is provided with sufficient amounts of sucrose, initial carious lesions of the adjacent enamel develop within a few weeks (von der Fehr et al 1970).

Subgingival plaque is formed in an environment which is different from the supragingival milieu. Experiments by Baumhammers and Stallard (1966) indicated that saliva is unlikely to be an important factor in subgingival plaque formation. Salivary components might not get access to the gingival crevice. The environment must be governed primarily by factors such as gingival fluid, desquamatic epithelial cells and emigrated white blood cells. The subgingival plaque has a profound influence on the progression of gingivitis and marginal periodontitis.

2.3 PLAQUE COMPOSITION

Dental plaque is composed of (Schroeder and de Boever 1970):

1. Various microorganisms.
2. An intercellular matrix of microbial origin.
3. Possible cell free cuticles alternating between microbial layers and various crystallites in mineralized plaques.

In 7 to 14 day old plaque, microorganisms occupy 70% and the intercellular space 30% of the area in plaque sections. The plaque structure is characterised by the three dimensional pattern exhibited by microorganisms in adhering to tooth surfaces, in accumulating and forming their own complex environment, and in arranging their interface to the outside.

The plaque - tooth interface is mediated by remnants of the epithelial attachment lamina, a salivary cuticle, or microbial extracellular polysaccharides. At the base of the plaque, a condensed microbial layer of coccoid organisms most often occurs.

Within the bulk of the plaque, colony-like clusters of morphologically different but taxonomically unidentified microorganisms are rather randomly arranged. Certain colonies appear to produce their own environment by synthesizing their own particular type of extracellular polysaccharide.

Filamentous organisms are orientated perpendicular to the tooth surface. Apart from extracellular polysaccharides, the extra cellular space contains crystallites and ghost-like cell wall and membrane structures.

The plaque surfaces seems to be covered by an excess of extracellular polysaccharide. Plaque located in deep fissures consists primarily of remnants of cell walls and only very few surviving microorganisms.

According to Theilade (1977), in the electron microscope the supragingival plaque was seen to contain predominantly cocci and rods, most of them gram positive. Some filamentous microorganisms were also present. Most of the bacteria at this early stage appeared to be intact. In comparison, an electromicrograph of 23 day old plaque reveals a more complex flora with many degenerating or lysed bateria.

The composition of plaque had changed by the appearance of gram negative cocci and rods, which comprised about 30% of the flora, so that the relative proportion of gram positive cocci and

rods decreased to approximately 70%.

During the following three days fusiforms and filaments appeared and increased until they constituted about 7% of the flora. In the subsequent period of 5 days (from days 4 - 9), the flora was further supplemented with spirilla and spirochaetes each of which finally comprised 2% of the dentogingival plaque flora. Thus it is evident that the bacterial flora of supragingival plaque is dependent on the age of the plaque, and that an increasingly complex flora develops during the first weeks of plaque formation.

Although light microscopical examination showed a basic similarity between the supragingival and subgingival varieties (Oshrain et al 1971), more ultrastructural studies indicate that subgingival plaque differs distinctly in bacterial composition from the supragingival deposits forming just outside the gingival crevice.

The subgingival plaque contains many motile bacteria, and in the surface layer adjacent to the gingival epithelium numerous thin filaments and spirochaetes are present (Listgarten et al 1975 , Listgarten 1976). In fissure plaque, gram positive cocci and rods predominate. Filamentous microorganisms are encountered, particularly at the entrance to the fissure, while spirillar microorganisms and spirochaetes are absent. Yeast cells are regularly present.

In contrast to smooth surface plaque the flora of the fissure seems to be more stable after the first colonization has taken place, even after several months the cocci and rods predominated the flora. In early fissure plaque another characteristic feature is the presence of food particles, some of which were identified in the electron microscope as plant tissue or animal tissue. Apparently the food particles serve as nutrients for the microflora, because after some months they constitute only a minor proportion of the plaque, or are even absent (Schroeder and de Boever 1970).

Plaque deposited at different locations in the oral cavity harbours its own characteristic flora. Smooth surfaces plaque differs in composition according to the age of the deposit, and it may be

influenced by the diet which has been available during its development. Fissure plaque does not appear to exhibit a similar dramatic shift in the bacterial flora as it becomes older.

Newman (1980) pointed out that the structure of plaque appears to depend on its thickness, which varies over the tooth surface. Plaque gradually increases in thickness as it approaches the contact area and the gingival margin. It is, therefore, thinnest at its buccal, lingual, and occlusal extremities.

The thickness of the bacterial layer at the gingival margin is variable. Where no bacteria are present in the crevice region, there may be a build up at the gingival margin. It is probable that organisms occur in the crevice region even in clinical health, although in this instances they do not succeed in adhering in large numbers to enamel or gingiva.

2.4 PLAQUE LOCATION

According to Grant et al (1972), whereas the acquired pellicle covers all tooth surfaces, plaque is prominent in areas protected against friction from food, tongue, lips, and cheeks. In the gingival sulcus area plaque formation may occur undisturbed by mechanical influences.

How far occlusally plaque can remain on the teeth depends on the mechanical forces acting on the individual surfaces. Thus vigorous chewing of hard foods (apples, raw carrots) can to a limited extent inhibit the occlusal extension of plaque on buccal and lingual surfaces. It has, however, no inhibiting effect on plaque formation on proximal surfaces and in the gingival sulcus area.

The maxillary palatal gingiva is regularly subjected to friction from the tongue and food particles (e.g. fibrous vegetables) and is to a degree self-cleansing, but other areas of the gingiva are not.

2.5 DISCLOSING PLAQUE

Mechanical plaque removal is more efficient when the plaque is clearly visible to the patient. The first requirement is a mirror with adequate lighting. Dyes or disclosing solution are helpful in staining the plaque deposits which otherwise are poorly contrasted, resembling the white or off-white color of the teeth.

According to Grant et al (1972), the use of stains such as basic fuchsin, bismark brown, or erythrosin can facilitate the patients efforts at plaque removal. Stains give the patient an objective, that is, the complete removal of plaque from the tooth surface. They also give him an effective means of determining whether this objective has been reached, namely, the absence of a red stain on exposed tooth surfaces.

Disclosing solutions and tablets can be used to make plaque visible. Disclosing solution (e.g. basic fuchsin 0.3%) impart a bright red color to the plaque, stains, and calcified deposits. They also stain the mucosa of the lips, cheeks, tongue, and the floor of the mouth.

Because these stains tend to last on mucosal for several hours, some patients object to the regular use of disclosing solutions. Basic fuchsin as disclosing tablets, on the other hand, do not impart such a lasting colorisation, but they do stain the plaque less brilliantly, making it more difficult to detect.

When basic fuchsin is used as a disclosing solution, ten drops are dispensed with an eyedropper into an ounce of water. The patient is asked to rinse vigorously for 30 seconds and to expectorate. He then should rinse with several mouthfuls of water to remove excess stain. The examination may then be made.

When disclosing tablets are used, the patient is instructed to chew the wafer thoroughly, working it into the saliva, and then to swish the fluid vigorously about his mouth for a minute. Care must be taken that the solution reaches all parts of the mouth. If it does not, surfaces of some teeth may not be stained, even when

plaque is present. Proper disclosure can be attained by a vigorous pumping action of the cheeks to force the solution between the teeth. After about a minute the mouth may be emptied and rinsed gently with water. Examination should be made immediately. The patient should be encouraged to observe the procedure with a mirror.

According to Newbrun (1978), some other disclosing agents are mercurochrome, malachite green, tartrazine, proflavine, and fluorescein sodium. The less commonly used plaque stains are bismark brown, methylene blue, and iodine solutions.

Erythrosine is most commonly used in the United States and is available in tablet, gel, and solution forms. A "two-tone" dye consisting of erythrosine and malachite green causing red and/or blue staining is also commercially available.

A similar dye used by Katayama, Suzuki, and Okada (1975) which is a mixture of methylene blue and 2,3,5 triphenyl tetra zoleum chloride. It showed that young plaque stained blue, with plaque 5 to 7 days old the initial methylene blue staining faded within a few minutes, progressively from the gingival margin, to reveal a red stain.

In addition to staining plaque, most of these dyes also stain the tongue and oral mucosa, persisting for several hours. This is esthetically undesirable and socially embarassing. Fluorescein sodium has the advantage that it is not normally visible, absorbing at 200 to 540 nm, and therefore does not discolor the mucosa. The disadvantages of this dye are the additional cost of the tungsten light and filters that are required to detect plaque stained with fluorescein,and the necessity of a darkened room.

Gillings (1977) found in his studies that erythrosine stained all visible surface deposits, but fluorescein usually did not. The fluorescent plaque disclosant stains only the old, mature, established plaque.

According to Forrest (1981), the desirable properties of a disclosing substance should be:

1. Ability to stain plaque selectively so that this will stand out

from the cleaner portions of the teeth.

2. Absence of prolonged retained staining of the rest of the oral structures (lips, cheeks, tongue).
3. Anterior tooth coloured fillings should not be adversely affected.
4. Taste must be acceptable.
5. No harmful effects on the mucous membrane, nor should there be a possibility of harm caused by accidental swallowing of the substance or from possible allergic reaction.

All commercially available disclosants of United States manufacturer are FDC certified, and can be considered safe for their intended use (Gillings 1977). Australia does not have the same certification system, but health authorities list dyes approved for use in foods and therapeutic substances. Some dyes approved for use in Australia and of dental interest are erythrosine (syn. food red 14, CI 45430), brilliant blue (food blue 2, CI 42090), and green S (CI 44090).

Among the currently available disclosant which fulfil most of the requirement are the two-tone dye and fluorescein. The former stain all surface deposits while the latter stain mature plaque and plaque exposed to sugars.

The frequency of disclosing agent use is dependent upon the effectiveness of the individual in brushing. Those who practise good care habits may need to check themselves only once a week (Allen et al 1968). Less proficient brushers may need to use the agents more frequently.

All the disclosants discussed are a means to encourage effective brushing, and thus without the latter all disclosants would be a waste of time and money.

3 MECHANICAL METHODS

According to Hoskins and Masters (1977), to be acceptable, an oral hygiene technique should satisfy three criteria, which are:

1. It must produce effective dental cleanliness.
2. It must be safe so that by doing it does not also do harm.
3. It must be very easy to teach, easy to learn, and relatively easy to perform with consistency.

Adherence to these standards encourages objectivity in the selection of oral hygiene methods and devices.

There are three major areas in the mouth, and each of them requires a specific device for effective dental care. The three major areas are:

1. The facial, lingual, and occlusal surfaces of the teeth.
2. The interproximal surfaces.
3. The crevicular areas (of any appreciable depth).

To most patients, dental hygiene has been limited to the toothbrush, with occasional help from jabbings with toothpicks and flushing with flavoured mouthwashes. Consequently, many patients have trouble accepting the fact that three different types of instruments may be necessary for adequate oral hygiene. It must be stressed that each instrument has its own area, one will not take the place of the other.

The first area is the responsibility of the toothbrush, the second area can be cleaned best by dental floss, and the third one is safely reached principally by dental irrigation. With practice, encouragement, and habitual use, the patient can learn to clean the areas with the specialized instruments, just as he learned to use the knife, fork, and spoon to eat his meals. Even with training, however, patients tend to relapse into using the toothbrush only.

The toothbrush, is the fundamental tool and it should be used properly in order to avoid any negative side effects that can affect the soft tissue and/or the tooth itself. The following are the most common causes of toothbrush trauma (Pawlak and Hoag 1980):

1. Excessive pressure.

2. Incorrect brush angulation.
3. Bristle consistency too hard.
4. Incorrect brush direction (horizontal brushing).
5. Puncturing the gingiva with the bristles.
6. Utilizing a toothbrush with frayed bristles.

