

Current Concepts in Preventive Dentistry



Course Author(s): Connie M. Kracher, PhD, MSD

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Intended Audience: Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assistant Students

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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.

Conflict of Interest Disclosure Statement

- Dr. Kracher reports no conflicts of interest associated with this course.

Introduction – Preventive Dentistry

The Current Concepts in Preventive Dentistry course is updated frequently and includes current, evidence-based literature that dentists and allied dental providers will utilize during patient assessment. Preventive dentistry is a comprehensive approach that calibrates the entire dental team, determining individualized care and education of each patient in the dental practice.

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Overview

It is difficult to believe that preventive dentistry has only been in practice for less than 60 years

in the United States. Prior to the 1960s, dentistry did not include routinely scheduled patient care. Although preventive dentistry is common practice in the U.S., we have seen an increase in dental caries in children age 2-11 years old. The most recent report by the National Institute of Dental and Craniofacial Research (NIDCR) indicates overall, dental caries in deciduous teeth in children age 2-11 declined from the early 1970s until the mid-1990s. From the mid-1990s until the latest NIH nutrition examination survey (1999-2004), this trend has reversed, and what is more troubling is that this trend is more severe in younger children. Currently 42% of children 2-11 years old have been diagnosed with dental caries in their primary dentition. Black and Latino children, and those living in families with lower incomes have more dental caries. With adolescent children ranging from 12-19 years old, dental caries did not decrease in Latino-Americans, and those living in families with lower incomes between 100% and 199% of the Federal Poverty Level (FPL). Current statistics indicate 59% of adolescents 12-19 years old have had dental caries in their permanent teeth and almost 5% of adults 20-64 years of age are edentulous. In this same adult age group, 92% have had dental caries in their permanent teeth. There also continues to be an unmet need where Black and Latino adults, younger adults, and those with lower incomes and less education have more untreated dental caries. In this same age category, we are also seeing White adults living in families with higher incomes and more education have been diagnosed with more dental caries than in past reports.

The U.S. Census reports by 2060 the number of seniors is expected to reach almost 95 million or 24% of the overall U.S. population. For the first time in U.S. History, older adults will outnumber children by 2035. With seniors age 65 years and older, approximately 5% are edentulous and 93% of seniors have had dental caries in their permanent teeth. Again, we also see White seniors and those living in families with higher incomes and more education have had more dental caries. The National Center for Health Statistics (NHANES) of the Center for Disease Control (CDC) indicates the average older adult takes 4-5 prescription drugs. In addition, seniors reported also taking 2-3 over-

the-counter drugs. Drugs most commonly prescribed for our patients include statins, antihypertensive agents, analgesics, drugs for endocrine dysfunction, e.g., hypothyroid and diabetes, anticoagulant and antiplatelet agents, and drugs for respiratory and gastrointestinal dysfunction. We know there are hundreds of drugs that contribute to xerostomia. A 2018 systematic review and metaanalysis examined medications that cause the reduction of saliva in the older population. The researchers found seniors who took medications for urinary incontinence had the greatest risk for xerostomia. They also found antidepressants and psycholeptic prescription drugs significantly affected saliva production. To learn more about pharmacological effects, see the additional resources section at the end of the course.

The American Academy of Pediatric Dentistry (AAPD) and the American Dental Association (ADA) recommend children be seen by a dentist in their first year of age. We know that evidence-based prevention, early detection and management of oral conditions greatly benefit children. Delayed care can exacerbate oral conditions, leading to the potential for future oral pain and costly dental care. A 2018 national survey conducted on behalf of the AAPD revealed 74% of parents do not take their children to the dentist by their first birthday. Even though 96% of parents surveyed indicated oral health is important, 3 in 10 parents considered toothaches a less serious ailment than earaches, tummy aches, and sore throats.

