Introduction to preventive dentistry

Health is what we want to preserve, and it is defined as a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity. For instance, some individuals may actually be in excellent health but believe, for some reason logical to them, that they have oral cancer. Such individuals do not have an optimum mental well-being and will continue to worry until they are somehow convinced otherwise that they are indeed healthy. Another person may be functionally healthy, although facially disfigured, and as such be socially shunned throughout life. Thus, health can at times be what the patient thinks and not the actual condition of the body. Even the terminology "preventive dentistry" has different connotations to different people. As a result, **preventive dentistry** can be arbitrarily classified into three different levels.

1. Primary prevention employs strategies and agents to forestall the onset of disease, to reverse the progress of the disease, or to arrest the disease process before secondary preventive treatment becomes necessary.

2. Secondary prevention employs routine treatment methods to terminate a disease process and/or to restore tissues to as near normal as possible.

3. Tertiary prevention employs measures necessary to replace lost tissues and to rehabilitate patients to the point that physical capabilities and/or mental attitudes are as near normal as possible after the failure of secondary prevention (Figure 1-1).

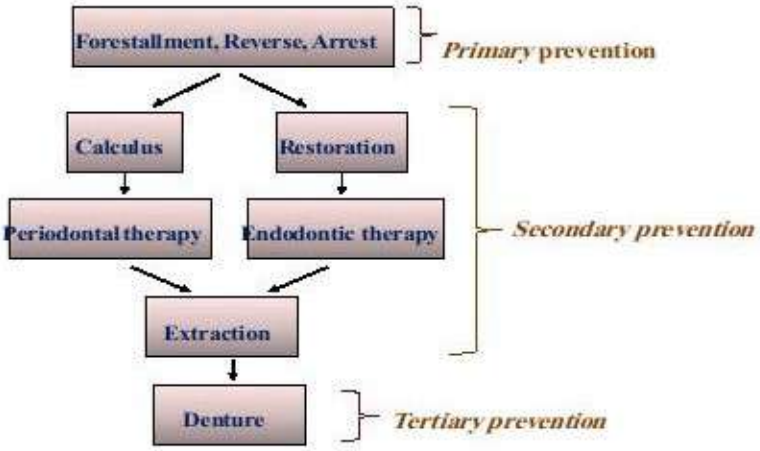


Figure 1-1 From natural teeth to denture teeth in three not-so-easy stages.

This text emphasizes primary prevention, and specifically focuses on primary prevention as it applies to the control of dental caries and periodontal disease. On the other hand, it must be recognized that primary prevention often fails for many reasons. When such failure occurs, two actions are essential to contain the damage: (1) early identification of the disease (diagnosis) and (2) immediate treatment of the disease.

Categories of Oral Disease

For planning purposes, dental diseases and abnormalities can be conveniently grouped into three categories: (1) dental caries and periodontal disease, both of which are acquired conditions, (2) acquired oral conditions other than dental caries and periodontal disease (opportunistic infections, oral cancer, HIV/AIDS), and (3) craniofacial disorders which would include a wide variety of conditions ranging from heredity to accidents. For instance, the ordinary seat belt and the air bags in a car exemplify how a simple preventive measure can greatly reduce the facial injuries of car accidents.

Strategies to Prevent the Plaque Diseases.

Dental plaque is composed of salivary proteins that adhere to the teeth, plus bacteria and end-products of bacterial metabolism. Both cariogenic and periodontopathogens accumulate in the plaque located along the gingival margin, interproximally, and in the pits and fissures. To control the plaque diseases with available methods and techniques, strong emphasis has been directed to four general strategies to reduce caries and two administrative requirements:

General Strategies

1. Diet modification.

2. Mechanical (toothbrushing, flossing, or rinse).

3. Chemical plaque control. Use of fluorides to inhibit demineralization and to enhance remineralization; use of mouthrinses containing antimicrobial agents that effectively help control the plaque bacteria involved in causing both caries and gingivitis. For helping to control gingivitis, a popular and economical over-the-counter product is Listerine; the most effective prescription rinse is chlorhexidine.

4. Use of pit and fissure sealants, when indicated, on posterior occlusal surfaces.

Administrative Strategies

5. Education and health promotion.

6. Establish access to dental facilities where diagnostic, restorative, and preventive services are rendered, and where planned recalls based on risk are routine.

Prognostic and Diagnostic Tests.

Several methods for preventing the onset or progress of caries and periodontal disease have been discussed. Because it is impossible to apply vigorously all the preventive procedures to all the people all the time, it would be desirable to have some tests to indicate the extent of caries and periodontal disease risk of an individual at any given time. This need is highlighted by the fact that an estimated

60% of all carious lesions in schoolchildren occur in 20% of the stu-dents. It would save much time to be able to identify this 20% group of high-risk students without having to examine an entire school population. Although no tests are 100% correlated with the extent of caries activity or periodontal disease, several test procedures are sufficiently well correlated with either condition to be of interest. To be successful, such screening tests should be simple to accomplish, valid, economical, require a minimum of equipment, be easy to evaluate, and be compatible with mass-handling techniques.

Laboratory methods exist for counting the number of bacteria in the saliva. If the caries-causing mutans streptococci or lactobacilli counts are high, the individual from whom the sample was derived can be presumed to have a higher risk for dental caries, whereas a low count permits the opposite assumption. A second general method for estimating caries susceptibility is by use of a refined-carbohydrate dietary analysis to (1) evaluate the patient's overall diet with special attention to food preferences and amounts consumed and (2) to determine if the intake of refined carbohydrates is excessive in quantity or frequency. A well-balanced diet is assumed to raise host resistance to all disease processes, whereas a frequent and excessive intake of refined carbohydrates (i.e., sugar) has been associated with a high risk of caries development. The dietary analysis is very effective when used as a guide for patient education.

The onset of gingivitis is much more visible than the early demineralization that occurs in caries. The sign of impending periodontal disease is an inflammation of the gingiva that can be localized at one site, or generalized around all the teeth. Red, bleeding, swollen, and a sore gingiva are readily apparent to dentist and patient alike.

If at the time of the clinical and roentgenographic examinations, emphasis was placed on searching out the incipient lesions ("white spots") and early periodontal disease (gingivitis), preventive strategies could be applied that would result in a reversal or control of either/or both of the plaque diseases. It is essential that both the profession and the public realize that biologic "repair" of incipient lesions, and "cure" of gingivitis is a preferred alternative to restorations or periodontal treatment.

Even if these primary preventive **dentistry** procedures fail, tooth loss can still be avoided. In practice, the early identification and expeditious treatment of caries and periodontal disease greatly minimizes the loss of teeth. When such routine diagnostic and treatment services are linked with a dynamic preventive-**dentistry** program that includes an annual dental examination and recall program based on risk assessment, tooth loss can realistically be expected to be reduced to zero or near-zero.

Nutrition, Diet, and Oral health

Oral health, diet, and nutritional status are closely linked (Table 2-1). Nutrition is an essential for the growth, development, and maintenance of oral structures and tissues. During periods of rapid cellular growth, nutrient deficiencies can have an irreversible effect on the developing oral tissues. Prior to tooth eruption, nutritional status can influence tooth enamel maturation and chemical composition as well as tooth morphology and size. Early malnutrition increases a child's susceptibility to dental caries in the deciduous teeth.

Malnutrition after initial organ and tissue development is usually reversible, but can still compromise tissue regeneration and healing and increase susceptibility to oral diseases.

After tooth eruption, the effects of diet on the dentition are topical rather than systemic. Dietary factors and eating patterns can initiate exacerbate or minimize dental decay. Fermentable carbohydrates are essential for the implantation, colonization, and metabolism of bacteria in dental plaque. Factors such as eating frequency and retentiveness of carbohydrates influence the progression of carious lesions, while foods containing calcium and phosphorus, such as cheese, enhance remineralization. Frequent intake of acidic foods or beverages can cause enamel erosion.

Nutrition in the Development and Integrity of Oral Tissues and Structures	
Protein deficiency	• Delayed eruption. • Decreased radicular osteocementum.
Vitamin A deficiency	• Calcification of teeth is affected • Retarded eruption • Periodontal tissues
Vitamin B complex deficiency	• Periodontal tissues might be disturbed • General growth is slow • salivary gland dysfunction
Vitamin C deficiency	• Lossening of teeth • Disturbed collagen fibre formation • Bleeding gum
Vitamin D deficiency	• Early loss of deciduous teeth • Disturbed calcification of teeth • Poor quality of enamel • Retarded eruption • Narrow maxilla • Short mandible
Hypervitaminosis D	• Poorly calcified teeth • Decalcification of bones • Increased osteoclastic activity
Iron deficiency	• Glossitis and fissures at the corners of the mouth (angular cheilitis) • The papillae of the tongue may be atrophied, which gives the tongue a smooth, shiny, red appearance.
Calcium deficiency	• Osteoporosis .

Table 2-1 Nutrition in the Development and Integrity of Oral Tissues and Structures

The Basis for a Healthy Diet

Dietary Reference Intakes

Daily food intake must be sufficient to meet metabolic requirements for energy and provide the essential nutrients that the body cannot synthesize in sufficient quantities to meet physiologic needs.

Food Guide Pyramid

To help people select nutrient-rich foods, the Food Guide Pyramid was developed by the U.S. Department of Agriculture. The Food Guide Pyramid displays foods in five categories based on their nutrient composition (Figure 2-1). Whole grains, such as rice, pasta, cereals, and breads, found at the broad base of the Pyramid should form the foundation of a healthful diet. They are good sources of carbohydrate (including fiber) and minerals. Fruits and vegetables form the next level of the Pyramid. The meat group contains good sources of protein, vitamins, and minerals. Meat alternates, legumes, eggs, nuts, and tofu, are included in the meat group. The dairy group is comprised primarily of good calcium sources. The small triangle at the top of the Pyramid is for the fats, oils, and sweets that provide primarily added calories and, thus, should be eaten in small amounts. No single food group is more important than another; each group provides some, but not all, of the essential nutrients.

Standardized serving sizes and the recommended number of servings for various age groups are specified. However, the caloric content of foods varies widely within a food group. The desirable number of servings from each food group depends not only upon age and sex, but also activity level. For example, if 1,600 calories were the daily energy goal, an individual would choose the minimum number of servings of low-fat food choices from each group. If additional calories are needed, increased servings should come from the grain, fruit, and vegetable groups, rather than the top of the pyramid.

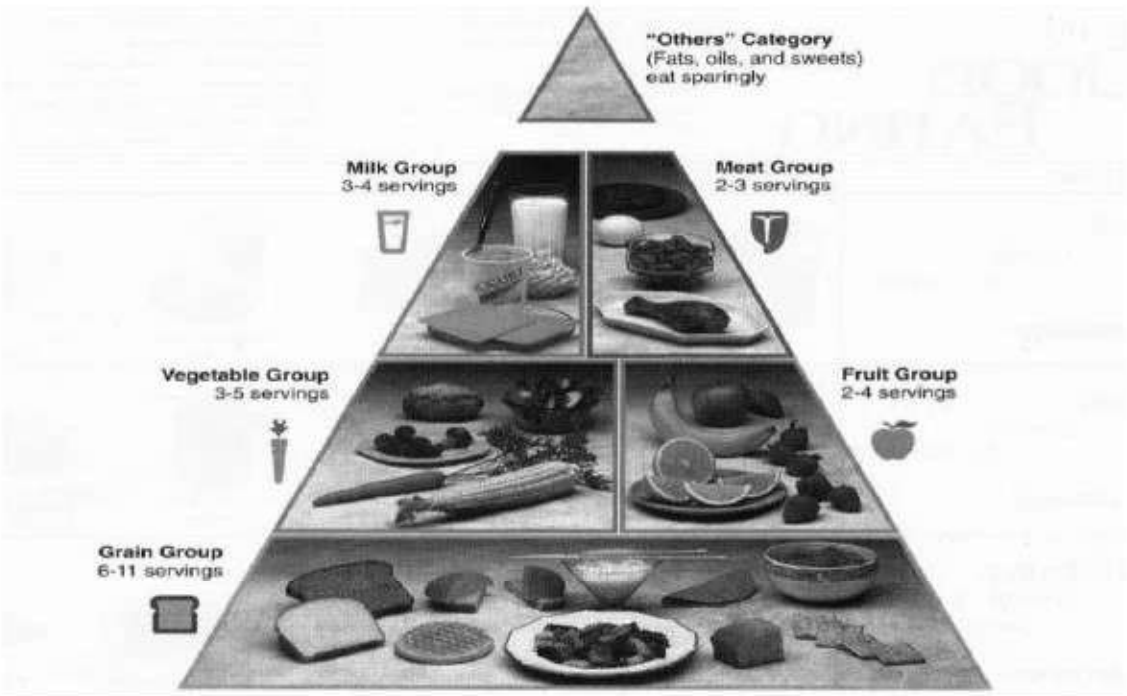


Figure 2-1 Food Guide Pyramid.

The National Academy of Sciences recommends the following calorie categories:

- 1,600 calories - Many sedentary women and some old adults
- 2,200 calories - Children, teenage girls, active women and many sedentary men. Women who are pregnant may need around 500 calories more per day and an additional 300 calories for breast-feeding.
- 2,800 calories - Teenage boys, active men and very active women

Food Labels

The Nutrition Facts panel found on most processed food packages helps the consumer select foods that meet the Dietary Guidelines (Figure 2-2). In accord with the mandatory food labeling regulations published by the Food and Drug Administration in 1994, the nutrition panel on processed foods must include the following:

- A standardized portion size (designed to make nutritional comparisons of similar products easier, and reflects the serving sizes that people actually eat).
- The number of servings per container.
- The amounts of total calories and calories from fat per serving.
- The number of grams per serving of total fat, saturated fat, cholesterol, sodium, total carbohydrates, dietary fiber, sugars, and protein. In addition, the nutritional contribution of one serving of the product must be stated as a percentage of the Daily Values. The Daily Values are based on the RDA for protein, vitamins, and minerals and on standards designed especially for food labels for nutrients not covered in the RDA such as fat, cholesterol, total carbohydrates, dietary fiber, and sodium. The calculations to determine the percents of Daily Values are based on a 2,000-calorie diet. Depending on a person's age, gender, and activity level, a person may need more or less than 100% of a Daily Value. The Daily Value also helps consumers see how a food fits into an overall daily diet.

Other information, such as the amounts of polyunsaturated or monounsaturated fats or other vitamins and minerals, is optional.