To avoid toothbrush trauma it is highly recommended that the patient's technique be checked and corrections made.

Toothbrushing should be supplemented with aids that assist either in cleaning or in gingival stimulation. These aids are meant to supplement toothbrushing, and by no means are intended to replace or substitude for the toothbrush. The various supplemented aids given to a patient will depend on the individual's clinical condition and those required to obtain or maintain optimum oral health.

According to random surveys conducted by Hoskins and Masters (1977), less than 10% of dental patient regularly use dental floss. In fact, most people fail to realize that cleaning the interdental surface is of any importance.

Johansen (1981) found in his studies that over 88% of pockets with depths equal to or greater than 6 mm occurred interproximally. It means that there is obviously great need for the dental profession to put more emphasis on interdental cleaning.

Most people in our society have been taught from childhood that one should brush the teeth everyday. After seeing the stained residue that remains between the teeth after brushing, however, it is obvious to the patient that brushing is not synonymous with cleaning. This helps to justify the emphasis on learning to clean the interdental surfaces.

Each of the accessory aids has a part to play in plaque removal but the two most commonly favoured are toothpicks and dental floss. Bergenholtz and Brithon (1980) reported that dental floss gives significantly higher plaque removal than toothpicks, especially on lingual axial surfaces and is therefore preferable for interdental cleaning. Anaise (1976) also found that dental floss was superior to toothpicks.

Pawlak and Hoag (1980) noted that "dental floss and dental tape are extremely effective interproximal cleaning aids." They can be utilized with either open or full embrasure spaces.

Gjermo and Flotra (1970) found that dental floss was more effective than toothpicks in removing plaque from lingual aspect of the proximal surfaces but when toothpicks were used in conjuction with an interspace (single tufted) brush, the effect was similar to that of floss. Flossing, however, took twice as long and called for greater dexterity than did sticks.

Pawlak and Hoag (1980) pointed out that toothpicks are usually made of a soft wood and triangular in shape to contour to the interdental spaces. These toothpicks are contraindicated for areas where the interdental papilla fill the interdental gingival embrasure spaces. If used when the embrasure spaces are full, they will create a space and can injure the tissue.

If used properly as a supplement to brushing, they are effective in removing plaque and debris, stimulating the gingiva, and recontouring the interdental papilla. When properly used, the toothpick can be an excellent adjunctive cleaning instrument for interproximal spaces. However, it can be hazardous unless thorough instruction is given.

According to Pawlak and Hoag (1980), gauze strips, pipe cleaners, and yarn, are effective cleaning aids in special situations. Pipe cleaners are effective for cleaning open furcation areas. The pipe cleaner is passed through the furcation with a back and forth movement.

Gauze strips and four-ply cotton yarn are effective aids for cleaning the proximal surfaces of tooth adjacent to edentulous areas and open embrasure spaces. The gauze strips and yarn were placed on the proximal surfaces of the teeth and moved back and forth in a "shoe shine motion".Some periodontists advocate various type and sizes of yarns for cleaning interdental areas. These yarns are effective for plaque removal but cannot be used in areas where gingival tissue still fills the interdental space.

All these aids (gauze strips, pipe cleaners, and yarn), however, are not commonly used, and barely discussed in most textbooks.

Forrest (1981) recommended polishing cloths to polish the surfaces of all teeth before brushing. It is a thin towelling cut to the shape of the fingers, and sometimes sewn to an average shape. However, this would seem to be a further complication for the already burdened patient but may be reserved as a special armamentarium for the difficult case, e.g. the handicapped child, and here it may be much easier for the mother or other attendant to use a cloth than a brush.

There are several different types of water irrigation devices on the market. They all utilize the principle of water under pressure to irrigate between and around the teeth to flush out debris. Some devices attached directly to the water faucet and deliver either a continuous or a pulsating stream of water. In others the water is contained in a reservoir and delivered in a pulsating stream. The pressure of the stream is controlled by a dial regulator.

These devices are effective adjuncts to brushing, but they do not replace the action of the brush since they are not known to remove tenaciously attached bacterial plaque. The effect of the use of these devices on gingivitis, plaque, calculus, pocket depth, and other variables has been studied in various populations and under various condition.

Bernier and Muhler (1975) reported that test results have generally shown a reduction in gingival inflammation at the clinical and microscopic levels, along with a reduction in pocket depth and new calculus formation, but little reduction in bacterial plaque.

Baer and Morris (1977) pointed out that water irrigating devices are ineffective in removing plaque from teeth. Hoskins and Masters (1977) noted that"it does reduce the thick outer layer of plaque." Unless an inordinate amount of time and skill is utilized, deep pockets are difficult to clean with an irrigator.

According to them, there is some truth to the suspicion that

many people may be fooled by the change in signs and symptoms at the upper level of the crevice while the substance in the deeper pocket continues its destructive process.

It was suggested by Selinger (1969), that water irrigation devices may be useful for delivery of therapeutic agents. If used according to manufacturers' directions, these devices will not traumatize the oral tissues.

Injury to the soft tissues can be caused by excessive water pressure and improper placement of the tip. The patient must be carefully instructed to follow directions. These devices should not be used to routinely rinse deep periodontal pockets because there is a danger of forcing the bacteria out into the surrounding tissues.

Water irrigation devices are particularly effective cleaning aids for patients with orthodontic appliances and fixed protheses. Water irrigation devices give many patients such a sense of security about their oral hygiene that they stop their interdental cleaning. Therefore any patient who is instructed to use water irrigation must understand that it is an aid and not a substitute for interdental cleaning.

After brushing, or using any other cleaning aids, mouthrinsing is important to flush away the debris that was loosened but not removed. Water or a mouthwash should be swished vigorously throughout the mouth.

Little appears to be known about the tooth cleansing benefits which are derived from rinsing the mouth with water. The procedure usually is recommended as one to practise immediately following toothbrushing, but not alone.

Cobb et al (1961) attempted to measure the relative tooth cleansing effectiveness of toothbrushing, eating certain foods, and rinsing the mouth with water. They concluded that the water rinse alone was the least effective of the three procedures.

However, it usually is recommended also that when a person

cannot brush immediately after eating, he should rinse with water. It is possible that this practice removes some of the recently acquired food debris, but it ineffective in dislodging material that has had time to become more firmly attached to the teeth.

Some textbooks on periodontics recommend the use of mouthwashes as part of oral physiotherapy. However, the emphasis is placed on their used as an adjunct to cleansing and not as a substitute for brushing. One such book (Goldman and Cohen 1977) states: "Mouthwashes are an excellent adjunct in oral physiotherapy because they will wash away loosened debris which brushes or any of the other adjuncts may have left behind. Mouthwashes are only efficient if used vigorously and forced interproximally the cheeks, lips, and tongue."

The use of plain water is recommended by a WHO expert committee on periodontal disease (1961). The committee further suggested that the addition of certain agents to the water (though none were named) possibly would increase the efficacy of the rinse.

Most commercially available mouthwashes contain flavouring agents that make the mouth feel clean. Some mouthwashes have bacteriostatic or bactericidal effects, but this is only a temporary action. Recent studies by Pawlak and Hoag (1980) have shown that certain mouthwashes may help in the chemical control of dental plaque. According to Allen et al (1968), in all probability their major benefit is by flushing action.

The belief that certain foodstuffs can remove plaque from tooth surfaces has to be critically examined. It is a general opinion that fibrous foods reduce plaque accumulation and gingivitis on tooth surfaces exposed to their mechanical cleansing action during mastication.

According to McKendrick (1970), large particle size can aid plaque removal, but only in regions close to the chewing surfaces of the teeth. During mastication some detergent foods, such as raw apples or carrots, may aid in cleansing the teeth and stimulating the gingiva.

Baer and Morris (1977) pointed out, however, that the anatomical contours of the crowns of the permanent teeth are so constructed that the chewing of fibrous foods plays no significant role in plaque removal. Vigorous mastication may have a physiological effect on the salivary glands but it is not capable of effectively removing plaque from the teeth by its mechanical action.

Investigation of plaque development by Löe et al (1965), as well as experimental studies by Wilcox and Everett (1963), have suggested that during mastication, the cervical areas of the tooth surfaces, the gingival margin and most of the attached gingiva are not subject to physical stress from food particles.

Excessive chewing of coarse food seems to have no effect on aggregations of plaque in the gingival area and systematic addition of fibrous vegetables between meals does not prevent plaque from forming (Lindhe and Wicen, 1969).

Löe (1969) pointed out that in young, healthy individuals on standard diets (including coarse bread, ample amounts of fruit and vegetables) with a complete dentition, normal gingiva, normal salivation, normal occlusion and mastication, plaque formation is so great that after 7 - 14 days without oral hygiene, heavy deposits of plaque are present in the gingival and interdental areas. Therefore, although self cleansing of teeth may have been a valid principle in the past, in most civilised populations today, natural cleansing of the dentition is seemingly non-existent.

Chewing apples has no cleansing effect on moderate amounts of plaque (Arnim 1963, Lindhe and Wicen 1969). According to Birkeland and Jorkjend (1974), the primary effect of chewing apples is the effective removal of food debris since plaque remains on the teeth. These facts, however, may justify endings a meal with an apple.

The chewing of gum is a common habit in many countries and a belief exists amongst the general public that, as with fibrous food, chewing gum has a cleansing effect on the teeth and gingiva.

Studies by Addy et al (1982) demonstrated that the chewing gum reduced the formation of plaque and removed established plaque from the smooth surface of the teeth. The effects were similar with the sugar-free and sugar-containing chewing gums. Chewing gum is capable of removing plaque deposits from the more exposed aspects of tooth surfaces and will reduced the presence of salivary debris immediately after eating food.

Ainamo et al (1977) suggested that people who chew gum should be encouraged to use the now readily available sugar-free gums.

4 TOOTHBRUSH

4.1 TYPE OF TOOTHBRUSH

4.1.1 Manual Toothbrush

There is a multitude of different shapes, textures, sizes and patterns of toothbrushes available to the public. Most of these brushes, according to the buyer, were recommended by dentists (Forrest 1981).

There are long head, short head, and the bristles may be natural or nylon filaments of various arrangements and degrees of hardness. Although the type of brush a particular patient should use (from the standpoint of bristles) is a matter of individual preference, most people will prefer a brush with a synthetic bristle because it will not wear out as soon as most bristle brushes and it will dry out much after use.

Some brushes seem to be quite inappropriate for tooth cleansing, others would appear to be not only ineffective but harmful. Strahan et al (1977) pointed out that there is no clear evidence to support any particular design. The most favoured types would appear to be short head multitufted brushes containing medium nylon filaments which have rounded ends.

According to Newbrun (1978), the limitations in size and shape are dictated by the curvilinear alignment of the teeth and anatomical structures, such as the ramus of the mandible, the cheeks, and the tongue.

A straight trim brush with soft, rounded, and polished bristles is preferable because it is less likely to cause tissue damage or abrasion, although the brushing habits of the individual and the abrasivity of the dentifrice are also important factors.

Bernier and Muhler (1975) suggested that only the dentist can advice a patient of what brush is best for his personal use.

The best for most patients is a straight handled brush with synthetic fibers and a small head.

The dentist can decide the hardness of the bristles after examining the state of the patient's oral health. Most dentists are beginning to recommend a multitufted medium hard bristled brush, which is necessary to allow patients to a thorough cleaning of the hard-to get-at areas.

If the patient has a considerable amount of gingival irritation, a soft toothbrush must be used initially, to permit the gingival tissue to heal. Similarly, young children during the period of the mixed dentition may have considerable pain and gingival irritation, and frequently they will not brush their teeth at all, or else not thoroughly enough, unless they use a soft bristle brush.

