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CDA JOURNAL, VOL 39, Nº9

The Flying Dutchman and E-cigarettes

KERRY K. CARNEY, DDS

Johannes (Honus) Peter Wagner was born on Feb. 24, 1874. He was 23 years old when he debuted with the Louisville Colonels and, in 1900, he joined the Pittsburgh Pirates. It was in Pittsburgh that Honus (pronounced "Hahnus") Wagner became known as "The Flying Dutchman" for the speed with which he ran the bases.

Wagner refused to give permission for the use of his image and insisted that the card be pulled from production.

Five times Honus led the league in stolen bases. He led the league five times in RBIs, eight times in doubles, and three times in triples. "He played nearly 2,800 games during his career, with 3,430 hits, 651 doubles, 252 triples and 722 stolen bases."[1] He batted .300 or better in 17 consecutive seasons. Babe Ruth is quoted as praising Honus as the best shortstop and right-handed hitter of all time. Wagner also was one of the first five players voted into the inaugural class of the Baseball Hall of Fame in 1936.

For all his accomplishments and honors Honus is best known for another reason. The Honus Wagner 1909 baseball card is the most valuable card sold to date. In 2007, it sold for $2.8 million. Though some refer to this as the "Mona Lisa" of baseball cards, its value does not reside in the handsomeness of Honus Wagner. No, based on the archive photos, Honus looked like a cross between Dennis Hopper and Jimmy Durante.

The Honus Wagner card was part of a set of cards produced by a tobacco company as a promotion. Wagner refused to give permission for the use of his image and insisted that the card be pulled from production. Estimates of the number of Honus Wagner cards in existence today range between 50 and 90.

As far as his motivation, that is a little unclear. Some sources say the withdrawal was based on a remuneration dispute but the more popular explanation attributes his refusal to allow the tobacco company to distribute his card to the fact that Honus did not want children to have to buy cigarettes to get the card. What a great guy.

"The ADA and the American Academy of Pediatrics, American Medical Association, American Cancer Society, American Heart Association, American Lung Association, Oral Health America, Legacy, Campaign for Tobacco-Free Kids and the Robert Wood Johnson Foundation are calling for Major League Baseball and the MLB Players Association to prohibit tobacco use at games … Use of tobacco products has been banned in the minor leagues since 1993, but as many as 30 percent of professional baseball players at the major league level still use some form of tobacco."[2]

"According to the U.S. Centers for Disease Control and Prevention, use of smokeless tobacco products has increased 36 percent since 2003, and an estimated 15 percent of high school boys currently use smokeless tobacco."[2]

It is all about image and addiction.

Spitting tobacco and cigarettes have been on our radar screen for a while. But there is a new twist to the nicotine issue: e-cigarettes.

The first time I heard about e-cigarettes was during an interview that Stanton Glantz was giving on a Sunday morning radio show. The topic of the program was the decline in smoking nationally and in California. As usual, Dr. Glantz pulled no punches when characterizing the tobacco industry and its never-ending pursuit of new recruits for their addictive products.

He pointed out that when significant money is devoted to anti-tobacco campaigns they can be very effective in helping reduce the use of tobacco products. Glantz underscored the fact that emphasizing the predatory nature of the tobacco industry was more effective in dissuading users and potential users than merely giving them the information on the health effects of tobacco use.

During the course of the conversation Glantz mentioned e-cigarettes tangentially. These are electronic nicotine delivery systems (ENDS). I did a little web surfing to learn more about them. When I Googled e-cigarettes I came upon a website that made my jaw drop.[3] I was reminded of my maid of honor's favorite saying: "The things you see when you don't have a gun."

It was incredible. Here was a site that had testimonials and recommendations by young attractive men and women, and men dressed as hunters, soldiers, and doctors. Their comments implied that the e-cigarettes had helped them or their loved ones quit or reduce their reliance on cigarettes. They also expounded upon how they could stay at their desks or on duty when they wanted their puff.

CONTINUES ON 608

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EDITOR, CONTINUED FROM 605

The site has "starter kits," brightly colored e-cigarette refill cartridges and accessories: cigarette cases, microstarter kits, and USB pass-throughs so you can attach your e-cigarette to your laptop. Though there is a warning that children should not use this product, it appears that anyone can purchase it online.

Within a week I spotted an e-cigarette placement in a TV crime drama. Within two weeks I had my first patient talking about how she had purchased the e-cigarette for her father to help him quit smoking. I pointed out that the information on the safety of e-cigarettes is limited and that there was no evidence that it was an effective aid in quitting smoking.[4] This was news to her. She had thought it would be "a cool way to quit smoking."

Tobacco use is the leading cause of preventable illness in the United States, responsible for more that 443,000 deaths annually.[4] E-cigarettes and other ENDS are just the newest kids on the block. Tobacco-use screening and cessation counseling have become an expected element of primary care medicine and dentistry.

My screening questions center around tobacco use rather than nicotine delivery systems. So now we have to include e-cigarettes when we ask about tobacco use. We do not spend a lot of time on nicotine counseling but the patients that we have helped quit smoking have been very grateful for our concern and help.

So the next time you win a trivia game based on knowing the most expensive baseball card ever, be sure to remember why Honus Wagner made it so. ■■■■

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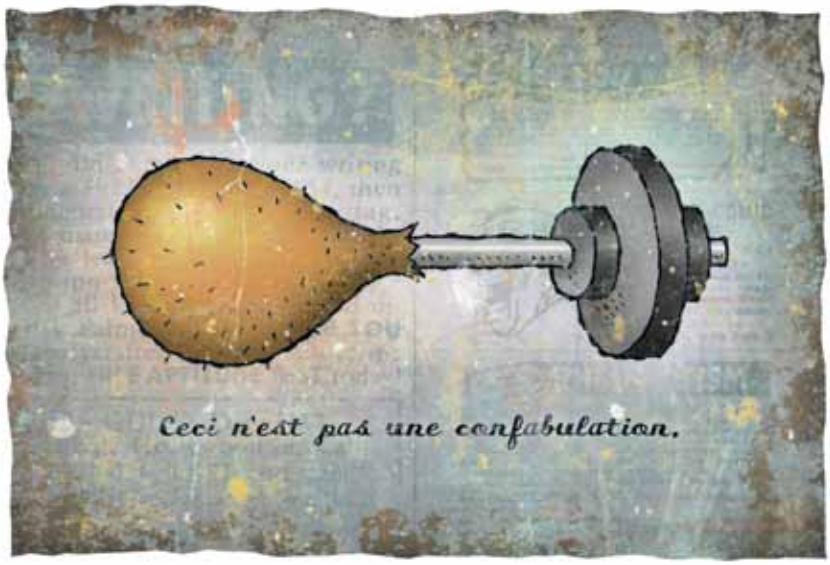

Matt Mullin

Confabulation

BY DAVID W. CHAMBERS, PHD

I have been confabulating a little more recently than I like. I did some over the weekend and felt embarrassed, though it seemed innocent enough at the time.

Confabulation baristas blend mostly truth and a little bit of creative self-deception. Its function is to make us look better than we really are. It is all about us. And it is quite natural, unless it gets carried away into narcissism.

Every time a successful full-mouth reconstruction is recounted, the initial patient condition becomes more challenging. At the peer-review hearing, the patient was "belligerently noncooperative" rather than slow in payments. It is reported that the number of people who say they were at the SF Giants and Oakland A's World Series game when the Loma Prieta earthquake hit in 1989 is four to five times the capacity of the Candlestick Park.

CONTINUES ON 612

Antibacterial Power Toothbrush

The Mouthwatchers Antibacterial Power Toothbrush features unique "flossing bristles," which operate at 5,000 oscillations per minute to access the central fossa area of a tooth and periodontal pockets to clean those areas in the same way as dental floss. It is the first toothbrush to utilize nano-silver technology to eliminate germs in the mouth as well as keep the toothbrush itself free from germs.

The bristles of each Mouthwatchers brush are composed partly of nano-sized colloidal silver compound particles, giving the brush its gum-cleaning effects and preventing the toothbrush from becoming a home to microorganisms. For more information go to mouthwatchers.net.

AAPD Establishes Pediatric Research, Policy Center

The American Academy of Pediatric Dentistry has created its Pediatric Oral Health Research and Policy Center to promote optimal health care for children.

The center, which will conduct policy analysis and research to improve oral health for all children, will focus on topics ranging from successful Medicaid dental reforms and effective oral health literacy efforts to the benefits of establishing a dental home by age 1 and the efficacy of expanded function dental assistant laws. Additionally, the center will assist federal and state policymakers to shape the best policies to improve the oral health status of children.

"Our center will allow the AAPD to produce timely and high quality research and policy analysis on critical issues impacting children's oral health," said John R. Liu, DDS, AAPD president. "Too often, policymakers are presented with simplistic 'solutions' to children's oral health that don't hold up to rigorous scrutiny. The AAPD's ce nter will serve as the resource for children's oral health policy and research."

Seizure Drug May Put Newborns at Risk for Cleft Lip, Palates

The U.S. Food and Drug Administration has announced that there is an increased risk for cleft lip and palate if mothers used the drug topiramate and its generic versions during pregnancy.

Recent data from the North American Antiepileptic Drug Pregnancy Registry suggests those medications used to treat certain types epileptic seizures increases the risk of oral clefts in infants exposed to topiramate during the first trimester of pregnancy.

Infants exposed to topiramate as a single therapy experienced a 1.4 percent prevalence of oral clefts, compared with a prevalence of 0.38 percent-0.55 percent in infants exposed to other anti-epileptic drugs, the registry concluded. Infants of mothers who did not have epilepsy and were not being treated with other anti-epileptic drugs had a prevalence of 0.07 percent and similar results were recorded in the United Kingdom.

The agency recommends that health care professionals warn patients of childbearing age about the potential hazard to the fetus if they become pregnant while using the drug. Topiramate also is approved to prevent migraine headaches, but not to relieve the pain of migraines, said the FDA.

For more information about the anti-epileptic drugs, go to www.fda.gov/Drugs/DrugSafety/ucm245085.htm. All FDA safety alerts relevant to dentistry are posted on ADA.org. Go to ada.org/2942.aspx?currentTab=1 for the latest updates.

CONFABULATION, CONTINUED FROM 611

Confabulation really is an ethical issue. We should not be saying things just because we want them to be true. Confabulations are small in order to be believable. But a lot of small distortions, a habit of shaving the truth, may undermine public trust more than a whopper one has to back away from by claiming hyperbole or puffery.