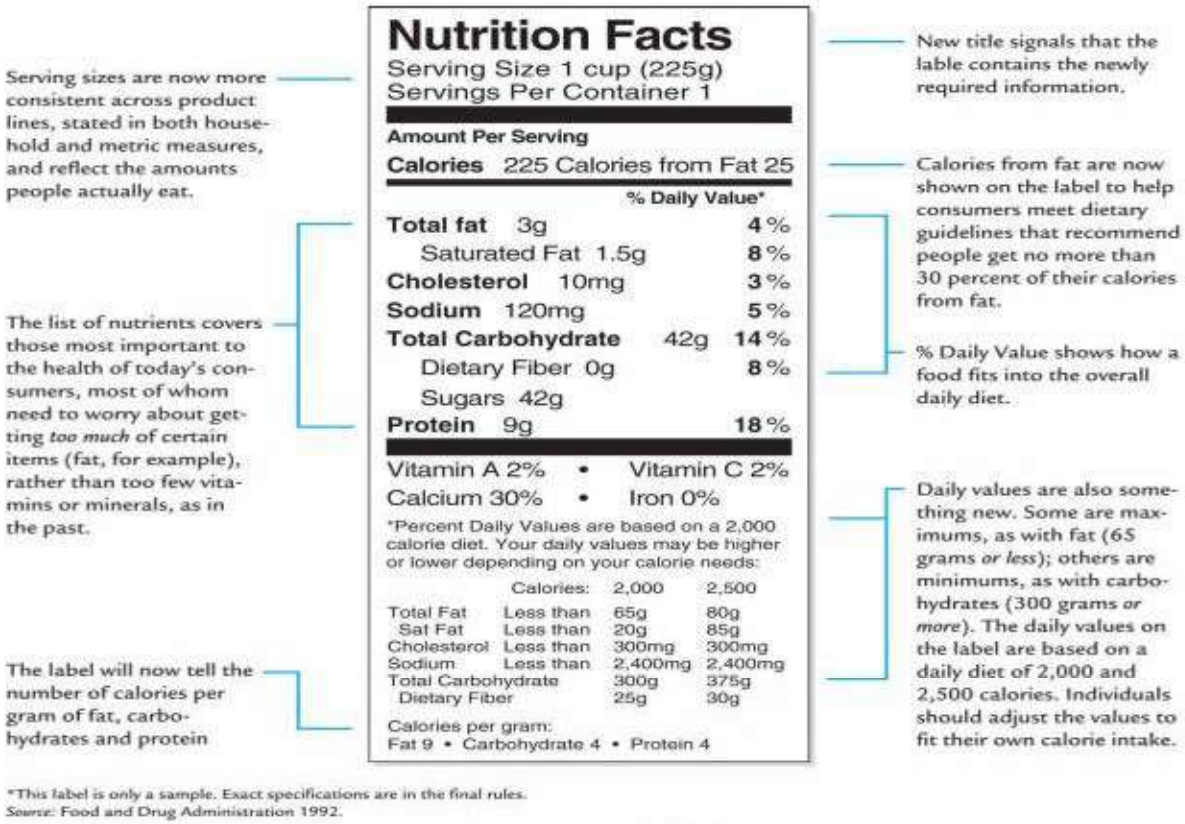


Figure 2-2 Food Label.

Dental Caries: Role of Carbohydrates in Caries Development.

The development of dental caries depends on four interrelated factors: (1) diet, (2) inherent factors of host resistance, (3) the number of challenge bacteria located in the dental plaque, and (4) time.

Mutans streptococci are the predominant oral bacteria that initiate the caries process. Newly erupted teeth with a thin enamel layer are very caries susceptible. Tooth morphology, especially the presence of deep pits and fissures, influences the likelihood that mutans streptococci will attach to and colonize the tooth's surface. Plaque bacteria ferment starches and sugars, producing organic acids. These acids demineralize dental enamel (There is no exact pH at which the demineralization begins, only a general range of 5.5 to 5.0).

Other dietary factors counteract the damaging effects of carbohydrates. The presence of protective minerals and ions such as fluoride, calcium, and phosphorus in plaque and saliva, promote remineralization of incipient lesions. In addition to transporting minerals, saliva contains buffering agents, bicarbonate and phosphates, that neutralize organic acids. Thus, the amount and composition of saliva affect the caries process. Other host factors that influence caries risk include: genetic predisposition, immune status, malnutrition during tooth formation, education level, and income status.

The causal relationship between sugar consumption and dental caries has been established. Animal studies suggest that an increase in the concentration of sucrose in the diet reduces dental plaque formation and increases the incidence of dental caries. People with very low sugar intakes have low-

caries scores. People in nations that have high sugar intakes have high rates of caries. It is unclear if this is primarily the topical effect of sugar consumption or systemic effects on dentin formation. However, the amount of sugar consumed is not the sole dietary variable associated with caries development. Sucrose plays a more dominant role than other sugars in the development of smooth surface caries. One of sucrose's metabolic by-products, an extracellular polysaccharide called glucan, enables the mutans streptococci to adhere to the smooth enamel surfaces. However, the amount of sucrose necessary for the implantation of mutans streptococci is very low.

The use of sugar alcohols and alternative sweeteners in foods also has had a role in reducing caries. Perhaps one of the most promising sugar substitutes to be studied is xylitol, a sugar alcohol that has been demonstrated to be non-cariogenic as well as promoting remineralization. Xylitol's ability to inhibit metabolic acid production by mutans streptococci results in minimal depression of plaque pH.

Effects of Eating Patterns and Physical Form of Foods

Other dietary factors that may hinder or enhance caries development include: the frequency of eating, the physical form of the carbohydrate (liquid vs. solid), retentiveness of a food on the tooth surface, the sequence in which foods are consumed (e.g., cheese eaten before a sweet food limits the pH drop), and the presence of minerals in a food. Frequent between-meal snacking on sugar or processed starch-containing foods increases plaque formation and extends the length of time that bacterial acid production can occur.

Some components of foods are protective against dental caries. Protein, fat, phosphorus, and calcium inhibit caries in rats. Aged natural cheeses have been shown to be cariostatic. When cheese is eaten following a sucrose rinse, the plaque pH remains higher than when no cheese follows a sucrose rinse. In addition, enamel demineralization, measured using the intraoral cariogenicity test, is reduced. The protective effect of cheeses is attributed to their texture that stimulates salivary flow, and their protein, calcium, and phosphate content that neutralizes plaque acids. Fluoride found in drinking water, foods, and dentifrices increases a tooth's resistance to decay and enhances remineralization of carious lesions.

Nutrition and Periodontal Disease

The nutritional factors related to preventing infection and enhancing wound healing in general applies to the prevention and management of periodontal disease as well. Defense in the gingival crevice and connective tissue all require an adequate intake of all nutrients to ensure adequate production and function of defense and supporting cells.

Diet Guidelines

These include:

- Eat a nutritionally adequate diet following the food pyramid guidelines.
- Increase the use of saliva-stimulating fibrous foods.
- Multivitamin/mineral supplements should be in doses no higher than one to two times

Recommended Dietary Allowance levels.

- Avoid fad diets which could be deficient in nutrients.
- Avoid single vitamin supplements.
- Avoid potentially detrimental megadoses of vitamins and minerals (10× RDA or higher).

Eating Disorders

Eating disorders, especially bulimia, are often first diagnosed in the dental office. Bulimia is characterized by recurrent episodes of binge eating (consumption of large amounts of foods at a time) followed by self-induced regurgitation (purging). The regurgitated acid in combination with xerostomia, results in rapid and extensive destruction of tooth enamel. The patient must be cautioned that for dental rehabilitation to be successful, the underlying problem (the eating disorder and its causes) must be resolved.

The Aging Patient

Impaired dental function may lead to poor nutritional health. Older adults with loose or missing teeth, or ill-fitting dentures often reduce their intake of foods that require chewing, such as fresh fruits, vegetables, meats, and breads. When the variety of foods in a diet is reduced, there is greater risk of nutrient inadequacies.

Older patients should be carefully screened for nutritional risk factors, and should be educated about the importance of good nutrition to general and oral health. When new dentures are provided, patients should be counseled on how to adapt their usual diet to a softer consistency for the first few days after denture insertion.

The Diabetic Patient

The diabetic dental patient is at greater risk for developing oral infections and periodontal disease than the nondiabetic patient. The dental team needs to be aware of current approaches to diabetes management and carefully monitor the patient's health status prior to initiating dental treatment.

The nutrition care plan generally requires that patients have meals and snacks of specific nutrient composition at regularly scheduled intervals, coordinated with medications (insulin or oral agents) and exercise. In the dental office, quickly assimilated carbohydrate sources such as juices, milk, and crackers, should be kept readily available in the event that a diabetic patient develops symptoms of hypoglycemia.

Patients with Immunocompromising Conditions (Cancer, AIDS)

The nutrition care plan initially focuses on providing high caloric intake in frequent small meals. Liquid supplements may be used if optimal nutriture cannot be achieved via food alone. In more serious cases, patients may need enteral (tube) feedings or more advanced nutritional support. The dental team should not caution patients to reduce the frequency of eating, since this will contradict nutritional management goals. Rather, thorough cleaning after each eating period, and use of fluoride mouth rinses and topical fluoride trays before bed should be stressed.

Oral Surgery and Intermaxillary Fixation

An adequate diet before surgery is needed to support adequate post-surgical response. If food consumption will be impaired for a short period of time, the risk of nutritional deficiency is low. The risk of deficiency increases with length of eating impairment. The surgery itself can result in an anorexia, inability to chew, and increased metabolic requirements. After surgery, a patient may need a liquid diet for 1 or 2 days, but should progress as soon as possible to a soft diet of high nutritional quality, until a normal diet can be resumed. In some cases, nutritionally complete liquid supplements may be appropriate and should be prescribed in consultation with the patient's dietitian and physician. Often patients prefer purees of normal foods over commercial liquid supplements. Multivitamin/ mineral supplements may be appropriate as well.

Toothbrushes and Toothbrushing Methods

The Manual Toothbrush

History

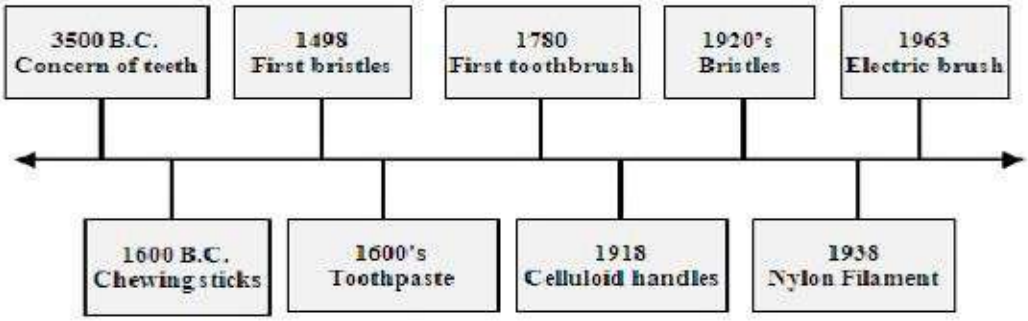


Figure 3-1 Timeline

Manual Toothbrush Designs

Manual toothbrushes vary in size, shape, texture, and design more than any other category of dental products.[5] A manual toothbrush consists of a head with bristles and a handle (Figure 3-2). When the bristles are bunched together, they are known as tufts. The head is arbitrarily divided into the toe, which is at the extreme end of the head, and the heel, which is closest to the handle. A constriction, termed the shank, usually occurs between the handle and the head. Many toothbrushes are manufactured in different sizes—large, medium, and small (or compact)—to adapt better to the oral anatomy of different individuals. Toothbrushes also differ in their defined hardness or texture, usually being classified as hard, medium, soft or extra soft. medium, soft or extra soft.

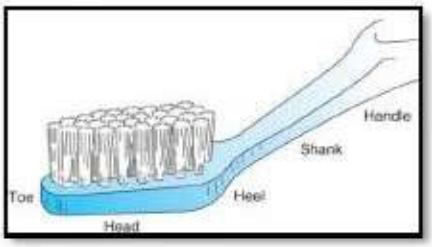


Figure 3-2 Parts of a toothbrush

Profiles

When viewed from the side, toothbrushes have four basic lateral profiles: concave, convex, flat, and multileveled (rippled or scalloped). The concave shape can be useful for improved cleaning of facial surfaces, whereas convex shapes appear more useful for improved cleaning of lingual surfaces. In laboratory and clinical studies, toothbrushes with multilevel profiles were consistently more effective than flat toothbrushes, especially when interproximal efficacy was monitored.

Bristle Shapes

Originally, individual toothbrush bristles were cut bluntly and often had sharp end configurations. In

1948, Bass reported that these bristle tips could damage the soft tissues and that rounded, tapered, or smooth bristle tips were less abrasive.

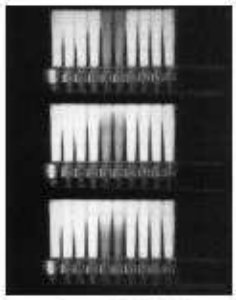


Figure 3-3 Blue dye in the center bristle tufts of this brush fades down from the end with use. When the dye reaches the half-way point (bottom brush), the manufacturer suggests replacing the brush.

Handle Designs

Many of the new toothbrushes in the United States have a styled-handle design. Modifications, such as triangular extrusions or indentations along the sides for a better grasp, a "thumb position" on the back of the handle for more comfort, and various angle bends to permit better access into and around the mouth, have been introduced. Four toothbrush-handle designs are shown in Figure 3-4. with a handle on the same plane as the bristle tips, as are dental instruments used for caries evaluations and prophylaxes. With both the offset and angled-offset designs, points of bristle contact are in line with the longitudinal axis of the handle during brushing.

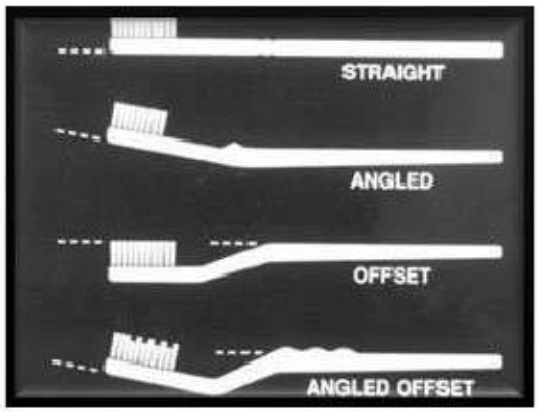


Figure 3-4 Four basic shapes of toothbrush handles.

Texture

Nylon bristles have a uniform diameter and a wide range of predictable textures. Texture is defined as bristle resistance to pressure and is also referred to as firmness, stiffness, and hardness. The firmness or texture of a bristle is related to its (1) composition, (2) diameter, (3) length, and (4) number of individual bristles per tuft. In the manufacturing process, the diameter of nylon bristles can be well controlled. Because the majority of toothbrushes contain bristles 10- to 12-millimeters long, the diameter of the bristle becomes the critical determinant of texture. The usual range of diameters for adult toothbrush bristles is from 0.007 to 0.015 inches. Factors such as temperature, uptake of water (hydration), and toothbrush-use frequency affect texture.

Texture labeling is not standardized. Individual manufacturers label their brushes according to their testing criteria. Thus one manufacturer's "soft" grade may be stiffer than another manufacturer's "medium" grade. The International Organization for Standardization (ISO) has formulated testing procedures that permit manufacturers to label their brushes in a consistent manner.

Nylon Versus Natural Bristles

The nylon bristle is superior to the natural (hog) bristle in several aspects. Nylon bristles flex as many as 10 times more often than natural bristles before breaking; they do not split or abrade and are easier to clean. The configurations and hardness of nylon bristles can be standardized within specified and reproducible tolerances. Natural bristle diameters, since they are tapered, vary greatly in each filament. This can lead to wide variations in the resulting texture of the marketed toothbrush. As a result of the advantages of nylon, as well as its ease and economy of production, relatively few natural bristle toothbrushes are marketed.

Characteristics of a toothbrush according the American Dental Association (ADA)

- Length 1 – 1.25 inches
- Width 5 / 16 – 3 / 8 inches
- Surface area 2.54 – 3.2 cm
- No. of rows 2 – 4 rows of brushes
- No. of tufts 5 – 12 per row
- No. of bristles 80 – 85 per tuft

Powered Toothbrushes

The heads of most powered or mechanical toothbrushes are smaller than manual toothbrushes and are usually removable to allow for replacements (Figure 3-5). The head follows three basic patterns when the motor is started: (1) reciprocating, a back-and-forth movement; (2) arcuate, an up-and-down movement; and (3) elliptical, a combination of the reciprocating and arcuate motions. Powered toothbrushes are consistently superior to manual toothbrushes in plaque removal and gingivitis efficacy. Differences are most significant when tested against manual toothbrushes.

