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Oral hygiene recommendations in the age of Dr. Google: An evidence-based approach for dental professionals

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ABSTRACT

From charcoal toothpaste to oil pulling to "Flossgate," recent controversies regarding ideal oral hygiene in the lay media have left many of our patients with questions about the best way to take care of their teeth at home. While dental associations, the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the United States Surgeon General agree on the importance of proper self-delivered oral hygiene,[1-3] there continues to be confusion in the lay media and the public with regard to the role of patient-administered oral hygiene for the prevention of oral diseases. Current recommendations include brushing for two minutes twice daily and cleaning between teeth to maintain a healthy mouth and smile.[4]

Furthermore, customization of oral hygiene recommendations for patients based upon their risk profiles allows for optimal outcomes for disease prevention. It is well established that there are over 700 identified species of bacteria and up to 1,500 putative pathologic microorganisms[5-7] found in dental plaque biofilms. Many of these organisms as well as other factors, including bacterial nutrients, food debris, molecules that facilitate bacterial adhesion and invasion and other extrinsic factors in the environment, and the body's own immune response, contribute to diseases of the teeth and gingival tissues. This course will review current recommendations for oral home care, discuss strategies to deliver person-centered oral hygiene instructions for patients based upon risks for oral diseases, and review the current evidence regarding oral hygiene practices and/or products.

EDUCATIONAL OBJECTIVES

1. Understand the risks and benefits of controversial oral hygiene practices and/or products
2. List the optimal strategies and rationale for oral hygiene, including toothbrushing, interdental cleaning, and use of dentifrices and mouth rinses
3. Develop home-care recommendations that focus on evidence-based strategies for oral health and emphasize individualized patient care recommendations based upon patient needs
4. Discuss the importance of preventive strategies for oral diseases, including maintaining good oral hygiene in order to promote oral and overall well-being with a wide range of patients and interdisciplinary colleagues

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INTRODUCTION

Dysbiotic dental plaque biofilm is the primary etiology for both dental caries and periodontal disease, the two most prevalent oral diseases.[8] To maximize benefits of dental care and maintain treatment results, patients are integral copractitioners with their oral health providers. The sustained daily maintenance of oral hygiene is critical to the success of professional oral health interventions. Unfortunately, patient levels of home care are variable and often suboptimal. Despite recommendations from the American Dental Association (ADA) that individuals brush for two minutes twice daily,[9] the average total daily toothbrushing time ranges between 45-70 seconds.[10] Similarly, patient compliance with regular and sustained daily use of dental floss for interdental cleaning has been estimated to be as low as 2%.[11] Patients also report low levels of satisfaction with flossing, with more than 35% of respondents to an American Academy of Periodontology (AAP) survey stating that they would rather perform an unpleasant task, such as filing a tax return or cleaning toilets, than floss.[12]

Given the lack of enthusiasm for oral hygiene measures,[12] interest in alternative methods of tooth cleaning and novel oral hygiene products continues to grow. Thus, establishing comparative efficacy of such practices and products to standard oral hygiene measures is imperative. This was brought into particularly sharp focus in August 2016 when the US government released a statement discussing the omission of oral hygiene recommendations in the 2015-2020 Dietary Guidelines for America (DGA).[13] For the first time since 1979, the DGA omitted recommendations for: 1) consumption of fluoridated water, 2) reduction of sugary food and beverage consumption, and 3) toothbrushing and flossing as effective methods to reduce the risk of dental caries. Furthermore, the government statement indicated that the flossing recommendation was excluded due to a lack of definitive scientific evidence stating flossing prevents dental caries.[14] The 2016 report cited a meta-analysis that found that data supports interdental cleaning for the prevention and treatment of gingivitis, but additional studies are needed to evaluate the role of interdental cleaning in the prevention of dental caries and periodontitis.[15] In response to the media coverage of this report and overall consumer interest in more natural or homeopathic therapies, dental practitioners and dental patients have demonstrated an increased interest in alternative therapies and products.

EPIDEMIOLOGY AND ETIOLOGY OF CARIES AND PERIODONTAL DISEASE

Caries: Dental caries, or tooth decay, results from the breakdown of the hard tissues of the tooth (enamel, dentin, and cementum) due primarily to the acid byproducts of bacterial metabolism of carbohydrates. Bacteria use simple sugars as a food source and produce metabolic acids as a part of the process to break down those sugars.[16,17] Conditions and medications that affect salivary flow, poor tooth cleaning, dietary sugar and acid content, and fluoride availability can all affect the rate of caries.[12]

Oral hard tissues undergo remodeling through a demineralization-remineralization process.[18] As pH within the oral cavity drops, demineralization occurs, and as the pH increases, remineralization of those tissues is seen. The net resultant mineral exchange is a determinant of caries development and progression.[19] Dentistry has been focused on prevention strategies to reduce caries rates for public health benefit. Water fluoridation has proven to be one of the most cost-effective methods for reducing overall caries rates in the population, with every $1 spent on water fluoridation returning $5-$32 in decreased health-care

