Current Concepts in Preventive Dentistry

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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Introduction
This course includes current, evidence-based content on preventive dentistry that dental clinicians will utilize during patient assessment. Preventive dentistry is a comprehensive approach that should calibrate the entire dental team in the individualized care and education of each patient in the dental practice.

Conflict of Interest Disclosure Statement
• Dr. Kracher reports no conflicts of interest associated with this course.

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Overview
It is difficult to believe that preventive dentistry has only been in practice for a little over 50 years in the United States (U.S.). Prior to the 1960s, dentistry did not include routinely scheduled patient care.

Although preventive dentistry is common practice in the U.S., currently dental caries affects 1 in 5 children 2-5 years of age. Recent statistics from the American Academy of Pediatric Dentistry (AAPD) indicate dental caries in children 2-8 years old was twice as high for Hispanic and non-Hispanic black children compared with non-Hispanic white children. Three in five adolescents 12-19 years of age had experienced dental caries in permanent teeth and 15% had untreated caries. According to the American Dental Association (ADA), only 61% of adults ages 65 and older have visited a dentist in the last year and the American College of Prosthodontists (ACP) report that 1/3 of elderly adults are edentulous. Each year more than 39,500 Americans have been diagnosed with oral and pharyngeal cancers. The American Cancer Society indicates 7,500 people have died from these cancers in 2015. This course includes current data for dental clinicians as they determine patient treatment.

Learning Objectives
Upon completion of this course, the dental professional should be able to:

• Identify bacteria most often associated with dental caries.
• Understand the caries process and caries prediction theories.
• Explain the general approach of caries risk assessment.
• Determine the cause of each pathology.
• Identify the typical visual cues and clinical significances for each pathology.
• Describe treatment for each pathology.
• Explain the process of plaque formation.
• Discuss manual and powered toothbrushes.
• Describe the various toothbrushing techniques.
• Identify the correct toothbrushing technique for the individual patient.
• Describe the two flossing methods.
• Identify which patients require auxiliary aids.
• Identify multiple sources of fluoride.
• Determine on an individual basis if a patient needs a professional fluoride application.
• Differentiate between pre-eruptive and post-eruptive fluoride.
• Identify the types of professional fluoride and their application.
• Discuss root surface caries treatment options.
• Identify foods that are considered cariogenic.
• Identify foods that are considered to be non-or low-acidogenic.
• Discuss how energy drinks, sports drinks and soda affect the oral cavity.
• Identify the criteria for selecting teeth for sealant placement.
• Identify the types of sealant material.
• List the requirements for successful sealant retention.
• Describe the sealant procedure.
• Identify sports that should use mouthguards.
• Identify which types of jaw fractures are more common.
• Identify which type of crown and root fractures are more common.
• Describe the treatment necessary when an emergency occurs with primary teeth.
• Describe the treatment necessary when an emergency occurs with permanent teeth.
• List the types of soft tissue dental injuries that can occur with sports.
• Identify the types of mouthguards available.

glossary

acidogenic – Acid producing.

antimicrobial – Destroying or suppressing the growth of microorganisms.

buffer – A substance that minimizes a change in pH of a solution by neutralizing added acids and bases.

calculus – Hard mineralized deposit on the teeth.

carbohydrates – A group of chemical compounds, including sugars, starches, and cellulose.

carcinogenic – A cancer causing agent.

cariogenic – A caries causing agent.

cavitation – Pitting of the enamel, resulting in caries.

chronic – Of long duration.

circumscribed – To confine within boundaries.

demineralize – A process by which mineral components are removed from mineralized tissues.

dentifrice – Toothpaste or tooth cleaning compound.

diastema – Abnormally large space between teeth.

enamel – The outer surface of the crown of the tooth.

erythroplakia – A flat red patch or lesion in the mouth.

erythematous – A redness of the tissue, often a sign of inflammation or infection.

etiology – The study of the cause of a disease.

expectorate – To spit.

hyperplastic – Unusual growth in a part of the body, caused by excessive multiplication of cells.

hypersalivation – Excessive production of saliva.

incipient – Early beginning or development of a cavity.

infectivity – Capable of producing infection.

interproximal – The area between two adjacent teeth.

localized – Confined to a specific area.

malignant – A disease or condition likely to cause serious harm or death.

metastasis – Transmitting from one area of the body to another.

neoplasm – Abnormal growth of tissue; tumor.

papilla – Gingiva in the interproximal spaces.

papillomavirus – Viruses that cause benign epithelial tumors.

paresthesia – Abnormal or impaired skin sensation.

pathology – Study of the nature of a disease; abnormal manifestations of a disease.
periodontal – Tissues surrounding the teeth.
plaque – A soft deposit on the teeth.
polysaccharides – A group of nine or more monosaccharides joined together.
premalignant – Precancerous.
prognosis – A prediction of the outcome of a disease.
remineralization – A process enhanced by the presence of fluoride whereby partially decalcified tooth surfaces become recalcified by mineral replacement.
subgingival – Below the gingiva.
sucrose – A type of sugar.
sulcus – Groove or depression.
systemic – Affecting the entire body.
supragingival – Above the gingiva.
ulcerated – To form an ulcer.
ventral – Lower surface of the tongue.
xerostomia – A lack of saliva causing unusual dryness of the mouth.

Caries Risk Assessment
More than 90% of adults have experienced dental caries before 30 years old. Dental caries is defined as a transmissible localized infection caused by a multifactorial etiology linking complex risk factors and protective factors. In order for dental caries to develop, four interrelated factors must occur:

1. the patient’s (host) diet must consist of repeated digestion of refined carbohydrates,
2. the host’s resistance to disease is decreased,
3. the factor of time, and
4. there must be a specific bacteria (Streptococci or S. mutans) present in the dental plaque.

The S. mutans bacteria play an active role in the early stages of the caries process, whereas the bacteria lactobacilli contribute to the progression of carious lesions. Carious lesions must be diagnosed in conjunction with a current clinical examination and imaging to verify suspicious lesions – especially interproximal lesions. Laser caries detectors can also be used as an adjunct in caries diagnosis.

Enamel is the most highly mineralized hard tissue in the body. The enamel matrix is made up of a protein network consisting of microscopic mineralized hydroxyapatite crystals arranged in rods or prisms. The protein network facilitates the diffusion of fluids, such as calcium and phosphate ions distributing these ions throughout the enamel. As carbohydrates are consumed by the host, the carbohydrates are broken down in the oral cavity by the protein enzyme amylase. This reaction causes lactic acid to be produced, thereby demineralizing the enamel matrix. If the demineralization of enamel is not reversed by the action of fluoride or calcium and phosphate ions, then the demineralization process continues further into the tooth structure, affecting the dentinoenamel junction (DEJ) and eventually the dentinal layer. The term “overt or frank” caries is used when it reaches the DEJ.

A carious lesion develops in three stages of demineralization. The first stage in demineralization of enamel is called the incipient lesion or “white spot” (Figure 1). This beginning carious lesion can be reversed with the daily use of the fluoride, calcium, and phosphate ions, persistent oral hygiene care to reduce plaque that harbors cariogenic bacteria, and a reduction of refined carbohydrates. The second stage of caries development involves the progression of demineralization of hard tooth tissue leading to the DEJ and into the dentinal layer. The third stage is the actual cavitation in the dentinal layer. Neither of the last two stages can be reversed and require mechanical removal of dental caries.

There are three levels of preventive dentistry that the dental professional should understand when educating patients in the dental caries process. The first step is primary prevention. This initial phase includes the transmission of S. mutans bacteria via saliva. Primary
prevention seeks to reduce the number of bacteria that cause dental caries, as well as using assessment tools to prevent future caries. The second step is secondary prevention, which prevents, arrests, or reverses the microbial shift before any clinical signs of the disease occur. The third step focuses on limiting or stopping the progression of the caries process by initiating remineralization therapy of existing lesions.