If the gingival tissues are in a good state of health and if the patient is practising careful toothbrushing, a hard bristle brush is more effective for brushing the occlusal surfaces. However, research may ultimately show that a softer brush may be more helpful in cleaning thoroughly the spaces in the gingival crevice.

Baer and Morris (1977) recommended (especially for the Bass brushing method) a soft bristle nylon brush with a straight head. The bristles should have rounded ends, 0.007 inches in diameter, and be arranged in three rows with six tufts per row.

4.1.2 Electrical Toothbrush

Within the past decade many different brands of electric toothbrushes have appeared on the market. Power is gained for brush movement by either battery source or electric current. Many of the electrical brushes employ the principle of a rechargeable energy source such that the brushing device is not connected directly to the current.

A mains driven brush could be a problem in areas where

convenient electrical outlets may not be available. Battery operated toothbrushes offer safety, but also they have the disadvantage of requiring the battery replacement at intervals. Forrest (1981) pointed out that another disadvantage is an immediate lessening of torque from the first day of use.

Most electrical toothbrushes have a relatively small brush head with multitufted filaments. While this limits the number of teeth covered by the bristles in any one area, it does offer the advantage of access in constricted areas. This feature may be of particular value on the lingual surface of mandibular teeth.

Patients should be instructed to follow a definite sequence of brush placement with the electrical toothbrushes. There is a tendency to move the electrical brushes too rapidly thus skipping area. Allen et al (1968) suggested that the patient bring the brush to the office and demonstrate the brushing method employed. With the power generated by the electrical brush the potential for damage to either tooth or gingiva may be increased. This chance of damage is greater if hard bristles are used.

No electrical brush can exert the same pressure which can be demonstrated by the manual brusher. The electrical toothbrush would stall before excessive pressure can be exerted. There is a potential shock hazard with any electrically powered device which goes into the mouth.

The owners of electrical toothbrushes must be taught carefully how to use them effectively. There is no easy way, even with these toothbrushes. It would be easier, however, for the less manually dextrous to achieve some sort of result and there is a saving in time over manual brushing.

Generally, the electrical toothbrushes have either an oscillating action in which the toothbrush rotates back and forth in a 60 degree arc, or they have a horizontal vibrating motion. Electrical brushes are sold usually with four replaceable brush heads for use by different members of the family.

Tests by Forrest (1981) have demonstrated a mixture of saliva and toothpaste on the handles of these brushes and unless strict cleaning and disinfection is carried out each time before use, the sharing of these brushes by different users is not recommended.

The effectiveness of electrical toothbrushes has been reviewed by Ash (1964). He stressed that the influence of electrical toothbrushes on gingival health can be more easily assessed than the effect on dental caries. This is because dental caries is a relatively slow disease, and evaluation of therapeutic agents and devices to prevent caries would take several years, while gingivitis is the result of local irritation, the removal of which produces rapid results.

According to him, there have been a number of studies in which these devices have been reviewed for their effect on gingival health and the removal of plaque and oral debris. Such studies compare electrical toothbrushing with manual brushing. Ash (1964) concluded that electrical toothbrushes are not more effective than manual brushes for the average patient. A toothbrush, whether electrical or manual, must be employed skillfully.

The effectiveness of the devices is a different function of the ability of the patient who uses it and the motivation of the patient to clean particular surfaces. Thus, one type of brush may be more effective for one individual than for another.

In certain individuals the electrical toothbrushes do appear to offer some special advantages. These brushes may be of value in encouraging children or hygienically lazy adults to brush their teeth. Also, electrical toothbrushes are helpful in cleaning around orthodontic appliances, handicapped or debilitated individuals, or if one has to brush another person's teeth.

Proper use of electrical toothbrushes caused no more trauma to gingival tissues than proper use of a manual toothbrush. Ash also concluded that there was no difference in interproximal cleaning ability.

Ripa (1977) cited that according to Keller and Manson-Hing, however, when manual brushing coupled with flossing was compared with electrical toothbrushing, the former combined method proved more effective for cleaning interproximal areas.

4.2 THE FALSE CLAIMS ABOUT SOME TOOTHBRUSHES

According to Forrest (1981), many dentists still believe that nylon bristle is harmful and that the use of natural bristle is essential. At the present time this concept is incorrect and is a relic of a genuinely held concern about the quality of nylon a quarter of a century ago.

Most people wet the brush under a running cold water tap before loading with dentifrice. Brushing goes on until the toothpaste has formed so much foam in the mouth that it then becomes necessary to spit and rinse. Most of them, however, constantly wetted the brush at short intervals during brushing.

Forrest also explained that the effect of the initial and/or continuous brush wetting action is to make natural bristles soft and soggy. For this reason the majority of toothbrushes sold were of the hard and extra-hard type. But during the days before nylon, the extra-hard toothbrush became, after its soaking, something like a soft or soft medium.

Nylon bristles brushes were developed initially, and the manufacturers, of course, followed the same hardness formula as was apparently desired by the mass of the population. But man-made fibre was much less moisture absorbent and therefore when wetted as usual by the brusher, it did not soften but remained hard, or extra-hard.

The gingiva, and even enamel, were often damaged and at that time nylon bristles were not well regarded. This should have referred only to the hardness of the bristles.

Eventually, multitufted plastic filaments, which did not require softening, were introduced and are superior to natural

bristle . Plastic bristles can be quality and size controlled to very fine limits. We can make what we want to precise measurements. They are potentially cleaner than natural bristles as they do not absorbed fluids and organisms. Natural bristles take longer to dry than the plastic.

4.3 THE CHOICE of TOOTHBRUSH

Over the years many types of toothbrushes have been developed, but most authorities are now agreed as to the same basic design.

According to Forrest (1981), the desirable qualities of a toothbrush are as follows:

1. Man-made (controllable) filaments.
   The diameter is generally 0.008 - 0.011 inches.
2. Medium or medium soft.
3. It has a short head (about 1 inch long), straight handled, and the total length is about 6 inches.
4. It has a straight trim.
5. Multitufted bristles.

All the above qualities, however, are relatively insignificant in relation to the essential quality (to be able to remove plaque from the teeth). The type found to be most satisfactory is a multitufted plastic filament brush. It means that many fine filaments are packed closely in each tuft and the latter are placed close together so that good coverage of the tooth surface and embrasures is afforded.

Allen et al (1968) suggested that the bristle should be equal length and approximately ½ inch in height. The size of the brush head may vary somewhat, but, in general, it should be small enough to reach crowded areas of the arch and large enough to include several teeth in the brushing stroke.

4.4 THE AMERICAN DENTAL ASSOCIATION STANDARD

According to Pawlak and Hoag (1980), the American Dental Association has not evaluated each toothbrush as to its particular

merit, but rather has established certain guidelines regarding acceptibility.

The American Dental Association recommended that toothbrushes should have a brushing surface from 1 to 1¼ inches long, and 5/16 and 3/8 inch wide, two to four rows, five to twelve tufts per row.

Some other considerations should be taken when selecting and recommending a toothbrush. The types of toothbrush selected for a patient depends on the needs of the individual rather than the superiority of any one particular type of toothbrush. No one toothbrush is adequate for all patients. The proper brush should provide easy accessibility to all areas of the mouth. Small headed brushes are often helpful in this regard.

It should clean efficiently and be easy for the patient to manipulate. Both natural and nylon bristles are equally satisfactory, although nylon bristles retain their firmness longer. The brush should be one that is compatible with the recommended brushing technique.

It is also suggested that two brushes are recommended and used alternately. They should be replaced when the bristles start bending or fraying.

4.5 THE BRITISH STANDARD

The current British Standard (1979) classifies brushes, into brushes suitable for adult, youth, or child (Forrest 1981). There is no hard bristle brush approved for youth or child.

The British Standard (1979) BS 5757 is:

Adult: Extra soft (1)
Soft (2)
Medium (3)
Hard (4)
Youth: Extra soft (1)

	Soft	(2)
	Medium	(3)
Child:	Extra soft	(1)
	Soft	(2)
	Medium	(3)

This standard has initiated a number of changes in the texture or hardness of toothbrushes which were until now assessed as soft or medium. Some confusion as to the choice exists at present because of the uncertainty between the use given by different manufacturers to the term soft or medium.

The effect of the new standard seems to be that the filament diameters have now been changed to thicker and more acceptable filament diameters around 0.01 inch (previously 0.007 inch).

4.6 TOOTHBRUSH in AUSTRALIA (Chong and Beech 1983)

At the present time there are at least 11 different brands of monofilament (nylon) toothbrushes available on the Australian market. There are also a large range of natural bristle brushes, a small but increasing range of electric toothbrushes, and the so-called disposable toothbrush devices.

The revision of the original Australian standard on toothbrushes (AS 1032) was published in August, 1981. The standard for toothbrushes is confined to the manually operated device, using synthetic monofilament (table 1). Brushes have either 3 or 4 rows of tufts. The trim of the brush can be either flat or serrated.

The majority of people use the toothbrush as supplied, but dentist, therapist, and hygienist may find it of benefit for particular patients to alter the angle of the brush head to the handle.

As a general rule the easiest brushes to alter are those which are made of transparant or translucent plastic. They are readily manipulated at a temperature of approximately 60% C.

The opaque type require a much higher temperature which can be damaging to the toothbrush unless used with great care.

Table 1. The Australian Standard of toothbrush.

Texture of toothbrush	Specification	Adult (mm)	Junior (mm)	Child (mm)
Hard	Diameter	0.29-0.32	-	-
	Minimum	150	-	-
	Maximum	15	-	-
Medium	Diameter	0.24-0.29	-	-
	Minimum	150	-	-
	Maximum	15	-	-
Soft	Diameter	0.19-0.24	0.19-0.24	0.19-0.24
	Minimum	150	125	100
	Maximum	15	13	11
Extra soft	Diameter	0.16-0.19	0.16-0.19	0.16-0.19
	Minimum	150	125	100
	Maximum	15	13	11

(Source: Chong MP & Beech DR 1983)

Although a few manufacturers still producing the natural bristle variety, they are not generally to be recommended, due to their rather poor hygiene qualities.

The hardness, abrasiveness, and stiffness of the disposable toothbrushes could cause damage to the soft tissues of the mouth. It is strongly recommended that their use should be actively discouraged by dentists and dental educators. Furthermore, based on minimum requirements of the Australian standard or any other official standard for toothbrushes, these devices cannot be classified as acceptable.

In the absence of a toothbrush the use of dental floss or interdental sticks together with a thorough mouth rinse would be preferrable to using currently available disposable toothbrushing

devices.

4.7 TOOTHBRUSH AGE and WEAR

The relationship between the state of wear of a toothbrush and its plaque removing effectiveness is a potentially important factor in home oral hygiene, since toothbrushes should be discarded before becoming worn out. It is very likely that the user has little idea of when his toothbrush needs replacing.

McKendrik et al (1971) found in their studies that the mean age at discard was 10.5 weeks, but there was no correlation between average brush age and an Oral Debris Index or Periodontal Index.

Thus, time in use is not per se the principle factor affecting the useful life of a toothbrush. The manner of brushing is more important than the length of time the brush is in use.

We should not say to a patient to replace his brush every 6 weeks or whatever, but rather should have a sample of a brush that is just ready to be discarded, and say that he should replace his toothbrush when it begins to look like it.

Kreifeldt et al (1980) confirmed the findings of Bergstrom's studies in 1973, that there was a correlation between the age of a brush and objectives measures of its wear and cleanliness.

Kreifeldt et al (1980) pointed out that plaque removal effectiveness of a worn toothbrush decreases with wear and becomes more pronounced as the tooth surface becomes more difficult to reach. Both matting and bristle tapering, as components of brush wear, contribute to loss of effectiveness.