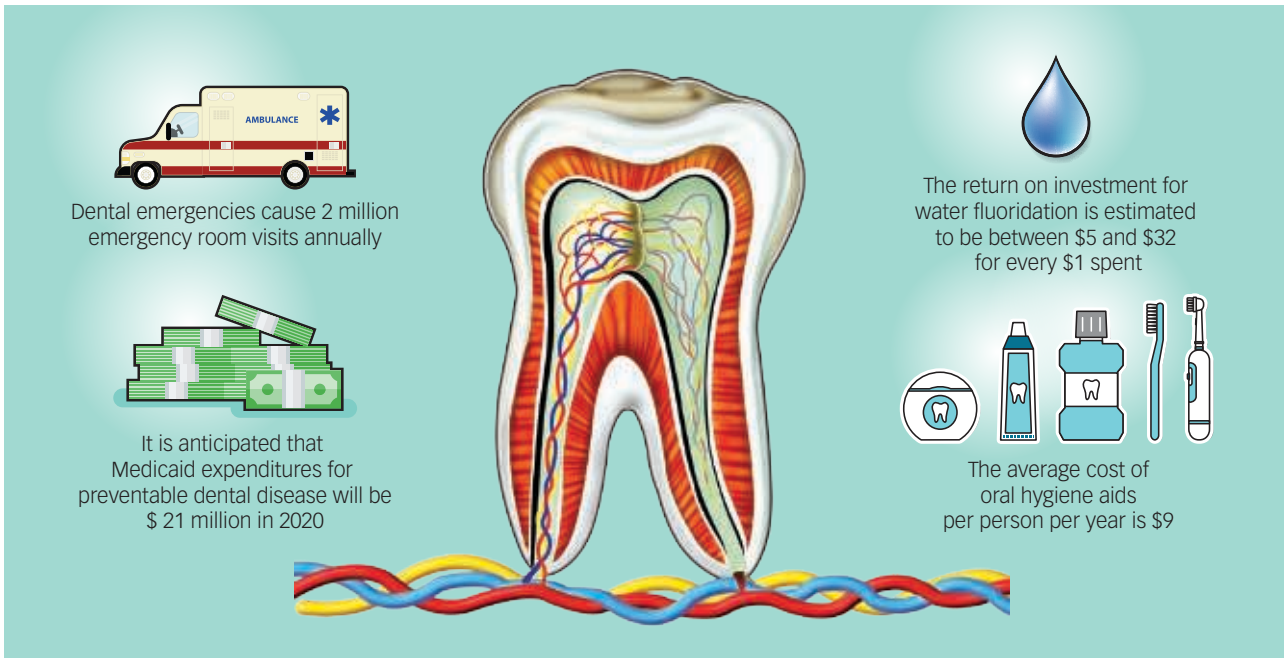

FIGURE 1: Caries impact in the United States

costs within the community.[20] However, fluoridation remains insufficient to fully control dental caries, particularly in the absence of regular, effective oral hygiene.

Dental caries is a highly prevalent disease in both children and adults, despite declining rates of both treated and untreated caries since the 1970s. Nearly 19% of US children ages 5-19 and almost 32% of US adults ages 20-44 have untreated caries.[21] Caries and subsequent edentulism negatively affect patients' quality of life.[22] Nearly 51 million school hours are lost each year to dental-related illnesses.[23] Employed adults also lose 164 million work hours each year to dental disease.[23] The emotional, financial, and educational impact of caries is critically important and proper oral hygiene and home care are vital to the management and prevention of dental caries (figure 1).

Periodontal diseases: Periodontal diseases include inflammatory and tissue-destructive diseases of the supporting structures around the teeth, comprised of the gingival tissues, periodontal ligament, alveolar bone, and cementum. All individuals are susceptible to gingivitis and will develop gingivitis within 21 days if no oral hygiene measures are instituted. Gingivitis is caused by bacterial plaque and, in most cases, the severity is related to the amount and type of bacteria present on tooth and soft tissue surfaces throughout the mouth and may be influenced by individual patient susceptibility to disease.[24,25] The percentage of adults without attachment loss who have gingivitis is 93.9%.[26] Removal of dental plaque biofilm and local etiologic factors is the definitive treatment for gingivitis and reduces local and systemic levels of inflammatory markers in such patients.[7,27]

Untreated gingivitis may progress to periodontitis. Periodontitis is a chronic disease of the hard and soft tissues supporting the teeth initiated by dysbiotic bacterial plaque biofilm, which initiates host immuno-inflammatory responses that cause progressive destruction of the periodontal ligament and alveolar bone.[28-33] Periodontitis typically has a slow to moderate rate of disease progression, but episodes of accelerated attachment loss may be associated with local and/or systemic factors.[30,31] Destructive periodontitis has been found to affect approximately 42% of US adults (figure 2).[1] Of those individuals, 7.8% have severe periodontitis.[34] Cigarette smoking and uncontrolled or poorly controlled diabetes mellitus have been shown to be risk factors for periodontitis development and progression.[35] Plaque control is critically important to prevent and treat gingivitis prior to development of periodontitis[36] and maintenance of periodontal health after arresting periodontitis.[37,38]