Figure 3-5 Powered toothbrush heads

Toothbrushing Methods

Natural Methods of Brushing

The most natural brushing methods used by patients are a reciprocating horizontal scrub technique, a rotary motion (Fones's technique) (Figure 3-6)., or a simple up-and-down motion over the maxillary

and mandibular teeth (Leonard's technique). Patients managing effective toothbrushing with these methods without causing traumatic problems or disease should not alter their brushing methods just for the sake of change.

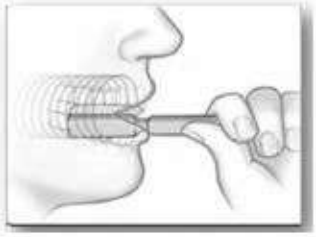


Figure 3-6 Fones's technique

Stillman's method was originally developed to provide gingival stimulation. The toothbrush is positioned with the bristles inclined at a 45-degree angle to the apex of the tooth, with part of the brush resting on the gingiva and the other part on the tooth (Figure 3-7). A vibratory motion is used with a slight pressure to stimulate the gingiva. The brush is lifted and then replaced in the same area, and pulsing is repeated.

Figure 3-7 Stillman technique.

Charters advocated a pressure-vibratory technique to clean interproximal areas. The toothbrush should be placed at a 90-degree angle to the long axis of the teeth so that the bristles are gently forced between the teeth but do not rest on the gums. The brush is moved in several small rotary motions so that the sides of the bristles are in contact with the gum margin. After two or three such motions, the brush is removed and replaced in the same area and the motions are repeated.

It is important to note that the Bass technique was the first to focus on the removal of plaque and debris from the gingival sulcus by the combined use of a soft toothbrush and dental floss. The method is effective for removing plaque adjacent to and directly beneath the gingival margins as part of the self-care regimen for controlling periodontal disease and caries. In the Bass technique, the toothbrush is positioned in the gingival sulcus at a 45-degree angle to the tooth apex. The bristles are then gently pressed to enter the sulcus. A vibratory action, described as a back-and-forth horizontal jiggle, causes a pulsing of the bristles to clean the sulci (Figure 3-8). Ten strokes are advised for each area.

Figure 3-8 Bass technique

In the rolling-stroke method (Figure 3-9), the toothbrush bristles are positioned parallel to and against the attached gingiva, with the toothbrush head level with the occlusal plane. The wrist is then turned

to flex the toothbrush bristles first against the gingiva and then the facial surface. A sweeping motion is continued until the occlusal or incisal surface is reached. The toothbrush bristles are at right angles to the tooth surface as the brush passes over the crown. The press roll action is repeated at least five times before proceeding to the next site.

Figure 3-9 Rolling stroke technique.

Modified Brushing Methods

In attempts to enhance brushing of the entire facial and lingual tooth surfaces, the original techniques have been modified. Some modifications like the Bass method may induce a more pronounced gingival trauma with standard brushes. New toothbrush designs such as multilevel and cross-section bristles that have been tested are not only more effective but can be also less harmful.

The following considerations are important when teaching patients a particular toothbrushing technique: (1) the patient's oral health status, including number of teeth, their alignment, patient's mouth size, presence of removable prostheses, orthodontic appliances, periodontal pockets, and gingival condition; (2) the patient's systemic health status, including muscular and joint diseases, and mental retardation; (3) the patient's age; (4) the patient's interest and motivation; (5) the patient's manual dexterity; and (6) the ease and effectiveness with which the professional can explain and demonstrate proper toothbrushing procedures.

Recommended Powered Toothbrushing Methods

Most powered toothbrush manufacturers do not recommend a specific brushing method, however, the electric brushes should be used in a specified manner. The Swiss Dental Society, in 2001 developed an instruction manual. Instructions for brushes with a sweeping and /or oscillating rotary motion are as follows:

1. The brushes are positioned on the tooth surfaces in a 45- or 90-degree angle to the incisal plane. Only when positioned should the brush be switched to "on." The mouth should be almost closed.

2. The brush should be moved slowly over and around each tooth for 3 to 5 seconds, making sure that the bristles clean the crevices between the teeth.

3. The brush head can be lifted distally and mesially into the interproximal areas to reach the interdental area; the brush always remains on a single tooth.

4. After a period of approximately 5 seconds, the brush is moved to the next tooth surface and repositioned.

5. Experienced individuals can use the brush also in a perpendicular angle to the teeth and gums, but the applied force has to be gentle. In this way, each tooth in the upper and lower arch is cleaned on the buccal and lingual surfaces.

6. It is best to divide the mouth into four quadrants (upper-right, upper-left, lower-right, and lower-

left) and to start brushing on a tooth in the upper rear and then clean one surface after the other very systematically.

7. It is an easy way, gives good control for the individual, and does not omit any tooth surface. This method takes more time, because at a single time interval, only one tooth surface can be cleaned.

Toothbrushing Time and Frequency

For many years the dental professional advised patients to brush their teeth after every meal. Thorough toothbrushing requires a different amount of time for each individual. Often a compromise is made by suggesting 5 to 10 strokes in each area or by advocating the use of a timer.

Toothbrushing Procedures

Occlusal Surfaces

The occlusal surfaces may be cleaned by either (1) short vibratory strokes, with pressure being maintained to accomplish as deep a penetration of the pits and fissures as possible; or (2) a rapid back-and-forth vibrating motion to force the bristles into the pits and fissures, followed by a sweeping motion to expel the dislodged debris (Figure 3-10).

Figure 3-10 Toothbrushing of occlusal surfaces

The Anterior Lingual Areas

Access to the lingual surfaces of the mandible and maxilla is difficult. Brushing in these areas can be facilitated by cutting off all tufts on a brush, except the first four or five rows in the toe.

Brushing Sequence

patients are taught to begin with the distal surface of the most posterior tooth and to continue brushing the occlusal and incisal surfaces around the arch until the last molar on the other side of the arch has been reached. The lower arch is then brushed in a similar manner.

Clinical Assessments of Toothbrushing

Whatever techniques are recommended, the main purpose of tooth brushing is to remove dental plaque from the teeth, including the gingival crevice, with the minimum amount of damage to the teeth and surrounding structures. Disclosing agents provide the means of evaluating the thoroughness of cleaning the teeth. The most widely marketed red disclosing products contain FD&C Red #28.

Disclosing agents may be in either a liquid or tablet form. The chewable tablet or the liquid disclosant should be swished around in the mouth for 15 to 30 seconds and then expectorated. Home use of

disclosants by the patient should be encouraged to permit self-evaluation of the effectiveness of plaque-control programs.

Toothbrush Replacement

Toothbrush wear (splayed, bent, or broken bristles) is influenced more by brushing methods than by the length of time or number of brushings per day. The average "life" of a manual toothbrush is approximately 3 months. This estimate can vary greatly, however, because of differences in brushing habits. It is also sound advice for patients to have several toothbrushes and to rotate their daily use, to assure drying between brushings. If toothbrushes need to be replaced more frequently than every three months, the patient's brushing technique should be checked. Even if the brushing technique is acceptable or has been corrected, toothbrushes should still be replaced frequently. Indeed, after every oral or contagious medical illness, it is imperative that patients be made aware of the importance of having a new toothbrush.

Special Needs

Tongue Brushing

Malodor from the mouth most often has its origin on the tongue. Tongue cleansing can be accomplished by placing the side of the toothbrush near the middle of the tongue, with the bristles pointed toward the throat. The brush is swept forward, and this motion is repeated six to eight times in each area. The palate should also be cleansed with a sweeping motion. A dentifrice should be used with this brushing of soft tissues to improve cleansing action.

Abutment Teeth and Orthodontic Appliances

Abutment teeth, implants, fixed bridgework and fixed orthodontic appliances require special emphasis on sulcular brushing to prevent gingivitis. Thorough cleansing between orthodontic appliances and gingiva will prevent dental caries. The effectiveness of a new toothbrush design in orthodontic patients has been documented in different publications. At the end of a 4-month study, a three-sided manual toothbrush significantly decreased gingivitis and was more effective in plaque removal compared to a flat multitufted toothbrush.

Dentures and Removable Orthodontic Appliances

Patients with full dentures can meet their oral hygiene needs with a soft nylon brush for the oral tissues and a denture brush that cleans all areas of the denture. The denture brush with a nonabrasive cleaner should reach into the recessed alveolar ridge area of the denture to ensure maximum cleansing. The oral tissues should be brushed at least once a day using a gentle vibration and long, straight strokes from the posterior to anterior mouth regions.

Patients with removable partial dentures and removable orthodontic appliances need at least three toothbrushes, one for the natural teeth, another for the appliance, and a third for clasps. Brushing clasps, wires, and other metal parts can wear out a regular toothbrush. A clasp brush—2 or 3 inches long, narrow, and tapered—can be obtained as a third brush. Special care is needed to carefully clean all plaque from the clasps as a preventive measure for the supporting teeth.

Handicapped Patients

A manual brush with an enlarged handle, elastic cuff, or small strap attached to the brush or a long-handled holder for patients who cannot raise their arms or do not have hands, permits the patient to brush. Mentally retarded patients can often brush using a soft toothbrush with the plastic handle bent for better grasping. A horizontal scrub is often the best that these patients can manage. A three-headed toothbrush or a powered toothbrush assisted by a caregiver can be useful.

Special Uses for Powered Toothbrushes.

Powered toothbrushes can be beneficial for parental brushing of children's teeth; for children and adults who are physically handicapped, mentally retarded, aged, arthritic, or otherwise with poor dexterity; and for those patients who are poorly motivated. These brushes are especially recommended for patients who require a larger handle, because powered models are easier to grasp.

Dental Floss

Dental floss is best indicated for plaque and debris removal from interproximal areas where the papilla fills the interproximal space and the teeth are in contact. Several types of floss are available. These vary from thin unwaxed varieties, to thicker waxed tapes and include variable thickness floss (Figure 3-11).

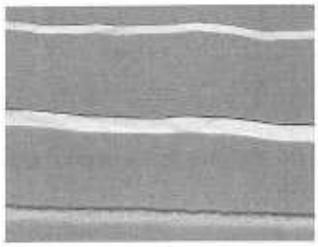


Figure 3-11 Several different types of dental floss are available:
thin (top), tape (middle), and meshwork (bottom).

Waxed dental tape, unlike round dental floss, is broad and flat, and may be effective in an interproximal space without tight contact points. Additional types of floss, such as those made of polytetrafluoroethylene (PTFE, teflon-like), are stronger and more shred-resistant. They have been shown to be preferred by those who have tight contacts or rough proximal tooth surfaces. Other varieties, such as tufted floss increments alternated with standard floss, and floss which stretches for insertion are alternatives.

Some brands of dental floss and tape are colored and flavored. Flosses impregnated with a variety of agents have been introduced; examples of these include floss treated with baking soda, fluoride, herbal extracts, antimicrobial agents, or abrasives agents.

One type of variable-thickness floss has a stiff end to allow for threading under bridges, beneath tight contact areas, under pontics, through exposed furcations, and around orthodontic wires. This floss combines a section of unwaxed floss with an area of thicker nylon meshwork to clean larger surface areas. Variable thickness floss may be recommended for use in cleaning implant abutments, areas with open contacts, wide embrasures. When recommending a type of floss, the specific oral conditions, patient preference, and ability are all factors that need to be considered.

Dental Flossing Methods

Two frequently used flossing methods are the spool method and the circle, or loop, method. Both facilitate control of the floss and ease of handling. The spool method is particularly suited for teenagers and adults who have acquired the necessary neuromuscular coordination required to use floss. The loop method is suited for children as well as adults with less nimble hands or physical limitations caused by conditions such as poor muscular coordination or arthritis. Flossing is a complex skill, so until children develop adequate dexterity, usually around the age of 10 to 12 years, an adult should perform flossing on the child. Younger children whose teeth still exhibit primate spaces (no interproximal contact) will not require flossing.

When using the spool method, a piece of floss approximately 18 inches long is utilized. The bulk of the floss is lightly wound around the middle finger. Space should be left between wraps to avoid impairing circulation to the fingers. The rest of the floss is similarly wound around the same finger of the opposite hand. This finger can wind, or "take up," the floss as it becomes soiled or frayed to permit access to an unused portion. The last three fingers are clenched and the hands are moved apart, pulling the floss taut, thus leaving the thumb and index finger of each hand free. The floss is then secured with the index finger and thumb of each hand by grasping a section three quarters to 1 inch long between the hands (Figure 3-12).

For the loop method, the ends of the 18-inch piece of floss are tied in a knot. All of the fingers, but not the thumbs of the two hands are placed close to one another within the loop. Whether using the spool or the loop method of flossing, the same basic procedures are followed. The thumb and index finger of each hand are used in various combinations to guide the floss between the teeth.

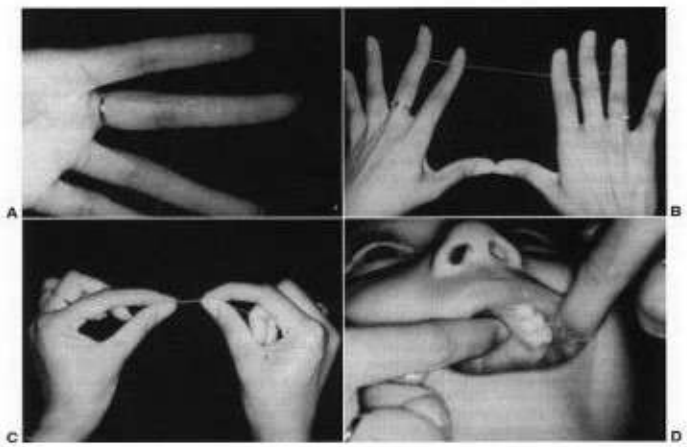


Figure 3-12 Flossing technique.

A, The length of floss is wrapped around the middle fingers of each hand. B, Enough floss should be left between the middle fingers to allow the thumbs to touch when the hands are laid flat. C, The index fingers and thumbs are used to manipulate the floss. D, The floss is carefully placed in a C shape between the interproximal contacts and gently sawed up and down until each tooth surface is clean.

When inserting, floss, it is gently eased between the teeth with a seesaw motion at the contact point. The gentle seesaw motion flattens the floss, making it possible to ease through the contact point and prevent snapping it through, thus avoiding trauma to the sulcular gingival. Once past the contact point, the floss is adapted to each interproximal surface by creating a C-shape. The floss is then

directed apically into the sulcus and back to the contact area (up-and-down against the side of the tooth) several times or until the tooth surface is clean. The procedure is repeated on the adjacent tooth in the proximal area, using care to prevent damage to the papilla while readapting to the adjacent tooth. A clean, unused portion should be used for each interproximal area.

In general, flossing is best performed by cleaning each tooth in succession, including the distal surface of the last tooth in each quadrant. The individual should be assisted with problem areas and encouraged to utilize whichever method produces the best results. Criteria for evaluation are based on the efficacy of plaque removal and safety of the flossing method.

Dental Floss Holder

The floss holder is a device that eliminates the need for placing fingers in the mouth. It is recommended for individuals with:

- Physical disabilities,
- Poor manual dexterity,
- Large hands,
- Limited mouth opening,
- A strong gag reflex, and/or
- Low motivation for traditional flossing.