Matting appears to be the primary cause, particularly when it is a heavy one. Bristle tapering, however, should not be neglected since a brush with light matting and heavy tapering could be the equivalent of a heavily matted and lightly tapered one.

The brush itself should be designed to resist matting, thus ensuring a longer useful life. It is also recommended that if standards for toothbrush are devised, the rate of loss of effectiveness of a brush with use shoul be considered to be an important item, since a new toothbrush loses its effectiveness with use.

Since even a lightly matted and tapered brush shows a significant loss of plaque removal ability, a brush should be replaced when it is perceptibly matted whether this occurs in two weeks or six months, regardless of age.

Baer and Morris (1977) recommended that the toothbrush should be replaced as soon as it shows evidence of frayed, bent, or broken bristles. No toothbrush should be used for more than one brushing per day. If advised to brush three times a day, the patient should use a different brush each time.

5 TOOTHBRUSHING METHOD

Toothbrushing is the method most commonly recommended throughout the world for removal of soft accretions on the teeth and gingiva. Aids should be used sparingly to avoid confusing patients with unnecessary cleaning devices. Kawashima (1979) suggested that whenever possible patients be encouraged to use only the toothbrush and handheld dental floss.

Toothbrushing effectiveness may be affected by dentifrice used, by the size and type of the brush, by type and configuration of the bristles, by the brush's power source. According to Greene (1966), however, the methods, skill and frequency with which brushes are used, are probably the most important things.

Löe (1970) pointed out that a universal mechanical cleansing procedure, which is adequate for every patient, has not yet been developed. There are certain universal principles that may be applicable in most cases, but just as no two dentitions are identical, no one method of cleansing is adequate for every dentition. Therefore, a specific oral hygiene programme must be designed for each patient.

Pawlak and Hoag (1980) made a list of certain criteria that need to be assessed when selecting a toothbrush method for the individual patient. These are based on the fact that technique selection is not an arbitrary decision, but rather one based on certain indications and contraindications.

We have to look at the patient's clinical situation and the patient's personal situation.

1. Patient's clinical situation:

   We should observe the state of gingival and periodontal tissues in regard to health or disease. The condition of the tissue (particularly its contour, tone, texture, and size) could be normal, fibrotic, bulbous, edemateus, or enlarged. The papillary contour could be open or a filled embrasure space, and also we should examine for pocket or sulcular depth.

The anatomical limitations are also need to be considered, such as:

- the size and contour of the dental arch.
- the position, inclination, and the contour of the individual teeth.
- presence of edentulous areas and of any type of replacement for the missing teeth.

2. Patient's personal situation:
   Different individuals have different levels of manual dexterity. We should look over the motivational level, ability, and willingness of the patient to act on recommended procedures.

5.1 METHODS of BRUSHING

According to Greene (1966), most methods of toothbrushing used for cleansing the teeth can be grouped into 7 general categories based on motion.
They are:

1. Vertical technique.
   Using this method, buccal surfaces are brushed by moving the brush in an up and down motion, with each stroke covering teeth in both arches. For lingual surfaces, the same motion is used with the teeth apart.
2. Horizontal technique.
   In this technique, the buccal and lingual surfaces of the teeth are brushed in back and forth motion.
3. Roll technique.
   The bristles of the brush are placed on the unattached gingiva as far away from the occlusal surfaces as possible with the side of the bristles resting against the gingiva, and with enough pressure to cause blanching (fig.2A).
   With a rolling motion, the bristles are swept across the tissue towards the clinical crown in such a way as to cause the back of the head of the brush to travel in an accurate motion (fig.2B). As the bristles pass over the tooth crown, they are almost at right angles to the enamel surface. This action is repeated 8 to 12 times in each areas of the mouth. The occlusal surfaces are cleansed by the scrub method.

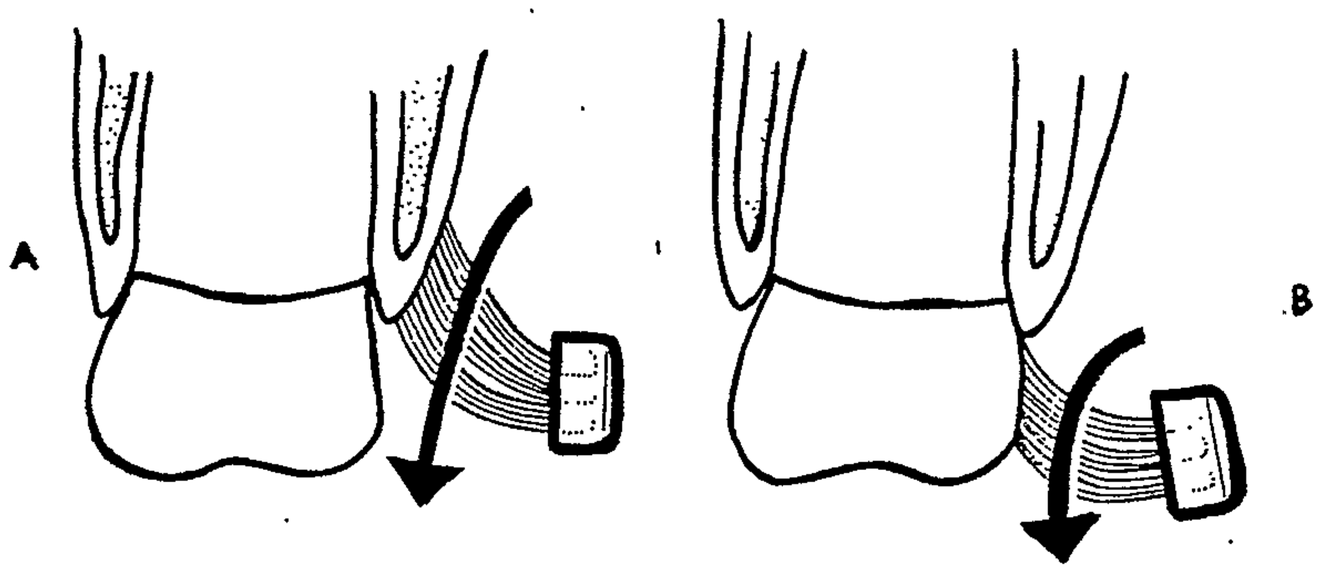

Fig 2. The roll technique. The bristles are first directed apically as in A and then swept in an occlusal direction with a rolling motion as in B. (From: Pawlak EA and Hoag PM: Essentials of Periodontics, 2nd ed. CV Mosby. 1980. p 119).

4. Vibratory technique.

The best known vibratory techniques are those described by Charter, Stillman, and Bass, which are the most common toothbrushing methods. Each technique is based on the vibratory motions of the bristles, and according to Pawlak and Hoag (1980), they are as follows:

4.1 Charter's method.

With this method, the bristles are placed at a 45 degree angle directed toward the occlusal surface. The sides of the bristles are then placed against the marginal gingiva and the tooth, extending the bristles into the interproximal spaces. Pressure is applied to the bristles and make a firm rotary vibratory movement, while keeping the bristles in position (fig.3).

This is one of the methods introduced, which specifically aims at interdental hygiene. The buccal and lingual surfaces, however, are normally also adequately cleaned during this procedure.

Charter's method is utilized when the interdental papillae do not fill the embrasure spaces. This technique is

contraindicated when there are full interdental embrasure spaces.

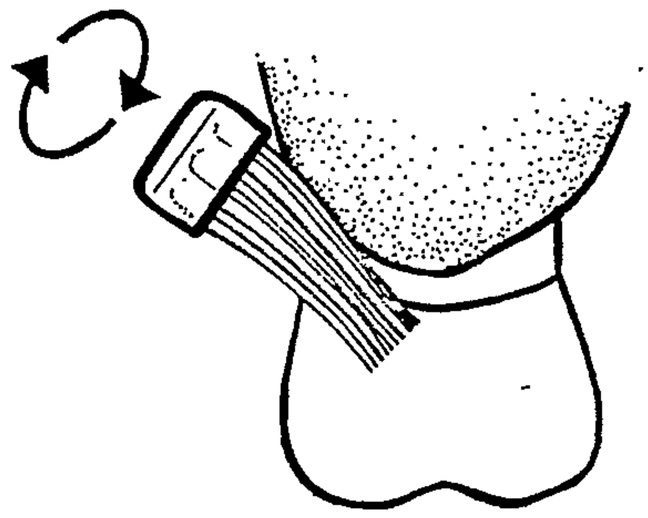

Fig 3. Charter's technique. The bristles are directed occlusally and the sides of the bristles are firmly flexed against the gingiva with a vibratory motion. (From: Pawlak EA and Hoag PM. Essentials of Periodontics, 2nd ed. CV Mosby. 1980. p 120).

4.2 Stillman's method.

This method is similar to Charter's method. The bristle ends are placed at a 45 degree angle with the bristles directed apically on the gingiva and partly on the cervical portion of the teeth.

Once the bristles are in place, pressure is applied to blanch the gingiva and a gentle but firm vibratory rotary motion is applied to the brush, with the bristles remaining in the same position (fig.4A).

4.3 Modified Stillman's technique.

The only difference between the Stillman's and the modified Stillman's technique is that with the modified Stillman's technique a rolling stroke is used after the vibratory motion (fig. 4B).

The Stillman's and the modified Stillman's method provide stimulation to the gingival tissues and remove soft deposits from the cervical areas of the tooth surface.

4.4 The Bass technique.

This method is also called sulcular brushing. It is

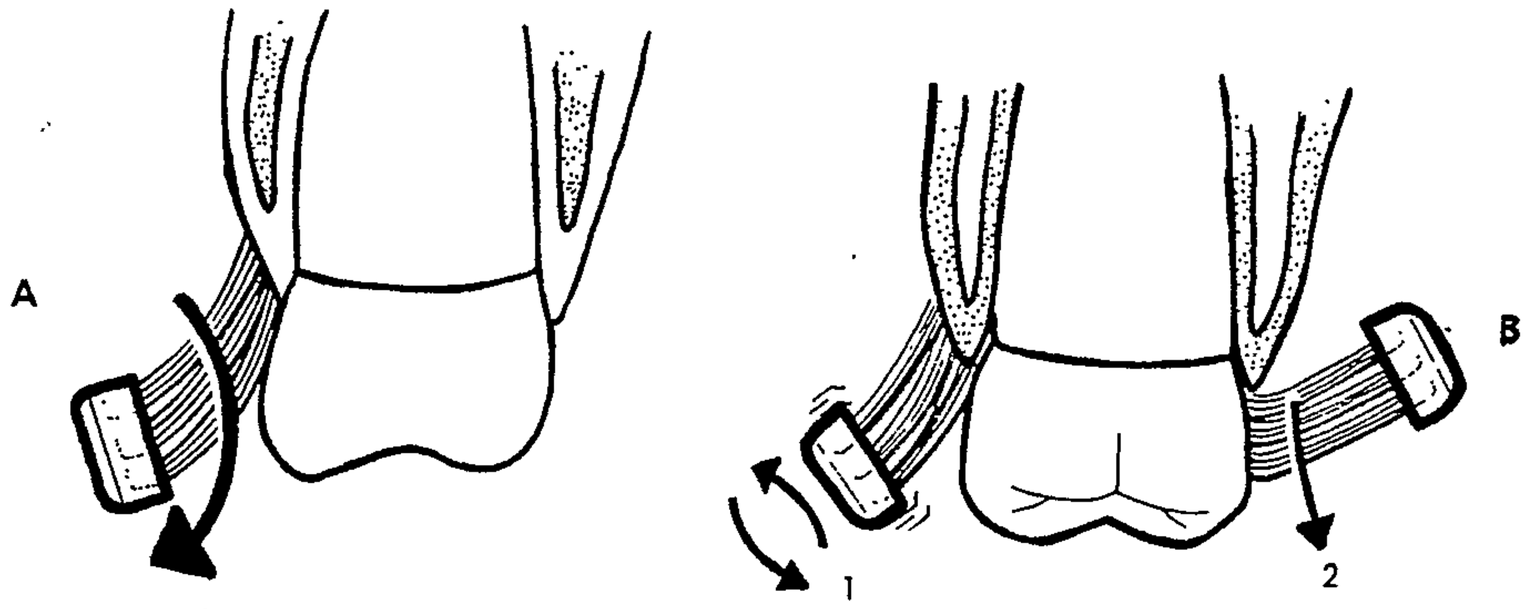

Fig 4. A, Stillman's technique. The bristles are directed apically and commpressed laterally against the gingiva. A vibrating rotary motion is used to activate the brush. B, Modified Stillman's technique. Following the vibratory motion shown at 1, the brush is moved occlusally with a rolling motion over the gingiva and tooth surface, as shown in 2.
(From: Pawlak EA and Hoag PM. Essentials of Periodontics, 2nd ed. CV Mosby. 1980. p 119).

recommended to use a soft nylon brush with round ended ends. The bristles are placed at a 45 degree angle to the long axis of the tooth with the bristle ends placed to move the bristles into the sulcular region.
When they are engaged in the sulcular area, utilize a vibratory motion, move the brush back and forth with very short strokes and keep the ends of the bristles in the sulcus (fig. 5).
If this method is properly done. it is efficient at removing dental plaque from the gingival third of the tooth (gingival margin) and within the gingival sulcus.
This method was created by Dr. Bass in the 1940s, and it is gaining the reputation of being the most effective method for dental plaque removal.