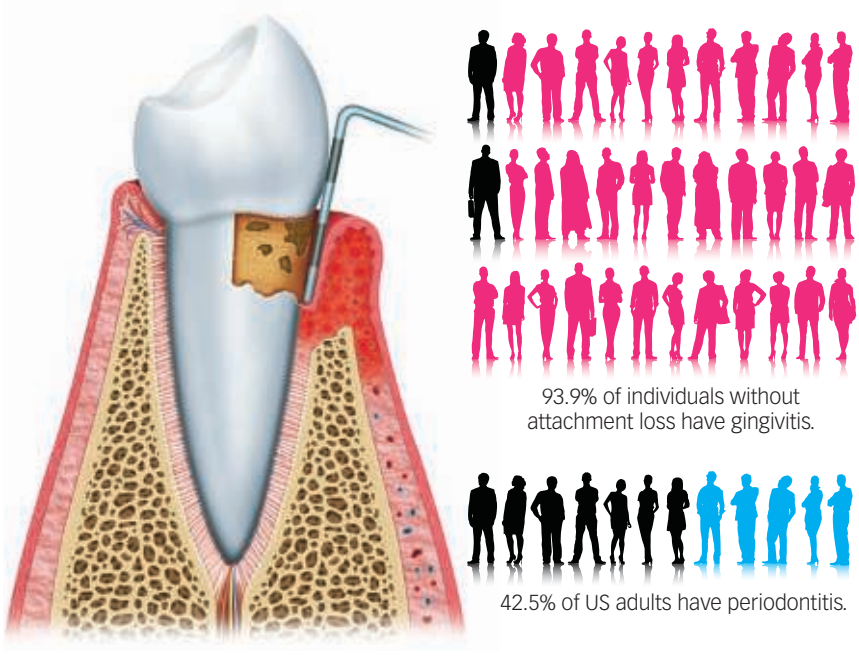

FIGURE 2: Periodontal disease prevalence in the United States

ORAL HEALTH AND HYGIENE AS PERSON-CENTERED CARE

Personalized assessments for caries and periodontal disease risk: Risk assessment to predict future risk of disease allows for more targeted interventions to prevent or control caries and periodontal diseases. Risk factors for both diseases may be anatomical/physical, biochemical, demographic, or lifestyle determinants that contribute to the development and progression of disease. A comprehensive evaluation should include a history of oral diseases as well as an assessment of risk factors associated with both caries and periodontal disease (tables 1 and 2).

Behavioral modification: Motivating and educating patients to adequately perform oral hygiene measures can be a clinical challenge. Patients may underestimate brushing time[12] and fail to adequately remove microbial biofilm despite demonstration of optimal methods.[13] Patients report that their rationale for performing oral hygiene focuses on social/esthetic factors, including fresh breath and attractive smile, and, lastly, to avoid disease.[14] Improving patients' understanding of the importance of plaque control for treatment of both caries and periodontal disease is critical to establishing new routines. Oral hygiene interventions also require reinforcement over time. Patients' effectiveness and compliance for oral hygiene has been shown to decrease after three to six months.[17] It is of utmost importance to personalize oral care instructions for patients. Individualized techniques have proven effective in improving oral hygiene levels,[14,18] and motivational interviewing may be one technique to allow for patient self-efficacy and improve awareness of the importance of plaque control to oral health.[19,39] A single session of motivational interviewing to improve oral home care has been shown to improve gingival bleeding scores and plaque index.[20]

TABLE 1: Caries risk assessment—considerations and screening

Anatomical and intraoral risk factors
• Active and/or new carious lesions? • History of previous carious lesions in the last three years? • Recurrent caries around existing restorations? • Deep pits and fissures? • Enamel hypomineralization? • Exposed radicular surfaces? • Plaque-retentive intraoral surfaces? • Orthodontic treatment or use of other intraoral fixed appliances?
Oral hygiene practices 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 (consumption of sugar-sweetened beverages, e.g., soda, fruit drinks, energy drinks, and sports drinks)? • Multiple between-meal carbohydrates/day ingested?
Microbial and salivary factors
• Bacterial biofilm composition and intraoral bacterial count (saliva testing)? • Xerostomia? • Prescription drugs affecting salivary rate and/or quality? • Decreased salivary buffering capacity?
Familial/genetic risk factors
• Family caries history? • Inherited anatomical considerations?
Social/psychological risk factors
• Dental anxiety? • Limited access to dental care or oral hygiene materials?
Systemic or medical risk factors
• Chronic systemic diseases? • Medically or physically challenged?

TABLE 2: Periodontal risk assessment—considerations and screening

History of past disease progression
• History of previous attachment loss over the past five years? • Overall bone loss/age? • Biofilm deposits as compared to disease progression?
Tobacco/nicotine consumption
• Pack-year tobacco consumption? • History of tobacco use (time since cessation)? • Alternative nicotine consumption (use of electronic nicotine delivery devices [ENDs])?
Diabetes mellitus/glycemic control
• Current HbA1c levels? • History of HbA1c over time? • History of diabetic complications? • Additional risk factors (use of corticosteroids, metabolic syndrome, obesity, etc.)?
Microbial pathogenicity
• Bacterial biofilm composition and intraoral bacterial count? • Presence of "red complex" bacteria? • High quantities of bacterial plaque biofilm deposits? • Inability to perform adequate oral hygiene measures?
Immunological deficits
• Neutrophil chemotactic deficiencies? • Existing immunodeficiency diseases? • Preexisting autoimmune diseases?
Familial/genetic risk factors
• Familial history of periodontal disease? • Familial history of early tooth loss? • Inherited anatomical considerations?
Social/psychological risk factors
• Low socioeconomic status? • Dental anxiety? • Limited access to dental care or oral hygiene materials?
Other systemic risk factors
• Pregnant individuals? • Patients with systemic diseases associated with periodontal diseases? • Mental or physical disabilities that prevent adequate delivery of oral hygiene?