The floss holder may also be helpful when one person is assisting another with flossing. Limited scientific data comparing finger-manipulated flossing to the use of a floss holder shows no difference in plaque removal. Studies have found that, when compared, a significant majority of individuals preferred the floss holder over finger-manipulated flossing. It should be emphasized that effective initial education and reinforcement are necessary for proper use of the floss holder. Use of the floss holder may aid in developing a flossing habit and should be considered when individuals experience difficulty with manual flossing.

A variety of different floss-holder designs are available (Figure 3-13). Most commonly, they consist of a yoke-like device with a 3/4- to 1-inch space between the two prongs of the yoke. The floss is secured tightly between the two prongs and the handle is grasped to guide the floss during use. Most floss holders require that floss be strung around various parts of the holder prior to each use.

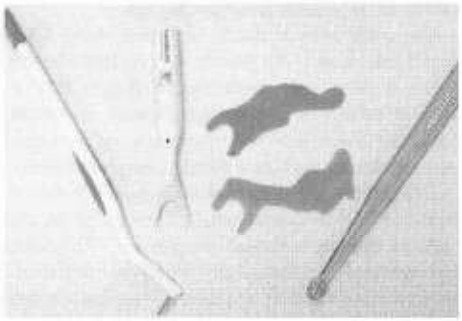


Figure 3-13 Several different methods for interproximal cleaning.
Left to right, Interdental brush, Y-shaped floss holder, disposable floss holders, and end tuft brush.

Dentifrices, Mouthrinses, and Chewing Gums

Dentifrices, mouthrinses, and chewing gums can be categorized as either cosmetic or therapeutic. Cosmetic products have traditionally been used to remove debris, provide a pleasant "mouth feel," and temporarily reduce halitosis. To improve on their marketability, flavors, stripes, sprinkles, and colors have been added to dentifrices and mouthrinses. Recently, other ingredients have also been added to temporarily depress the oral bacterial population or to prevent or moderate some disease process in the mouth.

Monitoring the Safety and Effectiveness of Therapeutic Dental Products

Caution is needed before introducing a new therapeutic product to the market. The process by which oral-care agents are evaluated and regulated in the United States has been reviewed by Trummel. Safety and efficacy standards apply not only to prescription medications but also to over-the-counter (OTC) drugs. There are three levels of regulation of oral chemotherapeutic agents. The government level includes the Food and Drug Administration (FDA) and the United States Pharmacopoeia Convention. The professional or voluntary level includes the Council on Scientific Affairs (CSA) of the American Dental Association (ADA). The third level of review includes consumer advocacy organizations, advertising standards review panels, and the Federal Trade Commission.

The FDA conducts an ongoing review of all OTC products. One aim of regulation is to protect the patient-consumer from useless or harmful products. All approval or disapproval decisions by the FDA have the force of law.

Over the years, the FDA has requested manufacturers of OTC products to submit a listing of the active and inactive ingredients in their products as a basis for helping to codify regulations governing OTC sales.

In addition to the FDA's regulation of OTC products, the American Dental Association's Council on Scientific Affairs (CSA) continually reviews dental products. Submission by a manufacturer to the ADA program is voluntary. If the product is safe and effective, the Seal of Acceptance is granted and can be used by the manufacturer in marketing the product. The Seal provides assurance to dental professionals and to the public. In addition to the traditional "print media," this information is available at the ADA website, www.ada.org.

Dentifrices

According to the dictionary, the term dentifrice is derived from dens (tooth) and fricare (to rub). A simple, contemporary definition of a dentifrice is a mixture used on the tooth in conjunction with a toothbrush. Dentifrices are marketed as toothpowders, toothpastes, and gels. All are sold as either cosmetic or therapeutic products.

Toothpastes contain several or all of the ingredients listed in Table 4-1. Gel dentifrices are also marketed. Gels contain the same components as toothpastes, except that gels have a higher proportion of the thickening agents. Both tooth gels and toothpastes are equally effective in plaque removal and in delivering active ingredients.

Name	Percentage
Abrasive	20 – 40 %
Binder	1- 2 %
Detergent	12 %
Preservative	0.05 – 0.5 %
Flavour	1 – 2%
Colouring	2 – 3%
Humectant	20 – 40 %
Theraputic	1 – 2%
Water	20 – 40 %

Table 4-1 Ideal dentifrice ingredients

Abrasives

The degree of dentifrice abrasiveness depends on the inherent hardness of the abrasive, size of the abrasive particle, and the shape of the particle. Several other variables can affect the abrasive potential of the dentifrice: the brushing technique, the pressure on the brush, the hardness of the bristles, the direction of the strokes, and the number of strokes.

Calcium carbonate and calcium phosphates were previously the most common abrasives used. These agents often reacted adversely with fluorides. Chalk (calcium carbonate) and baking soda (sodium bicarbonate) are also common dentifrice abrasives. New silicas, silicon oxides, and aluminum oxides are being introduced into dentifrice formulas, with additional efficacy claims.

When toothbrushing is done without toothpaste, there is little possibility of abrasion. When damage does occur, it usually appears as a V-shaped notch in the cementum immediately below the cementoenamel junction. This area is vulnerable, because enamel is about 20 times harder than dentin or cementum.

Humectants

Humectants help maintain the consistency of toothpaste. Synthetic celluloses in low concentrations are also often used as humectants; in higher concentrations they function as gelling agents in the formulation of gel dentifrices. At high concentrations (> 40%), humectants also act as preservatives.

Soaps and Detergents

Because toothpastes were originally manufactured to keep the teeth clean, soap was the logical cleansing agent. When detergents appeared on the market, soaps largely disappeared from dentifrices. Today, sodium lauryl sulfate (SLS) is the most widely used detergent.

Flavoring and Sweetening Agents

For taste acceptance, the flavor must be pleasant, provide an immediate taste sensation, and be relatively long-lasting. Usually synthetic flavors are blended to provide the desired taste. Spearmint, peppermint, wintergreen, cinnamon, and other flavors give toothpaste a pleasant taste, aroma, and

refreshing aftertaste. Some manufacturers use essential oils such as thymol, menthol, etc., which may provide a "medicinal" taste to the product.

Sweetening Agents

In early toothpaste formulations, sugar, honey, and other sweeteners were used. They have been replaced with saccharin, cyclamate, sorbitol, and mannitol as primary noncariogenic sweetening agents. Sorbitol and mannitol serve a dual role as sweetening agents and humectants. Glycerin, which also serves as a humectant, adds to the sweet taste. A new sweetener in some dentifrices is xylitol.

Therapeutic Agents

The most commonly used therapeutic agent added to dentifrices is fluoride, which aids in the control of caries. In a series of papers published in 1998, antiplaque, gingivitis reduction, stain-removal, and odor-reducing efficacy were documented for sodium bicarbonate-containing dentifrices. These baking-soda dentifrices actually contain only a small amount of baking soda, in addition to the standard fluoride-compatible abrasives.

Antiplaque agents can act directly on the plaque bacteria or can disrupt different components of plaque to permit easier and more complete removal during toothbrushing and flossing. Triclosan is a broad-spectrum antibacterial agent.

Toothpastes containing potassium nitrate, strontium chloride, and sodium citrate have antihypersensitivity properties; other toothpastes with tetrasodium phosphate and disodium dihydrogen pyrophosphate retard the formation of calculus.

Surveys reveal a growing market share for dentifrices claiming "whitening" or "stain control." These dentifrices control stain via physical methods (abrasives) and chemical mechanisms (surface active agents or bleaching/oxidizing agents). These products usually contain hydrogen peroxide or carbamide peroxide as their bleaching or whitening ingredient.

Mouthrinses

Freshening bad breath has been the traditional purpose of mouthrinses. The claimed active ingredients of mouthrinses include quaternary ammonium compounds, boric and benzoic acids, and phenolic compounds. As with dentifrices, commercial sales of cosmetic rinses have been related to taste, color, smell, and the pleasant sensation that follows use. The pleasant sensation is often enhanced by the addition of astringents. Commonly used astringents are alum, zinc stearate, zinc citrate, and acetic or citric acids. Zinc sulfate has been added to mouth rinses as a claimed antiplaque ingredient.

Alcohol in mouthrinses is used as a solvent, a taste enhancer, and an agent providing an aftertaste. The alcohol content of commercial rinses, ranging up to 27%, may constitute a danger for children, especially those from 2 to 3 years of age. According to the National Poison Center Network, 5 to 10 ounces of a mouthrinse containing alcohol can be lethal for a child weighing 26 pounds. The American Academy of Pediatrics has recommended that OTC liquid preparations be limited to 5% ethanol, that safety closures be required, and that the packaged volume be kept to a "reasonable minimum to prevent the potential for lethal ingestion."

The FDA has approved prescription plaque-control rinses containing 0.12% chlorhexidine. Directions call for a twice daily, 30-second rinse with 1 oz of such solutions.

Fluorides and chlorhexidine are the most effective agents used by the profession to combat the plaque diseases. The fluorides help prevent demineralization and enhance remineralization, while chlorhexidine severely suppresses the mutans streptococci that cause the demineralization. Chlorhexidine also helps suppress bacteria causing the inflammation of periodontal disease. Following root planing, prophylaxis, or periodontal surgery, chlorhexidine irrigation may be effective in helping to control inflammation and subgingival plaque.

Some side effects are associated with chlorhexidine use, of which stain is the most common. Chlorhexidine is inactivated by most dentifrice surfactants and, therefore it is not included in dentifrices. Also, because of this inactivation, it is critical for dental professionals to alert patients not to use chlorhexidine mouthrinses within 30 minutes before or after regular toothbrushing.

Listerine antiseptic was the first OTC antiplaque and antigingivitis mouth rinse to be approved by the ADA. Patients are advised to rinse twice daily with 20 mL of Listerine for 30 seconds, in addition to their usual oral-hygiene regimen. The active ingredients are thymol, menthol, eucalyptol, and methyl salicylate, termed essential oils. The original formula contains 26.9% alcohol.

Chewing Gum

Because gum chewing is pleasurable, people normally chew for long periods of time. During gum chewing, salivary flow rates increase, especially in the first few minutes, because of both mechanical and gustatory stimulation. Increased salivary stimulation can continue for periods of 5 to 20 minutes, usually until the flavor(s) in the product dissipates. However, even with unflavored chewing gum, saliva flow, as evidenced by swallowing rates, increase over baseline. The beneficial effects of additional saliva in the mouth include increased buffer capacity and mineral super saturation, both of which help regulate or increase plaque pH, and increase plaque calcium levels (pCa). In addition, increased saliva flow can assist in loosening and removing debris from occlusal or interproximal sites, and can be beneficial to xerostomia patients.

The focus of chewing gum research to date has been on "sugar-free" products, which contain polyol sweeteners such as sorbitol or xylitol. These sweeteners are not broken down by plaque or oral microorganisms to produce acid. Plaque pH studies have documented reduction of plaque acidity and maintenance of plaque neutrality both during and, with xylitol, for periods of 2 to 3 weeks following, gum chewing. In addition, gums containing xylitol have shown anticaries activity in several long-term studies. Chewing a sorbitol-based chewing gum after meals significantly reduced dental caries incidence in a three-year study.

Studies have shown that a commercial chewing gum containing 5% sodium bicarbonate (Arm and Hammer Dental Care) is capable of removing significant amounts of plaque and reducing gingivitis when used as an adjunct to regular toothbrushing. Stain removal is also of interest to the consumer. Studies simulating a realistic situation (twice-daily brushing and unsupervised use of a baking soda chewing gum) demonstrated reduction in stain after four weeks.

Reynolds has proposed the introduction of casein phosphopeptide to chewing gum as a mechanism to

remineralize early carious lesions. Compounds such as chlorhexidine and fluorides would appear to be useful when delivered using chewing gum as the vehicle, since there would be a minimum of potentially interfering agents in the gum product, as well as a sustained time of release and availability in the oral cavity.

Xylitol is considered noncariogenic and cariostatic. Since the 1970s, one of the favorite ways to take advantage of xylitols unique anticaries property, has been to use it to sweeten chewing gum, a product that is a popular item among school children.

Two other dental uses of xylitol chewing gum have come out in Scandinavia:

1. Chlorhexidine can dramatically suppress the number of mutans streptococcus in the saliva. However, after discontinuing use of the product, there is a rapid repopulation of the bacteria. This repopulation can be arrested or greatly slowed by the use of xylitol chewing gum.

2. Previously it was mentioned that a child's flora often reflected that of the mother. To help minimize this mother-child transmission of cariogenic bacteria, mothers have been urged to chew xylitol gum.

The chewing of PH-neutral sugar-free gum increase salivary flow and assists in remineralization and the prevention of demineralization.

Topical Fluoride Therapy

Fluoride has been introduced into proprietary products such as dentifrices and mouthrinses. As a result, the caries decrement directly attributable to water fluoride in the mid-20th century has declined. Yet, the placement of fluoride into communal water supplies still results in an estimated 20 to 40% reduction in coronal caries, and a similar 20 to 40% decrease in root caries.

Approximately 126 million individuals in the United States consume fluoridated water through communal water supplies and another 9 million are drinking naturally fluoridated water. It is estimated that 65% of the U.S. population, therefore, is receiving fluoride through drinking water. Many times during the past years, it has not been possible to fluoridate city water supplies because of political, technical, or financial considerations. In such cases, it is still possible to receive the systemic benefits of fluoride by using dietary supplements in the form of fluoride tablets, drops, lozenges, and vitamin preparations. Some countries permit fluorides to be added to table salt. Elsewhere, ongoing research studies are being conducted to determine the anticariogenic effect of fluoride when placed in milk, and even sugar.

It is also possible to apply fluoride directly to the surface of the teeth by use of cotton pledgets, and/or by use of fluoride-containing dentifrices, gels, varnishes or mouth rinses. Such applications to the surface of the teeth are referred to as topical applications. The extent of caries control achieved through topical applications is directly related to the number of times the fluoride is applied and the length of time the fluoride is maintained in contact with the teeth. Research data also indicate that it is better to apply lower concentrations of fluoride to the teeth more often than to apply higher concentrations at longer intervals.

Neither the action of topically applied nor of systemic (ingested) fluoride in preventing dental caries is completely understood. It is believed that fluoride has several key actions: (1) it may enter the dental plaque and affect the bacteria by depressing their production of acid and thus reduce the possibility of demineralization of the teeth. fluoride may accumulate in dental plaque in concentrations above 100 ppm. (2) it facilitates the remineralization (repair) of teeth that have been demineralized by acid end-products. The latter is probably the most important of these three effects. The natural source of minerals such as calcium and phosphate, fluoride and others needed for this remineralization is the saliva; and (3) it reacts with the mineral elements on the surface of the tooth to make the enamel less soluble to the acid end-products of bacterial metabolism. Some of the applied fluoride readily penetrates the relatively permeable enamel surface to depths of 20 to 30 millimeters and readily reacts with the calcifying apatite to form a fluorhydroxyapatite. It is known the most efficient means of forming this reaction product occurs with prolonged exposure of the enamel to low concentrations of fluoride.

The continued deposition of fluoride into enamel during the later stages of enamel formation, and especially during the period of enamel maturation, results in a concentration gradient of fluoride in enamel. Invariably the highest concentration of fluoride occurs at the very outermost portion of the enamel surface, with the fluoride content decreasing as one progresses inward toward the dentin.

Topical Fluoride Applications

Available Forms

Sodium Fluoride (NaF)

This material is available in powder, gel, and liquid form. The compound is recommended for use in a 2% concentration.

Stannous Fluoride (SnF_2)

This compound is available in powder form either in bulk containers or preweighed capsules. The recommended and approved concentration is 8%.

Acidulated Phosphate Fluoride (APF)

This treatment system is available in solution, gel, and foam. This compound is stable and ready to use. These forms contain 1.23% fluoride.