The National Cancer Institute (NCI) of the National Institutes of Health (NIH) indicates oral cancer kills one American every hour of every day and only 50% of those diagnosed with oral cancer will survive more than 5 years. As dental providers, we know early detection of oral cancer is critical. However, NCI indicates only 1/3 of oral cancer is found in the early stages, with 1/3 of oral cancer occurring in patients younger than 55 years of age. Recent studies by John Hopkins indicates 1 in 7 people diagnosed with oral cancer were younger than 40 years of age, with 25% of these patients not having the traditional risk factors for oral cancer. About 2/3 of oral cancer occurs in the floor of the mouth and tongue and 1/3 of cases are diagnosed as

oropharyngeal cancer. We know that tobacco use places our patients at high-risk for cancer. Current statistics indicate people who use tobacco are six times more likely to develop oral cancer, where 8 in 10 patients diagnosed with oral cancer have smoked. 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 electric 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.
- Based on caries assessment, determine 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

The National Institute of Dental and Craniofacial Research indicates 92% of adults 20-64 years of age have dental caries. 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 dental 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, carbohydrates are broken down in the oral cavity by the protein enzyme amylase. This reaction causes lactic acid to be produced by microorganisms as an end-product, thereby demineralizing (removing calcium and phosphate) in the enamel matrix. If the demineralization of enamel is not reversed by the action of fluoride and/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 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

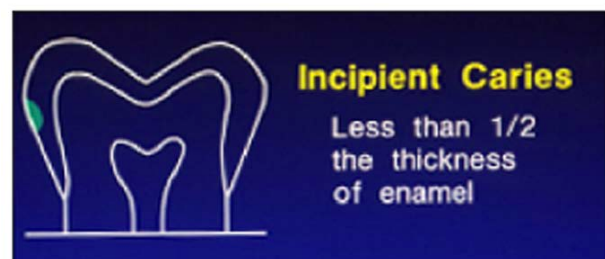


Figure 1. Incipient Interproximal Caries.

Image source: The Ohio State University College of Dentistry

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 caregiver's saliva. The colonization of *S. mutans* is facilitated by a frequent carbohydrate-rich diet of the parent or 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 due to the retentiveness of plaque. 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 fermentable carbohydrates are introduced into the oral cavity, lactic acid production occurs as an end-product of *S. mutans* 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 (removes 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 and/or calcium and phosphate 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 may occur. This incipient or 'white spot' lesion may take up to approximately nine months or more to be seen radiologically as radiolucent (dark spot) on a dental image.

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



Figure 2. Pit and Fissure Caries.

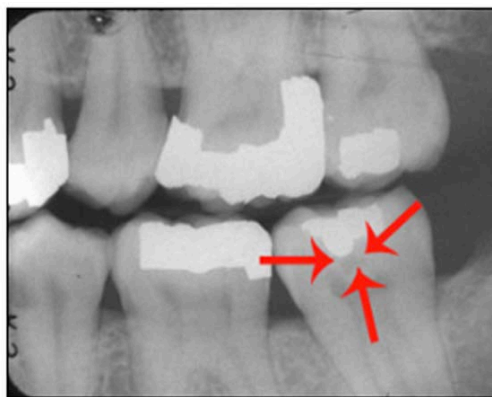


Figure 3. Smooth Surface Caries & Interproximal Surface Caries.



Figure 4. Root Surface Caries.

Image source: The Ohio State University College of Dentistry



Figure 5. Secondary or Recurrent Caries.

of the disease. Risk factors are the lifestyle 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 ADA's CRA Forms. However, dental providers can create customized caries risk assessments. For example, just one variable "dental caries in the last three years" can automatically place your patient in the high-risk category. This patient would be treated as a high-risk caries patient until they no longer have dental caries in three years. As with all caries risk assessments, individual assessment should be developed for each patient. We know that patients who are at risk for dental caries include those patients with certain factors related to general health (diseases, physically or mentally compromised individuals), 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), and patients with certain socioeconomic factors (low education level, low

income), However, the most current research conducted by the National Institute for Dental and Craniofacial Research indicates White adult patients (20-64 years of age) and White seniors (65 years and older) and those living in families with higher incomes and more education have had more dental caries. For example, we have seen an increase in energy drinks in the U.S. population.

We also know there are other contributing factors in 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 future dental appointments, we ensure their caries risk is current, as risk can change due to multiple variables, e.g., change in medications affecting saliva production, oral hygiene (removal of plaque and bacteria), the patient (host) immunity, and bacterial transmission from family members.

Table 1. Methods to Determine Caries Risk.