TOOTHBRUSHING

Toothbrushing with both manual and power brushes has been shown to be effective in the removal of plaque on tooth surfaces.[40,41] Time spent toothbrushing is associated with a significantly greater amount of plaque removal up to approximately two minutes, or 30 seconds per quadrant.[42] Softer toothbrush bristles are associated with superior plaque removal subgingivally and interproximally due to their increased flexibility and result in less gingival recession and abrasion to oral soft tissues than hard bristles.[43,44] Similarly, high amounts of force are not necessary for adequate plaque removal and can cause trauma to hard and soft tissues in the mouth.[45] It is important to counsel patients to replace toothbrushes regularly since bristle wear after nine weeks of normal use can affect the efficacy of plaque removal.[43]

Powered toothbrushes: In a meta-analysis of current evidence, powered toothbrushes were found to reduce plaque and gingivitis more than manual toothbrushing in the short (0-3 months) and long (> 6 months) terms.[46] Powered toothbrushing is effective and safe for oral soft tissues while providing a statistical benefit in both plaque and gingival indices.[46,47] While the clinical implications of these reductions is unknown, it should be noted that the recommendation of a powered toothbrush may improve plaque removal in patients who struggle to achieve adequate levels of oral hygiene or who have an increased susceptibility to periodontal diseases or high caries rates.[46,47] Acceptance of powered toothbrushes among patients of all ages has been reported to be high[41,48] and may be of particular benefit in individuals who demonstrate difficulty in motivation or execution of oral hygiene measures.

FLOSSING

Dental floss is the most widely recommended tool for removing dental plaque from proximal tooth surfaces.[49] In 2016 a controversy erupted in lay media when an article published in the *New York Times* suggested that flossing may not be beneficial to oral health.[50] Within the dental community, this controversy was referred to as "Flossgate" and reflected a disconnect between the scientific understanding of the benefits of interdental cleaning and the lack of longitudinal controlled trials that might demonstrate differences in caries rates. Regular flossing as an adjunct to toothbrushing has been demonstrated to decrease plaque levels interproximally and to decrease gingival inflammation over toothbrushing alone.[40] Furthermore, individuals who floss demonstrate lower levels of caries and gingival inflammation in observational studies.[51] In a matched twin cohort, the addition of flossing to toothbrushing alone decreased visible plaque, gingival bleeding, and altered the subgingival flora to reduce the proportions and amounts of bacterial species associated with periodontal disease and dental caries, including *T. denticola, P. gingivalis, T. forsythia, P. intermedia, A. actinomycetemcomitans,* and *S. mutans*.[52,53] While current randomized controlled trials do not have large enough samples over sufficient time to demonstrate lower caries

rates in patients who perform brushing and flossing compared to brushing alone, decreased plaque scores are associated with decreased decayed, missing, and treated (DMT) scores in adults and children.[15,54,55]

Flossing is economical, effective when performed correctly, and aids in removal of plaque and food debris interproximally. But challenges to implementation do exist. Flossing may not be optimally effective in areas with anatomical variations. Additionally, adequate flossing habits are difficult to establish. It is reported that only 8% of teenagers floss daily and the number of all individuals who floss daily may be as low as 2%.[12,56-58] Increasing patients' willingness to floss and their ability to sustain habits over time may depend upon the behavior modification techniques employed by the dental health-care professional, and we should be willing to recommend other interdental cleaning techniques if adherence is suboptimal.

OTHER INTERDENTAL CLEANING METHODS

In patients for whom flossing results in inadequate plaque removal or those who cannot adhere to a flossing regimen, additional interdental cleaning aids may be preferable.[58] Interdental brushes remove more plaque interproximally when compared to floss and have demonstrated similar reductions in interproximal probing depths and gingival bleeding.[59-61] Interdental brushes can be particularly helpful in areas of concavities and root anomalies. In patients who demonstrate gingival recession or those with previously treated periodontal disease, interdental brushes have been shown to be more effective than floss overall.[62,63] In adult patients who have adequate interdental space to use interdental brushes, plaque removal was greater with toothbrushing and adjunctive use of interdental brushes than with toothbrushing alone, toothbrushing with floss, and toothbrushing with interdental wooden sticks.[64] Furthermore, patients have been shown to prefer the use of interdental brushes over flossing.[61,63,64] Nevertheless, they may not be correct for all sites as they require more interdental space, and less papillary fill, than floss does for comfortable use.[58]

Triangular wooden tips inserted in interproximal areas, while better accepted by patients than flossing, demonstrate no overall reduction in plaque or gingival index, but do demonstrate a reduction in bleeding on probing (BOP) that is similar to that seen with flossing.[65]

Powered flossers have been shown to result in a reduction in interdental plaque deposits and gingival bleeding when compared to toothbrushing alone.[62,63,66] The magnitude of this reduction is variable and dependent upon the type and design of powered flosser.[62] These devices may be especially beneficial in individuals with dexterity issues. Implants present with differences in cross-section and emergence profile when compared to natural teeth; therefore, patients with implants may benefit from the use of a powered flosser, but the angle of the floss jet should be perpendicular to the implant fixture to protect the implant/soft-tissue seal.[67]

DENTIFRICES

Established products: The use of adjunctive chemotherapeutics delivered in dentifrices may offer some additional benefit over toothbrushing without such products. Fluoride-containing dentifrices have well-established effectiveness in reducing caries rates. Dentifrices with stannous fluoride have antimicrobial properties that may reduce gingival inflammation.[68] Many dentifrices contain pyrophosphates, which interfere with crystal formation of calculus and may reduce supragingival calculus formation by more than 30%.[24] The effect of pyrophosphate on subgingival calculus, however, is neglibile.[69]