Sir Frederick Bartlett was a British psychologist who studied memory in the 1920s and 1930s. He is the fellow who invented the "telephone game" where A gets a message to pass on to B who repeats it to C, etc. The message becomes hopelessly garbled by the time it gets to the end of the chain despite all communicator thinking they have been faithful. More than a knock on human foibles, Bartlett proved two things: First, memories are not permanent neural configurations like letters in a filing cabinet. They are dynamic and they change over time. Second, these changes are not random. Memory drifts toward stereotypes or ideals. When we confabulate, our recollections tend toward idealized representations of ourselves.

In one of Bartlett's most famous experiments, he showed subjects an ambiguous outline drawing of an elongated extension with uneven knobs at each end. Sometimes the picture was labeled "barbell"; sometimes it was labeled "drumstick." When individuals were asked sometime later to draw the picture from memory, those who saw the picture labeled barbell exaggerated the symmetry of the knobs, and the more times they drew the picture from memory, the more idealized the barbell became. The same happened for the drumstick, but this time the image converged on an idealized chicken leg. No verbal confusion was involved: he considered only drawings.

Our memory is a flatterer. It is just a little dishonest to confabulate: It is just a little dangerous for us to believe our own confabulations. Nub:

1. 1. When we report on our accomplishments, we are revealing to ourselves what kind of person we think we want to be.
2. 2. Be careful: someone may call our bluff.
3. 3. It is unethical to ask others to believe in a world that we know is a slight exaggeration.

David W. Chambers, PhD, is professor of dental education, Arthur A. Dugoni School of Dentistry, San Francisco, and editor of the Journal of the American College of Dentists.

A lot of small distortions, a habit of shaving the truth, may undermine public trust more than a whopper one has to back away from by claiming hyperbole or puffery.

Palatal Perforation Could Have Unusual Cause

There are a number of conditions that can result in an oronasal fistula, but one could surprise you. Some common and not-so-common causes of perforations in the palate include chronic cocaine use, rhinolithiasis, syphilis, and chronic snorting of oxycodone/acetaminophen (OxyContin). But according to an article in the *Virginia Dental Association Journal*, another cause, which has never been previously reported in the literature, is the chronic use of nasal decongestants.

In the article, the authors discussed a patient case: a woman who became dependent on topical nasal decongestants, using them regularly (contrary to indicated use). Because the chronic use of nasal sprays containing oxymetazoline results in rebound nasal congestion, a vicious cycle can develop, leading to tissue necrosis.

"Since nasal sprays are frequently prescribed for patients who have a possible antral perforation following tooth extraction, or who have undergone nasal or antral surgery, it is important that such patients be informed about the potential of rebound nasal congestion and the need to limit their use," the authors said. "Although nasal necrosis and palatal perforation may not be common occurrences, becoming habituated to the use of a nasal spray in an attempt to treat rebound nasal congestion is a real possibility that may occur more often than we realize."

FDA Recommends Zinc Removal From Denture Creams

The U.S. Food and Drug Administration has urged denture cream makers to remove zinc, conduct additional research on risks, and modify package labels. The move stems from the agency receiving nearly 400 complaints that use of the popular denture cream Fixodent resulted in serious nerve damage.

In a Notice and Recommendation Action, the FDA wrote: "Although zinc is an essential nutrient, overexposure may result in zinc toxicity. We are notifying all manufacturers of denture adhesives and asking for their assistance in dealing with this public health issue."

Consumers most at risk are those "using excessive amounts of the products over extended periods of time; people with poor-fitting dentures; and people who are unable to read or understand product labeling," the FDA wrote, while also "strongly" recommending that denture cream manufacturers replace "zinc with an ingredient that presents less health risks in situations of overuse." Poligrip, another leading denture cream, no longer contains zinc.

Proctor & Gamble, the company that makes Fixodent, said it is in active discussions with the FDA on this topic and that it takes the recent notice very seriously, and that it is "carefully considering the FDA's recommended actions."

Additionally, Proctor and Gamble also said it has already changed its product label to caution customers about overuse of the product, and said it is "always looking for new and improved formulas as we strive to improve our products."

Medical ethicist David Rothman of Columbia University said, "Clearly this captured the attention of the FDA. This is not a recall or a mandate, but if you are a manufacturer of such products, you would move quickly to get your product in order."

Dozens of Fixodent users have sued Proctor & Gamble claiming they were injured after long-term overuse of the product.

"We are encouraging consumers to consult with their doctors if they use significant amounts of zinc-containing denture adhesives such as Fixodent and have tingling or numbness in their extremities," said plaintiffs' attorney Eric Chaffin, in a news release.

"We are encouraging consumers to consult with their doctors if they use significant amounts of zinc-containing denture adhesives."

ERIC CHAFFIN

Gene Combination Could Indicate Whether Implants Are Successful

A gene combination has been identified as a risk factor in the success of dental implants. In a recent article in the *Journal of Oral Implantology,* authors reported on a study of individuals who had the combination of interleukin (IL)-1 allele 2 at IL-1A^{-889} and IL-1B^{+3954} which is considered "genotype positive" and at higher risk for periodontal tissue destruction.

Since peri-implantitis is very similar to periodontal disease, researchers looked to find any association of these genotypes with the severity of peri-implantitis progression and the effect of this combination on treatment outcomes.

Two groups of patients, all of whom had implants, were compared in this study. The first group consisted of 25 patients with peri-implantitis, while the second group of 25 patients had healthy tissue, according to a news release. Five from the second group and 17 from the first group were genotype positive.

Patients in the first group, those with peri-implantitis, took part in a treatment and maintenance program, the authors wrote. The genotype-positive patients in this group experienced greater periodontal tissue destruction and, increased discharge from tissues. The genotype-negative patients responded better to treatment. Statistically significant differences were noted between the groups.

The combination of these two alleles in patients with inflamed periodontal tissues indicated a risk factor that could lead to further tissue destruction. Patients with the specific genotype can have exaggerated local inflammation. Gene polymorphism may affect the outcomes of treatment for peri-implantitis in genotype-positive people and affect the long-term success of implants, authors said.

To see the full article, "The Effect of Interleukin-1 Allele 2 Genotype (IL-1a^{-889} and IL-1b^{+3954}) on the Individual's Susceptibility to Peri-Implantitis: Case-Control Study," published in the *Journal of Oral Implantology,* go to allenpress.com/publications/journals/orim.

UPCOMING MEETINGS

2011	
Sept. 12–17	American Association of Oral and Maxillofacial Surgeons, Philadelphia, aaoms.org
Sept. 14–17	FDI Annual World Dental Congress, Mexico City, fdicongress.org. Please also view this related video: youtube.com/watch?v=3N4okaVMYhs
Sept. 22–24	*CDA Presents the Art and Science of Dentistry,* San Francisco, 800-CDA-SMILE (232-7645), cdapresents.com
Oct. 10–13	ADA 152nd Annual Session, Las Vegas, ada.org
Oct. 23–26	National Primary Oral Health Conference, National Harbor, Md., nnoha.org/conference/npohc.html
Nov. 6–12	United States Dental Tennis Association, Palm Desert, Calif., dentaltennis.org
Dec. 16–17	First Dental Conference, Scientific Dental Committee at the Palestinian Dental Association in Lebanon, Beirut, Lebanon, 916-780-1955
2012	
March 29–April 1	CSPD/WSPD Annual Meeting, Portland, Ore., drrstewart@aol.com
April 22–28	United States Dental Tennis Association's 45th Annual Spring Meeting, Kiawah Island, S.C., dentaltennis.org or 800-445-2524.
April 26–28	World Federation for Laser Dentistry, 13th Annual World Congress, Barcelona, Spain, wfldbcn2012.com
May 3–5	*CDA Presents the Art and Science of Dentistry,* Anaheim, 800-CDA-SMILE (232-7645), cdapresents.com
Oct. 18–23	ADA 153rd Annual Session, San Francisco, ada.org

To have an event included on this list of nonprofit association continuing education meetings, please send the information to Upcoming Meetings, CDA Journal, 1201 K St., 16th Floor, Sacramento, CA 95814 or fax the information to 916-554-5962.

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ORTHODONTICS

GLENN SAMESHIMA, DDS, AND NICOLE SAKAI, DDS

Medical Disorders and Orthodontic Considerations

Patel A, Burden DJ, Sandler J, Medical disorders and orthodontics. *J Orthod* 36(suppl):1-21, December 2009.

AIM: To draw attention to some of the difficulties faced when orthodontic treatment is provided to patients with medical disorders and make recommendations on how to avoid potential problems.

METHOD: A review of different resources to determine the orthodontic considerations for a spectrum of medical disorders.

RESULTS: *Infective endocarditis:* Offer patients clear and consistent information, discuss the risks and benefits of antibiotic prophylaxis and their limited use, thorough oral hygiene instructions (OHI), and be very cautious when placing separators.

Bleeding problems: Inherited coagulopathies: Special care should be taken to make sure patient does not bleed unnecessarily, and plan a nonextraction treatment if possible.

Sickle-cell anemia: Be aware of possible pulpal necrosis involving healthy teeth, the changes in bone turnover, and the greater susceptibility to infections. Orthodontic forces should be reduced and rest intervals between activations should be increased to restore the regional microcirculation.

Leukemia: Treatment should be postponed if the patient requires chemotherapy and should be postponed until at least two years after BMT. Well-fitting removable aligners may be the best treatment. Respiratory system: Be aware that patients may not be comfortable in the supine position and should be scheduled in the morning if possible; good OHI because medications commonly cause reduced salivary flow.

Neurological disorders: Epilepsy: Removable appliances need to be used with caution as they can be dislodged during a seizure. Patients should carry a soft mouthguard with palatal coverage to help avoid trauma. The orthodontic team should be well-trained in seizure management.

Endocrine disorders: Diabetes mellitus: Patients should have early appointments, preventive measures should be taken because of increased risk of periodontal disease, and staff should be educated in response to a hypoglycemic event.

Medications: Drug-induced gingival overgrowth: Most common drugs are phenytoin, cyclosporine, and calcium channel blockers including nifedipine, diltiazem, and amylodipine. Oral hygiene is crucial as well as using small brackets, removing excess composite when bracketing, and not placing auxiliaries that can irritate the gingiva.

Corticosteroids: Postpone orthodontic treatment on patients taking acute doses. Orthodontic forces should be reduced and checked more frequently in patients on chronic steroid treatment.

Bisphosphonates: Plan to minimize risks including a nonextraction protocol favoring interproximal stripping to limit the treatment time and the degree of tooth movement.

Allergies: Nickel and latex: Confirm a true nickel or latex allergy with the dermatologist, and use nickel-free and latex-free products.

Eating disorders: Referral to physician while maintaining confidentiality, remind patients not to brush teeth after vomiting, and proper dieting and OHI.

CONCLUSION: Good communication with other health care providers is essential in treating patients with medical disorders. This article was a good review of the orthodontic considerations when treating patients with different medical disorders.