4.5 Modified Bass technique.
The first part is similar to the Bass technique. The modification is that the bristles are swept downward

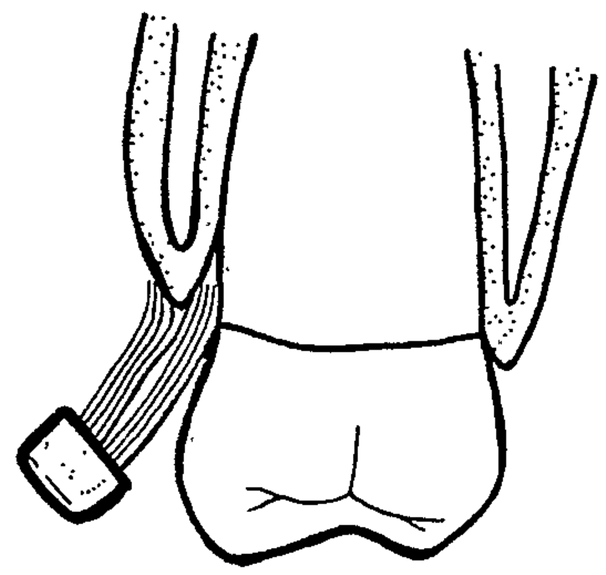

Fig 5. Proper placement of bristles with the Bass technique. The ends of the bristles are inserted into the gingival sulcus. The brush is activated with a slight vibratory motion.
(From: Pawlak EA and Hoag PM. Essentials of Periodontics, 2nd ed. CV Mosby. 1980. p 118).

over the tooth surface occlusally after completing the vibratory motion in the gingival sulcus.

5. Circular method.
   The buccal surface are brushed by a rotary motion while the teeth are in occlusion. The rapid circular motion swings over a large enough area to include the gingiva as well as the teeth. No special attention is given to the interproximal areas. The lingual surfaces are brushed by a back and forth motion. The palate also is brushed to stimulate the blood supply to the maxillary gingiva. The occlusal surfaces are cleansed by a scrubbing motion.
6. Physiologic technique.
   This technique was introduced by Smith in 1940. As the natural shedding of food is from the crowns on to the gingiva, it is suggested that the brushing action should be in this direction.
   Very soft bristles are swept over the crown and gingiva to give "physiologic" stimulation to the gingiva and interproximal tissue.
7. Scrub-brush method.

A brush is grasped firmly and the ends of the bristles rubbed vigorously over all surfaces of the teeth similar to scrubbing a wooden floor.

A common error in brushing the occlusal surfaces is the use of long scrubbing over all the occlusal surfaces. Pawlak and Hoag (1980) recommended, that to properly clean these surfaces the brush bristles are placed at a right angle on the occlusal surfaces with the ends of the bristles deep into the pits and fissures.

There are 2 types of strokes that can be used here, which are:
- using a circular action, vibrate the brush while keeping the bristles in position.
- force the bristles into the pits and fissures and, using sharp, quick strokes, lift the brush to remove deposits. After one area is completed, the brush is then moved to the next area, overlapping the area previously brushed.

There is another technique, i.e. Fone's technique, in which the teeth are held in occlusion and the brush is positioned with its bristles or filaments in the horizontal plane (Wade 1965). The brush is then moved round and round in a series of circles.

The advantage claimed for this method is that it employs a more natural action than other methods, and it has therefore been advocated for children. Fone's technique, however, cannot be used on the lingual aspect and this above all must be regarded as its chief disadvantage.

Macgregor and Gunn (1979) reported as the result of their studies, that when giving tooth brushing instruction, emphasis should be placed on the need to spend adequately time brushing lingual areas.

According to Löe (1970), most patients who are in possession of a toothbrush brush only the occlusal and facial tooth surfaces, and frequently only the labial surface of the anterior teeth. Very few, who have not received special instruction, seem

to pay any attention to the necessity of interdental hygiene.

The most common brushing method used by patients who have never had special instruction is a type of horizontal scrub technique characterised by a back and forth motion on the buccal and lingual, and the occlusal surfaces are cleaned by horizontal motions, and if sufficient time and care are used, it is feasible to obtain a high degree of cleanliness of these surfaces.

5.2 FREQUENCY of BRUSHING

The ideal frequency of toothbrushing is largely a matter of opinion at present. It has been investigated only rarely. Oral hygiene programmes prescribing one, two, or more brushing per day are scientifically unfounded and based only on tradition (Löe 1970).

Silverstone et al (1981) pointed out that many dentists recommend cleaning the teeth every meal, although it is arguable that brushing before meals might be more beneficial. Pre-prandial brushing should remove potential acid producing bacteria from tooth surface before exposure to fermentable carbohydrate and thus decrease the opportunity for caries attack.

It is possible that really meticulous plaque removal, including approximal plaque, need only be carried out once a day, or even less frequently. It has been shown that thorough cleaning every 48 hours can prevent the development of gingivitis (Lang et al 1973), but since the plaque removing ability of many people is limited it is probably undesirable to recommend brushing less frequently than once or twice per day.

Lang et al (1973) found that healthy gums could be kept free from disease by brushing only once every 2 days. This ignored the cariogenic potential of plaque during this time. According to Strahan et al (1977) , there is no study to show the frequency necessary to resolve established chronic gingivitis, but twice a day is commonly succesful in the experimental and clinical situation.

Baer and Morris (1977) recommended that at least once a day, at night, is probably sufficient brushing for maintenance of a healthy periodontium. However, patients with diseased periodontiums will require multiple brushings per day.

The onset of gingivitis seems to be more related to the age of plaque (i.e. bacterial composition) than to its amount and thickness (Löe et al 1965, Theilade et al 1966). Subclinical tissue changes first appear after 2 days of plaque development (Löe et al 1967).

Based on these observations, Löe (1970) investigated the effect on the gingiva of one thorough tooth-cleansing every second day. The results show that gingiva can remain clinically healthy with complete removal of plaque only every second day.

Although subclinical gingivitis has been shown to be produced by a 2 to 3 day old plaque, it is not known at what stage of development plaque is cariogenic. It is, therefore, difficult to design a scientifically founded programme for the mechanical removal of plaque which achieves prevention of both diseases.

Löe found that complete removal of plaque once daily or every second day, or possibly even once every third day, is more valuable from the point of view of preventing dental caries and periodontal disease than performing 2 or 3 inadequate brushings per day.

5.3 BRUSHING SEQUENCE AND TIMING

Regardless of the toothbrushing method selected, a sequence of brushing should be given to the patient. This pattern in brushing is important to ensure that the patient brushes all areas consistently.

According to Pawlak and Hoag (1980), it is recommended that the patient be instructed to start with the molar region of one arch around to the opposite side, then continue back around the lingual or facial surfaces of the same arch. This procedure is then followed on the other arch until all accessible surfaces are cleaned. The last surfaces to be brushed are the occlusals.

The number of strokes applied to each area or time spent cleaning an area is equally important to establishing a systematic routine. Depending on the particular needs of the patient and the method of brushing being utilized, the patient is instructed to stroke each area 10 times or spend 10 seconds per area, then move on the next area.

6 DENTAL FLOSS and TOOTHPICKS

6.1 TYPES of DENTAL FLOSS

Dental floss is a tool used to disorganize and remove the microbial masses that are located below the gum margins and between the teeth on mesial and distal surfaces (Dingerson and Dingerson 1973).

There are two types of dental floss, namely waxed and unwaxed dental floss. According to Bernier and Muhler (1975), waxed dental floss was available long before the importance of bacterial plaque was generally recognised.

It had been used to remove large particles of food or oral debris from between the teeth and was not usually thought of as a method for removing organised bacterial plaque.

Unwaxed dental floss has been generally available only during the last decade. Because of its smaller diameter, it can be slipped through interdental contacts more easily than waxed floss. The individual filaments of the unwaxed floss contact the tooth surface and scrape off the organised microbial colonies.

Any supragingival or subgingival calculus deposits and roughness or over-extension of restorations must be removed before the patient begins to use unwaxed dental floss. Otherwise they can cause bleeding and soreness of the gingival tissue, along with catching, fraying, and breaking of the floss. Incorrectly used floss may also cause damage to the gingiva.

Kawashima (1979) recommended the use of unwaxed dental floss, but patients who have jagged fillings or sharp calculus may prefer waxed floss at first until defective fillings can be replaced and calculus removed.

Dental floss, either waxed or unwaxed, will effectively clean all flat or convex interproximal surfaces when properly used. A majority of periodontists, however, appear to favour the use of

unwaxed dental floss as the primary means of interproximal cleaning.

Strahan et al (1977) cited that Keller and Manson Hing in 1969 did not find any difference between the cleaning ability of waxed and unwaxed dental flosses.

Dingerson and Dingerson (1973), however, did not recommend the waxed floss for cleaning purposes. They said it coats the enamel surfaces of the tooth and is inadequate for removing plaque.

Although more chairside instruction is generally required for a patient to become proficient in flossing and it is more time consuming for the patient to use, the high state of interdental cleanliness and the interproximal gingival health attained by patients who use floss attest to its great value in an oral health regimen.

6.2 TECHNIQUES of FLOSSING

In general, the piece of floss to be used should be from 18 to 24 inches long (Dingerson and Dingerson 1973). If too short a piece is used, it is difficult to manipulate properly, and easily to slip.

Most of the floss is wrapped on one finger of one hand. Right handed persons seem to prefer to wrap most of the floss on a finger on the right hand. The floss is anchored on a finger on the opposite hand (fig.6). The fingers used in this procedure are not important. Each patient will develop a technique that is comfortable for himself, but a few suggestions would be helpful.

The first step of the procedure for flossing is to pass the floss through the contacts between the teeth with a back and forth motion to minimize gingival injury. Once through the contact, the floss should be placed against the tooth and drawn apically as far as the gingival permits (fig.7).