**Prevention Step One - Transmission and Establishment of Cariogenic Bacteria**
Specifically, bacteria are transmissible via the parents or other primary caregivers. The most common routes of infection of children are from close contact with the primary caregiver's saliva. The colonization of *S. mutans* is facilitated by a frequent sucrose-rich diet of the parent/caregiver, as well as the child. The higher the count of *S. mutans* present in the primary caregiver's oral cavity, the more risk for the child. Another important factor in the caries process is that the earlier the *S. mutans* are introduced into the oral cavity and the greater number of bacteria present, the more likely it is that caries will develop in both the primary and permanent dentition. The 'window of infectivity' of *S. mutans* in children is usually between ages 19 and 31 months of age. For these reasons, educational programs that target parents and primary caregivers is extremely important.

**Prevention Step Two - Microbial Shift**
Once *S. mutans* and *lactobacilli* bacteria are established in the oral cavity, the greater the risk for future caries to develop. Where biofilm (plaque) accumulates, the bacterial count is considered to be higher, as in areas in the oral cavity that are difficult to reach during oral hygiene. Newly erupted teeth are deficient in mineral content (calcium and phosphate), making them more susceptible to bacteria. By introducing antimicrobial agents such as fluoride, the bacterial count will be reduced.

**Prevention Step Three - Demineralization of Enamel**
When refined carbohydrates are introduced into the oral cavity, lactic acid production occurs as an end product of *S. mutan* bacteria, causing the saliva pH to drop from a neutral pH slightly below 7 to an acidic pH of 4.5-5.5. This metabolizing acidogenic bacteria's lactic acid production is what demineralizes (removed calcium and phosphate ions) from enamel. Common reasons for the prolonged acid conditions include: consistent carbohydrate intake, reduced clearance of lactic acid due to low saliva content (hyposalivation or xerostomia), impaired saliva pH buffer capacity, and biofilm accumulation due to insufficient oral hygiene care. The more acidogenic bacteria that are present, the more lactic acid produced.

When saliva is released into the oral cavity, in the absence of fermented carbohydrates, the pH of the saliva returns to normal or an approximate pH of 7 and a period of remineralization (repair) occurs. This process is facilitated if fluoride, calcium, and phosphate ions are present locally. The balance between demineralization and remineralization is crucial. If the balance is not maintained and demineralization occurs too frequently, then an incipient lesion will occur. This incipient or 'white spot' lesion may take up to approximately 9 months or more to be seen via digital imaging or radiologically as radiolucent (dark spot) on a bite-wing radiograph.

**Carious Lesions Occur in Four General Areas of the Tooth**
- **Pit and Fissure Caries (Figure 2)** - includes Class I occlusal surfaces of posterior teeth, lingual pits of maxillary incisors, and buccal surfaces of mandibular molars.
- **Smooth Surface Caries & Interproximal Surface Caries (Figure 3)** - includes Class V buccal, lingual surfaces of anterior and posterior teeth, and Class II interproximal surfaces of all teeth below the interproximal contact points.
• **Root Surface Caries (Figure 4)** - cementum is exposed due to teeth traumatized by conditions such as malocclusion, consistent bruxing, or clenching. Due to cementum being only 50% mineralized, root surface caries can occur if the patient receives multiple lactic-acid exposures.

• **Secondary or Recurrent Caries (Figure 5)** - includes caries seen adjacent to or beneath an existing restoration.

**Methods to Determine Caries Risk**

By definition, caries risk assessment is to *predict future caries development* before the clinical onset of the disease. Risk factors are the life-style and biochemical determinants that contribute to the development and progression of the disease. There are two caries risk assessment plans that I utilize when teaching caries: CAMBRA and the American Dental Association’s CRA Forms. An assessment should be developed with each patient to determine their risk for dental caries. We know that patients who are at risk include those patients with certain socioeconomic factors (low education level, low income), patients with certain factors related to general health (diseases, physically or mentally compromised individuals), and those patients with epidemiologic factors (living in a high-caries family or having a past caries experience, especially new caries in the last three years). We know that multiple factors can contribute to caries development. The key to preventing or arresting caries is to determine potential risk factors and establish an individual treatment plan for each patient. By updating our patients’ caries risk assessment at recall appointments we ensure their caries risk is current, as risk can change due to multiple variables, such as change in medications (contributing to xerostomia), oral hygiene, immunity, and bacterial transmission.
Each of these categories must be addressed at each dental examination to determine risk assessment, as a patient's oral condition may be different due to physiological changes or self-care practices. Two significant factors that indicate a patient is at high-risk include caries in the last three years and past restorative care, thereby indicating a higher bacterial count. A current caries assessment should be performed at recall appointments. Oral and written instructions should be given to the patient indicating their individual home/self-care instructions. Do not assume the patient is an expert in their own preventive care. Spend time with your patients so that they understand the importance of daily plaque control and how frequent carbohydrate intake influences the daily demineralization-remineralization process.

**Moderate- to High-risk Caries Diagnoses**

If a patient is diagnosed as moderate- to high-risk, they should be referred to a specialist for further treatment.

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**Table 1. Methods to Determine Caries Risk.**

| Oral Risk Factors          | - New carious lesions?  
|                           | - Previous carious lesions in the last three years?  
|                           | - Recurrent caries around restorations?  
|                           | - Deep pits and fissures?  
|                           | - Orthodontic treatment?  

| Home Care: Oral Hygiene and Fluoride Exposure | - Plaque present?  
|                                              | - Current understanding of plaque control and the patient's motivation?  
|                                              | - Brushes with fluoridated toothpaste daily?  
|                                              | - Drinks city-added or naturally occurring fluoridated water?  

| Dietary Analysis | - Carbohydrate intake, including frequency (sugary drinks such as soda, fruit juice, energy, and sports drink consumption)?  

| Microbial and Salivary Factors | - Bacterial count?  
|                               | - Xerostomia?  
|                               | - Physiological conditions?  
|                               | - Prescription drugs affecting saliva rate?  
|                               | - Salivary stones?  

| Family or Social Risk Factors | - Multiple in-between carbohydrates/day ingested?  
|                              | - Dental fear?  
|                              | - Family caries history?  

| Immunity/Medical Risk Factors | - Chronic diseases?  
|                              | - Medically or physically challenged?  

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risk caries, follow the recommended treatment protocol by the American Dental Association or CAMBRA. The ADA Chairside Guides are very helpful when calibrating the entire clinical team on caries treatment protocols. Schedule frequent fluoride varnish applications in your office, as well as prescribe fluoride toothpaste. Although the current ADA evidence-based practice guidelines does not indicate xylitol gum/mint therapy evidence is strong. The ADA considers xylitol therapy as an “Expert Opinion.” In other words, the ADA believes that even though there is a lack of evidence about xylitol, they recommend it be chewed by their patients for 10-20 minutes after meals and snacks as it buffers saliva and stimulates saliva to assist with hyposalivation. Many sugarless chewing gum companies in the last couple years have xylitol as their first ingredient. One of my favorite flavored chewing gums is Peppermint Ice Breakers Ice Cubes. The flavor lasts a considerable time compared to other flavors and other different sugarless gum brands. As long as the patient does not have TMJ dysfunction, chewing gum is recommended by the American Dental Association and the American Academy of Pediatric Dentistry. There are also xylitol mints available over the counter. In fact, everyone can benefit from chewing sugarless xylitol gum, not just moderate- to high-risk caries patients.

Skin, Lip, Oral, and Esophageal Cancers

Introduction
The patient must be screened for oral cancer at the initial appointment and each routine dental examination by performing an extraoral and intraoral examination. Imaging is normally prescribed based on an individual’s diagnoses, but suspicious areas in the oral cavity may require additional imaging. There are various types of pathology lesions found in the oral cavity and the head and neck regions. Even though the allied dental professional cannot diagnose lesions, they should be educated in oral pathology to identify lesions when assisting the dentist in his or her diagnosis. Each of the dental team members should know what “normal” tissues look like when treating patients. It’s also important for all team members to know that the standard care of practice is to determine how long the lesion has been present and, if the lesion was there more than two weeks it should be examined more closely and a possibly a biopsy is performed. It is strongly recommended dental team members attend continuing education courses on oral pathology to keep current on pathologic lesions. Also, the American Academy of Oral and Maxillofacial Pathology’s website is one resource to download PDF instructional pages with photographs of common pathologies. Four pathologic categories are explained in this section of the course. Each dental facility should have oral pathology books and/or online resources with color photographs available for dental clinicians to assist with diagnoses.