BOTTOM LINE: Orthodontic treatment is an elective procedure and clinicians should consider all the treatment options to ensure a satisfactory risk-benefit ratio for each and every patient.

CDA JOURNAL, VOL 39, Nº9

IMPLANTS

RICHARD T. KAO, DDS, PHD, AND DAVID W. RICHARDS, DDS, PHD

Ceramic and Metal Implant Abutments

Sailer I, Philipp A, et al, A systematic review of the performance of ceramic and metal implant abutments supporting fixed-implant reconstructions. *Clin Oral Impl Res* 20:4-31, 2009.

AIM: A systematic review to assess the five-year survival rates and incidence of complications associated with ceramic versus metal abutments.

METHOD: Electronic Medline searches complemented by a manual search were reviewed. Screening criteria eliminated all but 51 studies. Failure rates and complications were analyzed using statistical models.

RESULTS: Of the 7,136 articles, 29 clinical and 22 laboratory studies were selected for inclusion. The estimated five-year survival rate for ceramic and metal abutments were 99.1 percent and 97.4 percent, respectively. The estimated incidence of technical complications after five years for ceramic and metal abutments was 6.9 percent and 15.9 percent. The most common complication was the loosening of abutment screws. Esthetic complications were more frequently associated with metal abutments.

CONCLUSION: The five-year survival rates and incidence of complications were statistically similar for both ceramic and metal abutments.

CLINICAL RELEVANCE: Given the available information, the performance of ceramic and metal abutments appeared to be similar. This provides assurance as more anterior-milled abutments are used in the anterior esthetic zone. However, it should be noted that this review did not provide evidence of differences of the technical and biological outcomes of ceramic versus metal abutments. These parameters are areas of future investigation that will prove useful for clinical practice.

TECHNOLOGY

JIN-HO PHARK, DDS, DR. MED.DENT.

Resin-Modified Glass-Ionomer Liners

Duque C, Negrini TDC, et al, Clinical and microbiological performance of resin-modified glass-ionomer liners after incomplete dentine caries removal. *Clin Oral Invest* 13: 465-71, 2009.

AIM: The aims of this study were to evaluate clinically and microbiologically the effects of two resin-modified glass-ionomer cements (RMGICs) used as liners after incomplete dentine caries removal and to identify *Streptococcus mutans* and *Streptococcus sobrinus* strains isolated from dentine samples, before and after indirect pulp treatment.

METHODS: Twenty-seven primary molars with deep carious lesions, but without signs and symptoms of irreversible pulpitis, were submitted to indirect pulp treatment. Treatment consisted of incomplete excavation of the carious dentine, application of one of the RMGICs (Vitrebond (3M, St. Paul, Minn.) or Fuji Lining LC(GC, Tokyo, Japan)) or calcium hydroxide cement (Dycal, Dentsply, Milford, Conn.), and sealing for three months with IRM (Dentsply). Clinical evaluation (consistency, color, and wetness of dentine) and carious dentine collection were performed before temporary sealing and after the experimental period. Microbiological samples were cultivated in specific media for subsequent counting of mutans streptococci (MS) and lactobacilli (LB). MS colonies were selected for identification of *S. mutans* and *S. sobrinus* by polymerase chain reaction.

RESULTS: After three months, the remaining dentine was hard and dry, and there was a significant decrease in the number of MS and LB, in all groups, although complete elimination was not achieved in 33 percent and 26 percent of the teeth for MS and LB, respectively. From 243 MS colonies selected, 216 (88.9 percent) were identified as *S. mutans* and only 2 (0.8 percent) as *S. sobrinus*.

CONCLUSIONS: The use of resin-modified glass-ionomer liners after incomplete caries removal, as well as a calcium hydroxide cement, promoted significant reduction of the viable residual cariogenic bacteria in addition to favorable clinical changes in the remaining carious dentine.

CLINICAL RELEVANCE: In clinical situations, in which complete caries removal in dentin is not performed, application of resin-modified glass-ionomer or calcium-hydroxide liners can help to reduce bacterial contamination and avoid endodontic complications.

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Winners of the 2011 Table Clinic Competition

Each year, the California Dental Association encourages dental, dental hygiene, and dental assisting students from across the state to enter the Table Clinic Competition held during *CDA Presents* in Anaheim. Blue-ribbon winners from the May 13–14 contests were invited to write an abstract of their work to appear in the *Journal of the California Dental Association.*

CLINICAL DENTAL STUDENT WINNERS

Drs. Andrew P. Soderstrom, James Van Sicklen, and Cindy Lyon (far right) pause with winners of the clinical dental student category: Mark Wierenga, Vanessa Browne, and Michael Flewelling, all of Loma Linda University.

Sterilization of Used and Contaminated Implant Healing Abutments and Impression Copings

Vanessa Browne; Michael Flewelling; Mark Wierenga, MBA; Neal Johnson, DDS, MS; Nikola Angelov, DDS, MS; Paul Richardson, DDS, MEd; Ray Aprecio, OD; and Alisa Wilson, RDA, Loma Linda University

Implant manufacturers recommend the use of new implant healing abutments and impression copings for each patient. Significant savings could be realized with the reuse of implant components. The aim of this study was to examine the response of these components to standard steam and chemiclave sterilization protocols. Components from four test groups (20 new and 20 used healing abutments, 20 new and 20 used impression copings) were placed in 2 ml nutrient broth and incubated at 37 degrees Celsius overnight. Broth was examined for turbidity. 100 µl of broth from each tube was spread on nutrient agar plates and incubated as above. Plates were evaluated for growth. Half of the components in each group were processed with steam sterilization and the other half processed with chemiclave sterilization.

After sterilization, components were incubated in 2 ml of broth preinoculated with *Enterococcus faecalis* for 24 hours at 37 degrees Celsius. Components were reprocessed with steam and chemiclave protocols, incubated, and plated as previously described. Chemiclave and steam sterilization eliminated bacteria and sterilized components. Baseline data indicated that new materials arrive sterile, while used components had multiple bacterial strains evident. After sterilization and re-inoculation of *E. faecalis,* similar sterilization results were observed. This information suggests that implant components may be reused following sterilization. Further research is ongoing to evaluate the physical tolerance of implant components after multiple rounds of sterilization and bacterial growth on the surface of used and new components. However, from a strict microbial standpoint, sterilization can be achieved for used implant components.

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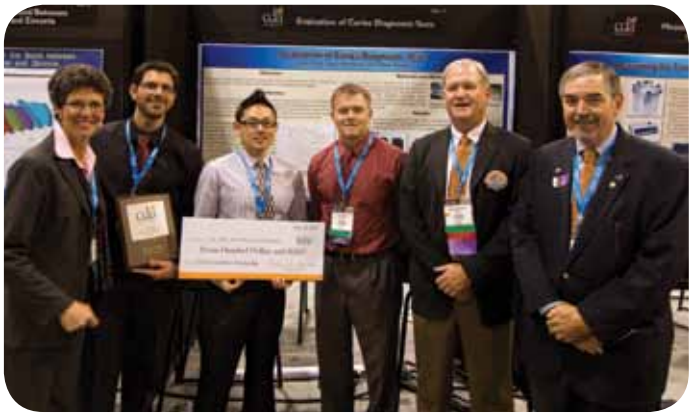
SCIENTIFIC DENTAL WINNERS



Drs. Cindy Lyon, James Van Sicklen, and Andrew P. Soderstrom (far right) flank Alex Matosian, John Chae, and Allan Reeder, all of Loma Linda University, first-place winners in the DDS student scientific category.

Evaluation of Caries Diagnostic Tests

John Chae; Alex Matosian; Allan Reeder; Brian Nový, DDS; Raydolfo M. Aprecio, OD; and William Keeler, Loma Linda University

OBJECTIVE: To evaluate two popular caries diagnostic tests on the basis of their potential to accurately predict caries risk by identification of *Streptococcus mutans*.

INTRODUCTION: *Streptococcus mutans* is known to be the main etiologic organism in tooth decay and is found at high concentrations in the oral environment of those who are at high caries risk. Studies have shown that other noncariogenic microorganisms may prevent *S. mutans* from colonizing teeth. One such species, *Streptococcus sanguinis,* has been found to be present in high concentrations in the low caries risk individual.

A number of diagnostic tools are available for dentists to use in determining a patient's caries susceptibility. Many of these tests predict a patient's caries risk by indicating the presence or absence of *S. mutans.* Two tests were selected and evaluated using *S. mutans* to represent a high caries risk state and *S. sanguinis* to represent a low caries risk state. Test A consists of a selective nutrient agar, which selects for and supports the growth of *S. mutans.* Test B involves immune chromatography using monoclonal antibodies specific for detecting the presence of *S. mutans.*

MATERIALS AND METHODS: Isolated cultures of *S. mutans* and *S. sanguinis* were obtained from the biomaterials laboratory at Loma Linda University, School of Dentistry, Center for Dental Research. Concentrations of the bacterial samples were standardized using a spectrophotometer and a series of test A and test B were performed according to the manufacturer's instructions.

RESULTS: Test A consistently resulted in a diagnosis of high caries risk status by supporting the growth of both species of bacteria. Test B, however, consistently provided a diagnosis of high caries risk only for *S. mutans* and did not diagnose high caries risk for *S. sanguinis.*

CONCLUSION: In a clinical setting, test A may lead to the overdiagnosis (through false positive results) of high caries risk by supporting the growth of noncariogenic species.

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RDH STUDENT WINNERS

Measuring the Concentration Effect of Xylitol

Erika Nelson, Angela Wakefield, Dulce Zavala, and Raydolfo M. Aprecio, OD, Loma Linda University

Erika Nelson, Dulce Zavala, and Angela Wakefield, all of Loma Linda University, are front and center with their winning smiles and first-place awards in the dental hygiene category. Offering their congratulations are Drs. Andrew P. Soderstrom, Cindy Lyon, and James Van Sicklen.

OBJECTIVE: To determine the relationship between the concentration and inhibitory effect of xylitol against *Actinomyces viscosus, Candida albicans, Streptococcus sanguinis,* and *Streptococcus mutans.*

METHODS: Xylitol solutions at 10 percent, 15 percent, 20 percent, and 25 percent were prepared in brain-heart infusion broth and were sterilized by autoclaving for 30 minutes at 121 degrees Celsius with 15 lbs of pressure. The overnight cultures of *A. viscosus, C. albicans, S. sanguinis,* and *S. mutans* were standardized using a spectrophotometer to 0.1 optical density. A triplicate of 6 mL per tube was dispensed into the different concentrations of xylitol, per bacteria. Then, 600 µl of the standardized bacteria was added into each tube. The tubes were incubated at 37 degrees Celsius for 24 hours and observed for turbidity.