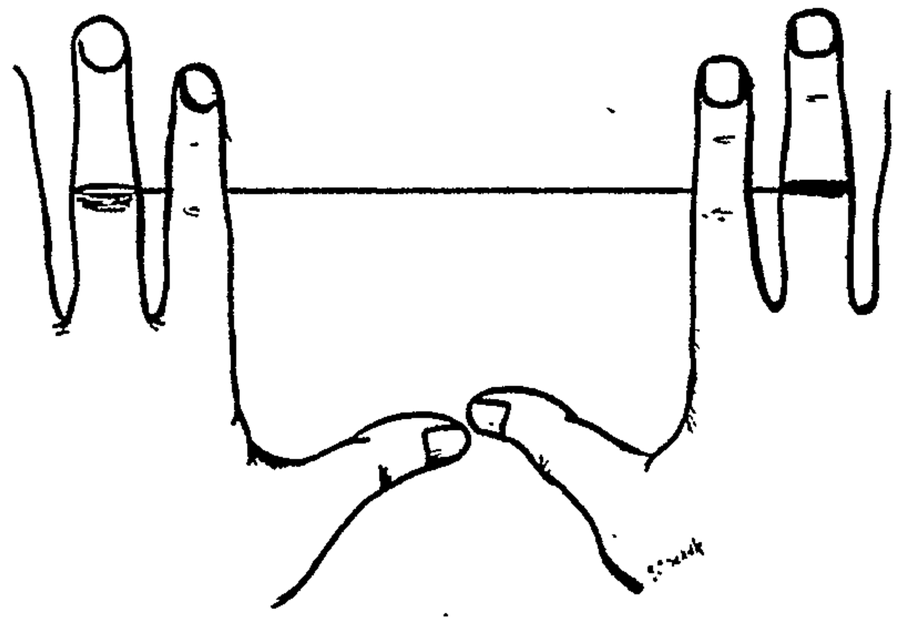

Fig 6. The floss wrapped around the fingers ready for use. (From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 74).

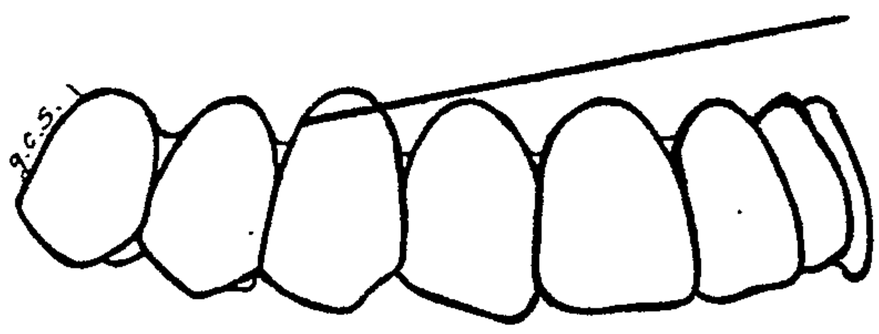

Fig 7. The floss carried into the gingival sulcus. (From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 74).

The floss should be gently slipped beneath the gum line and allowed to proceed as deep as it will go without using undue pressure, to avoid the injury of the soft tissue. Wrap the floss as much as possible mesially or distally around the tooth (fig.8).

With the floss held tightly against the tooth, it is cleaned with a scraping up and down motion (not a shoe-shine motion) for 6 or 7 times. Later the number of necessary strokes can be reduced to 3 if proper results are being obtained. This can also be

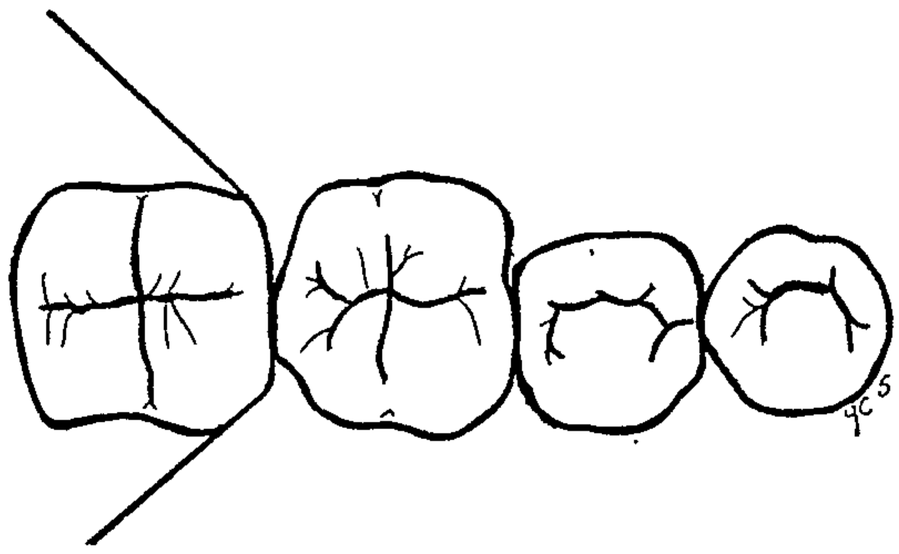

Fig 8. The floss wrapped tightly around the tooth.
(From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 74).

accomplished in a single stroke if the fingers have adequate strength.

It should be moved between the sulcus and the interproximal contact point. The floss is moved along the tooth surface, not the gingival surface. Flossing should be done slowly to avoid trauma with sloppy incorrect technique.

This procedure of cleaning should be repeated on the side of the adjacent tooth. Repeat again until all the proximal surfaces of all the teeth have been cleaned.

To clean the distal surfaces of the tooth, both fingers are brought forward toward the front of the mouth. To clean the mesial surface of the tooth, both fingers are pushed to the back of the mouth.

The tooth is clean when a squeaky sound is heard. Each tooth should be cleaned individually. It is best not to cross over from one tooth to the other. The floss can be deep under the gingival tissue and there is a danger of cutting the tissue, and the incisal third of the contact area of the tooth will not be adequately cleaned.

Beginning on the lower posterior teeth, the fingers are on top of the floss as it is carried down under the gingival margins (fig.9). As the center teeth are reached the hands are reversed,

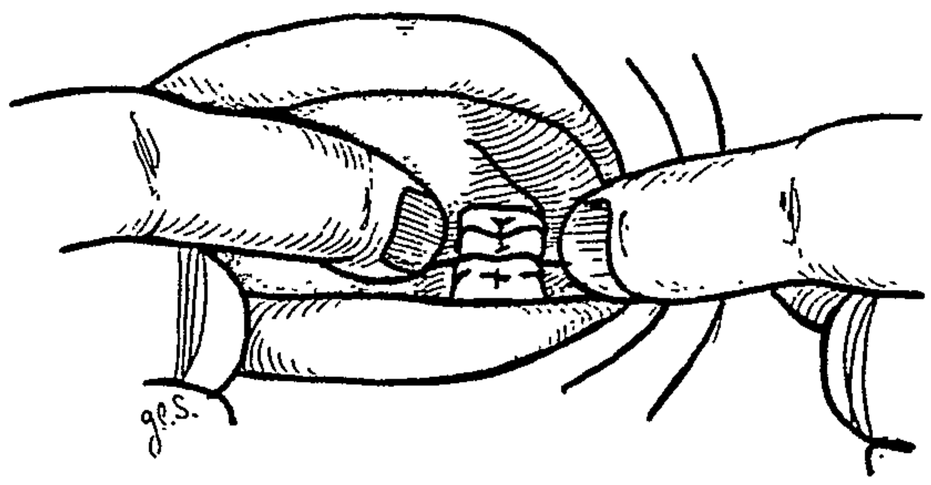

Fig 9. Placement of the fingers on the floss in cleaning the lower left back molars.
(From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 75).

the hand that was on the lingual or tongue side is now on the facial or cheek side (fig.10).

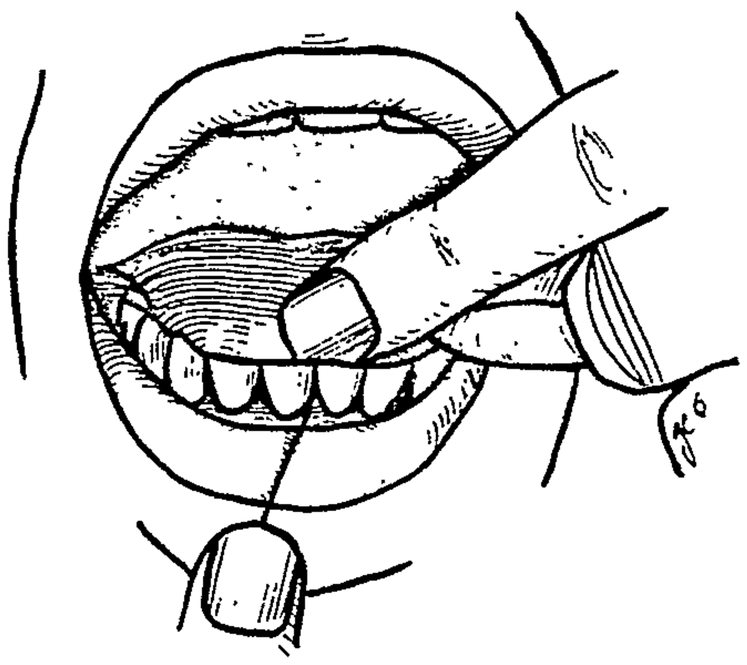

Fig 10. Placement of the fingers on the floss in cleaning the lower anterior teeth.
(From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 75).

When the upper arch is flossed, the floss is pushed up using the two thumbs, a thumb and finger, or two fingers (fig. 11).

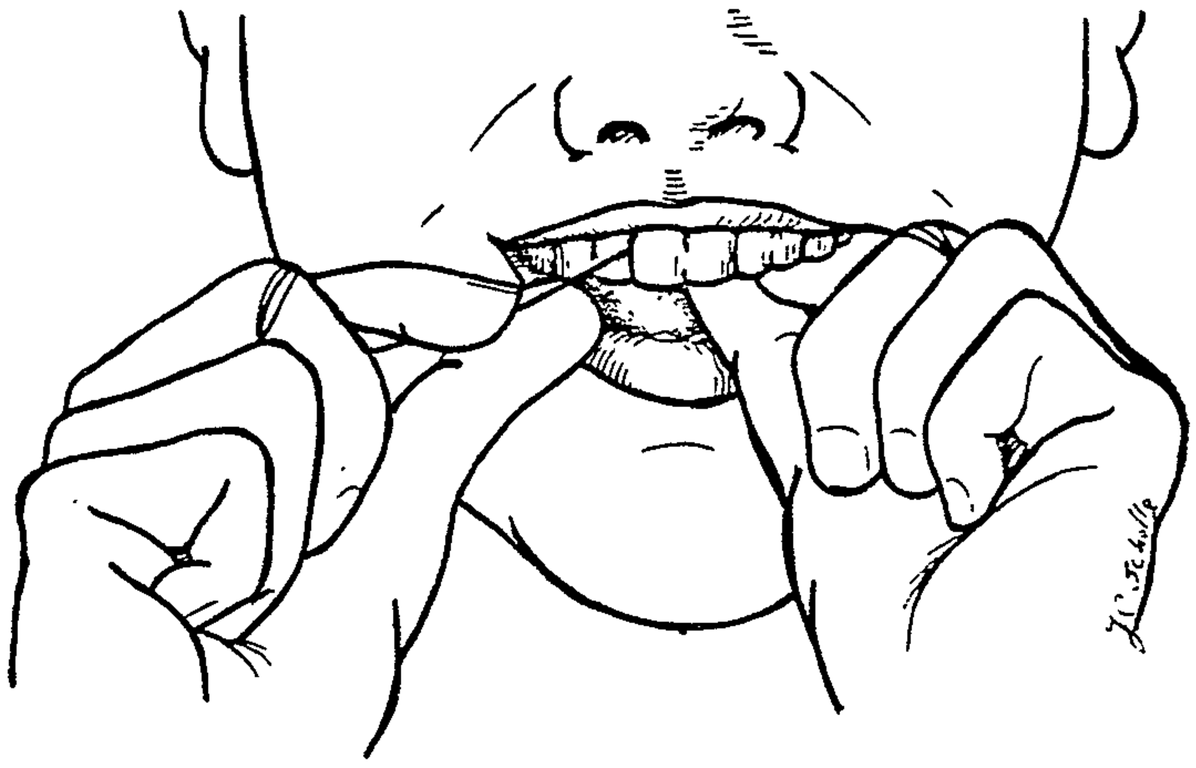

Fig 11. Position of the thumbs in flossing the upper anterior teeth.
(From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 76).