Four Types of Pathologies

Oral Leukoplakia – “White Lesion”

Etiology – an infection of the oral mucosa. Candidal leukoplakia is caused by fungus, candida albicans. Infected epithelial tissue can become hyperplastic with a formation of excess surface keratin (callused). Another common cause of leukoplakia is tobacco, typically cigarettes. Identifying leukoplakia is important, as a percentage of these white patches will transform to oral cancer.

Typical Visual Cues – a circumscribed white plaque that will not rub off with gauze. Most often found on the buccal mucosa, lateral border and ventral side of the tongue, floor of the mouth, and lips.

Demographics and Clinical Information – more common in adults, especially older men. Not as common in patients under 40 years of age. Diagnoses includes differential diagnoses ruling out other white lesions that can be rubbed off.

Treatment Recommendations – The type of treatment is determined by multiple factors, such as age, tobacco habits, medical status, and the location and size of the lesion. Often a biopsy is needed to determine its precancerous potential. For patients who diagnosed with moderate to severe dysplasia, AAOMP recommends a complete removal of the white patch, in order to prevent the
development of oral cancer. One in three lesions will regrow. The chance of reoccurrence is greater with patients who continue to smoke. It is recommended the patient is reexamined periodically and repeat biopsies are generally advisable.

**Clinical Significance** – oral lesions found in tobacco users should be viewed with increased suspicion for possible precancerous or cancerous lesions.

**Erythroplakia – “Red Lesion”**

**Etiology** – a chronic red macule that cannot be diagnosed as any other red lesion after differential diagnoses. Risk factors include chronic exposure to carcinogenic components found in all types of tobacco and ill-fitting dentures.

**Typical Visual Cues** – a flat or slightly raised lesion with a velvety appearance. May occur on the floor of the oral cavity, ventral area of the tongue, buccal mucosa, or the soft palate.

**Useful Clinical Information** – a painless and persistent lesion, found more commonly in adult males and patients who report tobacco use.

**Treatment Recommendations** – this lesion has approximately a 90% chance of premalignancy. If a biopsy reveals the lesion is premalignant, extensive therapy is indicated and the patient should be re-evaluated at regular intervals for other oral mucosal changes.

**Clinical Significance** – erythroplakia occurs less frequently than leukoplakia, but it is much more likely to exhibit evidence of premaligancy or malignancy.

**Squamous Cell Carcinoma**

**Etiology** – idiopathic (unknown). More than 9 of 10 cancers diagnosed in the oral cavity and oropharynx are squamous cell carcinoma. Risk factors include: tobacco use, alcohol use, sun radiation, genetic predisposition, nutritional deficiency, immunosuppression, and infections, such as candidal leukoplakia and human papillomavirus.

**Typical Visual Cues** – early lesions appear as flat and scale-like cells, adjacent tissues commonly firm to palpation, and may have residual leukoplakia and/or erythroplakia.

**Useful Clinical Information** – more common in adult males, continuous enlargement, local pain, referred pain often to the ear, and paresthesia of the lower lip.

**Treatment Recommendations** – the patient is referred to the oral surgeon for biopsy and treatment. They will also be referred to a medical provider for appropriate treatment (radiation therapy, chemotherapy). The patient
should be seen regularly in your practice for re-evaluation and counseled concerning their risk factors that contributed to cancer.

**Clinical Significance** – early diagnosis is crucial, as the presence of lymph node metastasis greatly worsens prognosis. Approximately 50% of patients have evidence of lymph node metastasis at time of diagnosis, that is why an extraoral examination is so critical with an intraoral examination. Patients who have had cancer are at greater risk of reoccurrence. The 5-year survival rate is 45-50%.

**Malignant Melanoma**

**Etiology** – a malignant neoplasm of melanin-producing cells. Chronic exposure to sun radiation and a fair complexion increases the risk for skin lesions.

**Typical Visual Cues** – larger than 0.5 cm in diameter, irregular margins, irregular pigmentation, any change in pigmentation, ulceration of the overlying mucosa, macular (superficial spreading) or elevated (nodular), and most often occurs on gingiva and the palate.

**Useful Clinical Information** – occurs most often in adult males, usually painless, rapidly enlarging.

**Treatment Recommendations** – refer to the oral surgeon for biopsy and treatment, as well as to the patient’s medical provider.

**Clinical Significance** – malignant melanoma is an extremely aggressive form of cancer, early diagnosis is crucial, as patients with oral melanoma generally have a poor prognosis. For skin mucosa, the 5-year survival rate is 65% and for oral mucosa the rate is 20%.

**Oral Management for the Cancer Patient**

**Bacterial Plaque Control**

Emphasize daily plaque removal to reduce microorganisms. The patient’s immunity will be compromised and there is a potential for oral side effects associated with cancer therapy. Toothbrushing instructions include using a soft or extra-soft toothbrush; a flavored dentifrice may not be tolerated, but fluoride is essential. Mouthrinses include saline solution to moisten the mucosa, as well as over-the-counter products managing oral mucositis. Chlorhexidine gluconate rinsing may also be recommended for antibacterial properties. Commercial mouthrinses that contain alcohol should be avoided. Biotene sprays and gels moisten the mucosa for patient comfort. I recommend the more viscous gels at night and the sprays during the day. However, patients can use the gel throughout the day to moisten their mucosal tissues.

**Homecare and Professional Fluoride Therapies**

Daily fluoride therapy is indicated for patients about to undergo head and neck radiation therapy, if the salivary glands are in the field of radiation. Make impressions and fabricate a custom fluoride tray, advise the patient to apply custom trays lined with prescription 5,000-ppm sodium fluoride gel to the teeth for 5-10 minutes once daily. Advise patient to refrain from eating, drinking, or rinsing for 30 minutes following fluoride application. Frequent sodium fluoride varnish applications in your office is recommended.

**Dietary Instructions**

Instruct the patient in food preparation. Avoid highly cariogenic foods, such as carbohydrates and also spicy foods. A soft, bland diet is recommended. Water is recommended throughout the day to moisten the oral cavity. Saliva substitutes are also recommended to decrease the risk of caries. See the [NIH website](http://www.nidcr.nih.gov) for current dental provider instructions for cancer patients.
Avoid Alcohol and Tobacco Products
If the patient uses tobacco products, a logical step for the cancer patient is to start tobacco cessation counseling. See dentalcare.com for continuing education courses on tobacco cessation programs.

Oral Hygiene Education

Educating Your Patients on the Role of Dental Plaque
Plaque is a biofilm that contributes to two oral diseases: dental caries and periodontal disease. It is a complex community of microorganisms.

Biofilm can not only cause decay or periodontal disease it also contributes to peri-mucositis and peri-implantitis around dental implants. The initial layer or formation of plaque is called the acquired pellicle. This layer will reform immediately after removal and will also form on artificial prosthesis, such as dentures. With over 800 species of aerobic and anaerobic bacteria in the human oral cavity, microbes grow as complex colonies in biofilm. In fact, it takes only two days for plaque to double in mass. Although calculus is an irritant, plaque is the contributing factor to periodontal disease rather than calculus. Daily removal of biofilm is critical to reduce oral diseases.

Manual versus Powered Toothbrushes
Both manual and power toothbrushes can effectively remove plaque if patients use correct technique and brush for an adequate time period (Figures 10 and 11). Certain toothbrush designs, however, provide more effective removal than others. Some studies show oscillating-rotating power brushes can be more effective at plaque removal than manual brushes. Power toothbrushes were shown to be as safe to use as manual toothbrushes if used properly.