Oral Risk Factors	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Carbohydrate intake, including frequency (consumption of sugar-sweetened beverages, e.g., soda, fruit drinks, energy drinks, and sports drinks)?
Microbial and Salivary Factors	<ul style="list-style-type: none"> • Bacterial count? (saliva testing) • Xerostomia? • Physiological conditions? • Prescription drugs affecting saliva rate? • Salivary stones?
Family or Social Risk Factors	<ul style="list-style-type: none"> • Multiple in-between carbohydrates/day ingested? • Dental fear? • Family caries history?
Immunity/Medical Risk Factors	<ul style="list-style-type: none"> • Chronic diseases? • Medically or physically challenged?

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 future dental 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 caries, follow the recommended treatment protocols as utilizing evidence-based dentistry recommendations by the ADA and the AAPD. The current ADA's Evidence-based Dentistry Clinical Practice Guidelines should be utilized when calibrating the entire clinical team on caries treatment protocols and other forms of treatment. The current ADA Clinical Guidelines include: nonrestorative treatments for carious lesions, topical fluoride, non-fluoride caries preventive agents, sealants, oral cancer, fluoride toothpaste for young children, prosthetic joint, and infective endocarditis, and nonsurgical treatment of chronic periodontitis.

With moderate to high-risk caries patients, schedule frequent fluoride varnish applications in your office, as well as prescribe fluoride toothpaste. Although the current ADA evidence-based practice guidelines do 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 have xylitol as their first ingredient. One of my favorite flavored chewing gums continues to be Peppermint Ice Breakers Ice

Cubes. The flavor lasts a considerable time compared to other Ice Breakers flavors and other different sugarless gum brands. As long as the patient does not have TMJ dysfunction, chewing gum is recommended by the ADA and the AAPD. There are also xylitol mints available over-the-counter. In fact, everyone can benefit from sugarless xylitol gum and mints, not just moderate- to high-risk caries patients, e.g., stimulating saliva and the sugar alcohol benefits.

Skin, Lip, Oral, and Esophageal Cancers

Introduction

Patients must be screened for oral cancer at the initial appointment and each routine dental examination by performing an extraoral and intraoral examination. Radiographic imaging is normally prescribed based on an individual's diagnoses, but suspicious areas may require additional imaging. There are various types of pathology lesions found in the oral cavity and the head and neck regions. Even though allied dental providers cannot diagnose lesions in most U.S. states, they should know 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 (AAOMP) website is one resource to download CPC Case Histories with photographs of pathologies. Four pathologic categories are explained in this section of the course. Each dental facility should have oral pathology books and online resources with color photographs available for dental clinicians to assist with diagnoses and differential 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.



Figure 6. Leukoplakia.
Image courtesy of AIDS Image Library

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 premalignancy 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



Figure 7. Erythroplakia.
Image courtesy of NYU College of Dentistry

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.



Figure 8. Squamous Cell Carcinoma.
Image courtesy of Associated Content



Figure 9. Melanoma.
Image courtesy of DoctorSpiller.com

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, if tolerated by the patient. Commercial mouthrinses that contain alcohol should be avoided. There are several saliva substitute products available over-the-counter, e.g., 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, e.g., 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](#) for current dental provider instructions for cancer patients.

Avoid Alcohol and Tobacco Products

If your patient uses tobacco products, a logical step for the cancer patient is to start tobacco cessation counseling. Electronic cigarettes in the U.S. have increased in recent years. In 2015, more than 1/4 of students in grades 6 to 12 and more than 1/3 of young adults had tried electronic cigarettes. The 2016 U.S. Surgeon General's Report on electronic cigarette use

among three age groups: young adolescents (11-14 years of age), adolescents (15-17 years of age) and young adults (18-25 years of age) is the first federal report to comprehensively address the public health issue of electronic cigarettes. See [Tobacco 101: A Guide to Working with Nicotine Addicted Patients](#) and [Tobacco and Nicotine Products: The Times They Are A'Changing](#) on dentalcare.com for continuing education courses on tobacco cessation programs. Some of the more common patient educational websites dental and medical providers use: ADA Oral Health Topics Smoking and Tobacco Cessation, CDC Quitting Smoking, CDC Electronic Cigarettes, Smokefree.gov, and American Cancer Society How to Quit Smoking or Smokeless Tobacco. For national websites on alcohol and cancer, NIH and CDC have educational materials on alcohol and cancer. There are multiple research studies on esophageal cancer and the combination of alcohol and tobacco use.