RESULTS: There was an inverse relationship between turbidity and xylitol concentration. With each increase in xylitol concentration, the turbidity decreased. A two-way ANOVA of ranked data was used to determine whether xylitol concentration and the organisms were significant factors that influenced the response variable. At 24 hours, there were differences in measurements due to both organisms ($F=11.77$, $df=3$, $p<0.001$) and concentration of xylitol ($F=63.12$, $df=4$, $p< 0.001$). However, no significant interaction was detected ($F=1.41$, $df=12$, $p=0.256$). A Scheffe analysis was run to determine the difference between the effects of xylitol on the organisms. *A. viscosus* was the most sensitive to the effects of xylitol, while *S. mutans* was more sensitive at higher concentrations.

CONCLUSION: These findings are consistent with the hypothesis that the inhibitory effect of xylitol is concentration dependent. It is crucial to know the amount of xylitol contained in various dental products in order to determine what adjunctive therapies to recommend to patients.

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RDA STUDENT WINNERS

The team of Jasmine Vogel, Sara Weigel, Jennifer Cazares, and Brittany Subia, all of Citrus College, relax with Drs. Cindy Lyon (far left) and James Van Sicklen (far right) after winning first prize in the dental assistant category.

Swish Swash, Which One Is the Best Wash?

Jennifer Cazares, Brittany Subia, Jasmine Vogel, and Sara Weigel, Citrus College

We did our project on which mouthwash was the most effective. We conducted two experiments to figure out whether Listerine, Scope, or hydrogen peroxide were the best products. We also used saliva as a control for the experiment. We started by disclosing to see which was best at visually removing plaque. The results from the mouthwashes were all about the same, but the Listerine and hydrogen peroxide were the most uncomfortable to rinse with. Then we used agar plates to see which mouthwash killed the most bacteria. Our findings were hydrogen peroxide was the most effective at killing bacteria, however, it should be mixed with water in a 50/50 solution and used no more than one or two times a week. Another plus to hydrogen peroxide is its teeth-whitening capabilities. Listerine and Scope were about the same in killing bacteria and saliva did kill a small amount of bacteria on its own.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Sara Weigel at sarisama@gmail.com.

Ergonomic Administration of Local Anesthetic

Andrew Taylor, Chad Nosek, Geoff Robinson, Loma Linda University

OBJECTIVE: Existing research has shown that dental practitioners are prone to musculoskeletal pain. Much of this is linked to poor ergonomic positioning during routine tasks such as the administration of a local anesthetic. The goal of this research is to present proper ergonomic guidelines for local anesthetic injections.

METHODS: Correct ergonomic positions were gathered from literature. Numerous injection techniques for IA, PSA, and mental nerve blocks and maxillary and palatal infiltrations were attempted. Techniques maintaining proper ergonomic positioning were photographed. Photographs were analyzed by researchers and experts in dental anesthesia, dental hygiene, and occupational therapy. Techniques were updated and photographs retaken. Final photographs were compiled into handouts.

RESULTS: A general ergonomic guidelines handout and 10 handouts specific to common injections were created to illustrate proper ergonomic technique for either right- or left-handed operators.

CONCLUSIONS: It is possible to administer ergonomic local anesthetic injections using the techniques documented in these handouts.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Andrew Taylor at antaylor@llu.edu.

COMMUNITY/EDUCATION

Drs. Andrew P. Soderstrom, Cindy Lyon, and James Van Sicklen take a moment with Loma Linda University's Andrew Taylor, Chad Nosek, and Geoff Robinson who won the top prize the community/education category.

Following are the judges for the annual Table Clinic Competition held May 13–14 during *CDA Presents* in Anaheim:

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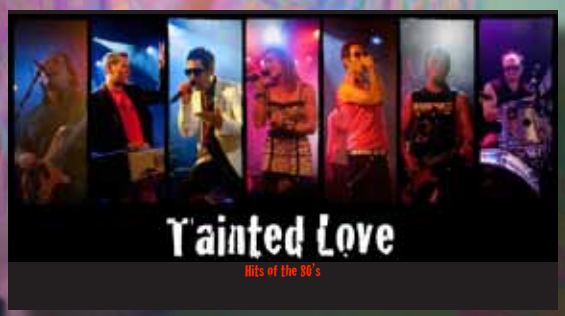

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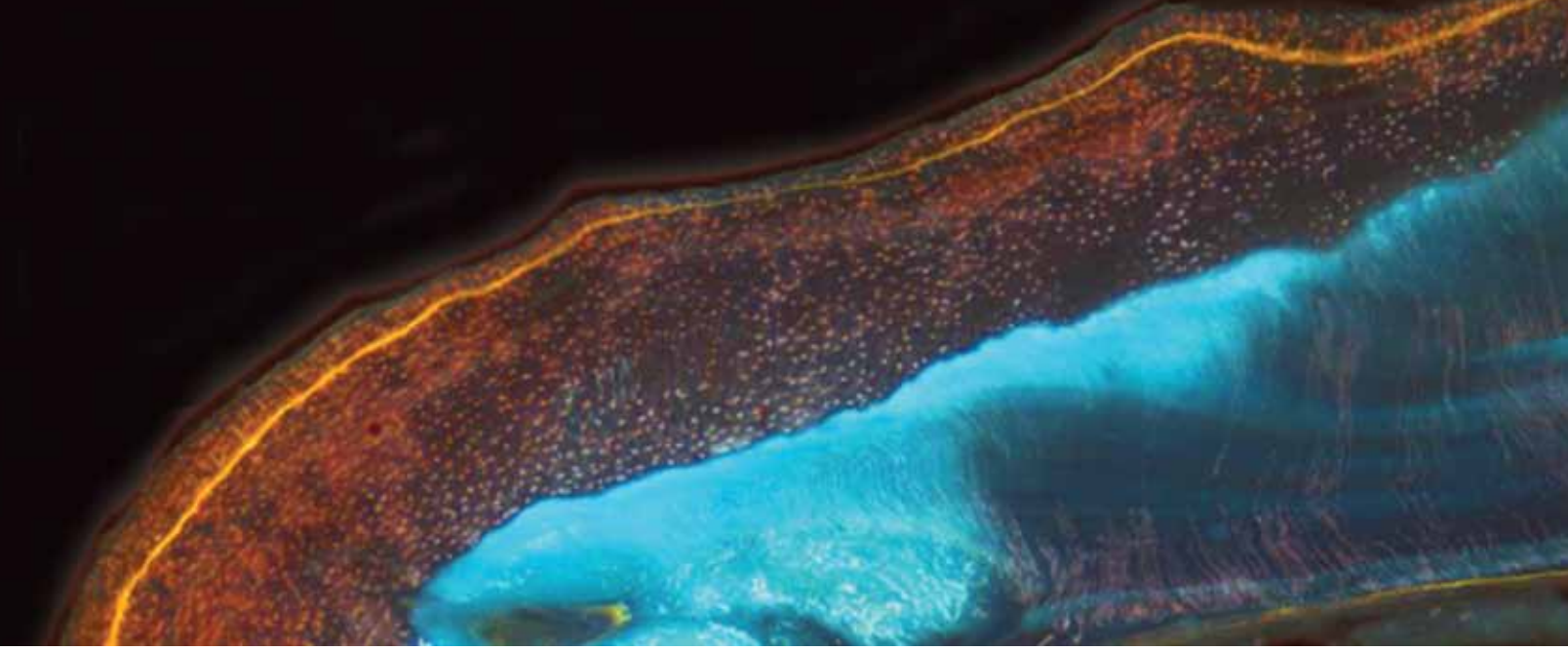

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CDA JOURNAL, VOL 39, Nº9

Saliva in Health and Disease

MAHVASH NAVAZESH, DMD

In 2011, the first members of the baby boom population in the United States reached age 65. The last members of this population will reach age 65 in 2029. The older population, those 65 years or older, represented 12.4 percent of the population in 2000 but are expected to grow to 19 percent by 2030.

GUEST EDITOR

Mahvash Navazesh, DMD, is a professor of Diagnostic Services and associate dean of Academic Affairs and Student Life, University of Southern California, School of Dentistry, Division of Periodontology, Diagnostic Sciences and Dental Hygiene, in Los Angeles.

Approximately 80 percent of all individuals older than 65 have at least one chronic condition, and 50 percent have at least two. Hypertension and heart diseases, diabetes, arthritis, and cancer are the most frequently occurring conditions among older persons. These conditions and the medications often prescribed for their management could impact the structure and function of salivary glands leading to complaints of xerosotomia (dry mouth) or clinical evidence of salivary gland hypofunction (low saliva flow rate). More than 400 medications list dry mouth as a potential adverse effect. In May 2011, the U.S. Food and Drug Administration (FDA) added dry mouth to its consumer health information.

The protein composition of saliva, or salivary proteomes, has been the focus of multiple investigators in recent years. Some proteins in serum, thought to be candidate markers for diseases such as cancer, cardiovascular disease, and stroke, can also be found in whole saliva. These comparisons between serum and salivary proteins have encouraged researchers to consider saliva as a diagnostic fluid to detect early signs of disease throughout the body.

The role of saliva in oral health is well-established, and increased susceptibility to oral diseases caused by diminished or absent saliva is well-documented. Advancing age, combined with the increasing prevalence of systemic diseases and polypharmacy in the older population, represents a

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challenge for public health in general and for oral health care providers in particular. In an effort to promote health, prevent oral diseases, and minimize the need for surgical approaches to restoring the form and function of dentition by early detection of salivary gland disorders, this issue of the *Journal* is focused on saliva in health and disease.

The first article includes the most recent information on Sjögren's syndrome, an autoimmune disorder that affects multiple systems and significantly diminishes the quality of life for those suffering from it. Sjögren's syndrome was considered a rare disease in the 1970s but today is considered one of the most common autoimmune rheumatic disorders. The authors discuss the epidemiology, manifestations, complications, and current American-European classification criteria, as well as recent management modalities.

The second article includes the advances in prevention and/or management of oral complications associated with head and neck cancer therapy. The authors discuss the epidemiology of oropharyngeal cancer and oral complications associated with radiation and chemotherapeutic approaches to managements. Stem cell therapy, neuromuscular stimulation, hyperbaric oxygen therapy, submandibular gland surgical transfer, cholinergic and cytoprotective agent utilization, and concurrent chemotherapy approaches are discussed. The evolving technologies and management approaches that attempt to provide a better quality of life for cancer survivors are reviewed.

The author for the third article reviews the imaging techniques available for the diagnosis of salivary gland disorders that are most relevant to oral health care providers in the everyday practice of dentistry. Indications for conventional X-ray sialography, computer tomography, magnetic resonance imaging, salivary gland scintigraphy, and ultrasound are discussed, and their applications are described.