Proctor & Gamble's Oral-B® PRO 5000 Smart Series power toothbrush has a red light that flashes in the handle when the patient presses too hard. It's difficult for patients who have always used a manual toothbrush to switch to a power toothbrush. For example, I recommend if they want to switch from a manual toothbrush to the Oral-B® PRO 5000 power toothbrush that they use the manual toothbrush style head initially to get used to the power toothbrush, then switch to one of the round heads. There are many powered toothbrushes available on the market. There are also less expensive battery-powered toothbrushes available for patients to try. Patients need to find a toothbrush that they will use for at least two minutes at least twice a day. Their favorite toothbrush may be a manual, battery-operated, or a power toothbrush. The key is to find one that they like and will use daily to disrupt plaque.

Power toothbrushes can be effective for all patients, particularly those with low manual dexterity or physical limitations. The larger handle is ideal for patients who cannot grip the smaller manual toothbrush handles, such as patients with arthritis or stroke victims. The patient should be encouraged to try both manual and powered toothbrushes and determine which is best for them. However, the patient should be instructed to use the new toothbrush for at least four weeks, as it takes approximately 3-4 weeks for someone to develop a habit. Trying new dental products requires time to adapt to new habits.
I personally recommend when a patient would like to switch from a manual toothbrush to a power toothbrush, they temporarily remove all manual toothbrushes from their home. I've found that patients will switch back and forth between the manual and power toothbrush and not develop a habit with the power toothbrush.

There are several manual toothbrushing techniques. They include the horizontal scrub, Bass, Stillman, Charters, and Fones, to name a few. The most popular method that an uneducated patient uses is the horizontal scrub. Unfortunately, gingival and enamel damage can occur with aggressive strokes and too firm of bristles. The Stillman method is used for massage and stimulation of the gingiva with a 45 degree angle of the bristles and a vibratory/pulsing method. The Charters method also involves a 45 degree angle with the bristles and a rotary or vibratory motion forcing the bristles interproximally. The Charters method can be recommended for orthodontic patients to clean ortho brackets and bands.

A preferred method for adults is the Modified Bass Method (Figure 12). This method was the first to focus on the removal of plaque and debris from the gingival sulcus with the combined use of the soft toothbrush and dental floss. The method is effective for removing plaque at the gingival margins and controlling plaque that leads to periodontal disease and caries. In the Bass technique, the toothbrush is positioned in the gingival sulcus at a 45-degree angle to the tooth apices. A vibratory action, described as a back-and-forth horizontal jiggle, causes a pulsing of the bristles to clean the sulcus. The term ‘modified’ indicates a final ‘sweep’ with the toothbrush toward the occlusal surfaces to remove debris subgingivally. Ten strokes are recommended for each area. This is the only toothbrush method that places the toothbrush bristles into the sulcus.

For children, the rotary method called the Fones technique (Figure 13) is preferred since children do not have the manual dexterity for a more advanced technique. The Fones technique is a circular method similar to the motion of the old rotary telephone. The teeth are clinched and the toothbrush is placed inside the cheeks. The toothbrush is moved in a circular method over both the maxillary and mandibular teeth. In the anterior region, the teeth are placed in an edge-to-edge position.
and the circular motion is continued. Children adapt to this technique rather quickly.

Whichever toothbrush is used, the patient should be taught to remove plaque in a sequential order when brushing to make sure they don’t skip any surface areas of the enamel or exposed cementum. The patient should be shown in the mirror the proper technique and their instruction should also include brushing their tongue to remove debris and bacteria. The patient should show that they understand their oral hygiene instruction by demonstrating it back to the dental professional. A combination of oral and written instructions is always preferred. Studies have shown that too much instruction at one time is overwhelming for the patient and they will not adopt new habits unless they understand and believe that they have value and are important.

Interdental Aids

Dental Floss and Flossing Methods

There are many different types of floss, tape, flossers, and floss holders on the market. Patients need to find some type of floss that they will want to use daily to disrupt plaque. There are two flossing methods available to teach your patients. One is the circle or loop method and the other is the spool method. The circle or loop method is preferred for children or any patient with low manual dexterity. A piece of floss approximately 18 inches long is tied at the ends to form a loop or circle. The patient uses the thumb and index finger of each hand in various combinations to guide the floss interproximally through the contacts. When inserting floss, it is gently eased between the teeth with a seesaw motion at the contact point, making sure not to snap the floss and cause trauma to the gingival papilla. Once through the contact area, gently slide the floss up and down the mesial and distal marginal ridges in a C-shape around the tooth directing the floss subgingivally to remove the debris.

The spool method (Figures 14 A-C) utilizes a piece of floss approximately 18-24 inches long where the majority of the floss is loosely wound around the middle finger of one hand and a small amount of floss around the middle finger of the opposite hand. The same procedure is followed as the loop method when positioning the floss interproximally. After each marginal ridge is cleaned, the used floss is moved or spooled to the other hand until all supragingival and subgingival areas have been cleaned, including the distal areas of the posterior teeth.
Patients with fixed prosthesis such as bridges, orthodontics, and bonded orthodontic retainers should be encouraged to use floss threaders (Figures 15 and 16) to remove debris. The floss is threaded underneath the prosthetic to remove any debris caught underneath. Patients should be instructed on their use and again asked to demonstrate to the dental professional that they understand and know how to use it.

Floss holders and flossers (Figure 17) are an alternative if the patient has difficulty flossing manually or for a patient with large hands, physical limitations, a strong gag reflex, or low motivation for traditional flossing. A floss holder or flosser is a good alternative to not flossing at all and should be shown to patients as a means of removing plaque. I’ve had good luck with patients flossing daily with Plackers flossers. They make a variety of flossers, but I prefer the GentleSlide tape for patients who have tight contacts. They resist shredding and stay taut when flossing. I encourage patients to keep bags in their car, work, and home for quick access after meals and snacks. I’ve also had success getting orthodontic patients to floss daily by using FlossFish. Their website has a video that you can show your patients, in addition to showing them in their own mouth.

**Toothpicks or Wooden/Plastic Triangular Sticks**

If your patients have large embrasures (spaces), they should be encouraged to utilize interproximal aids such as Stim-U-Dents. Made of balsa wood, Stim-U-Dents are used to remove debris and plaque, and are preferred by dental professionals over standard toothpicks, as toothpicks can splinter into the gingiva and damage the gingival tissue. If patients do not have access to floss, they can use the wooden balsa sticks to remove plaque and stimulate the gingiva (Figure 18).

**Interproximal Brushes**

These small interproximal brushes are attached to handles and are used for large spaced interproximal areas and for orthodontic patients to use between their brackets to remove debris. There are a variety of brushes available, including travel sizes for pockets and purses. The brushes are tapered for easy access to difficult areas and patients seem to adapt well to instructional use (Figure 19).
Fluorides
Both community water fluoridation (pre-eruptive fluoride) and topical fluoridation (post-eruptive fluoride) have proven to be an important mechanism in preventing dental caries in the United States. Through multiple studies, researchers have discovered that not only has water fluoridation contributed to the decline in dental caries, but also the post-eruptive effect of fluoride has played an even more vital role in reducing dental caries.

Current Theories Regarding Fluoride Use
Daily use of fluoride-containing dentifrices has significantly reduced the dental caries level in the United States. Other sources of fluoride include: added fluoride to city water sources; naturally occurring water fluoride in well water; over-the-counter mouthrinses; processed food and beverages at manufacturing plants that utilize fluoridated city water; rinses, gels, pastes, and tablets; professional fluoride varnish applications; and both in-office and at-home topical fluorides. This consistent application of fluoride to enamel and exposed cementum has reduced dental caries and has significantly changed how dentistry is practiced today.