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 that holds bacterial colonies cannot only cause dental caries 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. Daily removal of biofilm and bacterial colonies is critical to reduce oral diseases. As we introduce oral hygiene care, this is a good time to discuss the [mouthhealthy.org](#) website, brought to you by the ADA and endorsed by all of the other national dental organizations. Every patient should be shown this website. The site provides educational materials for our patients and the

community. We're often asked by K-12 teachers for materials they can use in the classroom. The website provides many resources, including educational videos and more.

Manual versus Powered Toothbrushes

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

There are many power toothbrushes available on the market. There are less expensive battery-powered toothbrushes for patients to try as their first power toothbrush. However, the professional toothbrushes have many more options than the battery-operated toothbrushes. For example, Procter & Gamble's Oral-B® pro series electric toothbrushes have

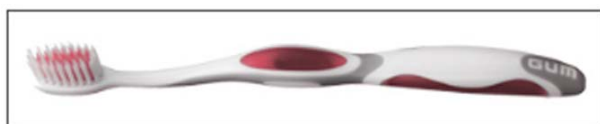


Figure 10. Manual Brush.

Image courtesy of Sunstar Americas



Figure 11. Power Brush.

Image courtesy of Crest® + Oral-B®

a red light that flashes in the handle when the patient presses too hard. We know it can be difficult for patients who have always used a manual toothbrush to switch to an electric toothbrush. I recommend if patients would like to switch from a manual to an electric toothbrush to temporarily remove all manual toothbrushes so the patient must use the electric toothbrush. We have found that the patient will go back to the manual toothbrush if it's still in the vicinity, typically alternating between the two. Since we know that we need several weeks of practice to create a new habit, access to manual toothbrushes may prohibit a permanent change to electric. Realistically patients need to find a toothbrush that they will use for at least two minutes at least twice a day, as recommended by the ADA. Their favorite toothbrush may be a manual, battery-operated, or an electric toothbrush. The key is to find one that they like and will use daily to disrupt plaque and bacterial colonies.

Electric toothbrushes can be effective for all patients, particularly those with low manual dexterity or physical limitations. The larger handle may be better for patients who cannot grip the smaller manual toothbrush handles, e.g., patients with arthritis or stroke victims. The patient should be encouraged to try both manual and electric 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 an electric toothbrush, they temporarily remove all manual toothbrushes from their home. I've found that patients will switch back and forth between the manual and electric toothbrush and not develop a habit with the electric 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.

The 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. This method is effective for removing plaque at the gingival margins and controlling plaque that leads to periodontal disease and dental 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, such as the Bass. 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 should 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

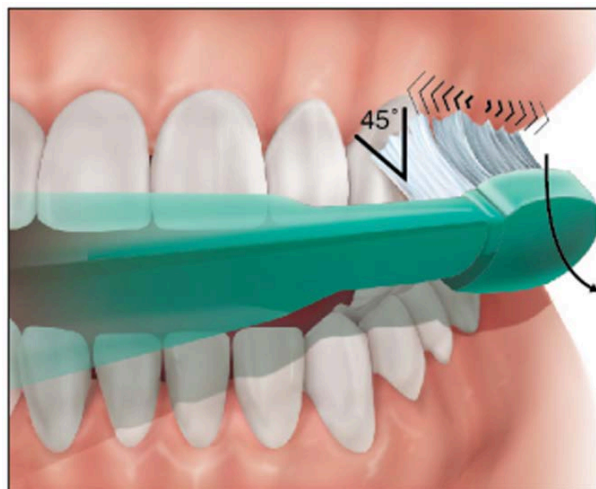


Figure 12. Modified Bass Method.



Figure 13a. Fones Technique.

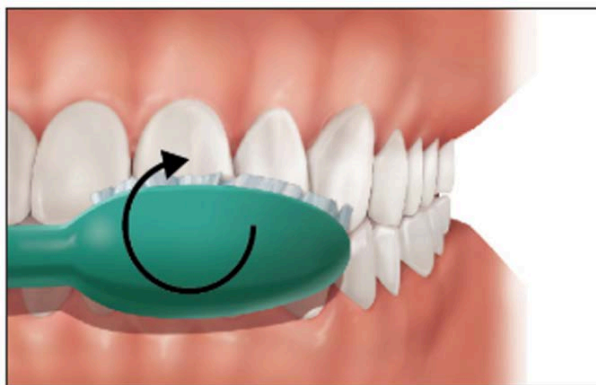


Figure 13b. Fones Technique - Anterior Teeth.