Dentifrices provide established benefits, but side effects may occur in some patients, causing them to discontinue use. Dentifrices containing stannous fluoride may result in temporary staining of teeth, although formulations that stabilize the stannous fluoride may demonstrate reduced staining and lead to better long-term adherence to prescribed use.[70] Additionally, the surfactant sodium hexametaphosphate has been shown in high doses to result in growth retardation and kidney swelling in laboratory animals. It has been concluded to be safe in concentrations less than 1% for topical application, but even those low concentrations may cause mucosal sloughing.[71]

While no commercially available dentifrices in the US contain the FDA-approved antigingivitis agent triclosan, it has been used in dentifrices in the past due to its ability to reduce gingival inflammation.[72] The CDC has noted that triclosan was present in the urine of nearly 75% of the individuals over six years old tested in the National Health and Nutrition Examination Study (NHANES) from 2003-2004.[71] While laboratory animal studies have demonstrated varied results,[73] evidence of thyroid disruption, carcinogenic potential, and allergic reactions have been seen in animal testing. However, the Environmental Protection Agency's Cancer Assessment Review Committee (CARC) has classified the carcinogenic potential of triclosan as "not likely to be carcinogenic to humans" based upon the current evidence.[73] Nevertheless, in 2016 the FDA issued a final rule that banned triclosan from many common over-the-counter (OTC) antiseptic agents, but allowed for its continued use in dentifrices and other products for antigingivitis uses.[74]

Emerging technologies: Emerging research has also shown dentifrices containing statin medications may reduce gingivitis through anti-inflammatory mechanisms.[75] Edathamil has shown promise in reducing gingivitis levels by chelation of cations that prevent the association of bacteria with the dental pellicle early in bacterial plaque biofilm formation.[76] Dentifrices containing propolis, aloe vera, and miswak have all been reported to reduce gingivitis and/or have bactericidal effects on cariogenic and periopathogenic bacteria, but larger randomized trials are necessary to fully explore safety and efficacy of these products.[77-80]

Activated charcoal dentifrice is widely available commercially. While homeopathic medicine and dentistry have used charcoal-based preparations since the period of Ancient Greece, there are limited current data to support the efficacy of charcoal-containing dentifrice for caries and gingivitis prevention.[81] Furthermore,

charcoal may alter or inactivate fluoride in dentifrice, and the abrasiveness of such charcoal-containing dentifrices may produce abrasion of enamel and dentin.[81]

MOUTH RINSES

Established products: Mouth rinses containing antimicrobial substances, including cetyl pyridium chloride (CPC), essential oils, and other antimicrobial ingredients, have been shown to be effective adjuncts to adequate levels of brushing and interdental cleaning in reducing plaque and gingival inflammation.[82-85] Establishment of adequate levels of mechanical oral hygiene in addition to the use of mouth rinses should be a goal of therapy. Bisbiguanide antiseptics (including chlorhexidine gluconate) have been shown to have antimicrobial and substantive effects.[86] However, long-term use is associated with several untoward side effects, including alterations in taste and tooth staining, which make compliance with use challenging when considered a long-term treatment. Additionally, there is emerging evidence that beneficial oral microflora may be affected by the long-term use of broad-spectrum anti-infective oral mouth rinses, such as chlorhexidine, and we do not yet know the effects of significant alteration in the overall oral microbiome.[87] Chlorhexidine mouth rinse has also been shown to have cytotoxic effects on gingival fibroblasts *in vitro*, which may alter cell turnover and tissue repair.[88]

Emerging technologies: Novel mouth rinses, including those containing propolis, oxygenating agents, amine alcohols, metal ions, triclosan, and salicylamide, have evidence to indicate their antimicrobial properties.[77,89] Further clinical trials are necessary to identify their utility and/or safety in clinical practice. There has also been considerable recent interest in the biocidal efficacy of hydrogen peroxide and povidone-iodine-containing mouth rinses. Hydrogen peroxide is generally considered safe and *in vitro* studies have shown the hydroxyl radical and other oxygenated species can act as potent oxidizing agents, reacting with lipids, proteins, and nucleic acids,[90] but further research needs to be performed on the *in vivo* efficacy of specific formulations. Povidone-iodine is considered to have a broad spectrum of antimicrobial action, showing efficacy against gram-positive and gram-negative bacteria, bacteria spores, fungi, protozoa, and several viruses, and has been proposed as a preprocedural rinse or as a prophylactic measure against respiratory infections.[91] Further research on the potential risks and benefits of long-term povidone-iodine use for maintenance of oral health is needed.

ADJUNCTIVE ORAL HYGIENE ACTIVITIES

Oil pulling: In oil pulling, one to two tablespoons of oil are swished in the mouth for about 20 minutes, twice daily. It has been postulated that coating intraoral structures with lipids may alter the composition and ultrastructure of the dental pellicle and subsequent biofilm adherence.[92] Additionally, it has been suggested that lipid presence at tooth surfaces may convey resistance to acid erosion of hard tissues, and anti-inflammatory effects of some lipids on oral soft tissues were described.[92] However, much of this data is preclinical and there is only limited evidence for the therapeutic benefits of oil pulling. Current published literature has not fully assessed the lipid composition of saliva and pellicle after oil pulling nor the interactions of lipids with biofilm formation and maturation.[92] Long-term, randomized, controlled trials are needed to determine the potential benefits of this practice.