By current convention, many dental professionals administer professional topical fluoride treatments to patients at their preventive maintenance appointments. However, is this routine procedure necessary for every patient? Although concentrated topical fluoride treatments usually are intended for annual or semiannual prophylaxis visits, a decline in caries prevalence brings into question the continuing need for such treatment in individuals who are diagnosed as a low-risk caries patient. Patients who are diagnosed as a low caries risk would be caries-free after a current examination, no new caries in the last three years, use a fluoridated toothpaste, and ingest fluoridated water. The decision to use a professionally applied topical fluoride should be based on a recent clinical examination, as well as scientific evidence.

Since current practice is to deliver a topical fluoride system to every young patient, the dental profession is faced with an ethical quandary when dealing with this issue. With exposure to so many outside sources, the patient may be receiving adequate amounts of fluoride to maintain a caries-free condition without routinely scheduled professional fluoride applications. These frequent exposures to low concentrations of fluoride, as received from toothpastes, are more effective in the prevention of caries than infrequent exposures to high concentrations of fluoride, as received from professional treatments. The American Dental Association utilizes evidence-based research when making clinical recommendations. The ADA states that “patients whose caries risk is lower may not receive additional benefit from professional topical fluoride.” Recommendations to use topical fluoride applications should be determined by whether or not the patient is exposed to multiple sources of fluoride or has other caries risk factors.

Pre-eruptive vs. Post-eruptive Fluoride
At the time of tooth eruption, enamel is not quite completely mineralized and will undergo what is now called the post-eruptive period (topical effect) that will take approximately two years. Throughout this enamel maturation period, fluoride continues to accumulate in the outer surfaces of the enamel. This fluoride is derived from the saliva, as well as exposure to fluoride-containing products such as food and beverages. Most of the fluoride incorporated into the developing enamel occurs during what is now called the pre-eruptive (systemic effect) period of enamel formation, but also occurs topically during the post-eruptive period of enamel maturation.

Types of Professional Fluorides
The two types of fluoride available for the dental professional to use to prevent or reduce caries are neutral sodium fluoride gels, foams, and varnish and acidulated phosphate fluoride gels and foams. Sodium and acidulated fluoride forms calcium fluoride in enamel after use. However, sodium fluoride’s main benefit is that it does not etch porcelain and ceramic restorations.

For many decades, an operator-applied professional fluoride method by disposable mouth tray was used with a 1.23% APF gel or a 2% sodium fluoride. This procedure offered a method that was convenient to use and was
somewhat tolerated by patients. However, sodium fluoride varnish is recommended as the standard of care for children by both the American Academy of Pediatric Dentistry and the American Dental Association. There are several reasons, such as patient compliance, the higher ppm of fluoride in varnish, and the ability to place it intraorally in any setting.

The AAPD and ADA continuously update their websites posting current evidence-based policies. The ADA Council on Scientific Affairs has posted several Clinical Practice Guidelines, including Topical Fluoride for Caries Prevention. Current guidelines indicate 2.26% sodium fluoride varnish and 1.23% APF fluoride gel is recommended over other types of fluoride. Other ADA Clinical Practice Guidelines include: Non-fluoride Caries Preventive Agents, Fluoride Supplements, and Fluoride Toothpaste for Young Children, to name a few. I’ve always said you “don’t have to be an expert on everything, you just need to know where to find it.” Almost monthly, I’m on the AAPD and ADA websites reviewing current professional guidelines and policies.

**One-minute vs. Four-minute Fluoride Applications**

Research studies continue to show that fluoride uptake in enamel is time-dependent due to a diffusion-controlled process and that it should be left on the teeth for the full four minutes with the gel tray method. Although the most update of fluoride is in the first minute, research continues to support the full 4 minutes providing the best topical benefit when using the tray method. The ADA states “there are considerable data on caries reduction for professionally applied topical fluoride gel treatments of four minutes or more. In contrast there is laboratory, but no clinical equivalency data on the effectiveness of 1-minute fluoride gel applications.” Upon examining current information on this topic, dental professionals need to determine if professional topical fluoride applications are appropriate for all their patients, based on caries risk factors. The American Dental Association’s current fluoride evidence-based guidelines indicate a 2.26% sodium fluoride varnish be applied at least every 3-6 months for children younger than 6 years of age at an elevated risk for caries. For children 6-18 years of age who are at risk for caries, the ADA recommends 2.26% sodium fluoride varnish every 3-6 months or 1.23% APF gel for 4 minutes at least every 3-6 months. However, with acidulated fluoride gel at only 12,300 ppm and sodium fluoride varnish at 22,600 ppm fluoride, it would appear sodium fluoride varnish would be more beneficial. However, we also know that fluoride’s efficacy is enhanced with an acidic environment. See the current ADA Clinical Recommendations for Use of Professionally-Applied or Prescription-Strength, Home-use Topical Fluoride Agents for Caries Prevention in Patients at Elevated Risk of Developing Caries on the ADA website.

**Professional Fluoride Treatment**

No matter which professional fluoride is used, note that a professional prophylaxis is not needed prior to the application of professional topical fluoride products, because fluoride uptake and caries inhibition are not improved by a prophylaxis. Also, the use of a fluoride prophylaxis paste at their recall appointment does not replace a professionally applied fluoride application. Moreover, the patient with a high caries risk should not only receive topical fluoride treatment on a quarterly basis, but will require a prescription for a 5,000 ppm toothpaste to use at home daily, as well. Based on a recent clinical examination, if a patient is diagnosed as a low caries risk, then a topical fluoride treatment is not necessary. There is little fluoride deposition lasting more than 24 hours when fluoride is applied to sound, fully-maturated enamel. Therefore, there appears to be no preventive benefits from the application of fluoride to adult patients with sound enamel.

**Root Surface Caries on the Rise**

Root surface caries has increased due to the increased retention of teeth during adulthood, thanks to various caries-preventive measures and patients living longer. About one-half of U.S. adults are affected with root surface caries by age 50, with an average of about three lesions by age 70. Fluoride is very effective in preventing root surface caries. A recent systematic review on root surface caries in the *Journal of Dental Research* indicated the regular
use of a 5,000 ppm fluoride dentifrice and quarterly sodium fluoride varnish treatments by a dental professional resulted in a decrease of root surface caries progression and initiation.

**Amorphous Calcium Phosphate (ACP)**

Although ACP is currently not indicated as “strong” in the evidence-based literature, ACP has anticariogenic properties to promote the remineralization of enamel and cementum, as well as balancing the pH of saliva and reducing dentinal sensitivity. Regular application of ACP with fluoride increases levels of calcium and phosphate levels in biofilm and tooth structure. In fact, an addition of 2% ACP (i.e., Recaldent) to as little as 450 ppm fluoride can significantly increase the incorporation of fluoride ions into biofilm and co-localize calcium and phosphate ions with fluoride ions at the tooth surface. An adjunct treatment of ACP and a 1,100 ppm fluoridated dentifrice (toothpaste) can decrease bacteria and increase mineralization. Patients who benefit from ACP include conditions such as orthodontic, white spots, tooth whitening, oncology, hypersensitivity, high caries risk, xerostomia, and acid erosion due to sodas and other drinks. Calcium phosphate with fluoride can be added to teeth with various applicators. Custom mouthguards can also be used for longer application times.

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**Diet and Dental Caries**

**Introduction**

Local bacteria, *S. mutans* ingest fermentable carbohydrates decreasing plaque pH. Similarly, any food or beverage that contains fermentable carbohydrates, consumed over a prolonged period, or with increased frequency will have the same effect. Fruits in general tend to have low cariogenic potential, with the exception of dried fruits and certain fresh fruits. Apples, bananas, and grapes contain 10-15% sucrose, citrus fruit 8%, and berries and pears only 2%. Although citrus fruits are high in water, stimulate saliva production, and provide an excellent source of vitamin C, they can potentially erode tooth enamel if consumed in large quantities over an extended period of time.