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 many instructions 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 a type of floss that they will like 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 a patient with low manual dexterity. A piece of floss approximately 18-24 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 (Figure 14) 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 15-16) 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

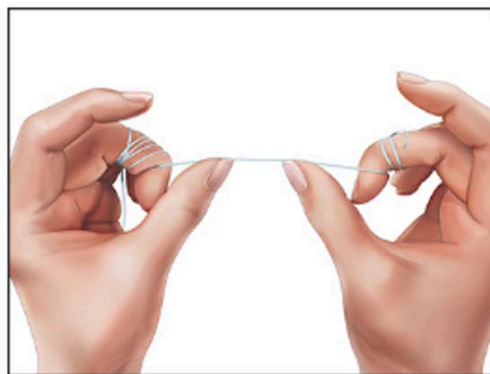


Figure 14a. Use about 18-24" of floss, leaving an inch or two to work with.



Figure 14b. Gently follow the curves of your teeth.

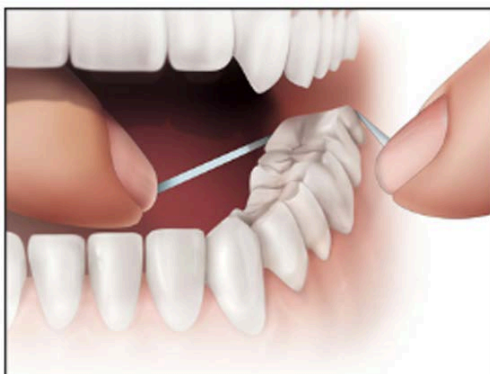


Figure 14c. Be sure to clean beneath the gingiva, but avoid snapping the floss on the gingiva.

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

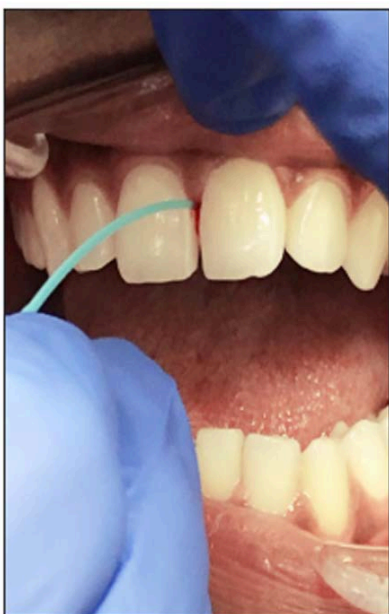


Figure 15. Floss Threader.



Figure 16. Floss Threader.

holder or flosser is a good alternative to spool flossing and should be shown to patients as another means of removing plaque biofilm. 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.



Figure 17. Floss Holders.
Image courtesy of flossAwl.com



Figure 18. Interproximal Stick.

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



Figure 19. Travel Proxabrush.
Image courtesy of Sunstar Americas

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 U.S. Multiple research studies have continue to enforce that water fluoridation has contributed to the decline in dental caries, but the post-eruptive (topical) 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, dental providers 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 in some patient populations 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 professional topical fluoride application 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 effective in the prevention of caries. The ADA utilizes evidence-based research when making clinical recommendations and 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 completely mineralized and will undergo a *post-eruptive* period (topical effect) of fluoride 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. Most of the fluoride incorporated into the developing enamel occurs during 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 the professional fluoride method included a disposable mouth tray 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 AAPD and ADA. There are several reasons, such as patient compliance, the higher ppm of fluoride in varnish (22,600 ppm), 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 Evidence-based Dentistry Clinical Practice Guidelines include Topical Fluoride for Caries Prevention. For children younger than 6 years, current guidelines indicate 2.26% sodium fluoride varnish at least every 3-6 months. With patients 6-18 years of age, 2.26% sodium fluoride varnish or 1.23% APF fluoride gel for 4 minutes at least every 3-6 months. I've always said you "don't have to be an expert on everything, you just need to know where to find it." I'm frequently on the AAPD and ADA websites reviewing current professional guidelines and policies.

One-minute vs. Four-minute Fluoride Applications

Research studies continue to confirm 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 four 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 ADA'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 four 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.