Application Procedure

In essence, two procedures are available for administering topical fluoride treatments. One procedure, in brief, involves the isolation of teeth and continuously painting the solution onto the tooth surfaces. The second, and currently more popular, procedure involves the use of fluoride gels applied with a disposable tray.

Many different types of trays are available; selection of a tray adequate for the individual patient is an important part of the technique. Most manufacturers of trays offer sizes to fit patients of different ages. An adequate tray should cover all the patient's dentition; it should also have enough depth to reach beyond the neck of the teeth and contact the alveolar mucosa to prevent saliva from diluting the fluoride gel. Currently, disposable soft styrofoam trays are available and seem to be adequate. These trays can be bent to insert in the mouth and are soft enough to produce no discomfort when they reach the soft tissues.

If a prophylaxis is given, the patient is permitted to rinse, and the teeth of the arch to be treated are dried with compressed air. A ribbon of gel is placed in the trough portion of the tray and the tray seated over the entire arch. The method used must ensure that the gel reaches all of the teeth and flows interproximally. If, for instance, a soft pliable tray is used, the tray is pressed or molded against the tooth surfaces, and the patient may also be instructed to bite gently against the tray.

It should be stressed that various precautions should be routinely taken to minimize the amount of fluoride that is inadvertently swallowed by the patient during the application procedure., It has been suggested that the ingestion of these quantities of fluoride by young children may contribute to the development of dental fluorosis in those teeth that are unerupted and in the developmental stage. Precautions that should be undertaken include (1) using only the required amount of the fluoride

solution or gel to perform the treatment adequately; (2) positioning the patient in an upright position; (3) using efficient saliva aspiration or suctioning apparatus; and (4) requiring the patient to expectorate thoroughly on completion of the fluoride application. The use of these procedures has been shown to reduce the amount of inadvertently swallowed fluoride to less than 2 mg, which may be expected to be of little consequence.

After the topical application is completed, the patient is advised not to rinse, drink, or eat for 30 minutes.

Recommendations—Topical Fluoride Treatments

- Accepting the relative inefficiency of single, topical applications of fluoride solutions, patients with existing evidence of caries activity, whatever their age, should be given an initial series of topical fluoride treatments followed by quarterly, semiannual, or annual treatments as required to maintain cariostasis. The initial series of treatments should consist of four applications administered during a 2- to 4-week period, with the first treatment preceded by a thorough prophylaxis if indicated. Patients with little evidence of existing or anticipated caries should be given single applications every 12 months as a preventive measure.

- Whatever fluoride system is selected, the application period (i.e., the time the teeth are kept in contact with the fluoride system) should be 4 minutes in all patients with existing caries activity. Shorter treatment periods may be permissible in the performance of treatments to maintain cariostasis.

- Special effort should be made by the dentist to schedule topical fluoride applications so as to provide the treatment to newly erupted teeth within 12 months after eruption, and preferably as close to eruption as possible.

Fluoride Varnishes

Most varnishes contain 5.0% sodium fluoride (2.26% fluoride) and a typical application requires only 0.3 to 0.5 mL of the varnish, which contains 3 to 6 mg of fluoride. The application procedure involves cleaning the tooth surfaces by toothbrushing, painting the varnish on the teeth, and drying. The varnish is retained for 24 to 48 hours during which time fluoride is released for reaction with the underlying enamel. It is recommended that the applications be repeated at 4- to 6-month intervals.

Initiation of Therapy

Topical fluoride therapy should be initiated when the child reaches about 2 years of age, when most of the deciduous dentition should have erupted. The treatment regimen should be maintained at least on a semiannual basis throughout the period of increased caries susceptibility.

Problems and Disadvantages

The use of stannous fluoride may be contraindicated for aesthetic reasons in specific instances. The reaction of tin ions with enamel, particularly carious enamel, results in the formation of tin

phosphates, some of which are brown in color. Thus, the use of this agent produces a temporary brownish pigmentation of carious tooth structure.

Another problem frequently raised concerns the strong, unpleasant, metallic taste of stannous fluoride. APF preparations are much better accepted by children.

Acidulated phosphate fluoride systems have the disadvantage of possibly etching ceramic or porcelain surfaces. As a result, porcelain veneer facings and similar restorations should be protected with cocoa butter, vaseline, or isolation prior to applying APF. Alternatively, sodium fluoride may be used instead of APF.

Dentifrices

They have been prepared in a variety of forms, including pastes, powders, and liquids.
The original level of fluoride in OTC dentifrices and gels was restricted to 1,000 to 1,100 ppm fluoride and a total of no more than 120 mg of fluoride in the tube, with a requirement that the package include a safety closure. Therapeutic toothpastes, dispensed on prescription, could contain up to 260 mg of fluoride in a tube.

The following fluorides are generally recognized as effective and safe for OTC sales: 0.22% sodium fluoride (NaF) at a level of 1,100 ppm, 0.76% sodium monofluorophosphate (MFP) at a level of 1,000 ppm, and 0.4% stannous fluoride (SnF_2) at a level of 1,000 ppm.

The risk of toothpaste ingestion is increased in younger children, and some studies have shown that very young children may ingest enough toothpaste to be at risk of dental fluorosis.[138] In fact, one study found that children who brush with a fluoride toothpaste before 2 years of age have an elevenfold greater risk of developing fluorosis than children who begin brushing later. These considerations have prompted the ADA to recommend that children under age 3 should be advised to use only a "pea-sized" quantity of a fluoride dentifrice for brushing and that this quantity be gradually increased with age so that not until age 6 is the child using a "full-strip" of dentifrice on the brush head. In making recommendations, the practitioner must consider what other sources of fluoride the child may be ingesting, such as fluoride or fluoride-vitamin supplements, fluoridated communal-water supplies.

In general, the use of approved fluoride dentifrices results in a significant decrease in the incidence of dental caries (20 to 45%). Not all fluoride-containing dentifrices have demonstrated anticaries activity. The level of active fluoride must be adequate and must be maintained over the shelf-life of the dentifrice.

Fluoride Rinses

Fluoride rinses were approved as safe and effective by the FDA in 1974.

These are available as

1. over-the-counter (OTC) ~~daily rinses~~ (0.05% NaF, 230ppm F; 0.02% NaF, 200ppm; 0.02% APF, 200 ppm F).

2. prescription weekly rinses (0.2% NaF, 910ppm F or 0.4% SnF_2, 970ppm F).

The dose directions are 10 ml of product to be used for 1 minute. These restrictions included the distribution of quantities containing no more than 300 mg fluoride in a single container, a cautionary label to avoid swallowing, and an indication that the preparations should not be used by children younger than 6 years of age.

As a general rule, daily rinses should be recommended rather than a weekly regimen; not only does the daily procedure appear to be slightly more effective.

For children living in nonfluoridated areas, the prescription of fluoride supplements may also be considered (Table 5-1).

AGE	F in drinking water		
	<0.3ppm	0.3-0.6ppm	>0.6ppm
6m-3y	0.25	0	0
3-6y	0.5	0.25	0
6-16y	1.0	0.5	0

Table 5-1 Dietary Fluoride Supplementation Schedule
1ppm=1mg/l

Fluoride Gels for Home Use

These procedures contain 0.4% stannous fluoride (1,000 ppm fluoride) or 1.0% sodium fluoride (5,000 ppm) and are formulated in a nonaqueous gel base that does not contain an abrasive system. Their recommended manner of usage involves toothbrushing with gel (similar to using a dentifrice), allowing the gel to remain in the oral cavity for 1 minute, and then expectorating thoroughly.

Fluoride-Releasing Dental Restorative Materials

Fluoride-releasing dental restorative materials may provide an additional benefit in preventive dentistry. (i.e., glass ionomer cements, and fluoride-releasing resin composites).

Toxicology of Fluoride

The Probable toxic dose (PTD) is 5 mg F/kg body weight. Sub-lethal toxic symptoms are manifested quickly after the dose and consists of vomiting, excessive salivation, tearing and mucous discharge, cold wet skin and convulsions with higher doses. Counter measures which should be administered immediately are emetics, 1% calcium chloride, calcium gluconate or milk.

Fluorosis:

Fluorosis occurs when teeth are developing. The most critical ages are from 0 to 6 years. After 8 years, risk of fluorosis is essentially past.It is a condition caused by an excessive intake of fluoride.

The effects of Fluorosis are mainly aesthetic. Mild Fluorosis results in lacy markings on the tooth s enamel surface; in moderate Fluorosis, a white opacity is easy to see over 50% of the tooth; and severe Fluorosis results in pitted, brittle enamel.

Caries

Approximately 90% of all the carious lesions in the mouth occur on the occlusal surfaces of the posterior teeth. These surfaces represent only 12% of the total number of tooth surfaces, so that occlusal surfaces with their deep pits and fissures are approximately eight times as vulnerable as all the other smooth surfaces.

The interest in caries formation in pits and fissures, attempts have been made to provide an elaborate classification system for pits and fissures.

Two main types of pits and fissures are usually described:

1. shallow, wide V-shaped fissures that tend to be self-cleaning and somewhat caries resistant.
2. deep, narrow 1-shapyed fissures that are quite constricted and may resemble a bottleneck in that the fissure may have an extremely narrow slit-like opening with a larger base as it extends toward the dentinoenamel junction. These caries-susceptible, 1-shaped fissures may also have a number of different branches extending toward or into the underlying dentin. The typical fissure usually contains an organic plug composed of reduced enamel epithelium, microorganisms forming dental plaque , and oral debris.

The methods of diagnosing at these different sites include:

1. Thorough , careful clinical examination, using :
   - Direct vision of clean and dry teeth.
   - Gentle probing .
   - Transillumination.
2. Radiographic examination.

Clinical hint: The traditional use of a probe or explorer in pits and fissures and on demineralized smooth surfaces may damage demineralized enamel and transfer cariogenic bacteria from one site to another, increasing the likelihood of restorative intervention. The diagnostic value of an explorer examination of the occlusal surfaces decreases as the "stickiness" of the fissure increases—this at a time when the need for validity increases. For instance, the sensitivity of an explorer examination can decrease from 80% for wide fissures to 52% for those that are narrow. Therefore, the diagnostic criterion of "sticky fissure" should be eliminated.

In the past tow decades, laser and light-induced fluorescence methods have been developed to detect and quantify enamel mineral content. These methods rely on the different fluorescence characteristics (loss of fluorescence) of demineralized enamel due to the scattering of light in the carious lesion. There is a strong correlation between mineral loss and fluorescence in white spot (demineralized) lesions of enamel.

Early childhood caries (ECC)

One of the most severe forms of caries occurs in infants. Inappropriate feeding practices may result in progressive dental caries on the buccal and lingual surfaces of newly erupted primary maxillary anterior teeth of infants and toddlers. The overall prevalence of early childhood caries (also called

baby bottle tooth decay or nursing caries) is estimated to be 5%. Primary risk factors for early childhood caries include putting a child to sleep at naptime or bedtime with a bottle containing a liquid other than plain water, allowing an infant to breast-feed at will during the night, and extended use of the nursing bottle or sippy cup beyond 1 year of age.

children with the highest number of MS for deciduous teeth usually experience a higher attack rate for the later permanent teeth. Mutans streptcoccoi require a solid surface –the tooth surface– for successful colonization. During the first year of life before eruption of the primary teeth, very few MS are found in the mouth. When teething begins at approximately 8 months, MS often rapidly colonizes the plaque of newly erupting teeth. It has been shown that an important source of infection of infants by MS is from the caregivers (usually the mother) by the mouth-to-mouth transmission, such as via kissing, or by sharing a spoon during feeding. Mothers with the highest MS counts often have infants with similarly high caries lesion counts.

Measurements of Caries

An important tool used in examinations of a population group is a dental index, a numeric score that quantifies the magnitude of the disease measured.

- The most common index for measuring dental caries in the primary dentition in the world is dmft index. This index is based on detection of dentinal caries in the past and present including the present untreated decay (dt) and evidence of past disease as teeth with filling (ft), or missing due to caries (mt).
- deft is used to record decayed (dt), extracted (et) and filled teeth (ft) in the primary dentition
- defs is used to record decayed(ds), extracted (es) and filled Surfaces (fs) in the primary dentition.
- DMFT is used to record Decayed(DT), Missing (MT) and Filled Teeth (FT) in permanent dentition.
- DMFS is used to record Decayed (DS), Missing (MS) and Filled Surfaces (FS) in permanent dentition.

Recommendations of American Academy of Pediatrics for prevention of ECC

- Reducing the mother's/primary caregiver's/sibling(s) MS levels (ideally during the prenatal period) to decrease transmission of cariogenic bacteria.
- Minimizing saliva-sharing activities (eg, sharing utensils) between an infant or toddler and his family/cohorts.
- Implementing oral hygiene measures no later than the time of eruption of the first primary Tooth.
- Establishing a dental home within 6 months of eruption of the first tooth and no later than 12 months of age
- Avoiding caries-promoting feeding behaviors.

First dental visit

Dentist will:

- Check:
  - Face and Jaws
  - Gums, Tongue, Tissues
  - Teeth and Bite
- Ask questions
- Give information.

Dental visit is an opportunity to:

- assess caries risk and potential problems
- supply anticipatory guidance to parents
- Provide appropriate counseling on feeding/diet management, tooth cleaning, and fluoride management for parents of infants and toddlers.

Determining patients at risk of dental caries

The development of a treatment strategy for patient that is based on risk factors pertinent to that individual is the gold standard of minimally invasive treatment. That is, before deciding the appropriate methods and preventive products to advice, the patient,s caries risk should be determined. This may be achieved by considering several aspects such as presence of white spot lesions, individual and familial caries history, socioeconomic status, ethnicity, diet, fluoride exposure, salivary flow and quality, oral hygiene, medical history, and presence of development defects of enamel (table 10-1).

TABLE 10-1 American Academy of Pediatrics Dentistry Caries-Risk Assessment Tool

CARIES RISK INDICATORS	LOW RISK	MODERATE RISK	HIGH RISK
CLINICAL CONDITIONS	• No carious teeth in past 24 months	• Carious teeth in the past 24 months	• Carious teeth in the past 12 months
	• No enamel demineralization (enamel caries "white spot lesions")	• One area of enamel demineralization (enamel caries "white spot lesions")	• More than one area of enamel demineralization (enamel caries "white spot lesions")
			• Radiographic enamel caries
	• No visible plaque; no gingivitis	• Gingivitis[a]	• Visible plaque on anterior (front) teeth
			• High titers of mutans streptococci
			• Wearing dental of Orthodontic appliances[b]
			• Enamel hypoplasia[c]
ENVIRONMENTAL CHARACTERSTICS	• Optimal systemic and topical fluoride exposure[d]	• Suboptimal systemic fluoride exposure with optimal topical exposure[d]	• Suboptimal topical fluoride expsure[e]
	• Consumption of simple sugars or foods strongly associated with caries initiation[e] primarily at mealtimes	• Occasional (e.g., one or two) between-meal exposures to simple sugars or foods strongly associated with caries	• Frequent (e.g., three or more) between-meal exposures to simple sugars or foods strongly associated with caries
	• High caregiver socioeconimic status[f]	• Midlevel caregiver socioeconomic status (e.g., eligible for school lunch program or SCHIP)	• Low-level caregiver socioeconomic status (e.g., eligible for Mediacid)
	• Regular use of dental care in an established dental home	• Irregular use of dental services	• No usual source of dental care
			• Active caries present in the mother
GENERAL HEALTH CONDITIONS			• Children with special health care needs[g]
			• Conditions impairing saliva composition/flow[h]

Pit-and-Fissure Sealants

DEFINITION

"A fissure sealant is a material that is placed in the pits and fissures of teeth in order to prevent or arrest the development of dental caries".