**Non- or Low-Acidogenic Foods**

- Raw vegetables.
- Meat, fish, poultry.
- Beans, peas, nuts, natural peanut butter.
- Milk and cheeses.
- Non-sugar sweeteners, such as xylitol, aspartame, saccharin, sucralose.

Soft drinks, sport drinks, and energy drinks containing sugar are big business in the U.S. Frequent consumption of sugary drinks has long been known to contribute to dental caries. According to the Centers for Disease Control (CDC), consumption of soft drinks in the U.S. has increased over the last 30 years with both adults and children. Soft drinks have been linked to obesity and type-2 diabetes. Teenagers and young adults consume more sugar drinks than other age groups. Males consume more soft drinks than females and low-income Americans consume more soft drinks than those with higher incomes. A non-diet soft drink is made from carbonated water, added sugar and flavors. Each can of soda contains the equivalent of about ten teaspoons, or 40 grams, of sugar. Mountain Dew® is so popular in the U.S. that the coined phrase “Mountain Dew Mouth” is a recognized term used by the dental profession for patients diagnosed with rampant caries and/or erosion.

**Energy and Sports Drinks**

A recent study published in *General Dentistry*, the clinical journal for the Academy of General
Dentistry (AGD) indicated there is a rise in energy and sports drink use, especially with adolescents. The researchers conducted a lab experiment where they exposed samples of human tooth enamel to 13 different energy and sports drinks and found that energy drinks had the potential to be more harmful than sports drinks after five days. The AGD reports 30-50% of teenagers consume energy drinks regularly and approximately 62% of adolescents consume at least one sport drink daily. Even if sugar-free drinks are consumed to prevent dental caries, acids in these types of drinks can cause enamel erosion if chronically consumed. We’ve heard the phrase “everything in moderation.” As dental professionals we educate our patients about frequently consuming sugary drinks and the potential for dental caries. However, to ask our patients to stop drinking their favorite drink would seem unreasonable. Asking our patients to consume their favorite drinks with meals and not throughout the day, would reduce the number of daily lactic acid attacks to enamel and exposed cementum.

**Pit & Fissure Sealants**

**Introduction**

Sealants have been endorsed by the American Dental Association and the U.S. Public Health Service as being effective in preventing pit and fissure caries. Pit and fissure caries accounts for over 80% of active caries in children. However, these surfaces make up only 15% of the total tooth surfaces. Sealants must not be overlooked as another form of preventive dentistry, along with plaque control, fluoride therapy and sugar discipline.

**The Criteria for Selecting Teeth for Sealants**

The criteria for selecting teeth for sealant placement include deep-occlusal fissures, fossae (Figure 21), or occlusal/lingual pits. A sealant may be contraindicated (not indicated) if:

1. a patient’s behavior does not permit the required dry-field to place sealants,
2. an open carious lesion exists,
3. caries exist on other surfaces of the same tooth and restoration will disrupt an intact sealant,
4. a large occlusal restoration is already present.

The disease susceptibility of the tooth should be considered when selecting teeth for sealants, not the age of the patient. Sealants appear to be equally retained on occlusal surfaces of both primary and permanent dentition. Sealants should be placed on the teeth of adult patients if there is evidence of existing or impending caries susceptibility, such as a diet excessive in carbohydrates or as a result of a drug or radiation-induced xerostomia.

**Types of Sealant Materials**

There are two types of resin-based sealants available today, filled and unfilled. Filled sealants are a combination of resins, chemicals, and fillers. The purpose of the filler is to increase bonding strength and resistance to abrasion and wear. Due to the hardness and wear resistance of filled sealants, they must be checked after placement with articulating paper and adjusted with a dental hand piece and appropriate bur. Unfilled sealants have a higher ratio of resin to filler material, and do not need to be adjusted with a dental handpiece; they are in essence self-occluding. Due to high viscosity (rate of flow) of unfilled sealants, they readily flow into the pits and fissures.

Because fluoride uptake increases the enamel's resistance to caries, the use of a fluoridated resin-based sealant may provide an additional anticariogenic effect. Fluoride-releasing sealants have shown antibacterial properties, as well as a greater artificial caries resistance compared to a non-fluoridated sealant material. The fluoride will leach out over a period of time into the adjacent enamel. Eventually the fluoride content of the sealant should be exhausted, but the content of the enamel greatly increased.
Successful Sealant Retention
For sealant retention, the surface of the tooth must:
1. have a maximum surface area,
2. have deep, irregular pits & fissures for better retention,
3. be clean, and most crucial to retention,
4. be absolutely dry and uncontaminated with saliva residue at the time of the sealant placement.

All of these criteria must be present for a sealant to be retained. If within a few months the sealants are lost, it is most likely due to the faulty technique by the dental clinician.

The Pit & Fissure Sealant Procedure
It is highly recommended that sealant application be performed as a two-person procedure. Even when the patient is an adult, isolation and application are difficult with just one clinician.
1. Prior to the application of a tooth conditioner, the tooth surface should be cleaned by air polishing, polishing with non-fluoridated pumice paste, hydrogen peroxide, or enameloplasty. All heavy stains, deposits, debris and plaque should be removed. After cleaning the occlusal surface, dry the area thoroughly for 10 seconds.
2. Increasing the surface area requires a phosphoric acid tooth conditioner/etchant. Since sealants do not directly bond to the teeth, the adhesive force must be improved by tooth conditioner. If any of the tooth surfaces do not receive the tooth conditioner, the sealant will not be retained. Isolation of the teeth includes cotton rolls, dry-angles, or ideally with a dental dam. Follow manufacturer recommendations for the required to remain on the enamel, as well as rinsing times. The appearance of the enamel by the tooth conditioner/etchant should appear as white, dull, and chalky. If the enamel does not appear white and chalky, tooth conditioner is reapplied according to manufacturer instructions. Dry thoroughly before sealant application.
3. The application of the sealant material requires the pits and fissures to be filled and the material brought to a knife-edge approximately halfway-up the inclined plane of the cusp ridge (Figure 22). Any bubbles must be broken before polymerization to prevent a defect. Polymerize with a curing light. Follow manufacturer directions for time.
4. Check the sealant with an explorer for proper placement and polymerization. Check occlusion with articulating paper and check interproximal contacts with floss. If sealant material is present interproximal, use a scaler to remove excess. If occlusion is high, use a slow-speed rotary bur such as a no. 4 or 8 round bur. Recheck the occlusion again. Sealants should be checked at each dental examination for retention.

Mouthguards & Sports Dentistry
Introduction
Whether for exercise, competition, or the simple enjoyment of recreational activity, increasing numbers of health-conscious Americans are involved in sporting activities. Approximately 30 million children participate in various sports programs and another 80 million are involved in unsupervised recreational sports. Dentistry plays a large role in treating oral and craniofacial injuries resulting from sporting activities.

Prior to the 1980s, little was available in the scientific literature in terms of sports-related injury assessment. Several injury surveillance systems have been established in an attempt to track sports-related accidents and injuries. While all injury surveillance systems provide valuable information on generalized sports injuries, very little information is available regarding dental or craniofacial injuries. In terms of data collection and analysis of dental injuries due to sporting activities, the field continues to be open for dentistry to assume a major leadership role in assessing dental injuries resulting from sporting activities.
Statistics
More than 5 million teeth are knocked out each year; many during sports activities, resulting in nearly $500 million spent on replacing these teeth each year. In an issue of Dental Traumatology it was reported among children ages 13-17, sports-related activities were associated with the highest number of dental injuries. Males are traumatized twice as often as females, with the maxillary central incisor being the most commonly injured tooth. Studies of orofacial injuries published over the last thirty years reflects various injury rates dependent on the sample size, the age of participants, and the specific sports. In soccer, baseball, and softball, a small percentage of children wear mouthguards. The National Federation of State High School Association (NFHS) indicated that of all injuries, less than 1% are oral injuries because football players are wearing properly fitted mouthguards. Prior to the use of mouthguards, injuries to the orofacial areas occurred over 50% of the time. The NFHS recommends mouthguards for any sports where there is a potential for orofacial injury from body contact. It is clear that the need for studies, education, and regulations for mouthguard implementation is a major concern in the dental field.