In the last article, the authors have summarized the most common potential contributing factors to salivary gland dysfunction as well as its signs and symptoms, diagnostic work-up, and preventive and therapeutic managements. It is hoped that by enhancing readers' awareness of the aging population, who is commonly at risk for salivary gland hypofunction and its complications, proper actions are taken in the early detection of associated signs and symptoms and prevention of the major complications. Ultimately, the quality of life of the patient is improved. The heterogeneity of the manifestations of salivary gland disorders frequently makes the diagnosis and management of the patients challenging. A systematic approach to data collection, diagnostic work-up including clinical, imaging, and laboratory findings, as well as close collaboration among different health care professionals, will lead to accelerated timely diagnoses and, hopefully, earlier intervention, prevention, and management protocols for patients. ■■■■

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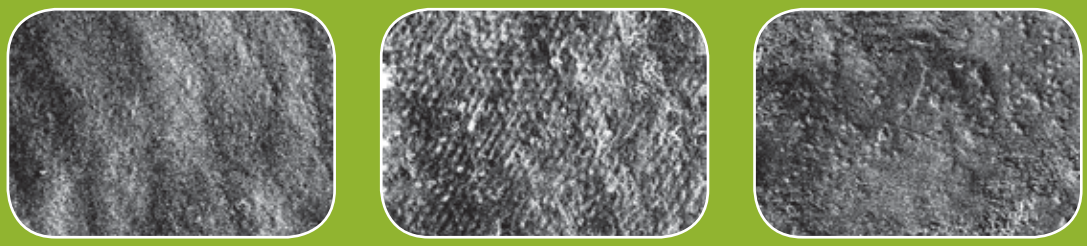

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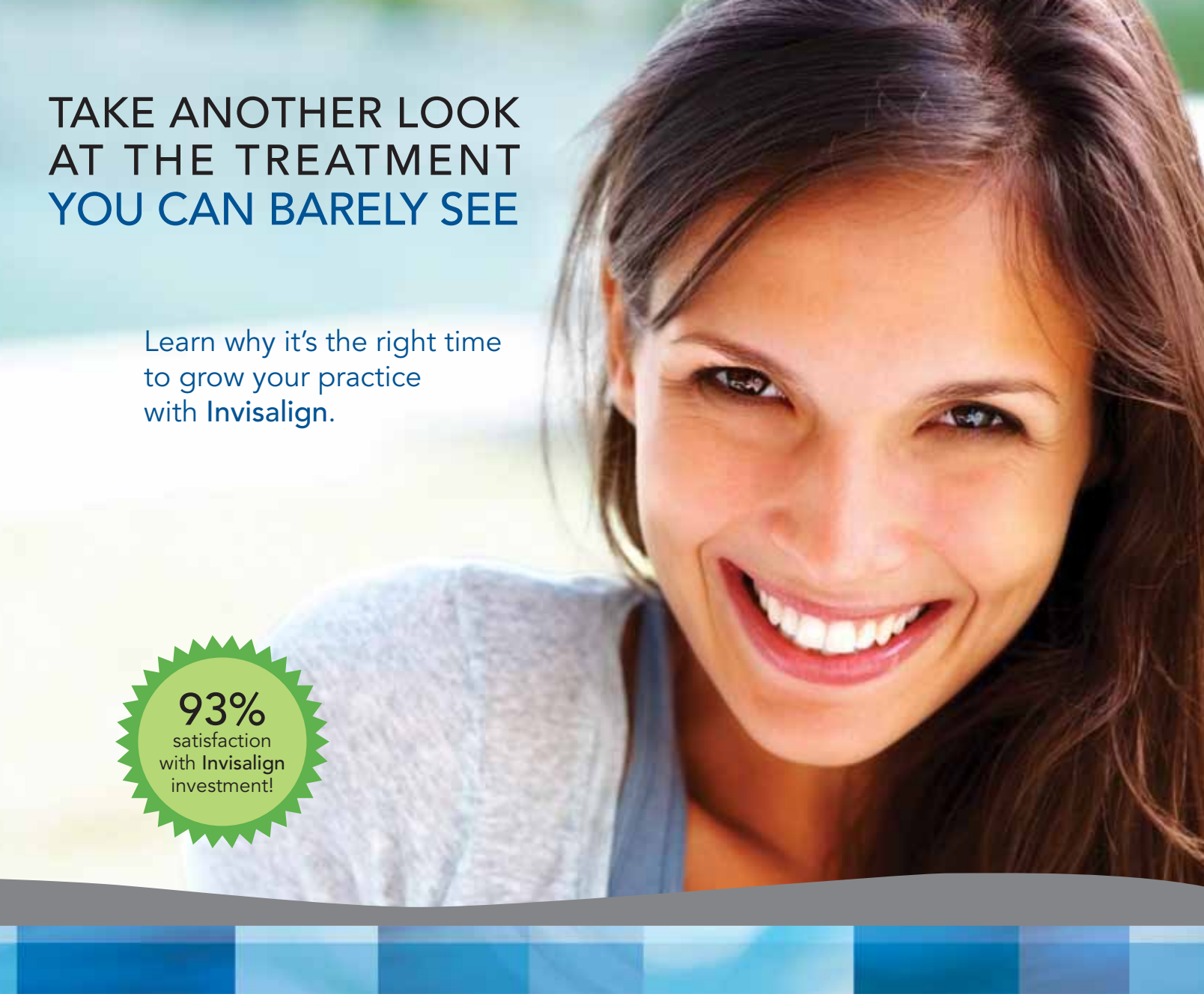

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A Current Perspective on Sjögren's Syndrome

ABU N. M. NAZMUL-HOSSAIN, DDS, MSC, PHD; GEORGE M. MORARASU, DDS, MS; SAMUEL K. SCHMIDT, BS; AMBER J. WALKER, BS; SANDRA L. MYERS, DMD, MS; AND NELSON L. RHODUS, DMD, MPH, FICD

ABSTRACT Sjögren's syndrome is a common autoimmune disorder characterized by dry mouth and dry eyes. Symptoms and signs are chronic and can be severe. The diagnosis of Sjögren's syndrome can be confusing and time-consuming. The management can also be a significant challenge for the clinicians. However, recent genomic and proteomic developments are unlocking the mystery of the disease process as well as contributing to our ability to define, diagnose, and develop new treatment modalities for patients with this complex disorder.

AUTHORS

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Sjögren's syndrome (SS) is a common, chronic, heterogeneous inflammatory autoimmune disorder characterized by dry mouth (xerostomia) and dry eyes (keratoconjunctivitis sicca). Lymphocytic infiltration of the salivary and lacrimal glands is a hallmark feature of SS and may lead to destruction of their functional capacity.[1] SS can be divided into primary SS (pSS) when it occurs alone or secondary SS (sSS) when it is associated with another autoimmune condition, most commonly systemic lupus erythematosus (SLE) or rheumatoid arthritis (RA).[2-3] Extraglandular manifestations can occur in about one-third of patients with pSS and can include arthritis and arthralgias, myalgias, neuropathies, vasculitis, and nephritis.[4] The etiology of pSS is largely unknown and current diagnostic criteria are not well-defined. Treatment strategies are mostly directed at symptoms.

Epidemiology and Clinical Manifestations

The prevalence estimates of SS range from 0.5 to 2 percent in adult population.[2,5-6] SS is the most common autoimmune rheumatic disease and even occurs more frequently than SLE and RA[7] (**TABLE 1**). However, it is frequently unreported, unrecognized, and untreated. The peak incidence is in the fourth and fifth decades of life, but the disease may occur in all ages.[2] It predominantly affects women by 9:1, however, signs and symptoms in males and females are the same. Although the disease may occur in all races and ethnicities to a similar extent, the typical patient is a Caucasian female, particularly of Northern European ancestry. The average time from onset of symptoms to diagnosis of SS is at least three and a half years.[8] Variations with initial and subsequent symptoms can make the disease difficult to recognize.

TABLE 1

Prevalence of arthritis and other rheumatic conditions in the United States.[5]

Rheumatic Conditions	U.S. Prevalence
Rheumatoid arthritis	1.3 million adults
Juvenile arthritis	295,000 children
Spondylarthritides	0.6–2.4 million adults
Systemic lupus erythematosus	161,000–322,000 adults
Systemic sclerosis	49,000 adults
Primary Sjögren's syndrome	0.4–3.1 million adults

TABLE 2

Effects of Dry Mouth and Dry Eyes in Sjögren's Syndrome

Symptoms	Consequences
Dry mouth	Difficulty in chewing, swallowing, and speaking Changes in taste Burning sensation in the mouth Rapidly progressing dental decay Advanced periodontal diseases Problems wearing dentures Erythematous, fissured, or ulcerated tongue Sticky buccal mucosa Oral candidal infection Enlarged and/or tender salivary glands Malignant lymphoma of the salivary glands
Dry eyes	Eye redness, itching, and burning Photosensitivity and glare Blurred vision Conjunctival infection Corneal ulceration Blindness

FIGURE 2. Patient with Sjögren's syndrome and very dry, atrophic, fissured tongue

FIGURE 1. Patient with Sjögren's syndrome and enlarged parotid glands.

The signs and symptoms of SS can be divided into "hallmark" features of glandular origin, and systemic signs and symptoms of extraglandular origin. Patients with SS typically present with sicca symptoms characterized by dry mouth and dry eyes. Dry mouth is the predominant oral symptom and may result in difficulty with chewing, swallowing, and speaking (**TABLE 2**). Dental decay is a common complication and the risk increases progressively with dryness.[9-10] In addition, the decrease in mucin production predisposes patients to loss of taste, bacterial infection, and increased predisposition to periodontal diseases.[11] Oral candidiasis has been reported to occur in up to 80 percent of patients.[12] This usually takes the form of angular cheilitis and acute erythematous candidiasis (**FIGURE 1**). Major salivary gland enlargements, particularly the parotid glands, occur in 25-60 percent patients[13] (**FIGURE 2**). Dryness of eyes is another major manifestation of SS. Diminished secretion of tears leads to corneal and bulbar conjunctival ulceration.[1] Patients frequently complain about a "sandy" feeling, itchy eyes, a burning sensation, blurred vision, and an inability to tolerate light.[14] Clinical signs are dilatation of the bulbar conjunctival vessels and irregularity of the corneal image.