As long as the sealants are retained, no bacteria or bacterial acids can affect the sealed areas. If they are not retained, no damage to the teeth results from a retreatment. The lost sealant can be easily replaced. One 10-year study demonstrated a 57% retention of the original sealants.51 In another study, approximately 95% retention occurred over 2 years.52 With these performances, the average life of the sealant approximates the 10 years projected for an amalgam.53 It should be emphasized that sealant placement should be followed by a topical fluoride application to the teeth, because fluorides are most effective in protecting the smooth surfaces and least effective on the occlusal surfaces, a situation that is the reverse of the results expected of the sealants.

TYPES OF PIT AND FISSURE SEALANTS

Resins

Resin sealants are bonded to the underlying enamel by the use of the acid etch technique. Their caries preventive property is based on the establishment of a tight seal which prevents leakage of nutrients to the microflora in the deeper parts of the fissure. The resin sealants may be either pure resin, composites (All the commercial sealants are of the same Bis-GMA chemical family) or compomers, and their polymerisation may be initiated chemically or by light, Filled or unfilled, With or without fluoride, and Clear, opaque or tinted.

Glass Ionomer Cement (GIC)

One of the main clinical advantages of GIC is their ability to bond chemically to dentin and enamel without the use of the acid-etch technique, which makes them less vulnerable to moisture. This, in conjunction with active fluoride release into the surround enamel, has led to the development and evaluation of GIC as an alternative fissure sealant system, particularly in cases where moisture control is difficult to achieve. This pattern of fluoride release is common for all the conventional and resin modified GIC's.

Studies of the use of GIC, and resin modified glass ionomers as fissure sealants indicate significantly lower retention rates than resin-based pit and fissure sealants. The use of GIC has been suggested for erupting teeth where isolation is a problem, especially in the high caries risk individuals.

Compomers

Since the amount of fluoride released in distilled water is considerably less than GIC, and that three year clinical results show comparability with resin sealants, their properties should be estimated as comparable to the resins.

SEALING OF CARIOUS FISSURES

Several studies have shown that resin sealants are able to stop further progression of carious lesions in pits and fissures, even dentin lesions. The rationale for this approach is that the placement

of a sealant isolates the carious lesion from the surface biofilm. This suggests a therapeutic use for sealants in addition to a preventive one. However, it seems to be a general convention that the use should be limited to fissures where the lesion seems to be confined to the enamel, and that dentin lesions should be restored, preferably by the use of minimal intervention techniques, like the preventive resin restoration.

TECHNIQUE FOR RESIN SEALANTS

i) Surface Cleaning

It is concluded therefore that there is a need for removal of most organic substance in order to obtain sufficient bonding fissure. cleansing with a rotating bristle brush and pumice may be beneficial.

iii) Isolation

The isolation procedure may frequently be extremely challenging, particularly in the partially erupted teeth or in those children with poor co-operation.

A dry field can be maintained in several ways, including use of a rubber dam, employment of cotton rolls, and the placement of bibulous pads over the opening of the parotid duct. The rubber dam provides an ideal way to maintain dryness for an extended time.

iv) Etchants and Conditioners

The goal of etching is to produce an uncontaminated, dry, frosted surface. The most frequently used etchant is orthophosphoric acid, provided that its concentration lies between 30 and 50% by weight (gel or solution). Small variations in the concentration do not appear to affect the quality of the etched surface.

The etchant is placed for only 20 seconds on the enamel of both primary and permanent teeth (range is 15-60). Another 15 seconds of etching is indicated for fluorosed teeth to compensate for the greater acid resistance of the enamel. The etching period should be timed with a clock .

v) Washing and Drying

The tooth is usually irrigated vigorously with air and water for about 30 seconds and then dried with uncontaminated compressed air for 15 seconds(until chalky appearence). If the tooth is contamination it should be re-etched for 15 seconds.

vi) Application of the Sealant

Apply a thin coat of sealant to the pits and fissures, making sure to include the buccal extension on lower molars and the palatal groove in upper molar teeth. Apply the polymerization light for 20 seconds.

Following polymerization, the sealants should be examined carefully before discontinuing the dry field. If any voids are evident, additional sealant can be added without the need for any additional etching. If a sealant requires repair at any time after the dry field is discontinued, it is prudent to repeat the same etching and drying procedures as initially used.

vii) Remove the rubber dam and check the occlusion.

At times an excess of sealant may be inadvertently flowed into a fossa or into the adjoining interproximal spaces. To remedy the first problem, the occlusion should be checked visually or, if indicated, with articulating paper. If the premature contact of the occlusal contact is unacceptable the occlusion should be modified by burs. The integrity of the interproximal spaces can be checked with the use of dental floss. If any sealant is present, the use of scalers may be required to accomplish removal.

viii) Evaluating Retention of Sealants

The finished sealant should be checked for retention without using undue force. In the event that the sealant does not adhere, the placement procedures should be repeated, with only about 15 seconds of etching needed to remove the residual saliva before again flushing, drying, and applying the sealant. If two attempts are unsuccessful, the sealant application should be postponed until remineralization occurs.

Teeth that have been sealed and then have lost the sealant have had fewer lesions than control teeth. This is possibly due to the presence of tags that are retained in the enamel after the bulk of the sealant has been sheared from the tooth surface (Figure 6-1).

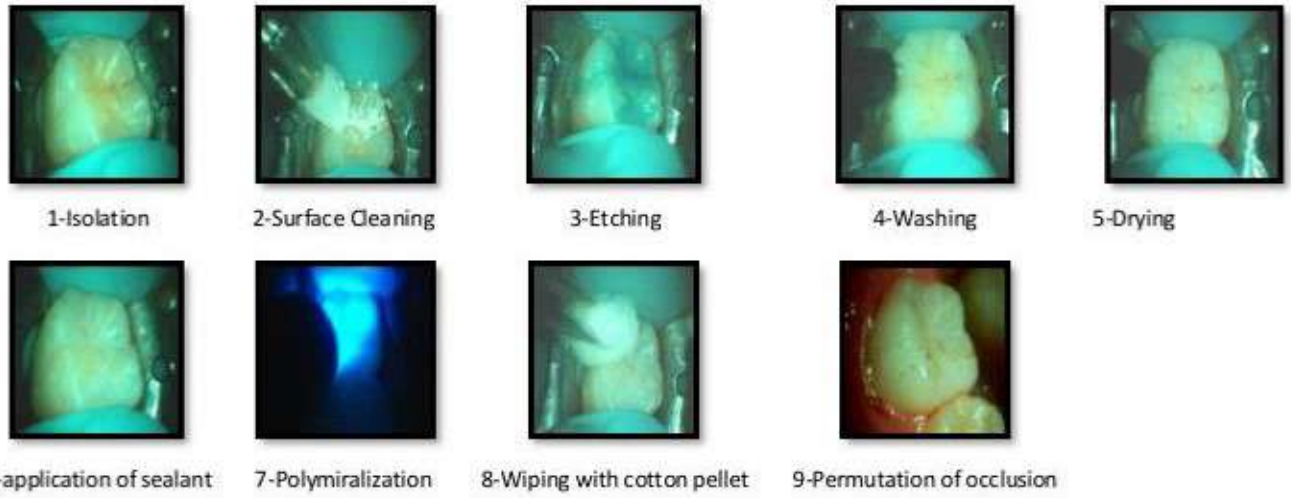


Figure 6-1 Technique for resin sealants

RECOMMENDATIONS FOR USE

The decision to apply a fissure sealant should be made on clinical grounds based on a thorough clinical examination, supported by radiographs where appropriate, and taking into account risk factors such as medical and social history as well as past caries experience and present caries activity.

Patient and tooth selection

1. Children and young people with medical, physical or intellectual impairment: The application of sealant to all susceptible sites of primary and permanent teeth should be considered, especially when systemic health could be jeopardised by dental disease or the need for dental treatment.

2. Children and young people with signs of acute caries activity: All susceptible pit- and fissure sites should be considered for sealing including the buccal fissures of permanent molars

3. Children and young people with no signs of caries activity: Only deeply fissured (extremely plaque retaining fissures) and thus potentially susceptible surfaces should be considered for sealing.

It should be mentioned that all children, irrespective of caries activity, should be regularly monitored for any change in risk factors and/or clinical or radiographic evidence of a change in their caries status.

Clinical considerations

1. When there is an indication for placement, then sealants should be placed as soon as possible since the tooth is most caries susceptible during the post-eruption period. However, susceptible sites of teeth can be sealed at any age depending on assessment of risk factors.

2. The choice between resin/composite and glass-ionomer sealants should be based on adequacy of moisture control. Since the resins are most durable they should generally be preferred, while glass ionomer cements should be used in cases where moisture control is difficult, e.g. in erupting or newly erupted teeth. GIC sealants in these cases are regarded more as a temporary sealant or a fluoride release vehicle, rather than a true fissure sealant.

3. Where there is a real doubt about the caries status of a susceptible site on clinical examination, e.g. a stained fissure, then a bitewing radiograph should be obtained. If there is unequivocal evidence that the lesion is confined to enamel then the surface can be sealed and monitored clinically and radiographically. When the evidence is equivocal, then removal of the stained areas in the fissures (enamel biopsy) should be performed, using rotating instruments.

4. If the lesion extends into dentine after removal of staining then a sealant restoration ("preventive resin/glass ionomer restoration") may be placed. A more extensive cavity will require a conventional restoration.

Follow up and review

1. All sealed surfaces should be regularly monitored clinically and radiographically. Bitewing radiographs should be taken at a frequency consistent with the patient's risk status, especially where there has been doubt as to the caries status of the surface prior to sealant placement. The exact intervals between radiographic review will depend not only on the risk factors, which may change with time, but also on the monitoring of other susceptible sites, for example approximal surfaces.

2. Defective sealants and/or preventive resin or glass ionomer restorations should be investigated and the sealant reapplied in order to maintain the marginal integrity, provided the surface is caries free.

Preventive Resins Restorations (PRRs)

Due to its superior wear resistance and superior mechanical properties, composite resin materials rather than glass ionomers are the material of choice for treatment of early occlusal caries in permanent teeth.

Indications

- ✓ Tooth that can be isolated.
- ✓ Minimal "catches" in the grooves / areas with distinct incipient enamel caries.
- ✓ Isolated lesions / minimal evidence of dentinal caries.
- ✓ No / minimal evidence of radiographic caries.

Method of PRRs

- ✓ Use local anaesthesia and rubber dam isolation if caries extends into dentine.
- ✓ With a small high-speed diamond bur obtain access into the questionable fissure.
- ✓ Remove the carious dentine. Although it is important not to remove more enamel than necessary it is essential to have adequate access to the underlying dentine to be certain of complete caries removal. Unsupported enamel need not be removed if access and vision are clear. The cross-section most closely resembles a tear drop shape.
- ✓ Deeper dentinal caries should be removed using a slow-speed round bur.
- ✓ Place a glass ionomer liner over the dentine extending it up to the amelodentinal junction and light cure for 40 seconds.
- ✓ Gel etchant is placed for 20 seconds on the enamel margins and occlusal surface. And washed and dried. It is not necessary to etch the liner; sufficient roughening of the surface of the glass ionomer cement (GIC) will result from the washing process.
- ✓ Place a thin layer of bonding resin into the cavity and cure for 20 seconds. An excess of resin will produce pooling and reduce the integrity of the bond.
- ✓ Incrementally fill and polymerize the cavity with hybrid composite resin until it is level with the occlusal surface.
- ✓ Flow opaque unfilled fissure sealant over the restoration and the entire occlusal fissure pattern and cure for 20 seconds. There is no need to re-etch the occlusal surface prior to placing the fissure sealant.
- ✓ Remove the rubber dam and check the occlusion.

Periodontal Disease Prevention

The normal periodontium consist **(**Figure7-1**):**

1-The gingiva (G)

2-The periodontal ligament (PL)

3-The root cementum (RC)

4-The alveolar bone (AB).

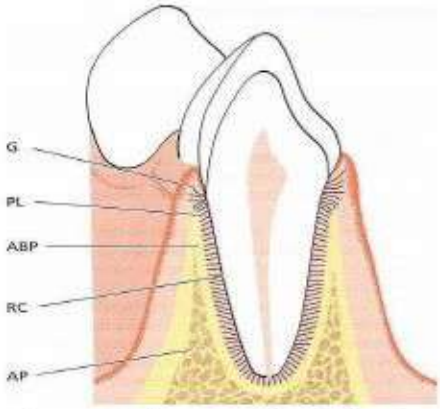


Figure 7-1 The normal periodontium

The gingiva divide anatomy to (Figure 7-2):

1-Marginal or free gingiva (FG)

2-Attached gingiva (AG)

3-Interdental gingiva (IG).

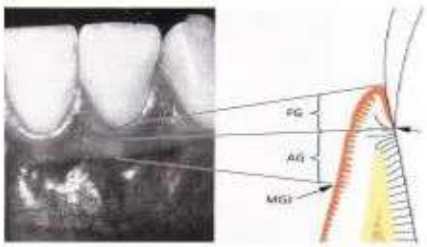


Figure 7-2 Anatomic parts of gingiva

The gingiva is connective tissue covered by stratified squamous epithelium. Gingival epithelium is three types (Figure 7-3):

1-Oral Epithelium (OE)

2-Oral Sulcular Epithelium (OSE)

3-Junctional Epithelium (JE)

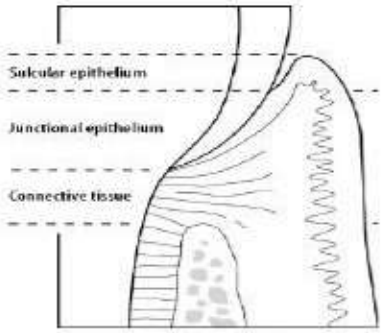


Figure 7-3 types of gingival epithelium

Bacteria in dental plaque are the direct cause of the most widespread of all human diseases—dental caries and inflammatory periodontal diseases. Plaque forms initially on the organic layer coating the erupted tooth. This organic layer originates from salivary products that are deposited on the teeth, forming an acquired pellicle to which bacteria adhere. Adhesion is mediated by a variety of bonding mechanisms, including physicochemical and electrostatic interactions, and stereo-chemical interactions between bacterial adhesins and receptors in the acquired pellicle and bacterial surfaces. The earliest of the primary bacterial colonizers are mainly Gram-positive facultative cocci. They are followed by a variety of Gram-positive and Gram-negative species—the secondary colonizers. Caries-related bacterial species have a greater ability than others to adapt to excess sugars and their metabolites. Supragingival plaque is associated with caries and gingivitis, whereas subgingival plaque

is associated with gingivitis and periodontitis. With higher pH (i.e., less acidity), some plaques mineralize to form supra- and subgingival dental calculus. In calculus formation, mineralization of dental plaque generally begins in the extracellular matrix and eventually spreads to include the bacteria. Rarely, mineralization may begin within the walls of bacterial cells and spread to the extracellular matrix. Calculus is generally covered by actively metabolizing bacteria, which can cause caries, gingivitis, and periodontitis. Regular toothbrushing and flossing can remove dental plaque and control its formation. Once dental plaque mineralizes to form calculus, professional instrumentation is necessary for its removal. Notwithstanding the contribution of calculus to inflammatory periodontal diseases, it is stagnation of pathogenic bacteria at critical sites that leads to both dental caries and periodontal diseases. Later chapters deal with the wide range of methods, mechanical and chemical, increasingly used to control plaque and calculus formation. All of these methods have the aim of preventing, arresting, or reversing the progression of dental caries and periodontal tissue inflammation.