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. However, if plaque biofilm is prevalent, it is prudent to remove it first before a professional application of fluoride. 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. 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-matured 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. 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 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



Figure 20. Sodium Fluoride Varnish.
Image courtesy of DECS

a dental provider resulted in a decrease of root surface caries progression and initiation.

Silver Diamine Fluoride

Silver topical products, e.g., silver nitrate and silver diamine fluoride (SDF) have been utilized in Japan for over 40 years to arrest dental caries and reduce hypersensitivity in deciduous and permanent teeth. Over the last decade it has been introduced in other countries internationally. SDF has been marketed in the U.S. as a 38% product, equivalent to a 5% fluoride and a pH of 10. At this time, SDF is not fully understood. One theories with SDF is that silver ions, like other heavy metals, are antimicrobial. Another theory is that SDF reacts with hydroxyapatite in an alkaline environment to form calcium fluoride. One side effect with SDF is the discoloration of demineralized or cavitated surfaces. The FDA approved its use as a desensitizing agent and over-label as an anticaries agent. There are many research studies on SDF indicating it is more effective in arresting dental caries than sodium fluoride varnish. Therefore, the AAPD supports the use of SDF as part of a caries management plan. However, the AAPD recommends a consultation with the patient/parent with an informed consent recognizing SDF is a valuable therapy and informing them of the dark discoloration. Prior to the placement of SDF, the AAPD recommends patients receive a comprehensive dental exam, diagnoses, and a plan for ongoing disease management.

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, e.g., 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 over-the-counter fluoridated dentifrice (toothpaste) can decrease bacteria and increase mineralization. Patients who benefit from ACP include conditions such as orthodontic, white spot lesions (WSL), tooth whitening, oncology, hypersensitivity, high caries risk, xerostomia, and acid erosion due to chronically consuming acidic drinks and food. Calcium phosphate with fluoride can be added to teeth with various applicators. Custom mouthguards can be used for longer application times.

Diet and Dental Caries

Introduction

S. mutans ingest fermentable carbohydrates creating the end-product lactic acid. The acid then decreases 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% sugar, 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 sweetener stevia.

Sugar Sweetened Beverages

Soft drinks, sport drinks, and energy drinks containing sugar are popular in the U.S. Frequent consumption of sugary drinks has long been known to contribute to dental caries. According to the CDC, 63% of youth and 49% of adults consume sugar-sweetened beverages (SSB) daily. SSB drinks include: regular soda, fruit drinks, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugar. Among youth, SSB intake is higher in boys, adolescents, non-Latino Blacks, or youth living in low income families. Among adults, SSB intake is higher among males, young adults, non-Latino Blacks or Mexican-American, or low-income adults. In 2011 the American Academy of Pediatrics made recommendations that children and adolescents should not consume energy drinks, as they can harm children, especially those children at risk, e.g., diabetes, seizures, cardiac abnormalities, or mood and behavior disorders. However, recent statistics by the National Institutes of Health (NIH) indicate men between the ages of 18 and 34 years of age consume the most energy drinks, and almost 1/3 of teens between 12 and 17 years of age drink energy drinks regularly. Soft drinks have been linked to medical conditions such as obesity and type-2 diabetes. A regular 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.

A study published in *General Dentistry*, the clinical journal for the Academy of General Dentistry (AGD) reported there was 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. 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 need to 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 ADA 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 biofilm control, post-eruptive and pre-eruptive fluoride therapy, and dietary restrictions.

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,



Figure 21. Deep Occlusal Fissures.

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 chronic diet of fermentable carbohydrates or as a result of a pharmacological or radiation-induced xerostomia.

Types of Sealant Materials

There are two types of resin-based sealants, 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 handpiece and rotary 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 low 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 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 dental 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.
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 time for the conditioner to remain on the enamel, as well as rinsing times. There are one-step systems that limit the number of steps. No matter which system you use, the enamel should appear as white, dull, and chalky after the product is used. If the enamel does not appear white and chalky, the tooth conditioner should be 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 placed 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 or silk and check interproximal contacts with floss. If sealant material is present interproximal, use a scaler to remove excess. If occlusion is high, use a rotary bur, e.g., no. 4 or 8 round bur. Recheck the occlusion again. Give the patient post-op



Figure 22. Occlusal Sealants.

instructions, according to the manufacturer's instructions. Sealant retention should be checked at each dental examination.