The autoimmune process in SS preferentially targets the salivary and lacrimal glands. However, numerous other organs in the body may be affected such as skin, muscles, joints, nerves, vessels, heart, lungs, esophagus, stomach, liver, pancreas, and kidneys (**TABLE 3**). Involvement of the major organs is not often life-threatening, but can be severe and significantly impair a patient's quality of daily life.[4] Major organ involvement is seen in about one-third of patients with SS.[15] Manifestations of lung, liver, and kidney diseases usually occur early, almost around the time of diagnosis.[16] These manifestations are characterized by a common immune process that involves infiltration of the affected organ by lymphocytes. On the other hand, a less common type of kidney involvement, glomerulonephritis, and the involvement of peripheral nerves often occur later in the disease process and are usually not present at the time of diagnosis.[9,16] These two conditions are also characterized by a common immune process known as vasculitis, which is caused by the deposition of immune complexes on the vessel walls.[1]

The dermal manifestations are usually nonpalpable purpura, but palpable purpura can also be seen.[17] Dryness of the skin in some patients has been associated with lymphocytic infiltration

TABLE 3

Manifestations of Organ System Involvement in Sjögren's Syndrome

Systems	Components	Manifestations
Dermal	Skin	Pruritis (xerosis)
	Hair	Hair loss
Musculoskeletal	Joints	Arthralgia and arthritis (nonerosive)
	Muscles	Myositis and fibromyalgia
Neurological	Nerves	Peripheral neuropathy (sensory and motor) Cranial (trigeminal) neuropathy Mononeuritis multiplex Carpal tunnel syndrome
	Brain	Cognitive impairment Anxiety, depression, and fatigue
Hematological	Vessels	Purpura (nonpalpable and palpable) Vasculitis Raynaud's phenomenon Lymph adenopathy Non-Hodgkin's lymphoma
Cardiac	Heart	Pericarditis
Pulmonary	Nose	Atrophic rhinitis
	Larynx	Dyspnoea
	Trachea	Laryngotracheobronchitis
	Bronchi	Atelectasis
	Lungs	Interstitial lung disease Pulmonary hypertension Pleurisy and pleural effusion
Gastrointestinal	Esophagus	Esophageal dysmobility Esophagitis
	Stomach	Gastro-esophageal reflux Dyspepsia Chronic atrophic gastritis
Hepatobiliary	Liver	Chronic active hepatitis Primary biliary cirrhosis
	Pancreas	Pancreatitis
Endocrine	Thyroid glands	Hypothyroidism
Urogenital	Kidneys	Interstitial nephritis Glomerulonephritis Nephritogenic diabetes insipidus
	Uterus	Interstitial cystitis
	Vagina	Vaginal dryness

in the eccrine glands.[18] The musculoskeletal manifestations include general malaise, arthralgia, and myalgia.[19] Neurological manifestations include peripheral sensory or sensory-motor neuropathy or mononeuritis multiplex and occur in approximately 30 percent of patients with SS.[20] Cranial neuropathy and carpal tunnel syndrome may occasionally occur. Anxiety, depression, and cognitive disorders are common, while fatigue is also a relatively common symptom.[21] In the hematological system, Raynaud's phenomenon is found in more than one-third of patients with SS.[22] Vasculitis of the skin is common and presents with palpable purpura.[23] Other sites that may be involved with vasculitis include the lungs, kidneys, and bladder. Patients with SS are at increased risk of developing non-Hodgkin's lymphoma.[24] These lymphomas are primarily of B cell origin. Pulmonary manifestations are common and include dry cough due to dryness in tracheobronchial mucosa, and dyspnea due to interstitial lung disease.[25] In the gastrointestinal tract, dryness of the pharynx and esophagus may cause dysphagia.[26] Other manifestations may include esophageal dysmobility and reflux esophagitis with gastritis. Liver involvement is rare in SS, though, when present, it may show features of primary biliary cirrhosis.[27] Urinary acidification test results are abnormal in about one-third of patients with SS. Most of these patients may have distal renal tubular acidosis resulting from interstitial nephritis.[28] However, glomerulonepritis may also occur in patients with SS.

Current Classification Criteria

A number of different sets of patient classification criteria have been developed for SS since 1975 and remain controversial. Many of the problems have evolved from disagreements on whether or not a given set of criteria requires evidence of oral, ocular, histopathological, and serological components. More recent attempts have been made to address these issues when Vitali et al. in 1993 initiated the formation of an International Sjögren's Syndrome Diagnostic Criteria Group.[29] Their efforts led to the publication of an American-European Consensus Criteria (AECC) in 2002 after revising the 1993 European Classification Cri-

TABLE 4

American-European Classification Criteria for Sjögren's Syndrome

1. Ocular Symptoms	A positive response to at least one of the following three questions: Have you had persistent feeling of dry eyes for more than three months? Do you have a recurrent sensation of a foreign body in the eyes? Do you use tear substitutes more than three times a day?
2. Oral Symptoms	A positive response to at least one of the following three questions: Have you had a daily feeling of dry mouth for more than three months? Have you had recurrently or persistently swollen salivary glands? Do you frequently drink liquids while swallowing dry foods?
3. Ocular Signs	A positive result for at least one of the following two tests: Schirmer's test, performed without anesthesia (≤ 5 mm in 5 min). Rose bengal score or lissamine green score ≥ 4 (according to Bijsterveld's scoring system).
4. Oral Signs	A positive result for at least one of the following three tests: Unstimulated whole salivary flow (≤ 1.5 ml in 15 min). Parotid sialography showing presence of diffuse destruction without major duct obstruction. Salivary scintigraphy showing delayed uptake, reduced concentration or delayed excretion of tracer.
5. Histopathology	A focus score ≥ 1 (50 lymphocytes per 4 mm^2) in minor salivary glands.
6. Serology	Presence of autoantibodies (anti-Ro/SSA and/or anti-La/SSB) in serum.

Note: Diagnosis of primary Sjögren's syndrome requires four out of six criteria, including item 5 or item 6. Diagnosis of secondary Sjögren's syndrome requires a well-defined connective tissue disease and any one from items 1-2 and any two from items 3-5.

teria (ECC).[30] The new criteria contain a set of questionnaires on subjective symptoms, and objective tests for oral and ocular dryness. A patient must also have positive histopathology indicating lymphocytic infiltration into minor salivary glands or presence of autoantibodies (anti-Ro/SSA and/or anti-La/SSB) in conjunction with oral and ocular features in varying combinations to be classified with SS (TABLE 4).

In practice, the clinical tests for SS are often inconsistently applied. Diagnosis often relies on a clinician's impression and is not fully based on any of the published criteria. Diagnosis and treatment are further complicated because they involve multiple specialties including dentistry, ophthalmology, and rheumatology.

Proposed Etiopathogenesis

The exact etiology of SS is unknown, and multiple factors are thought to be involved. Previous studies indicated that SS results from the interaction of environmental agents and susceptibility of genes that modulate the immune system in attacking a target organ.[2,4]

The evidence for genetic susceptibility in SS has evolved on the basis of familial aggregation and candidate gene association studies. There have been few studies concerning the heritability of SS and the relative genetic risk is not known. Large twin studies in SS are lacking and therefore the twin concordance rate cannot be estimated. There are only a few case reports describing twins with SS.[31] However, as with most autoimmune diseases, a close association between human leukocyte antigen (HLA)-DR and HLA-DQ alleles and the production of anti-Ro/SSA and anti-La/SSB autoantibodies has been described.[32] Variations in certain cytokine genes such as interleukin (IL)-10 and IL-6, and polymorphisms in the apoptotic signal molecules (e.g., Fas and FasL) have been associated with SS.

The putative role of different viruses in SS has been reported in the literature.[33] Potential viral triggers include a number of viruses such as Epstein-Barr virus (EBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and human T cell leukemia virus-1 (HTLV-1). Specific evidence supporting these pathogenic viruses vary, but include certain properties as the ability to infect glandular and immune-related cells, similarities between viral sequences and autoantigens, symptoms resembling SS following viral infection, and association between viral infection and lymphoma formation. A possible association between the bacterium, *Helicobacter pylori,* and SS has also been reported.[34] This bacterium might trigger a widespread clonal B cell expansion leading to mucosa-associated lymphoma formation. However, studies with antibodies against this bacterium have given conflicting results.

The predominance of female patients with SS supports a role for hormonal factors for the causation of the syndrome. The presence of estrogen receptors in cultured epithelial cells from salivary glands of SS patients and the development of autoimmune exocrinopathy in estrogen-deficient mice suggest that estrogen influences the growth, differentiation, and function of salivary gland epithelial cells.[35-36] However, human studies analyzing serum levels of estrogen and other hormones have not shown similar results.

Existing Treatment Modalities

The management of SS can be divided into replacement and stimulation therapy for dry mouth and dry eyes and systemic therapy for specific extraglandular manifestations. Most patients with SS require the former for dry mouth and dry eyes. However, patient education and regular care by a dentist, an ophthalmologist, and a rheumatologist are vital when treating a patient with SS.

General measures for dry mouth include avoidance of drugs that precipitate dry mouth problems as much as possible. Maintenance of good oral hygiene and regular dental check-ups are also important. General measures for dry eyes include avoidance of low humidity environments such as air-conditioned or centrally heated areas, and irritants such as cigarette smoke.

Replacement therapy consists of artificial saliva and/or tears that aim at replacing the deficient saliva and tears with numerous saliva and tear substitutes available for patients to try. The efficacy of these substitutes can be dependent on individual differences.

Systemic treatment can be subdivided into symptomatic therapy and specific therapy. For symptomatic problems with dry mouth and dry eyes, secretogogues such as pilocarpine and cevimeline can be prescribed. Pilocarpine is a muscarinic receptor agonist that can stimulate salivary secretions. Oral pilocarpine has been shown to be effective in the treatment of SS-associated xerostomia and keratoconjunctivitis sicca.[37] However, its use is limited by adverse effects such as sweating, flushing, headache, abdominal pain, and increased urination. Cevimeline, a newer sialogogue, has more selective muscarinic receptor agonist properties with higher affinity for M1 and M3 receptors, which are prevalent in salivary and lacrimal epithelial cells. Randomized placebo-controlled trials have shown that cevimeline is effective for SS-associated sicca symptoms.[38-39] Adverse events reported include nausea, abdominal pain, and increased sweating. Although oral pilocarpine and cevimeline are the drugs of choice for patients with residual salivary gland function, neither of them addresses the underlying disease process nor leads to increase in basal nonstimulated salivary flow.[40]

Immunosuppressive therapy has been used for extraglandular features of SS. Hydroxychloroquine is generally used to treat arthralgias, fatigue, and dermal manifestations. Methotrexate, on the other hand, showed improvement with subjective sicca symptoms, but had no effect on objective tests.[41] Systemic corticosteroids are mainly used to treat severe extraglandular complications. Low-dose prednisolone has been reported to improve saliva flow and reduce anti-Ro/SSA and anti-La/SSB antibodies and also serum immunogloubulin levels.[42]

THE PREDOMINANCE of female patients with SS supports a role for hormonal factors for the causation of the syndrome.