Several agents are currently available to reduce calculus formation, including dentifrices that contain pyrophosphate, or metal ions such as zinc. One dentifrice contains two soluble phosphates, tetrasodium pyrophosphate and disodium dihydrogen pyrophosphate, in addition to fluoride. The pyrophosphate ion not only serves as a structural analog of the orthophosphate ion, disrupting the formation of calcium phosphate crystals, but also inhibits some bacterial growth at concentrations significantly lower than the levels found in dentifrices.

Two of the most important messages of the entire chapter are: (1) at the first sign of gingival bleeding, regardless of age, a dentist should be seen immediately for diagnosis, treatment, education and monitoring; and, (2) for all patients who smoke, to encourage and help facilitate their participation in an anti-smoking program.

Many indices are used to determine the prevalence and severity of gingivitis and/or periodontitis among a given population, or to determine the severity of gingivitis and/or periodontitis among individual patients. The most commonly used markers are a plaque index, gingival bleeding, loss of epithelial attachment and pocket depth. With computer software, data collection can be easily extended to include recession, suppuration, furcation involvement, tooth mobility and others. The most important detail that delineates gingivitis from periodontitis is the integrity of the epithelial attachment. As long as the pocket depth measurements approximate 3 millimeters with no bleeding and no recent loss of epithelial attachment, the periodontium can be considered in excellent health. As the pocket probing depths become greater, noninvasive preventive procedures become more difficult to apply while invasive treatment becomes more frequent and complex. Manual probes are used to determine sulcus depth; however, the constant-force electronic probes appear to be more accurate, reproducible and easier to use in recording data.

Facts about Gingivitis and Periodontitis

There are powerful influencing factors that can modify the course of the diseases such as (1) smoking, (2) genetic differences, (3) baseline severity of disease, (4) Presence of P. gingivalis, P. intermedia, and B. forsythus, and Actinobacillus actinomycetemcomitans, and (5) individual compliance with established standards for oral self-care. Another strong risk indicator is the observed relationship of

several systemic diseases to gingivitis and periodontitis. Among these are diabetes mellitus, Down's syndrome, and more rarely diagnosed conditions such as Haim-Munk syndrome and Papillon-Le Fevre syndromes. Also noticed has been a greater frequency of cardiovascular accidents and nonhemorrhagic strokes among individuals with periodontitis.

Possibly one of the most important harbingers of gingivitis and periodontitis is cigarette smoking and/or use of smokeless tobacco products. Many studies have found that tooth loss from periodontal disease is associated with tobacco use. Investigators have reported that current smokers have a greater prevalence of severe periodontal problems, as well as accompanying breakdowns of various components of the immune system than do individuals who have never smoked. With smoking, the challenge organisms are rarely confronted by a fully effective immune defense system.

Epidemiology and Risk Assessment

Periodontal Disease Indicators

O'Leary's Plaque Record (Index), (Figure 8-4):

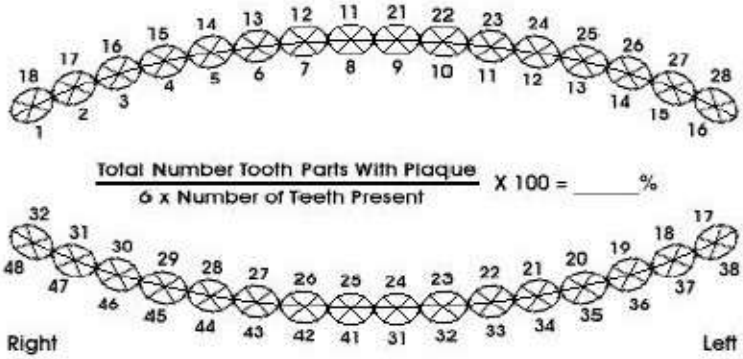


Figure 8-4 The chart used for O'Leary's Plaque Index

Plaque Index(PI) (Silness and Löe 1963)

The index of Silness and Loe also requires that the four surfaces of designated teeth be visually examined and a score recorded, viz., the maxillary right first molar, maxillary right lateral incisor, and the left first bicuspid; the the mandible, the mandibular left first molar, the left lateral incisor and the right first bicuspid—a total of six teeth. For each of the surfaces of these teeth a score of 0 to 3 is given that matches the severity of the listings in Table 8-1. In this way, the average amount of plaque for each tooth can be determine by dividing by 4; the scores for all six teeth be divided by 6 to get the average for the mouth. The highest scores can be expected to occur on the interproximal surfaces.

Score	Criteria	
0	No plaque	
1	Thin film of plaque at the gingival margin. Visible only when scraped wirh an explorer or Detection Dye	

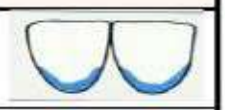
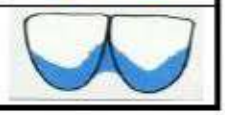
Score	Criteria	
2	Moderate amount of plque along the gingival margin: interdental space free of plaque: plaque visible with the naked eye.	
3	Heavy plaque accumulation at the gingival margin: interdental space filled with plaque	

Table 8-1 Plaque Index(PI) (Silness and Löe 1963)

Gingival Index (GI) Loe and Silness

Gingival inflammation Index (GI) Loe and Silness assesses severity of gingivitis based on color, consistency & bleeding (Table 8-2).

Score	Criteria
0	Normal
1	Mild inflam, slight color change and edema, no bleeding
2	Moderate inflam, redness, edema, bleeds on probing
3	Severe inflam, marked redness and edema, ulceration, spontaneous bleeding

Table 8-2 Gingival Index (GI) Loe and Silness

Papillary Bleeding Index (PBI) Muhlemann

Papillary Bleeding Index (PBI) Muhlemann Measures severity of bleeding, quantifies bleeding in the papillary region (Table 8-3).

Score	Criteria
0	No bleeding
1	Point of blood
2	Line, points, speck
3	Triangle
4	Profuse bleeding

Table 8-3 Papillary Bleeding Index (PBI) Muhlemann

Periodontal Probes

As illustrated in Figure 8-5, there are several variations of periodontal probes. Each has circumferential markings on the probing tip to aid in determining sulcular depth; others also have

color-coding to further facilitate accurate measurements. The probe is used for four main purposes: (1) the measurement of pocket depth, (2) the measurement of epithelial attachment loss, and (3) the detection of subgingival calculus as part of the periodontal examination. The probe may be of metal, or of a hard polymer. The probing tip is approximately 0.5 millimeter in diameter. Its tactile reproducibility and accuracy depends much upon the experience of the operator.

There is always a need for caution in probing, especially in the presence of inflammation. Probing inflamed gingival tissue sites with its fragile capillaries risks inducing a bacteremia. For individuals at risk of infective endocarditis, both a clinical and radiographic assessment is indicated prior to a decision to probe. Prophylactic antibiotic coverage may be indicated.

WHO (3,5-8,5-11,5mm)

Williams (1,2,3,5,7,8,9mm)

Figure8-5 Two types of calibrated periodontal probes useful in assessing the depth and configuration of periodontal pockets

Periodontal Probing

As previously mentioned, two of the main purposes of periodontal probing are to determine pocket depth, and to measure the amount of attachment loss. Both have one requirement in common, namely a careful step-by-step circumferential probing around each tooth.

The measurement of epithelial attachment loss involves the same format of probing as for determining pocket depth. The main difference is the reference point from which the measurement is recorded. For pocket depth, it is from the depth of the pocket to the crest of the free marginal gingiva. For calculating attachment loss, the measurement is made from the depth of the pocket on each surface to a fixed site, such as the cementoenamel junction or occlusal plane. Two measurements separated in time but at the same site are necessary to estimate the amount of apical migration (if any) of the epithelial attachment. Sites that show a 2-millimeter loss of attachment between two sequential recall examinations should be considered as active.

Gingival Recession

As the attachment loss continues, the free gingival margin may recede apically along with the epithelial attachment as well as the underlying alveolar bone. In such a case, the pocket depth may be

near normal (as measured from the crest of the free gingival margin), while the attachment loss increases (as measured from the cementoenamel junction).

Community Periodontal Index of Treatment Needs (CPITN)

The previous plaque, and bleeding indices were epidemiological instruments that could be visually accomplished for events occurring above the gingival margin. The next one widely used epidemiology indices, the Community Periodontal Index of Treatment Needs (CPITN) require probing to evaluate the periodontal health (or otherwise) that occurs below the gingival margin.

A special color-coded black banded probe from 3.5 to 5.5 mm and circular rings at 8.5 and 11.5 facilitates uniformity of scores in the world-wide accomplishment of the CPITN (WHO probe, pressure: no greater than 15-25g). In this screening index, the periodontal treatment needs are recorded for six segments (sextants). The segments are the anterior and two posterior sets of maxillary and mandibular teeth. The system excludes the third molars, except where the third molars are functioning in the place of the second molars. A sextant must have at least two functional teeth. The highest (worst) of the coded conditions in Table 8-4 is recorded for each sextant.

Score	Condition	Treatment Needed
0	Healthy No pockets- entire black area of probe visible	Preventive
1	Bleeding on probing No pockets- entire black area of probe visible	Oral hygiene instruction (OHI)
2	Calculus or iatrogenic marginal irritation No pockets- entire black area of probe visible	OHI and debridement
3	Shallow pockets up to 5mm Gingival margin is on black area of probe	OHI and debridement
4	Deeper pockets from 6mm Black area of probe not visible	OHI, calculus removal and complex treatment

Table 8-4 Community Periodontal Index of Treatment Needs (CPITN)

Noninvasive Treatment Guidelines for Gingivitis

Gingivitis of plaque origin is a preventable and curable periodontal disease. The objective of professional and home self-care is to eliminate or severely reduce the etiologic organisms in the dental plaque and to prevent or reverse gingival inflammation. This effort can be abetted by a thorough prophylaxis, supplemented at home by use of the toothbrush, dental floss and an irrigation device (Figure 8-6). This "brush, floss, and flush" routine can be enhanced by the daily use of a fluoride toothpaste, over-the-counter products with essential oils, such as Listerine, or dentist prescribed chlorhexidine mouthrinses.

Figure 8-6 Two irrigation devices

Noninvasive Primary Preventive Care for Periodontitis

Once a patient develops periodontitis, therapy usually includes additional measures to those recommended for gingivitis. As the probing depth increases, it becomes more difficult to eliminate the bacteria of the subgingival plaque. In addition to routine calculus removal at the time of the prophylaxis, scaling and root planing needs to be accomplished.
The mouthrinses used in a self-care programs do not penetrate deeply enough into the periodontal pockets. However, when irrigation is accomplished in the office, a greater penetration of the pocket can be attained by placing the therapeutic irrigating solution in the fluid container of the ultrasonic scaler (Figure 8-7). To complete the treatment, often a slow-delivery medication is placed in the pocket, or antibio- tic therapy can be initiated to eliminate microbes that have invaded the sulcular tissues. Once a maximum treatment success has been achieved, an every-3-month monitoring is mandatory.

Figure 8-7 The ultrasonic scaler.

Invasive Procedures Required to Access the Subgingival Pocket

As the pocket continues to deepen it becomes more difficult to apply noninvasive preventive procedures. To solve this problem, the clinician should be to refer patients to periodontist for treatment.

Prevention of dental trauma

Dental injuries are very common, and up to 30% of children injure their primary teeth. Tooth injury is more common in males (greater than a 2:1 ratio).

Patterns and Risk Factors:

The most common injury site is the maxillary (upper) central incisors, which account for more than 50% of all dental injuries.
Oral injuries typically result from falls (most common), bike and car accidents, sports-related injuries, and violence.

Missing Teeth

Missing teeth should be accounted for. Do not assume that missing teeth were lost at the scene of the accident because they may be imbedded in soft tissues, intruded into the alveolar bone or sinus cavity, aspirated, or swallowed.
Radiographs (soft tissue and chest X-rays) should be done to look for missing teeth.

Types of Tooth Injury

Tooth injury can be divided into 7 main categories:

1. Concussion
2. Subluxation
3. Lateral Luxation
4. Intrusion
5. Extrusion
6. Avulsion
7. Fracture

Prevention

Prevention is the most effective intervention. Pediatricians are in a unique position to help families prevent accidental trauma, including oral trauma, by providing anticipatory guidance at routine visits.

Accident Prevention

Suggestions for accident prevention specifically related to oral trauma:
1. Advise parents about possible injury to developing permanent teeth from trauma if a primary tooth is injured.
2. Review and anticipate developmental milestones.
3. Counsel about the risks of walkers and trampolines.
4. Discuss childproofing the home.
5. Review safety measures for outdoor activities and sports.
6. Stress the importance of adequate supervision at all times, especially on furniture, stairs, at the playground, and at athletic events or practices.

Sports and Protective Gear

Sports participation poses a significant risk for trauma. The highest risk sports for oral trauma arebaseball, soccer, football, basketball, and hockey. Skateboarding, rollerblading, and bicycling injuries are also common.

Helmet and face masks should be properly fitted and worn during all games and practices for the sports in which they are recommended. Statistically, children are more often injured in practice than during a game, so all protective gear should be worn during practice as well.

Mouth Guards

Mouth guard use is mandatory for football, ice hockey, lacrosse, field hockey, and boxing. Several states have also passed regulations to mandate mouth guards for soccer, basketball, and wrestling.

- Facts About Mouth Guard Use

1. Mouth guards help to protect the teeth and soft tissues of the mouth from injury.
2. The better the fit, the more protection offered.
3. Mouth guard use may reduce the risk or severity of a concussion.

- Types of Mouth Guards

There are 3 types of mouth guards(Figure 9-1):

1. Stock. (A)
2. Mouth-formed, or "boil-and-bite." (B)
3. Custom fit.(C)
   - Vacuum thermoformed
   - Pressure laminated

Figure 9-1 A,B, and C Some types of mouth guards

Stock Mouth Guards

These pre-formed, over-the-counter, ready-to-wear mouth guards are generally the least comfortable and, therefore, the least likely to be worn. Because of poor fit, they also offer the least protection and require constant biting down to stay in place.

Boil and Bite Mouth Guards

Made of thermoplastic material that conforms to the shape of the teeth after being placed in hot water, these mouth guards are commercially available and the most common type used by athletes. They vary in fit, comfort, and protection.

Custom Fit Mouth Guards

This type of mouth guard must be made by a dentist for the individual. It is the most expensive, but also offers the most protection and comfort.
Custom mouth guards are preferred by dentists and usually preferred by athletes because of their increased comfort, wear-ability, and retention, as well as ease of speaking when worn.

- Recommendations for Mouth Guards

The American Academy of Pediatric Dentistry (AAPD) recommends properly fitted mouth guards for all children participating in organized and unorganized contact and collision sports.

The AAPD supports mandates for use of athletic mouthguards in any sporting activity containing a risk of orofacial injury.

Proper Care of Mouth Guard

• Mouth guards should fit properly and not block breathing or interfere with Speech

- Prevent possible disease transmission and infection through cleaning and proper maintenance.
- Mouth guards are porous and may allow bacterial growth
- Bacteria in a mouth guard may cause gum infection and illness.

Steps to Keeping Mouth Guard Clean

- Wash after each use in cold water
- Do not use warm, hot or boiling water because it will change the shape
- Use a soft toothbrush to clean
- Store in a protective case after cleaning
- Soak in cold denture cleaning solution if white, hard deposits form.

Equally or more important to prevent serious facial injuries is that the use of seat belts should be strongly advocated across all age.