It should be noted that oil pulling may not be without risk. Kuroyama et al. reported two cases of exogenous lipid pneumonia associated with use of edible oils in oil pulling for oral hygiene purposes.[93] The symptoms of exogenous lipid pneumonia are fever, weight loss, cough, dyspnea, chest pain, and hemoptysis. Forty percent of patients had mild or no symptoms.[93] Severe pneumonia with acute symptoms can be fatal to the patient.[93]

Dietary supplements: Bee products, including honey, wax, and propolis; licorice root (glycyrrhizin); and polyphenols from green tea, berries, and wine have been touted to have properties that may be anticariogenic and bacteriostatic, which might affect dental plaque biofilm.[94] While data are still emerging, the adjunctive use of dietary supplements may improve oral health outcomes in some patients. Furthermore, the use of anti-inflammatory compounds to reduce gingival inflammation may also prove to have adjunctive effects for patients at higher risk for periodontal diseases.[94] Many of these ingredients have also been proposed to be added to oral health-care home products, such as mouth rinses and dentifrices. Further research is needed to determine their efficacy in standardized clinical environments.

STANDARDS OF CARE FOR ORAL HYGIENE AND ORAL HYGIENE INSTRUCTION

Current oral hygiene recommendations: Dental professional and advocacy groups are united in reinforcing the importance of regular and effective oral hygiene practices.[1-4] It has been stated that "the most important behavioral factor, affecting both dental caries and periodontal diseases, is routinely performed oral hygiene with fluoride" and that "management of both dental caries and gingivitis relies heavily on efficient self-performed oral hygiene, that is toothbrushing with a fluoride-containing toothpaste and interdental cleaning."[95] Emphasis on oral hygiene as primary prevention of oral diseases and maintenance of health is tantamount for public health and individual patient care.

CONCLUSION

As dental health-care professionals, it is imperative that we are able to adequately interpret the scientific literature in a manner that allows our patients to understand and implement the best practices for their oral health. While splashy headlines associated with novel approaches and oral health controversies such as "Flossgate" may be eye-catching to our patients, the underlying science is less titillating. Caries and periodontal disease are prevalent, serious diseases that represent a huge burden to the health and well-being of the population as well as a cost burden on society. While professional dental prophylaxis has been shown to improve plaque levels and gingivitis in the short term, these improvements cannot be maintained without subsequent

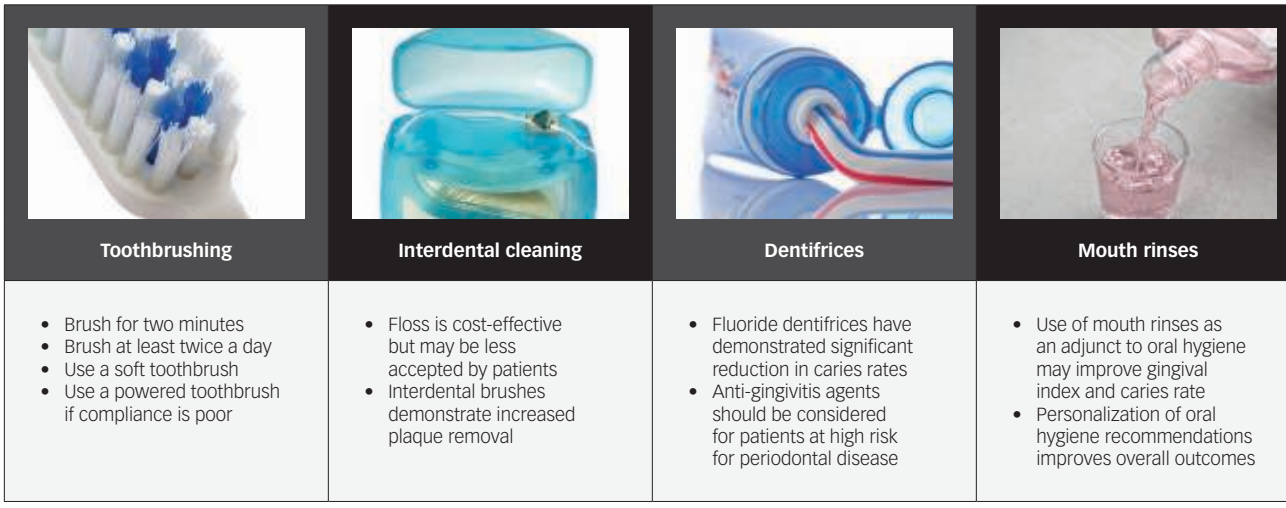

FIGURE 3: Oral hygiene recommendations and personalized dental care

optimization of home care by the patients themselves (figure 3).

Clinical recommendations: Both dental caries and periodontal disease are largely preventable diseases. Proper evaluation and diagnosis of patients and motivation to perform adequate oral hygiene and limit sugar intake are critical to their prevention and management.

Regular patient-centered risk-assessment and oral health and hygiene recommendations should be implemented.

Oral hygiene education should be reinforced at regular dental visits and use practical, accessible approaches to allow for optimal clinical outcomes.

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QUESTIONS

1. The primary etiologic factor for both dental caries and periodontal disease is:

A. Dental calculus
B. Xerostomia
C. Dysbiotic dental plaque biofilm
D. Tobacco use

2. Despite recommendations from the American Dental Association that individuals brush for two minutes twice daily, how long does the average individual brush in total daily?

A. 15-30 seconds
B. 45-70 seconds
C. 60-90 seconds
D. 120-240 seconds

3. Patient compliance with regular and sustained daily use of dental floss for interdental cleaning has been estimated to be as low as:

A. 2%
B. 10%
C. 15%
D. 25%

4. According to a survey from the American Academy of Periodontology, ___% of individuals state that they would rather perform an unpleasant task, such as filing a tax return or cleaning toilets, than floss.