Recent studies in SS have elucidated the pathophysiological mechanisms and led to the identification of some biological agents. Initially, anti-TNF agents such as infliximab and etanercept have been tested but with no success.[43-44] Subsequently, convincing evidence on B cell hyperactivity has led to B cell depletion therapies for SS. Thus the B lymphocyte pathogenic axis has been targeted by numerous drugs currently in evaluation. Rituximab was the first B cell targeting therapy to be evaluated in SS. This monoclonal antibody directs against the CD20 cell surface antigen present on B cells and results in depletion of circulating B cells. The evidence suggests that rituximab is effective for reduction of glandular inflammation and regression of lymphoepithelial lesions that predispose to the development of lymphoma.[45] Several studies have also shown improvements in subjective sicca symptoms with rituximab.[46-47] Epratuzumab is a monoclonal antibody that directs at the CD22 cell surface antigen present on B cells and induces their depletion. It alleviates dryness and pain and possibly improves the salivary flow.[48] At present, three more drugs such as belimumab, atacicept, and BR3-Fc are being evaluated. Belimumab is a monoclonal antibody that specifically targets a cytokine molecule known as BAFF (B cell activating factor of the TNF family) or BLys (B lymphocyte stimulator).[49] Atacicept is a soluble receptor that inhibits BAFF and its ligand, APRIL (a proliferation-inducing ligand). BR3-Fc is also a soluble receptor that inhibits only BAFF. Given their efficacies in SLE or RA, these B cell directed therapies hold significant promise for the treatment of SS.

Recent Developments in Sjögren's Syndrome Research

Recently, high-throughput molecular techniques have provided enormous opportunities to highlight the disease process and to discover disease-specific markers for SS. These approaches have given a broader and a more complete picture of the repertoire of molecules that are active simultaneously during autoimmune inflammatory processes. Using microarrays, several gene expression profiling studies in SS have been reported and thus far, focus on salivary gland tissue and peripheral

blood.[50-52] These studies strongly support the role of innate immunity, in addition to adaptive immune mechanisms, in the pathogenesis of SS. Currently, interferons (IFNs) and interferon-regulatory factors (IRFs) are of major focus in studies of SS disease mechanisms.

Efforts to develop protein-based markers for SS are also in progress. New proteomic technologies utilizing mass spectrometry have been in use to explore the molecular basis of disease initiation and progression. Using mass spectrometry and microarray concurrently to identify proteomic and genomic biomarkers in whole saliva collected from SS patients have shown significant promise.[53-54] Interestingly, these candidate biomarkers were IFN-inducible, or were related to lymphocyte infiltration and antigen presentation known to be involved in the pathogenesis of SS. Thus, the molecular signature in saliva supports other findings suggesting a major role of IFN in the pathogenesis of SS.

Conclusions

SS is a disabling disorder affecting a substantial proportion of the general population. The precise etiology is unknown. Clinical manifestations are heterogeneous and management can be challenging. High-throughput genomic and proteomic studies are underway to clarify distinctive pathogenic process and disease-specific markers. So far, these studies have supported the existing dogma that IFNs are the prime factors in modulating the disease process. These findings also suggest therapeutic utility of IFNs in SS. Further investigations are essential to reveal these and other molecules and associated pathways involved in the evolution, progression, and complications of the disease. Additional work to characterize such biomarkers could greatly advance our ability to define, diagnose and develop new treatment modalities for SS patients. ■■■■

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Timothy G. Giroux
DDS/Broker

ASK THE BROKER

Question:

Your last article spoke about confidentiality when selling a practice, but what is the best time to tell the staff and the patients?

Normally, most doctors do not inform the staff until we have a signed contract, a signed lease, and financing in place to complete the purchase. We usually try to have all these important elements in place at least two to three weeks prior to close, but for many reasons, these key elements may not come together until just before the closing date.

It may seem harsh to attempt to keep the staff out of the picture until the end, but it is similar to a single mother not introducing multiple possible future prospects to her children until she is sure he is the right one! The staff will be alarmed about the change, but explaining that they are especially important in the transfer of goodwill of the practice usually alleviates their concern of possibly losing their jobs. We strongly advise the new doctor to maintain the same staff with their current pay and benefits.

If the staff begins to suspect the sale, we advise the doctor to inform the staff. Again, they must be informed as to why they are so critical in the transition process and why they are not in danger of losing their jobs. Telling white lies to a suspecting staff will often create ill feelings and create resentment when they are finally informed. For the same reasons stated above, we still advise keeping all the possible buyers from the staff while meeting with the interested buyers after hours. Unfortunately, any call to the office from an unfamiliar doctor might create a buzz of suspicion.

If the doctor has a long-standing relationship of trust with the staff and has always included them in his executive decisions regarding the office, he may decide to consult with them from the onset of his decision. Many times the doctor does not know how to run any of the management programs in the office computer. Informing the staff early actually makes the broker's job easier as key staff members can be contacted to retrieve vital information regarding the practice. As always, inform the staff of their importance in the process as it is still necessary to alleviate their fear of change.

In my next article, I will share my thoughts on informing the patients during a transition.

Timothy G. Giroux, DDS is currently the Owner & Broker at **Western Practice Sales (westernpracticesales.com)** and a member of the nationally recognized dental organization, ADS Transitions. You may contact ***Dr Giroux at*: wps@succeed.net or 800.641.4179**

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Salivary Gland and Associated Complications in Head and Neck Cancer Therapy

SATISH KUMAR, DDS, MDSC; SARAVANAN RAM, DDS, MS; AND MAHVASH NAVAZESH, DMD

ABSTRACT Xerostomia and salivary gland hypofunction are two of the most common and significant complications of head and neck cancer therapy in the head and neck region. This article will provide a brief overview of salivary gland hypofunction and associated complications in head and neck cancer therapy, mainly in radiation therapy. The discussion will include quality of life issues as well as current advances in cancer therapy to reduce xerostomia and salivary gland hypofunction.

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Head and neck cancer (HNC) usually involves squamous cell carcinomas affecting the oral cavity, lip, oropharynx, nasopharynx, larynx, paranasal sinuses, salivary glands, parathyroid, and thyroid. According to the American Cancer Society, cancers involving the oral cavity and pharynx accounts for 2.4 percent of all cancers in the United States. Cancers of the oral cavity and pharynx affected 36,540 Americans in the year 2010 and 7,880 lives were lost to these cancers.[1] The five-year survival rate of these patients is 61 percent, and the 10-year survival rate is 50 percent.[1] However, the survival rates may vary depending on the tumor staging referred to as "TNM staging" where tumor size, nodal involvement, and distant metastasis determines the severity of the tumor and, hence, treatment and prognosis. Globally, about 400,000 new cases of cancers of the oral cavity and pharynx are reported with the highest incidences in Southern Asia and Central and Southern Europe.[2] Although the overall incidence has been decreasing, there has been a shift in the epidemiology with a much younger population being afflicted with oral and pharyngeal cancers (OPC) mainly attributed to human papillomavirus.[3-6]

Salivary Gland and Associated Oral Complications in HNC Therapy

(**TABLE 1**) HNC management requires a multidisciplinary team that may contribute to improved survival.[7] Treatment involves surgery, radiotherapy, and chemotherapy usually used in combination. Combination therapy reduces the quality of life (QoL) to a greater extent than monotherapy.[8] Treatment choices are made based on tumor-related factors such as tumor site, staging based on site, nodal involvement, and distant metastasis, depth of invasion, previ-

TABLE 1

Salivary Gland and Associated Oral Complications in HNC Therapy

Xerostomia and salivary gland hypofunction
Difficulty in chewing and speaking
Difficulty in swallowing (dysphagia)
Taste abnormalities (dysguesia) and smell abnormalities (dysosmia)
Oral inflammation and infections (fungal, bacterial, and viral)
Dental caries and periodontal disease
Osteoradionecrosis
Loss of appetite and nutritional impairment

ous treatment, impact on QoL, and patient preferences.[9-11] Xerostomia and salivary gland hypofunction are the most significant long-term complications of radiotherapy in the head and neck region.[12] Xerostomia is the subjective complaint of dry mouth, which may or may not be associated with objective evidence of salivary gland hypofunction (SGH). A patient is considered to have reduced salivary flow if the unstimulated salivary flow is ≤0.1 ml/minute measured for five to 15 minutes, or if the chewing stimulated salivary flow ≤0.7 ml/minute measured over five minutes.[13] Other oral complications related to this include difficulty in chewing, speaking, swallowing, taste and smell abnormalities, oral infections and inflammation, osteoradionecrosis, dental caries (root caries) and periodontal disease. These conditions affect the overall QoL after treatment of HNC.[14] Another form of cancer therapy, radioactive iodine (RAI) in the form of *I-131*, is used as adjuvant therapy to treat thyroid cancer after thyroidectomy to ablate the residual normal thyroid remnant and to treat thyroid cancer metastases. The use of RAI therapy involves both acute complications (nausea and vomiting, loss of taste, salivary gland swelling, and pain) and long-term complications (recurrent sialadenitis associated with xerostomia, mouth pain, dental caries, pulmonary fibrosis, nasolacrimal outflow obstruction, and second primary malignancies).[15]

Xerostomia and Salivary Gland Hypofunction

Of all the therapeutic modalities used in management of HNC, radiotherapy plays the main role in causing permanent damage to salivary glands thereby disrupting all essential functions of saliva. Radiation causes DNA damage and, thereby, cell death of salivary gland tissue. Both qualitative and quantitative changes in saliva may lead to xerostomia, salivary gland hypofunction, alterations in taste, smell, chewing, swallowing and speech, dry and atrophic oral mucosa, oral ulceration, oral infections, radiation caries, and periodontal disease.[10] It is important to understand that patient-reported xerostomia (dryness) may not correlate with the salivary flow and that patient-reported xerostomia is of higher clinical relevance.[16] Chemotherapy has been shown to induce temporary xerostomia in some patients and the salivary flow usually returns to pretreatment levels after chemotherapy is completed. The mechanism of chemotherapy-induced transient xerostomia is not understood. In addition, some patients do not develop xerostomia after chemotherapy.

XEROSTOMIA
and salivary gland hypofunction are the most significant long-term complications of radiotherapy in the head and neck region.

Difficulty in Chewing and Speaking

Quantitative and qualitative changes in saliva in the oral cavity may lead to difficulties in chewing and speaking. Other complications associated with cancer therapies such as surgery or radiotherapy-induced fibrosis, radiotherapy- and chemotherapy-associated mucositis, and dental infections, can also make the simple acts of chewing and speaking extremely difficult in these patients.[18] Speech and swallowing therapists will help patients in improving these abilities and thus the overall QoL.

Difficulty in Swallowing (Dysphagia)

Difficulty in swallowing is a frequent complication associated with HNC therapy. In a recent and objective assessment of a dysphagia study involving 47 patients treated with chemoradiotherapy (CRT) for head and neck squamous cell carcinoma (HNSCC), there was significant impairment of objective swallowing function in all domains following CRT, with residue and aspiration domains being affected most significantly.[19] Speech and swallowing therapists will help patients overcome these difficulties.