It is important to change the floss at regular intervals because as it becomes used and frayed it becomes ineffective as a cleaner and will in time break. Occasionally a piece of floss will lodge between the teeth. This usually can be removed by inserting another piece of unwaxed floss or if necessary a piece of waxed floss. If the floss becomes snagged by an obstruction on the tooth surface and cannot be removed, the floss is disengaged from one finger and pulled through to one side.

Flossing once a day is essential (Kawashima 1979). Ten or fifteen minutes a day is required to remove plaque adequately in the beginning. Less time is needed as patients become more proficient. This schedule of cleaning is required to combat plaque which forms in 24 hours, whether a bite of food is eaten or not.

6.3 FLOSS THREADERS and FLOSS HOLDERS

The floss threader is a means by which floss can be carried under fixed bridges, between splinted teeth, and under low solder joints to remove plaque and food debris (Dingerson and Dingerson 1973). These are generally made of a pliable plastic or wire.

A length of unwaxed floss approximately 24 inches long is placed through the eye of the threader. The threader is passed through between the abutment (natural) tooth and the pontic (artificial tooth) (fig. 12).

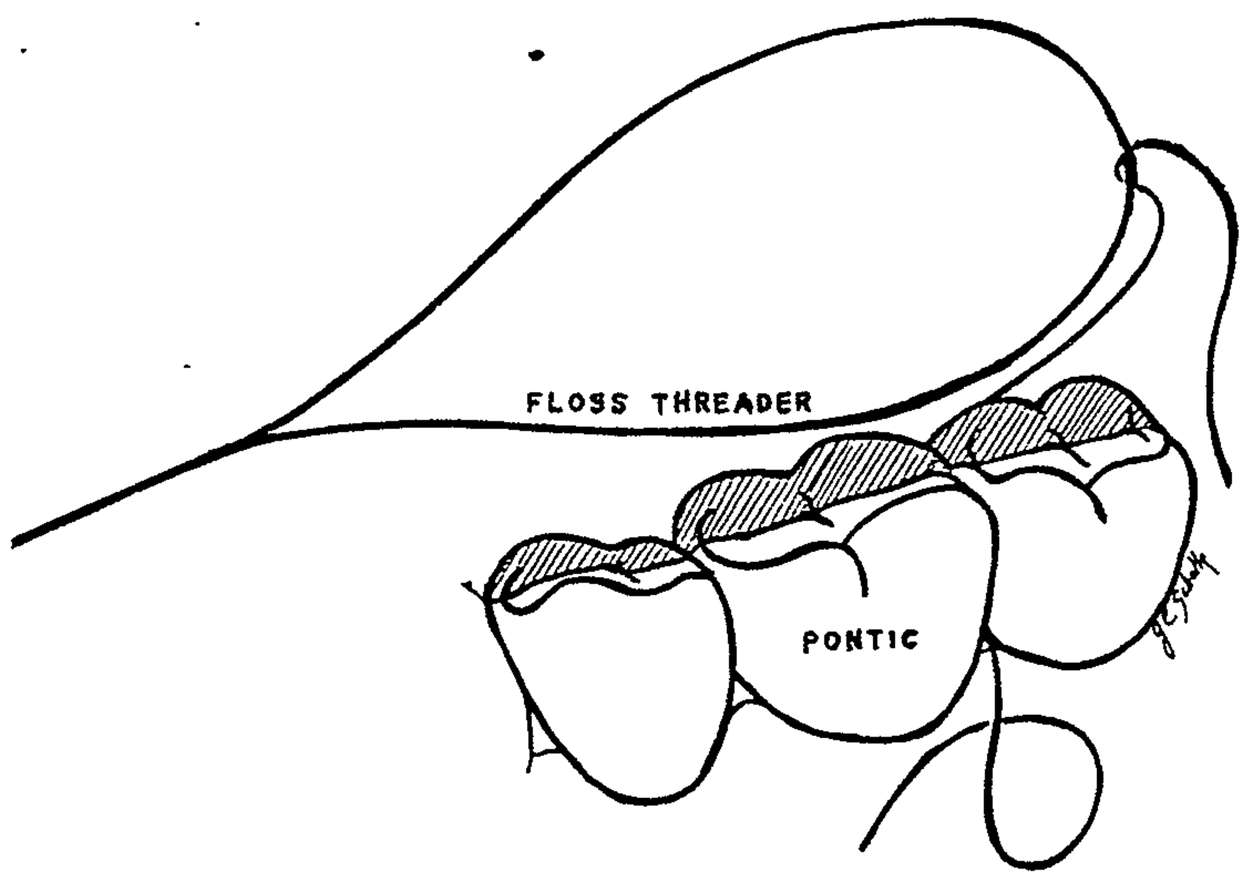

Fig 12. Placement of floss under a bridge using a floss threader.
(From: Dingerson AG and Dingerson MR. Practice Management in Preventive Dentistry, JB Lippincott Company, Philadelphia, Toronto. 1973. p 77).

Care should be taken not to injure the gum. The threader is then disengaged from the floss.

The floss is manipulated with the index fingers. It is curved toward the tooth as it is carried to below the gum margin of the abutment tooth. With firm pressure, the abutment tooth is scraped

in an up and down motion until the tooth no longer feels slimy or sticky. The floss is moved to a position under the pontic and scraped in a back and forth motion. The remaining abutment tooth is cleaned in the manner previously described.

There are some factors to be considered in selecting the proper floss threader. The threader must be narrow enough to pass between the teeth. The size of the eye must be large enough so that it can be easily seen and threaded. The threader should be long and firm enough to be easily picked up by the fingers after it has been passed between the teeth.

There are several devices on the market for holding dental floss (floss holder), possibly making the job a little easier for the patient, but not necessarily improving the effectiveness of dental floss as an interproximal cleaner (Hoskins and Masters 1977). They have tested several of these and have found no device that is clearly outstandingly acceptable from all standpoints.

The chief objection is the limitation of the present arc in tucking around the tooth to clean line angles. However, if all attempts to obtain effective and habitual use of floss are unsuccessful, one should consider recommending a floss holding device to the patient.

Floss holders can be helpful to the handicapped, to those who because of their age or physical condition, are unable to manipulate the floss, and to those who emotionally cannot floss without assistance (Dingerson and Dingerson 1973).

They can be used by the mother for the young child, 2 to 5 years of age. Some children aged 5 to 7 years can adequately floss their teeth by using a floss holder. The cleaning of the tooth is accomplished in the same manner as when the fingers are used.

To clean the distal surfaces of the tooth, the floss holder is pulled (curved) forward and the tooth is scraped with an up and down motion. The mesial surface of the tooth is cleaned in the same manner except that the floss holder is pushed towards the

back of the mouth.

6.4 TYPES of TOOTHPICKS and HOW TO USE THEM

Toothpicks may be made of hard or soft wood, plastic, or metal. According to Strahan et al (1977), there are no studies which support any particular material. There are slight differences in plaque removing removing capacity among the wooden toothpicks. Generally the shapes are round, rectangular, and triangular.

Bergenholtz et al (1974) pointed out, that analysis of the various interdental aids shows that the round toothpick is too thick and too blunt to reach the lingual half of the tooth when trying to angle it. The curved surface of this toothpick provides only point contact with the tooth surface. For those reasons no cleaning is performed lingually when using the round toothpick.

The rectangular toothpick is also wrongly designed for interdental cleaning. This toothpick is too pliable to be able to clean lingually. When an attempt is made to angle this toothpick, it bends or breaks.

The result of his studies supported Waerhaug's findings in 1959, that the triangular toothpick seems to be correctly shaped to fit the interdental space. The tapered form makes it possible for the patient to angle the toothpick interdentally and even clean the lingually localized interdental surfaces.

He concluded that patients with periodontal disease and open interdental spaces ought to use triangular toothpicks for interdental cleansing. Bergenholtz et al (1980) also suggested that it should have low surface hardness and high strength values. Round and rectangular toothpicks cannot be recommended for prophylaxis or as aids to oral hygiene in the treatment of periodontal disease.

Pawlak and Hoag (1980) suggested that to use the toothpick properly, it should be placed interproximally with the base of the triangle toward the tissue and at a slight angle toward the crown.

The toothpick is then used with an in and out motion and is not completely removed from the area. This is repeated several times in each area.

7 DENTIFRICE AS AN AID

According to Greene (1966), the American Dental Association's Council on Dental Therapeutics defined dentifrice as "a substance used with a toothbrush for the purpose of cleansing the accessible surfaces of the teeth."

There are three physical forms of dentifrices, namely liquid, powder, and paste. The predominant form, however, is the paste (Volpe 1982).

Dentifrices are composed of a variety of materials, which include cleaning and polishing agents, detergents (or surface active agents), binding agents, flavoring agents, preservatives, water, and a drug substance (in the case of therapeutic dentifrices).

Additionally, miscellaneous ingredients such as colouring materials, corrosion inhibitors, and whitening agents are often utilized in the dentifrice formulation. The approximate amounts of these ingredients that are present in typical dentifrice formulations are as follows (Volpe 1982):

Table 2. The dentifrice formulation.

Ingredients	Approximate per cent of formulation
Cleaning and polishing agents	25 to 60
Detergents (surface-active agents)	Up to 2
Humectants	20 to 40
Binding agents	Up to 2
Flavoring agents	Up to 1.5
Water	15 to 50
Colours, preservatives, sweeteners, stabilizers, etc.	Up to 3
Therapeutic (or drug) substance	Up to 2

(Source: Volpe AR 1982)

The largest component is the cleaning and polishing agent, which

has mechanical ability for removing dental deposits.

These substances are also commonly referred to as "abrasives". Dentifrice cleaning and polishing agents may be defined as solid substances that have a twofold purpose:
- to remove debris, stain, and plaque from tooth surfaces.
- to polish the tooth surface.

Ideally, a cleaning and polishing agent should provide a maximum of cleaning with a minimum of abrasion, so as not to damage the tooth surfaces or the surrounding structures. Also, it is essential that the cleaning and polishing agent be chemically and physically compatible with the other dentifrice ingredients.

Some examples of the abrasives usually used are Calcium Carbonate, Calcium Phosphate, Calcium Sulphate, insoluble Sodium Metaphosphate, Hydrated Aluminium Oxide, Magnesium Carbonates and Phosphates, Sodium Bicarbonate, Sodium Chloride (Greene 1966).

The greater the mineral particle size and the greater the concentration, the greater is the abrasive action on both dentine and enamel (Davis 1980). The hardness of the mineral affects the toothpaste abrasiveness.

Some abrasives, according to Volpe (1982), are excellent cleaning substances but have only limited polishing ability and thus tend to leave a dull finish on the tooth surfaces. Conversely, other abrasives have excellent polishing characteristics but are less efficient in reference to their cleaning properties. Thus, manufacturers often combine different agents in an effort to take advantage of the cleaning ability of one material and the polishing ability of another.