How to Respond to a Dental Emergency

If a Tooth is Knocked Out

- Time is critical
- Do not touch the tooth root
- Gently rinse the tooth
- Place in milk or water (not tissue!)
- Go to the dentist or emergency room, with the tooth, immediately.

If a Tooth is Pushed Out of Place Or Broken

- Clean injured area with warm water
- If there is swelling, apply cold packs to outside of face
- Go to a dentist or emergency room immediately.

If a Jaw is Broken

- DO NOT move the jaw
- Wrap a scarf, handkerchief or towel around the head to keep the jaw still
- Go to a hospital emergency room immediately!

Prevention of malocclusion

Preventive orthodontics

General factors influence the development of a malocclusion

1. Abnormal oral musculature. High tongue position coupled with a strong mentalis muscle may damage the occlusion after the loss of a mandibular primary molar and distal drifting of the anterior segment will result. A collapse of the lower dental arch

2. Oral habits. Thumb or finger habits cause abnormal forces on the dental arch and are responsible for initiating a collapse after the untimely loss of teeth.

3. Existing malocclusion. Arch-length inadequacies and other forms of malocclusion, particularly class II, division 1, usually become more severe after the untimely loss of mandibular primary teeth.

4. Stage of occlusal development. In general, more space loss is likely to occur if teeth are actively erupting adjacent to the space left by the premature loss of a primary tooth.

Preventive Orthodontics:

Preventive Orthodontics is the action taken to preserve the integrity of what appears to be normal at a specific time. Any procedure that attempt to ward off untoward environmental attacks or anything that would change the normal course of events.

Various Preventive procedures are

1. Pre-dental procedures:

1. Proper nutrition of the child
2. Proper nursing care of the infant.
3. Bottle feeding should be discouraged.

2. Care of deciduous dentition:

- Prevention and timely restoration of carious teeth. Every afford should be made to preserve the integrity of deciduous dentition by under taking regular dental checkups, simple preventive procedures like application of fluorides, pit and fissure sealants etc.

3. Patient and parent's education programs:

- Need of maintaining good oral hygiene should be explained to the patient and the parents. Demonstration of brushing methods and diet counseling etc are also important.

4-Anomalies of teeth number:

Each jaw is designed to hold only a specific number of teeth at a particular age. However, if the number of teeth present increases, or size of teeth is abnormally large, it can cause crowding or hamper the eruption of succedaneous teeth in their ideal positions

- Similarly, if the number of teeth present is less than normal then gaps will be seen in the dental arch.

- **Anomalies in the number of teeth can be of two types:**
  - Increased number of teeth or supernumerary teeth.

- Less number of teeth or missing teeth

supernumerary teeth

Supernumerary teeth can vary remarkably in size, shape and location.

The most commonly seen supernumerary tooth is the "mesiodens" It is usually situated between the maxillary central incisors and can vary considerably in shape.

Supernumerary teeth can cause:

- Noneruption of adjacent teeth
- Delay the eruption of adjacent teeth
- Increase the arch perimeter
- Crowding in the dental arch

Supernumerary teeth, which bear a close resemblance to a particular group of teeth and erupt close to the original sight of these teeth, are called supplemental teeth. They are more commonly seen in the premolar region or the lateral incisor region.

❑ **Missing teeth:**

- Congenitally missing teeth are far more commonly seen as compared to supernumerary teeth.
- The most commonly congenitally missing teeth are the third molars, followed by the maxillary lateral incisors

5. Early loss of deciduous teeth:

Early loss of the primary adjacent tooth decrease space availability for eruption

Early loss of primary tooth leading to mucosal thickening over the permanent tooth.

Early loss of the primary tooth might cause excessive bone disposition over the permanent tooth

Space maintainer should be fitted after the early loss of deciduous teeth particularly the molars.

6. Ankylosed deciduous teeth:

- Ankylosis is a condition characterized by absence of the periodental membrane in a small area or whole of the root surface.
- Presence of ankylosed deciduous teeth. These might not get absorbed causing a delay in the eruption of the permanent tooth .
- They should be removed surgically at appropriate time to allow emergence of the successor.

7. Ectopic eruption:

Appropriate measure should be taken to prevent ectopic eruption of any teeth by timely removal of any supernumerary tooth, retained root etc.

8. Proximal caries:

- Proximal caries are especially to blame for the reduction in arch length. This might be brought about by migration of adjacent teeth or tilting of adjacent teeth into the space and/or supra-eruption of the teeth in the opposing arch.
- Caries can also lead to the premature loss of deciduous or permanent teeth.

- To maintain the integrity of dental arch, carious teeth must be treated promptly.
- Dx: By clinical and radiographic examination (Bitewing radiograph)
- Malocclusions can be caused due to improper dental restorations.
- Under contoured proximal restoration can lead to a significant decrease in the arch length especially in the deciduous molars.
- Over contoured proximal restorations might bulge into the space to be occupied by a succedaneous tooth and result in a reduction of this space.
- Overhang or poor proximal contacts may predispose to periodontal breakdown around these teeth.
- Premature contacts on over contoured occlusal restoration can cause a functional shift of the mandible during jaw closure.
- under-contoured occlusal restorations can lead to the supra-eruption of the opposing dentition.

9. Prolonged retention of deciduous teeth:

It causes:

- Buccal/labial or palatal/lingual deflection in its path of eruption.
- Impaction of the permanent tooth
- Most commonly impacted tooth is the maxillary canine (third molars not taken into account).
- They should be extracted to allow the successor teeth to erupt in normal position.

10. Labial frenum:

- At birth the labial frenum is attached to the alveolar ridge with some fibers crossing over and attaching with the lingual dental papilla.
- As the teeth erupt, bone is deposited and the frenal attachment migrates superiorly with respect to the alveolar ridge.
- Some fibers may persist between the maxillary central incisors . These fibers which persist between these teeth are capable of preventing the two contra lateral central incisors from coming into close approximation causing the midline diastema .
- Surgical removal of the abnormal labial frenum is needed to prevent median diastema.

11. Grinding of cusp tips/occlusal equilibration:

Cuspal interference should be removed by selective grinding of the tooth. Abnormal anatomical features like enamel pearl, may cause premature contact.
Problem:
Deviation in the mandibular path of closure
Predispose to bruxism
Dx: articulating paper/bite paper

12. Tongue tie:

If such tie of the tongue interferes with the normal speech and or swallowing, it should be removed surgically.

13. Oral habits:

Abnormal oral habits should be recognized and patient should be helped by motivation or by fitting a suitable habit breaking appliance.

14. Space maintainers:

Premature loss of deciduous teeth can cause drifting of the adjacent teeth into the space. Space maintainers must be inserted in appropriate cases after the loss of teeth, particularly after the loss of deciduous molars in inadequate arches.

Preventive management of the development occlusion

A tooth is maintained in its correct relationship in the dental arch as a result of the action of a series of forces (Figure 10-1).

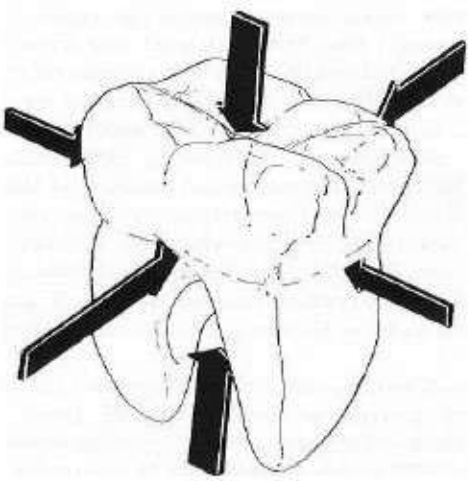


Figure 10-1 Forces that act on a tooth to maintain its relationship in the arch.

If one of these forces is altered or removed, changes in the relationship of adjacent teeth will occur and will result in drifting of teeth and the development of a space problem.

Oral Cancer Prevention

Most cancers of the mouth are easy to see, while those of the floor of the mouth can be easily palpated. The typical early intraoral lesion is usually an indurated ulcer. Any ulcer that persists for 3 weeks should be biopsied. The early detection, and early referral leading to a more favorable outcome of therapy, is a crucial responsibility of the general dentist!

A tragedy associated with many head and neck cancer deaths is that in most cases the disease could have been prevented. The great majority of head and neck cancers arise from three sources: (1) smoking and the use of smokeless tobacco, (2) exposure of the lips and face to the sun, and (3) excessive consumption of alcohol.

Usually, there are early nonhealing, precancerous changes in the oral cavity or on the face that should alert an individual to immediately seek professional care. Cessation of the use of tobacco, avoiding excessive exposure to the sun, and consuming alcohol in moderation will help return the tissues to normal. Finally, if the cancer is diagnosed in the early stages, immediate treatment is usually followed by a "clinical cure," provided there is not a return to the original habits.

The Profile of the Oral-Cancer Patient

The average oral cancer patient is over 40 years of age, with men afflicted more often than women. The most common intraoral cancer is a squamous cell cancer that might have been preceded by leukoplakia. The seriousness of the cancer is designated by a TNM classification system (staging) with scoring assigned in three areas of clinical assessment: (T)umor size, involvement of the lymph (N)odes draining the area and presence/extent of (M)etastasis. The greater the scoring numbers from 0 to 4 in each of the categories, the more serious the prognosis.

Treatment of Oral Cancer

The treatment for cancer of the oral cavity involves a choice of surgery, radiation, chemotherapy, or combinations thereof. Surgery is used to excise smaller cancerous lesions or to debulk large tumors (remove as much as possible of large volume cancers). As a co-therapeutic modality, chemotherapy or radiotherapy can be an option following surgery. The addition of radiotherapy adds two very disconcerting problems to the treatment regimen—mucositis and osteoradionecrosis (ORN). Host damage by radiation is usually localized to the field of irradiation, while the side effects of chemotherapy are systemic.

Dental Intervention, Cancer

If possible, all needed dental surgery for the newly diagnosed cancer patient should be accomplished prior to radiotherapy. All teeth with a questionable prognosis should be extracted, such as those with moderate-to-severe periodontal disease, extensive caries, impacted third molars and irreversible pulpitis. In making a decision to extract or retain teeth, consideration should be given to the past evidence of the patient having maintained a fastidious level of plaque control, overall prognosis, attitudes and expected compliance with written and verbal preventive dentistry instructions.

After exodontia there should be a 21-day waiting interval before radiation since the risk of developing ORN increases with a shorter interval elapsing between surgery and radiation therapy.

Following radiation, all dental care should be conservative, emphasizing endodontic and other tooth retention measures instead of extraction. Unfortunately, regardless of the adequacy of self-care of the preserved teeth, the risk of ORN is perpetual, even though the risk exists only for the osseous tissue that was within the field of radiation. Recognizing that patient compliance with oral care instructions following radiotherapy is reported to be less than 50%, frequent recalls are essential. Research to date has clearly shown that routine self-care hygiene measures combined with use of fluoride therapy plus regular dental monitoring, significantly reduces the incidence of postradiation caries and the progression of periodontal disease.

Diagnosis and Prevention of Dental Erosion

Aetiology

Erosion is undoubtedly a multifactorial process but the pattern of tooth tissue loss may give some clues as to the most important of the aetiological factors.
All acids, whether from within the body or from external sources, are capable of de mineralizing tooth tissue and therefore of causing erosion.

1. Intrinsic Acidic Sources

These are essentially of gastric acid origin and enter the mouth from gastric reflux, vomiting or rumination.

2. Extrinsic Acid Sources

A. Environmental

Various sources of contact with acids as part of work or leisure activities have been reported.

B. Dietary

This is particularly the case in relation to the consumption of soft drinks with a considerable increase in quantity and change in age distribution. Some alcoholic drinks, such as dry wines and alcopops are also acidic. However, it is not just the total consumption of acidic dietary sources that is important but also the periodicity and relationship to toothbrushing practices.

C. Medication and Oral Hygiene products

A number of common medications, such as Vitamin C tablets and iron preparations are very acidic as well as some proprietary mouthwashes.

D. Lifestyle

Changes in general lifestyle have increased exposure to extrinsic acidic sources.

Management

Early diagnosis is important so that possible aetiological factors can be identified and preventive measures can be taken to halt further progression.

1. Recording Erosion

The most useful diagnostic index is the Tooth Wear Index (T.W.I) of Smith and Knight. Study casts are essential and good clinical photographs helpful.

2. Dietary Analysis

Record at least a 3 day detailed diet history.

3. Dietary Counselling

This must be tailored to the individual.

- Limit acidic foods and drinks to mealtimes.
- Reduce frequency.
- Finish meals with alkaline foods.
- Avoid acid foods and drinks last thing at night.

- Avoid toothbrushing after acidic substances.
- Check the pH of medication, mouthwashes etc.
- Chewing gum has been shown to stimulate salivary flow but may also cause increased gastric secretions.

4. Intrinsic Acid Sources:

Gastric Reflux and Vomiting

- If there is evidence or suspicion then referral to the General Medical Practitioner and onwards to a Gastroenterologist or Psychiatrist may be required.
- Anti reflux medication may be helpful. This should be prescribed in liaison with the General Medical Practitioner and/or Gastroenterologist. Omeprazole can be useful.
- Following reflux, rinsing the mouth with water and sodium bicarbonate helps to neutralise the oral environment.
- An occlusal guard containing sodium bicarbonate can be used at night if there is significant reflux at that time.

5. Remineralisation and Desensitisation

- Fluoride mouthrinses and varnish.
- High fluoride level toothpaste. (Caution in children under 6 years).
- Low abrasive toothpaste.
- Sugar free chewing gum.
- Dentine bonding agents.

6. Restorative Treatment

Identify the problem first, covering eroded teeth may merely disguise the problem. Adhesive restorations in composite/compomers may be useful as an interim treatment. Adhesive metal castings and porcelain veneers may be used later.

Dental Health Programs

The maintenance of good oral health requires a partnership between the dental professional and the patient. No preventive program can be a success unless the patient participates in a home self-care program to supplement office care programs, with the level of success being proportionate to the amount of participation. Maximum participation can be expected when the patient knows what to do, how to do it, and above all has the motivation to adhere to recommended procedures. Educational strategies can be used to teach facts and skills, but these are useless without motivation. Motivation can be initiated by an individual based on some need or desire, or it can be facilitated by persuasion from external sources.

Health promotion and health education are integral components of most successful dental public-health programs. Health promotion consists of any planned combination of educational, political, regulatory, and organizational supports for actions and conditions conducive to the health of a community or group of individuals in a defined geographic location. Projects designed to be administered in schools, such as fluoride mouthrinse programs and dental-sealant programs, have been particularly successful, because dental caries is prevalent in children and those with the greatest needs may reside with parents/guardians who are otherwise unable to provide for their treatment needs in personal healthcare facilities.

School-Health Programs Past and Present

School-health programs (SHP) originated around the beginning of the 20th century to help cope with contagion, screening needs for physical disabilities, nutritional deficiencies, and first aid ministrations. Since their inception, school-health programs have varied in quality and content by state and community. children were provided nutritional supplements, eye examinations, health education, smallpox vaccinations, and in some cases oral-health services.

But, the concepts and requirements of school health programs have been greatly broadened over the last three decades. At the onset of the 21st century, school-health services now include or attempt to address major societal health issues that have invaded the schools. These include: alcohol, drugs, and tobacco use (smoking and "spit"); safe-sex, HIV, AIDS, other sexually transmitted diseases; gang violence and child abuse; and self-esteem, depression...

Protecting the oral health of future generations is a commitment that must be shared by parents, teachers, school administrators, and all health professionals.