A. 15
B. 25
C. 35
D. 50

5. The 2015-2020 Dietary Guidelines for America omitted, for the first time since 1979, recommendations for all of the following except:

A. Consumption of fluoridated water
B. Reduction of sugary food and beverage consumption
C. Toothbrushing and flossing as effective methods to reduce the risk of dental caries
D. Increasing consumption of vegetables and fruits

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QUESTIONS

6. Intraoral bacteria use simple sugars as a food source and produce metabolic acids as a part of the process to break down those sugars. This demineralization is influence by:

A. Salivary flow
B. Dietary sugar and acid content
C. Fluoride availability
D. All of the above

7. Nearly ___ million school hours are lost each year due to dental-related illnesses.

A. 10
C. 51
B. 26
D. 80

8. Employed adults lose ___ million work hours each year to dental disease.

A. 68
C. 128
B. 96
D. 164

9. Water fluoridation has proven to be one of the most cost-effective methods for reducing overall caries rates in the population with every $1 spent on water fluoridation returning from___ in decreased health-care costs within the community.

A. $1-$4
B. $5-$32
C. $28-$64
D. $75-$100

10. All patients are susceptible to gingivitis and will develop gingivitis within 21 days after cessation of oral hygiene measures. 93.9% of adults without attachment loss have gingivitis.

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. NHANES III data suggest that periodontitis affects an estimated ___% of US adults.

A. 27
C. 42
B. 38
D. 57

12. Patients report that the top rationale for performing oral hygiene includes all of the following except:

A. Preserving systemic health
B. Fresh breath
C. Attractive smile
D. Avoiding disease

13. Oral hygiene interventions require reinforcement over time. Patients' effectiveness and compliance for oral hygiene has been shown to decrease after 12 months.

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.

14. ___ of motivational interviewing to improve oral home care has/have been shown to improve gingival bleeding scores and plaque index.

A. One session
B. Once-weekly sessions over a month
C. Bimonthly sessions
D. Every three-month sessions

15. Softer toothbrush bristles are associated with___ plaque removal subgingivally and interproximally due to their increased flexibility and result in less gingival recession and abrasion to oral soft tissues than hard toothbrush bristles.

A. Equivalent
B. Superior
C. Inferior
D. Excellent

16. It is important to counsel patients to replace toothbrushes regularly as bristle wear after ___ weeks of normal use can affect the efficacy of plaque removal.

A. 4
C. 12
B. 9
D. 20

17. A meta-analysis suggests that powered toothbrushes were found to reduce plaque and gingivitis more than manual toothbrushing in the short (0-3 months) and long (> 6 months) terms. Powered toothbrushes may improve plaque removal in patients who struggle to achieve adequate levels of oral hygiene or who have an increased susceptibility to periodontal diseases or high caries rates.

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. Individuals who floss regularly demonstrate all of the following except:

A. Lower levels of caries and gingival inflammation
B. Decreased visible plaque
C. Decreased caries rates over five years
D. Altered subgingival flora with decreased proportion of *T. denticola*, *P. gingivalis*, *T. forsythia*, *P. intermedia*, *A. actinomycetem-comitans*, and *S. mutans*

19. Interdental brushes remove ___ plaque interproximally when compared to floss and demonstrated ___ reduction in interproximal probing depths and gingival bleeding.

A. As much; more
C. More; similar
B. More; less
D. Less; more

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QUESTIONS

20. Fluoride-containing dentifrices have well-established effectiveness in reducing caries rates. Sodium fluoride-containing dentifrices also have antimicrobial properties that may reduce gingival inflammation.

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.

21. The Centers for Disease Control and Prevention has noted that triclosan was present in the urine of nearly___% of individuals over six years old tested in the NHANES study from 2003-2004.

A. 25
B. 50
C. 75
D. 95

22. Edathamil-containing dentifrice reduces gingivitis levels by:

A. Biocidal action against bacteria through bacterial cell wall degradation
B. Decreases in host collagenase function
C. Decrease in immune cell reaction
D. Chelation of cations that prevent the association of bacteria with the dental pellicle early in bacterial plaque biofilm formation

23. Concerns regarding charcoal dentifrices include all of the following except:

A. Charcoal may alter or inactivate fluoride in dentifrice.
B. The abrasiveness of charcoal-containing dentifrices may produce abrasion of enamel and dentin.
C. Activated charcoal is associated with increased pro-inflammatory markers.
D. There are limited current data to support the efficacy of charcoal-containing dentifrices for caries and gingivitis prevention.

24. Bisbiguanide antiseptics (including chlorhexidine gluconate) have been shown to have antimicrobial and substantive effects. But some negative effects of bisbiguanide include:

A. Alterations in taste
B. Tooth staining, which makes compliance with use challenging when considered a long-term treatment
C. Alterations of beneficial oral microflora may be affected by the long-term use of chlorhexidine
D. All of the above

25. For patients who are performing oil pulling, it is advised to use one to two tablespoons of oil swished in the mouth for ___ minutes twice daily.

A. 5
B. 10
C. 20
D. 30

26. The potential mechanisms of action of oil pulling are purported to include all of the following except:

A. Lipids coating intraoral structures alter the composition and ultrastructure of the dental pellicle
B. Altered dental pellicle structure interferes with biofilm adherence
C. Lipid presence in the mouth increases salivary production
D. Lipid presence at tooth surfaces decreases acid erosion of hard tissues

27. Professional dental prophylaxis has been shown to improve plaque levels and gingivitis in the short term. Such improvements cannot be maintained without subsequent optimization of home care by the patients themselves.