A dentifrice that has good cleaning properties and produces a high polish is desirable because a highly polished tooth surface will stain less readily and will remain clean longer (Bernier and Muhler 1975). According to Volpe (1982), it is difficult to conclude the optimal level of abrasiveness that a dentifrice should possess. The abrasive needs of individuals vary to such a

great extent.

The dentist, of course, is the only counsel in such matters and should advise the patient only after he has thoroughly examined the oral soft and hard tissues and become acquainted with that patient's particular clinical case.

For example, if the patient is elderly and has had a severe amount of gingival damage, resulting in a considerable amount of exposed dentin or cementum, the dentist may suggest a very mildly abrasive dentifrice for the majority of the time the patient brushes his teeth (Bernier and Muhler 1975).

On the other hand, persons with healthy dentitions, periodontium, and mucosal tissues can safely utilize much more abrasive dentifrices (Volpe 1982). A heavy cigar or cigarette smoker may require a different type dentifrice to properly clean his teeth from that required by a non-smoker.

Detergents as another ingredient in a dentifrice exert their cleaning effect by lowering the surface tension, penetrating and loosening surface deposits, and emulsifying and suspending the debris. Additionally, detergents provide dentifrice with the foaming characteristic that is so popular and expected by almost all dentifrice purchasers.

The function of a humectant in a dentifrice is to retain moisture. The most commonly utilized dentifrice humectants are glycerin and sorbitol, which have a sweet taste, and thus also function to some extent as sweetening agents in the dentifrice.

The function of a binding agent is to prevent separation between liquid and solid phases of a dentifrice, by increasing the consistency of the mixture of both.

The utilization of a flavouring agent is to make the dentifrice pleasant to use and refreshing to the taste. Preservatives such as one of the parahydroxy benzoates are common dentifrice ingredients. In addition to naturally sweet humectants

(such as glycerin and sorbitol), sodium saccharin is also used as a sweetening agent.

The two most important and beneficial oral health effects of a therapeutic dentifrice are:

- the prevention or reduction of the incidence of dental caries formation.
- the prevention or reversal of gingival disease.

There are many non fluoride therapeutic dentifrices (e.g. antibiotic-containing dentifrice). By far, however, the greatest attention given to the therapeutic dentifrices, both by the profession and by the patient, has been directed toward a dentifrice containing fluoride (Bernier and Muhler 1975).

According to Volpe (1982), some fluoride-containing dentifrices are sodium fluoride dentifrices, stannous fluoride dentifrices, and sodium monofluorophosphate dentifrices.

Some dentifrices specifically claim to have a beneficial effect on hypersensitive teeth. Strontium chloride or formalin are commonly used as the active agents. The precise mechanism of action is not known, but they have been evaluate in a variety of clinical studies, many of which have indicated that they do provide a desensitizing effect (Volpe 1982).

Ideally, the teeth should be cleaned initially without the use of a dentifrice (Hoskins and Masters 1977). This permits the bristle to perform the sweeping action effectively. When disclosing agents are used, it is easier to visualize the areas inadequately cleaned if no dentifrice is used. Following plaque removal, a small amount of dentifrice should be used to polish the teeth and freshen the mouth.

8 DISCUSSION

The most commonly used mechanical method to obtain clean teeth is toothbrushing. All patients, where possible, should be initially taught an effective plaque removal technique with the manual brush.

The toothbrush formerly recommended was a stiff natural bristle brush. More recently many periodontists (e.g. Forrest 1981) have recommended a medium or medium soft (0.008-0.011 inches in diameter), nylon filament multitufted brush, probably because it is felt that this medium/ medium soft brush can be used for cleaning the area of the gingival sulcus without producing injury. Children clearly should use a smaller toothbrushes.

Electrical toothbrushes appear to be gaining acceptance by both the public and the profession. But these have not been recommended as superior for routine use for removing the dental plaque.

The electrical toothbrush and the manual toothbrush can be used with equal effectiveness for removing and preventing the formation of dental plaques, and for removing debris and materia alba. The electrically operated brush may be especially useful in the oral health care of physically and mentally handicapped persons.

In those who have difficulty in mastering a suitable hand brushing technique, the use of an electrical brush with its standard movements may result in more frequent and better cleansing of teeth.

Some other materials have been devised to supplement the toothbrush. Dental floss and toothpicks are some of the tools recommended for interdental cleaning.

According to Johansen (1981), even though the need to use interdental cleaning aids has been known for over 20 years, very few Australians use them. Nixon (1978) in a survey in Brisbane

found that only 11.5% used dental floss or toothpicks. The WHO study (1983) found that in metropolitan Sydney (in 1973) 35% of the adults combined toothbrushing with the use of toothpicks or dental floss, and it was more frequent in the metropolitan Ontario (47%), Trondelag (56%), and Yamanashi (54%).

It is not unusual to encounter patients who have never heard of dental floss. Some patients find it tedious, time consuming and difficult to use dental floss. Re-instruction and encouragement is essential and in some cases toothpicks may be a better alternative.

Rinsing with plain water and the use of water irrigation devices has had only a limited evaluation. Water irrigation devices look promising as a cleaning adjunct but not as a substitute for brushing (Goldman and Cohen 1962, Forrest 1981).

According to Ripa (1977), in terms of caries control programs, the water irrigation devices may have its greatest use as a vehicle for transporting anticariogenic agents.

Selective chewing of certain foods is believed to be of some value in oral cleansing, possibly due to increased salivary flow and detergent action. The eating of an apple at the end of a meal, is a pleasant way to improve oral hygiene, but it may not be efficient in removal of plaque.

The chewing of sugar free gums cannot at this time be considered a hazard to dental health and may also act as suitable replacement for confectionery or other cariogenic food. There is great variation in the cleansing action of foods, but no food appears to be as effective as the toothbrush.

Some of the toothbrushing methods that have been introduced, appear to have some disadvantages. The horizontal method, for instance, is particularly harmful to both gingiva and the teeth (Hine 1950). In addition, the lingual aspect receives no brushing because a horizontal stroke cannot be used easily in this area.

The vertical method may also cause atrophy of the periodontal tissues, which could be followed by abrasion of the exposed roots of the teeth.

Some other methods appear to be difficult to carry out. The vibratory techniques could cause trauma to the gingiva by the cut ends of the bristles or filaments (Wade 1960). Great co-operation is required from a reasonably intelligent patient to ensure that the movements are sufficiently small to bring about vibration only.

Studies to compare the relative effectiveness of toothbrushing techniques are faced with many serious problems. These problems include inadequacy of methods to measure effectiveness, the great variety of toothbrush designs, variation in manual dexterity of patient, and difficulties in teaching the methods in a standard way.

Shick and Ash (1961) compared the effectiveness of the vertical and roll technique in removal and prevention of dental plaque formation. Junior dental students brushed with equal effectiveness.

In 1970, Frandsen et al studied the effectiveness of the Charter's, scrub, and roll methods, using 60 participants. The largest percentage reduction in plaque was 66% by brusher B (a dental hygienist) using the scrub method and the smallest reduction was 47% by brusher A (a dentist) with the roll method of toothbrushing.

There was significant interaction between method of brushing and brusher. As the result of this study, Frandsen pointed out that the roll method was either inferior to or no better than the others in regard to plaque control. Although the roll method was a widely advocated method of toothbrushing, substantial evidenve to support its effectiveness is not readily found.

The dental profession has not advocated the use of a scrub

method, probably because of fears that a scrubbing action might cause abrasion of the teeth and gingival recession.

Although conclusive evidence to substantiate such claims has not been found, one cannot exclude the possibility that the injudicious use of a horizontal scrub method, particularly with a hard bristle toothbrush, may lead to damage.

On 1971, Hansen and Gjermo pointed out that the roll method could not be recommended as the toothbrushing method of choice.

In 1972, Frandsen et al carried out another comparative study to compare the Charter's, scrub, and roll methods. They found that the Charter's and scrub methods appeared more effective in removing plaque than the roll method. However, the Charter's method was not significantly better than the Charter's method.

Anaise in 1975, concluded that the horizontal scrub method exhibited a better plaque removing effect than the roll, modified Stillman, and Charter's methods. There was no significant difference between the modified Stillman and roll method in plaque removal. The Charter's method was the least effective.

Dental professionals must aim for the best possible results within practical limits in educating their patients, and according to Burt (1983) the scrub method seems the best one.

The scrub method emerges as the simplest method available and one that is no less effective than any other. It requires minimal manual dexterity and patient concentration. Using this method, the brush is moved back and forth with scrubbing motion on buccal, lingual, and occlusal surfaces of the teeth.

The Fone's technique has been advocated for children, but we should remember that it cannot be used on the lingual surface. It seems unwise, to teach one method at the beginning and then

change to another at a later age.

For some individuals receiving treatment for advanced disease, a special method that they are able to manage may be needed. If periodontitis is present, for instance, the patient can be taught Stillman's method in conjunction with the roll technique (Hine 1950). As the brush is carried occlusally, and rolled slightly, the handle is gently vibrated to force the bristles between the teeth.

There are many opinions about the frequency of brushing. They are not completely substantiated by scientific research and some of them are based only on tradition (Löe 1970). Some information indicates that a thorough oral cleansing should be carried out at 24 to 48 hours interval. When one considers the time needed for plaque to mature, brushing after every meal which was usually impractical anyway, seems unnecessary.

Burt (1983) pointed out that thorough cleaning at 24 hour intervals (Baer and Morris 1977), recommended at bed time , is a routine that probably best fits in with most people's daily schedules and is one that is compatible with gingival health.

Dentifrices help to cleanse the teeth. It is necessary to avoid using dentifrices more abrasive than necessary to keep the teeth clean but the degree of abrasiveness needed appears to vary from person to person. The toothbrushing procedure may be made more acceptable to the individual by the use of a pleasant tasting dentifrice.

9 CONCLUSION

In order to be succesful in preventing caries and periodontal diseases by mechanical plaque removal methods, the main point that should be kept in mind is that the all plaque deposits must be removed thoroughly.

Attention must be given to approximal surfaces. Dental floss, toothpick, or any other interdental cleaning devices should be used daily for this purpose.

The toothbrush is the device most widely used and recommended for oral health care. A considerable number of different techniques have been suggested for use in cleaning one's teeth. The best one for a particular patient must be determined by the dentist only after a complete oral examination.

A number of factors must be considered in making this decision, among which are the state of the gingival health, the anatomical configuration, and the cooperation of the patient.

Regardless of what particular technique is recommended, certain general principles apply to all cases. The main purpose of the toothbrush is to remove dental plaque from between the teeth and from the free gingiva crevice with the minimum amount of damage to the teeth and their surrounding soft tissues.

In principle, one can do this by brushing the teeth with the most effective technique to get the bristles in between all teeth, down into the pits and fissures of the molars and bicuspid teeth, and into the gingival crevice and effectively massages gingival tissues.

To date, the scrub method seems the best. The conscientious and correct application of a brushing method, however, is more important than the method itself. As the method of choice, the scrub method might be introduced to young children as well, by using a small size toothbrush.

Frequency of plaque removal may be less important than efficacy. One thorough clean per day is preferable to three inefficient attempts at brushing.

The teeth can be cleaned with or without the use of toothpaste, although its abrasive action has the ability to help to remove plaque. To aid one's ability to clean the teeth properly, disclosing tablets or solutions can be used to check the efficacy of the plaque removal methods.

Disclosing preparations are highly coloured and are useful in picturing in colour the areas on the teeth where plaque accumulates, so that one may learn to brush such areas more carefully.

It is necessary to remind the patients that periodic professional prophylaxis is a necessary adjunct to home tooth cleaning procedures.

In order to arrive at more definite recommendations regarding the best methods of toothbrushing, further studies are needed. These studies should investigate related factors, such as the ease with which various methods can be taught, and possible tissue damage resulting from long term use of a particular method.

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