All athletes constitute a population that is extremely susceptible to dental trauma. Dental injuries are the most common type of orofacial injury. An athlete has a greater chance of receiving an orofacial injury every season of play. It is estimated that mouthguards prevent between 100,000 and 200,000 oral injuries per year in professional football alone. The American Academy of Pediatric Dentistry and the American Dental Association recommend a mouthguard for all children and youth participating in any organized sports activity.

Following is a list of types of injuries an athlete may sustain that are of particular concern to the dental professional.

Soft Tissue Injuries
The face is often the most exposed part of the body in athletic competition and injuries to the soft tissues of the face are frequent. Abrasions, contusions, and lacerations are common and should be evaluated to rule out fractures or other significant underlying injury. These usually occur over a bony prominence of the facial skeleton such as the brow, cheek, and chin. Lip lacerations are also common.

Fractures
Fractures of the facial bones present an even more complex problem. One of the most frequent sites of bony injury is the zygoma (cheekbone). Fractures of the zygoma, occurring as a result of direct blunt trauma from a fall, elbow, or fist, account for approximately 10% of the maxillofacial fractures seen in sports injuries. Like the zygoma, the prominent shape and projection of the mandible cause it to be frequently traumatized. Approximately 10% of maxillofacial fractures resulting from sporting activities occur in the mandible when the athlete strikes a hard surface, another player, or equipment. In a mandibular fracture, airway management is the most important aspect of immediate care. In both children and adults, the condyle is the most vulnerable part of the mandible. Fractures in this region have the potential for long-term facial deformity. Recent data suggest that condylar fractures in children can alter growth of the lower face.

TMJ Injuries
Most blows to the mandible do not result in fractures, yet significant force can be transmitted to the temporomandibular disc and supporting structures that may result in permanent injury. In both mild and severe trauma, the condyle can be forced posteriorly to the extent that the retrodiscal tissue is compressed. Inflammation and edema can result, forcing the mandibular condyle forward and down in acute malocclusion. Occasionally this trauma will cause intracapsular bleeding, which could lead to ankylosis of the joint.

Tooth Intrusion
Tooth intrusion occurs when the tooth has been driven into the alveolar process due to an axially directed impact. This is the most severe form of displacement injury. Pulpal necrosis occurs in 96% of intrusive displacements and is more likely to occur in teeth with fully formed roots. Immature root development will usually mean spontaneous re-eruption. Mature root
development will require repositioning and splinting or orthodontic extrusion.

**Crown and Root Fractures**

Crown fractures are the most common injury to the permanent dentition and may present in several different ways. The simplest form is crown infraction. This is a crazing of enamel without loss of tooth structure. It requires no treatment except adequate testing of pulpal vitality. Fractures extending into the dentin are usually very sensitive to temperature and other stimuli. The most severe crown fracture results in the pulp being fully exposed and contaminated in a closed apex tooth or a horizontal impact may result in a root fracture. The chief clinical sign of root fracture is mobility. Radiographic evaluation and examination of adjacent teeth must be performed to determine the location and severity of the fracture as well as the possibility of associated alveolar fracture. Treatment is determined by the level of injury.

**Avulsion**

Certainly one of the most dramatic sports-related dental injuries is the complete avulsion of a tooth. According to recent studies by the American Academy of Pediatric Dentistry, 0.5-3% of injuries involving the mouth result in an avulsed tooth. A tooth that is completely displaced from the socket may be replaced with varying degrees of success depending, for the most part, on the length of time it is outside the tooth socket. If the periodontal fibers attached to the root surface have not been damaged by rough handling, an avulsed tooth may have a good chance of recovering full function. After two hours, the chance for success is greatly diminished. The fibers become necrotic and the replaced tooth will undergo resorption and ultimately be lost. See the American Academy of Pediatric Dentistry website relating to avulsed teeth recommendations for dental professionals.

**Emergency Treatment**

Due to the high incidence of sports-related dental injuries, it is vital that primary healthcare providers such as school nurses, athletic trainers, team physicians, and emergency personnel are trained in the assessment and management of dental injuries. Interested dental professionals can assist these providers by offering to speak at schools or community functions, so that the primary health care providers who will deliver immediate treatment at sporting events understand the proper protocol for orofacial injuries, such as displaced teeth, avulsed teeth, lacerations, and crown fractures. The ADA has urged its members to work together with schools, colleges, athletic trainers, and coaches to develop mouthguard programs and guidelines to prevent sports injuries.

The main method for preventing orofacial injuries in sports is to wear mouthguards and headgear, consisting of a helmet and face protector. Parental perceptions of children's risks to injury, expenses associated with protective gear, and peer pressure may influence use of mouthguards. The observed patterns of mouthguard wearing by males and females can represent cultural differences, peer pressure, and/or nature of sports played, including the following:

- perceptions that females are less aggressive and thus, a reduced risk of injury may exist,
- perceptions regarding the absence of long-term commitment to a sport may result in a differential willingness to devote resources to females,
- aesthetic appeal may influence protective orofacial gear usage, and
- females may play in non-league-based sports with fewer or less stringent rules or may play less combative sports than males.

The literature indicates the behavior of athletes is most influenced by their coaches. Coaches report that most information about mouthguards comes from sales representatives, educational materials, and dentists.

**The Ideal Mouthguard**

When considering recommendations, an ideal mouthguard:

- protects the teeth, soft tissue, bone structure, and temporomandibular joints
- diminishes the incidence of concussions and neck injuries
- exhibits protective properties that include high power absorption and power
distribution throughout the expansion
• provides a high degree of comfort and fit to the maxillary arch
• remains securely and safely in place during action
• allows speaking and does not limit breathing
• is durable, resilient, tear resistant, odorless, and tasteless

The American Society for Testing and Materials and the manufacturers of mouthguards have classified the mouthguards into three types:

• **Stock Mouthguards**
  Stock mouthguards may be purchased from a sporting goods store or pharmacy. They are made of rubber, polyvinyl chloride, or a polyvinyl acetate copolymer. The advantage is that this mouthguard is relatively inexpensive, but the disadvantages far outweigh the advantages. They are available only in limited sizes, do not fit very well, inhibit speech and breathing, and require the jaws to be closed to hold the mouthguard in place. Because the stock mouthguards do not fit well, the player may not wear the mouthguard due to discomfort and irritation. The Academy of Sports Dentistry has stated that the stock mouthguard is unacceptable as an orofacial protective device.

• **Mouth-formed Protectors**
  There are two types of mouth-formed protectors: the shell-liner and the thermoplastic mouthguard. The shell-liner type is made of a preformed shell with a liner of plastic acrylic or silicone rubber. The lining material is placed in the player's mouth, molds to the teeth and then is allowed to set. The preformed thermoplastic lining (also known as “boil and bite”) is immersed in boiling water for 10 to 45 seconds, transferred to cold water and then adapted to the teeth. This mouthguard seems to be the most popular of the three types and is used by more than 90% of the athletic population (Figure 23). The mouthguard is made by the dental office and fits exactly to the athlete's mouth. The advantages include: fit, ease of speech, comfort, and retention. By wearing a protective mouthguard, the incidence of a concussion by a blow to the jaw is significantly reduced because the condyle is separated form the base of the skull by placing the mandible in a forward position.

• **Custom-Made Mouth Protectors**
  This is the superior of the three types and the most expensive to the athlete. But isn't it worth the cost to protect an athlete's teeth from injury? Most parents will spend quite a bit of money on athletic shoes, but might not think about protecting their child's teeth. This mouthguard is made of thermoplastic polymer and fabricated over a model of the athlete's dentition (Figure 24). The mouthguard is made by the dental office and fits exactly to the athlete's mouth. The advantages include: fit, ease of speech, comfort, and retention. By wearing a protective mouthguard, the incidence of a concussion by a blow to the jaw is significantly reduced because the condyle is separated form the base of the skull by placing the mandible in a forward position.