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.

28. Caries assessment related to plaque levels and fluoride exposure should include evaluation of all of the following except:

A. Assessment of plaque levels present
B. Assessment of patient plaque control and motivation
C. Qualitative salivary assessment
D. Assessment of fluoridated toothpaste and mouth rinse use

29. Dietary analysis to assess caries risk should include:

A. Assessment of carbohydrate intake frequency
B. Assessment of carbohydrate intake method (beverages/foods)
C. Assessment of between-meal carbohydrates ingested
D. All of the above

30. All of the following are risk factors associated with periodontal disease progression except:

A. History of periodontal disease progression
B. History of caries rates
C. Tobacco/nicotine use
D. Patient diabetes status/glycemic control

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ANSWER SHEET

Oral hygiene recommendations in the age of Dr. Google: An evidence-based approach for dental professionals

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EDUCATIONAL OBJECTIVES

1. Understand the risks and benefits of controversial oral hygiene practices and/or products
2. List the optimal strategies and rationale for oral hygiene, including toothbrushing, interdental cleaning, and use of dentifrices and mouth rinses
3. Develop home-care recommendations that focus on evidence-based strategies for oral health and emphasize individualized patient care recommendations based upon patient needs
4. Discuss the importance of preventive strategies for oral diseases, including maintaining good oral hygiene in order to promote oral and overall well-being with a wide range of patients and interdisciplinary colleagues

COURSE EVALUATION

1. Were the individual course objectives met?

Objective #1: Yes No Objective #2: Yes No

Objective #3: Yes No Objective #4: Yes No

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

2. To what extent were the course objectives accomplished overall?	5	4	3	2	1	0
3. Please rate your personal mastery of the course objectives.	5	4	3	2	1	0
4. How would you rate the objectives and educational methods?	5	4	3	2	1	0
5. How do you rate the author's grasp of the topic?	5	4	3	2	1	0
6. Please rate the instructor's effectiveness.	5	4	3	2	1	0
7. Was the overall administration of the course effective?	5	4	3	2	1	0
8. Please rate the usefulness and clinical applicability of this course.	5	4	3	2	1	0
9. Please rate the usefulness of the supplemental webliography.	5	4	3	2	1	0

10. Do you feel that the references were adequate? Yes No

11. Would you participate in a similar program on a different topic? Yes No

12. If any of the continuing education questions were unclear or ambiguous, please list them.

_____

13. Was there any subject matter you found confusing? Please describe.

_____

14. How long did it take you to complete this course?

_____

15. What additional continuing dental education topics would you like to see?

_____

Mail/fax completed answer sheet to:

Endeavor Business Media
Attn: Dental division
7666 E. 61st St. Suite 230, Tulsa, OK 74133
Fax: (918) 831-9804

☐ Payment of $59 is enclosed.
Make check payable to Endeavor Business Media

If paying by credit card, please complete the following: ☐MC ☐Visa ☐AmEx ☐Discover

Acct. number: _____

Exp. date: _____ CVC #: _____

Billing address: _____

_____

Charges on your statement will show up as PennWell / Endeavor.

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	16.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	17.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

AGD Code 490

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.

INSTRUCTIONS

All questions have only one answer. If mailed or faxed, grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a Verification of Participation form. The form will be mailed within two weeks after receipt of an examination.

COURSE EVALUATION AND FEEDBACK

We encourage participant feedback. Complete the evaluation above and e-mail additional feedback to Aileen Southerland (asoutherland@endeavorb2b.com) and Laura Winfield (lwinfield@endeavorb2b.com).

COURSE CREDITS AND COST

All participants scoring 70% or higher on the examination will receive a verification form for three (3) continuing education (CE) credits. Participants are urged to contact their state dental boards for CE requirements. The cost for courses ranges from $20 to $110.

PROVIDER INFORMATION

Endeavor Business Media is an ADA CERP–recognized provider. ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP neither approves nor endorses individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry. Concerns about a CE provider may be directed to the provider or to ADA CERP at ada.org/gotocerp.

Endeavor Business Media is designated as an approved PACE program provider by the Academy of General Dentistry. The formal continuing dental education programs of this program provider are accepted by the AGD for fellowship, mastership, and membership maintenance credit. Approval does not imply acceptance by a state or provincial board of dentistry or AGD endorsement. The current term of approval extends from 11/1/2019 to 10/31/2022. Provider ID# 320452. AGD code: 490.

Dental Board of California: Provider RP5933. Course registration number CA code: 03-5933-21000. Expires 7/31/2022. "This course meets the Dental Board of California's requirements for three (3) units of continuing education."

Endeavor Business Media is designated as an approved provider by the American Academy of Dental Hygiene Inc. #AADHPNW (January 1, 2021–December 31, 2022). Approval does not imply acceptance by a state or provincial board of dentistry. Licensee should maintain this document in the event of an audit.

RECORD KEEPING

Endeavor Business Media maintains records of your successful completion of any exam for a minimum of six years. Please contact our offices for a copy of your CE credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

CANCELLATION AND REFUND POLICY

Participants who are not 100% satisfied can request a refund by contacting Endeavor Business Media in writing.

IMAGE AUTHENTICITY

The images in this educational activity have not been altered..