Mouthguards & Sports Dentistry

Introduction

Over the past decade, 46 million U.S. children were involved in sports. It's estimated that 30 million of these children are participating in organized sports. The popularity of organized youth sports has resulted in a significant number of dental and facial injuries. 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

In 2018 the AAPD reported from 1990 to 2003, there were on average 22,000 dental injuries annually in children less than 18 years of age. Children 17 years and younger represented 80.6% of dental injuries (sport and non-related sport) presented in emergency room visits.

During a single athletic season, athletes have a 1 in 10 chance of suffering a facial or dental injury. In fact, the lifetime risk of such an injury is estimated to be about 45% according to the National Youth Sports Foundation (NYSSF). The NYSSF estimates more than 3 million teeth will be avulsed in youth sporting events. They also report that athletes who don't wear mouthguards are 60 times more likely to experience trauma to the oral cavity. In a survey commissioned by the American Association of Orthodontists (AAO), 84% of children do not wear a mouthguard during organized sports because they are not required to wear them, even if they're required to wear helmets and other safety gear. In a recent review of data that was collected by the National High School Sports-related Injury Surveillance Study, 72.5% of dental injuries occurred when athletes were not wearing a mouthguard. Although the data indicated that dental injuries were not as common as other injuries, the majority of dental trauma occurred when the athlete was not wearing a mouthguard. Dentistry plays a large role in treating oral and craniofacial injuries resulting from sporting activities.

More than 5 million teeth are lost each year; many during sports activities. 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 injured twice as often as females, with the maxillary central incisors being the most commonly injured teeth. 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 AAPD and ADA recommend a mouthguard for all children and youth participating in any organized sports activities.

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, 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 AAPD 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 electric absorption and electric 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).

- **Custom-Made Mouth Protectors**

This is the preferred mouthguard 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 clothing and 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 from 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 ADA publishes a brochure called Handling your Child's Dental Emergency. The ADA also has information on their website about mouthguards in the Oral Health Topics portion of the website. A field emergency kit is a simple and inexpensive item for the dentist attending a sporting event (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.”



Figure 23. Boil and Bite Mouthguard.

Image courtesy of fortnet



Figure 24. Tri-Laminated Mouthguard.

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

Table 2. Dental Emergency Kit for Sporting Events.

- Gloves
- mouth mirror
- pen light
- tongue depressor
- scissors
- rope wax
- zinc oxide eugenol (e.g., IRM)
- spatula
- mixing pad
- 2x2 & 4x4 sterile gauze
- sterile small wire cutters (for removal of broken orthodontic wires)
- spare commercial mouthguard
- emergency tooth-preserving solution [Save-a-Tooth™](#) for the avulsed tooth

literature in order to educate their patients. Although dental caries has declined in certain patient populations in 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

providers 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 recall appointment. With a new clinical examination, updating the patient's risk assessment, and taking the time to educate each patient on plaque 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/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 ingested by bacteria, producing the end-product lactic acid causing dental caries (demineralization or loss of calcium and phosphate ions).**
 - 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 tray 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 about _____ teaspoons of sugar.**
A. 2
B. 6
C. 8
D. 10
26. **In sports injuries, males are twice as often as females to be injured. Mandibular central incisors are the most commonly injured teeth.**
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. **In regards to sports 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 sports-related tooth injury regarding permanent dentition 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

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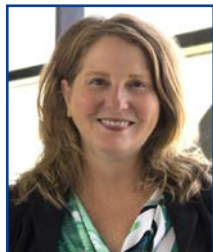
Additional Resources

Sources for Patient Educational Materials:

- To learn more about pharmacological effects and the clinical implications of prescription drugs, see the latest dentalcare.com courses.

About the Author

Connie M. Kracher, PhD, MSD



Dr. Kracher is an Associate Professor of Biology and Director of the Institute for Research at Purdue University Fort Wayne. Dr. Kracher is a national Key Opinion Leader (KOL) for several R&Ds, consultant for national dental organizations, and has presented for the American Dental Association, American Dental Education Association, and the World Dental Federation. Dr. Kracher is a member of several professional organizations, including the American Association of Dental Research.

Email: kracher@ipfw.edu