**Dental Team's Role**
Sports dentistry should encompass much more than mouthguard fabrication and the treatment of fractured teeth. As dental professionals, we have a responsibility to educate ourselves and the community regarding the issues related to sports dentistry and specifically to the prevention of sports-related oral and maxillofacial trauma. The American Dental Association publishes brochures that explain the different types of mouthguards and their advantages. A field
emergency kit is a simple and inexpensive item for the dentist attending a sporting event (see Table 2).

“Fitting mouthguards is a perfect activity for a dental society,” according to a Professor of Prosthodontics at the University of Texas-San Antonio Dental School. “You simply get a group of dentists together at the school and begin making impressions. It spreads out the costs and cuts down on the time. And it's worthwhile.” A general dentist in San Marcos, Texas, and the dentist for the Southwest Texas State University football team indicates, “It's a great practice builder. I don't charge for my time or the materials to make a mouthguard. I do it for free. As a result, we get a lot of referrals.”

As dental professionals your role should include:
- Good impression techniques and knowledge of mouthguard materials/manipulations in mouthguard creation.
- Communications with children and parents/guardians. Dental charting should include questions about involvement in sports and the use of mouthguards. If patients are unwilling/unable to pay for an office-made guard, the dental assistant should educate patients about affordable boil and bite-type guards for minimal protection.
- Basic instructions on emergency treatments of dental emergencies such as avulsion, fracture, extrusion, and intrusion that an adult can perform immediately until dental treatment can be attained.

Summary
Dental professionals must be aware of the current evidence-based preventive dental literature in order to educate their patients. Although dental caries has declined in parts of the U.S. due to the contribution of fluoride, dental professionals will unfortunately, continue to see dental caries among dental patients due to chronic social habits such as energy, sports drinks, and soda that increase...
the amount of lactic-acid attacks the patient receives daily. Our role as dental professionals is to complete caries risk assessment on each of our patients routinely. We know that our patients’ risk of caries can change, even at their last 6 month recall appointment. With a new clinical examination, updating the patient’s risk assessment, and taking the time to educate each patient on biofilm removal we can hopefully prevent future dental caries.
Course Test Preview
To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/professional-education/ce-courses/ce334/start-test

1. Preventive dentistry started in the ____________.
   a. 1950s  
   b. 1960s  
   c. 1970s  
   d. 1990s

2. Dental caries can be defined as ____________.
   a. transmissible  
   b. broad spectrum  
   c. circumscribed  
   d. carcinogenic

3. A carious lesion is considered incipient when the demineralization occurs only in the ____________.
   a. enamel  
   b. DEJ  
   c. dentin  
   d. pulp cavity

4. ______ acid is produced by bacteria in the oral cavity after the ingestion of carbohydrates.
   a. Carbonic  
   b. Lactic  
   c. Hydrochloric  
   d. Sulfuric

5. ______ is the type of early stage bacteria that causes dental caries.
   a. Lactobacilli  
   b. Streptococci mutans  
   c. Porphyromonas gingivalis  
   d. Prevotella

6. ______ is the nutrient required to cause dental caries.
   a. Lipids  
   b. Proteins  
   c. Fats  
   d. Carbohydrates

7. The oral pathology lesion that is associated with fungus is ____________.
   a. candidal leukoplakia  
   b. erythroplakia  
   c. squamous cell carcinoma  
   d. malignant melanoma
8. The pathology that is associated with sun exposure is ____________.
   a. candidal leukoplakia
   b. erythroplakia
   c. squamous cell carcinoma
   d. malignant melanoma
   e. Both C and D

9. It takes only ________ for dental plaque to double in mass.
   a. two days
   b. twelve hours
   c. twenty-four hours
   d. two weeks

10. Recent research studies link calculus as the contributing factor to periodontal disease rather than plaque. Daily removal of biofilm is critical to reduce oral diseases.
   a. Both statements are true.
   b. The first statement is true. The second statement is false.
   c. The first statement is false. The second statement is true.
   d. Both statements are false.

11. The preferred toothbrushing method for children is ____________.
    a. Charters technique
    b. Modified Bass technique
    c. Stillman technique
    d. Fones technique

12. The flossing method preferred for children is the ____________.
    a. spool technique
    b. circle or loop technique

13. When teaching your patient to floss, the floss should be approximately ____________ in length or more.
    a. 18 inches
    b. 10 inches
    c. 13 inches
    d. 12 inches

14. If a patient has large spaces (embrasures), the recommended interdental aid/s are ____________.
    a. wooden/plastic triangular sticks
    b. interproximal brushes
    c. dental floss
    d. Both A and B

15. Professional topical fluoride applications are based upon ____________.
    a. the caries risk factors of the individual patient
    b. what type of fluoride you have on hand
    c. the number of restorations present
    d. if the patient is caries free
16. The ADA recommended sodium fluoride varnish is ______%.
   a. 2.26
   b. 1.23
   c. 8
   d. 10

17. A professional prophylaxis is required prior to the application of professional topical fluoride products. The post-eruptive (topical) effect of fluoride has played an even more vital role in reducing dental caries.
   a. Both statements are true.
   b. The first statement is true. The second statement is false.
   c. The first statement is false. The second statement is true.
   d. Both statements are false.

18. __________ is the recommended professional fluoride treatment for children younger than 6 years of age by the ADA and AAPD.
   a. Stannous fluoride
   b. APF fluoride
   c. Fluoride varnish
   d. Sodium fluoride

19. Fluoride content in acidulated phosphate fluoride is approximately ______ percent.
   a. 2.03
   b. 1.23
   c. 3.04
   d. 4.12

20. For adequate sealant retention, the tooth must __________.
   a. have no pits for optimum retention
   b. be moistened before placement
   c. be clean and fully dried before placement
   d. be shiny and translucent prior to placement

21. According to studies, root surface caries has __________ in the last 30 years.
   a. decreased
   b. increased
   c. remained constant
   d. no pattern

22. Regular use of a 5,000 ppm fluoride dentifrice and quarterly sodium fluoride varnish treatments may decrease root surface caries progression and initiation. About one-fourth of U.S. adults are affected with root surface caries by age 70.
   a. Both statements are true.
   b. The first statement is true. The second statement is false.
   c. The first statement is false. The second statement is true.
   d. Both statements are false.
23. The patient should not eat or drink anything for _____ minutes after a professional fluoride application.
   a. 5-10 minutes
   b. 20-30 minutes
   c. 1 hour
   d. It is not necessary to wait.

24. Contraindications for placement of a sealant is (are) ____________.
   a. an open carious lesion exists
   b. an occlusal restoration is already present
   c. the patient's behavior does not permit a dry isolated field
   d. All of the above.

25. One can of regular soda contains _____ teaspoons of sugar.
   a. 2
   b. 6
   c. 8
   d. 10

26. In sports injuries, males are traumatized twice as often as females. The mandibular central incisor is the most commonly injured tooth.
   a. Both statements are true.
   b. The first statement is true. The second statement is false.
   c. The first statement is false. The second statement is true.
   d. Both statements are false.

27. Concerning mouthguards, the literature indicates the behavior of athletes is most influenced by their ____________.
   a. coach
   b. dentist
   c. parent
   d. peers

28. The dental professional's role in promoting sports safety is to ____________.
   a. obtain good impressions for custom mouth guards
   b. encourage coaches and parents to promote mouth guard use
   c. give correct basic instructions immediately during an emergency
   d. All of the above.

29. The most common tooth injury regarding permanent dentition sports injuries is ____________.
   a. crown fracture
   b. root fracture
   c. intrusion
   d. avulsion

30. The best success rate for a re-implanted avulsed tooth after a trauma is ____________.
   a. within 2 hours
   b. between 2-3 hours
   c. between 4-5 hours
   d. between 6-10 hours
References
About the Author

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