Taste Abnormalities (Dysguesia) and Smell Abnormalities (Dysosmia)

Taste and smell abnormalities commonly follow radiotherapy and/or chemotherapy. This affects food intake considerably and hence nutrition and overall QoL. The reported prevalence of dysgeusia ranges from 56 percent to 76 percent depending on the type of cancer treatment. Prophylactic use of zinc sulfate and amifostine can be of limited use in some patients. Nutritional counseling such as modification of dietary habits, including avoidance of certain foods, is required to minimize the symptoms of dysgeusia and dysosmia.[20]

Oral Inflammation and Infections (Fungal, Bacterial, and Viral)

A persistent decrease in salivary flow makes the oral mucosa dry, friable, prone to irritation, and subsequent inflammation and infection. Oral candidiasis is a common infection in HNC patients during and after radiotherapy and/or chemotherapy. It usually presents as white plaque (pseudomembranous candidiasis) during radiation therapy that can be easily wiped off with underlying inflammation. Atrophic (erythematous) candidiasis, which does not have removable white plaque, is seen in postradiation therapy patients. The incidence of oral candidiasis during radiotherapy has been reported to be significantly higher compared to patients who did not receive radiotherapy. Oral candidiasis along with oral mucositis can increase oral and pharyngeal discomfort in HNC patients.[21] In a recent systematic review, radiotherapy and chemotherapy in the head and neck region were independently found to be associated with a significantly increased risk for oral fungal infection. The prevalence of oral fungal colonization was determined to be 48.2 percent, 72.2 percent and 70.1 percent, before, during, and after cancer treatment, respectively.[22] Topical antifungal medications such as clotrimazole troches and nystatin rinses may not be as helpful as systemic medications (especially those that are absorbed from the gastrointestinal tract such as ketoconazole) in treating candidal infections.[18,23] Most topical antifungal drugs available for use in oral candidiasis have highly cariogenic amounts of sucrose or glucose. It makes them inappropriate for use in postradiation therapy patients with decreased salivary flow. Sugar-free vaginal preparation of antifungals can be used in such situations.

Chemotherapy and the associated complication of neutropenia increase the risk of oral herpes simplex virus (HSV) infection. In patients treated with chemotherapy in combination with radiotherapy, the prevalence of oral HSV infection has been shown to increase up to 43.2 percent. The anti-viral drugs acyclovir (800 mg/day) and valacyclovir (500 or 1000 mg/day) help in the prevention of HSV infection. Reactivation of HSV can occur despite taking these anti-viral medications.[24]

THE INCIDENCE OF oral candidiasis during radiotherapy has been reported to be significantly higher compared to patients who did not receive radiotherapy.

Dental Caries and Periodontal Disease

A recent systematic review by Hong et al. reported the weighted overall prevalence of dental caries as 28.1 percent after analyzing a total of 19 studies. The weighted prevalence of dental caries was 37.3 percent in chemotherapy patients, 24 percent in radiotherapy patients, and 21.4 percent in patients who received both chemotherapy and radiotherapy. The weighted prevalence of severe gingivitis from three studies was reported to be 20.3 percent. All three studies were conducted on patients undergoing chemotherapy. The overall plaque index and gingival index was reported to be higher in patients who underwent cancer therapy compared to healthy controls. The authors recommend the use of fluoride products to reduce caries activity in patients who are postradiotherapy and the use of chlorhexidine rinse to reduce plaque scores and oral streptococcus mutans scores. The specific preventive fluoride regimen should be determined by the dentist and patient by considering the extent of salivary gland hypofunction and the caries rate. HNC patients with more significant reduction in salivary gland function may benefit from use of a prescription-strength topical fluoride, which may be delivered in custom fluoride trays or in a brush-on preparation. As far as chlorhexidine, clinicians should keep in mind the possible side effect of tooth staining, increased calculus, and taste changes that can occur with use of chlorhexidine. Based on their review, the authors also suggest the use of resin-modified glass ionomer, composite resin, or amalgam restorations, and not conventional glass ionomer restorations in patients who have been treated with radiotherapy.[25]

Osteoradionecrosis

Osteoradionecrosis (ORN) is as a nonhealing area of exposed bone of at least six months duration in a patient who has been treated with radiation therapy for cancer. A systematic review that included 43 articles between 1990 and 2008 showed that the weighted prevalence for ORN was between 5.1 percent (IMRT) and 7.4 percent (conventional RT). Hyperbaric oxygen (HBO) therapy is used to prevent or treat osteoradionecrosis seen in HNC patients.[26]

Loss of Appetite and Nutritional Impairment

Xerostomia can lead to nutritional compromise after treatment in patients with head and neck cancer.[27] Food characteristics such as mild temperature and smell may help the HNC patient to maintain an appetite at high radiation doses of 30/50 Gy.[28] Patients with head and neck cancer are at risk of malnutrition during radiotherapy; hence, it is important to offer nutritional counseling.[29]

General and Oral Health Quality of Life

QoL decreases dramatically in HNC patients as treatment usually affects simple yet significant functions such as chewing, swallowing, and speaking. Oral cancer patients treated in the tongue and mouth-floor region experienced deterioration for dental state, chewing ability, and xerostomia after five years compared with the level before the oncologic intervention.[30] Trismus is another complication in patients with oral cancer that can disrupt the QoL by causing difficulties in eating, drinking, and speaking.[31]

HNC patients after therapy experience poor sleep. In a multisite cohort study by Shuman et al., it was shown that pain, xerostomia, depression, the presence of a tracheotomy tube, comorbidities, and younger age were statistically significant predictors of poor sleep one year after a diagnosis of HNC. Interestingly, the actual type of treatment (surgery, radiation, and/or chemotherapy), primary tumor site, and cancer stage were not significantly associated with one-year sleep scores. These adverse factors are potentially modifiable and contribute to a decreased QoL. Strategies to reduce pain, xerostomia, depression, smoking, and problem drinking may be warranted, not only for their own inherent value, but also for improvement of sleep and the enhancement of QoL.[32]

Lower unstimulated and stimulated whole saliva flow rates and xerostomia worsens overall QoL and affects speech, eating, swallowing, social interactions, nutritional intake, and sleep. Parotid-sparing IMRT has shown to improve some QoL domains compared to conventional or 3-D conformal radiotherapy and improves xerostomia-related QoL up to 24 months after radiation therapy.[17] Novel validated questionnaires such as the Groningen radiotherapy-induced xerostomia (GRIX) may be used in the future to focus specifically on patient-rated xerostomia and sticky saliva during day and night in relation to the newer radiotherapy techniques used to reduce the incidence of xerostomia.[33]

Prevention and/or Management of Xerostomia and Salivary Gland Hypofunction in HNC Therapy

Research has shown that salivary gland hypofunction and xerostomia following cancer therapy can be reduced. A recent systematic review has suggested management guideline recommendations for preventive agents including drugs and procedures involved in cancer treatment. These include intensity-modulated radiation therapy (IMRT), amifostine, muscarinic agonist stimulation, oral mucosal lubricants, acupuncture, and submandibular gland transfer.[16] Palliative management of radiotherapy-induced xerostomia is the same as the xerostomia caused by other factors. These are discussed in another article in this issue. Preventive and therapeutic modalities used specifically for xerostomia and salivary gland hypofunction and associated complications for HNC therapy will be discussed below.

TRISMUS IS ANOTHER complication in patients with oral cancer that can disrupt the QoL by causing difficulties in eating, drinking, and speaking.

Amifostine

Amifostine is a cytoprotective agent and has been shown to be effective in reducing the incidence of moderate to severe xerostomia in patients undergoing postoperative radiation treatment for head and neck cancer, where the radiation port includes a substantial portion of the parotid glands. The efficacy of radiotherapy is not affected by the use of this drug and patients receiving amifostine are able to achieve higher rates of complete response.[34] Amifostine administration has also been shown to reduce the severity and duration of xerostomia two years after treatment and does not seem to compromise locoregional control rates, progression-free survival, or overall survival in HNC patients receiving radiotherapy.[35] Nausea and emesis are common side effects reported with the use of amifostine.[36] In contrast, amifostine has no significant radioprotective effects on salivary glands in high-dose radioactive iodine treated differentiated thyroid cancer patients as well as in patients treated with combination chemotherapy and radiotherapy.[37,38] Also, the main concern that lingers with the use of amifostine is that it seems to protect tumor cells from being destroyed by cancer therapy.[39]

Pilocarpine

Pilocarpine, a cholinergic agonist, is used to treat xerostomia induced by radiotherapy in HNC patients and in Sjögren's syndrome patients. Pilocarpine has been approved for the management of postradiation xerostomia. Pilocarpine has been shown to relieve xerostomia in thyroid cancer patients treated with radioactive iodine, because it is able to stimulate salivary flow; however, the observed side effects made the patients refuse long-term therapy.[40] Concomitant administration of pilocarpine during radiotherapy

did not improve xerostomia. However, in patients who receive a mean dose above 40 Gy, pilocarpine administration may help in sparing the parotid gland function and, hence, may be helpful in patients in whom sufficient sparing of the parotid is not achievable.[41] In addition, despite pilocarpine's efficacy in improving unstimulated salivary flow in radiation-related xerostomia, it does not seem to improve the overall QoL compared to placebo.[42]

Cevimeline

Cevimeline is also a cholinergic agonist that has been shown to be helpful in increasing the salivary flow in HNC patients following radiotherapy. Cevimeline is reported to be well tolerated by patients with xerostomia after radiotherapy for HNC, and oral administration of 30-45 mg of cevimeline three times daily increased unstimulated salivary flow.[43] However, cevimeline is only available in 30 mg capsules making a 45 mg dose difficult to administer.

Saliva Substitutes

Saliva substitutes such as those based on carboxymethylcellulose and animal mucin have been shown to reduce xerostomia after radiotherapy at least for a short duration. A recent systematic review recommends use of oral mucosal lubricants or saliva substitutes for short-term improvement of xerostomia.[16]

Intensity-Modulated Radiotherapy

Over the years, radiotherapy has undergone several improvements in the management of HNC. Altered fractionation radiotherapy has been shown to improve survival in a systematic review of 15 randomized clinical trials with 6,515 patients with head and neck squamous cell carcinoma with hyperfractionation radiotherapy providing the greatest

benefit.[44] Another recent systematic review of 30 randomized clinical trials involving 6,535 participants with oral or oropharyngeal cancer has also shown that some form of altered fractionation (hyperfractionation/accelerated) radiotherapy improves overall survival and local and regional control compared to conventional radiotherapy.[45] Intensification of radiotherapy treatment for locally advanced head and neck cancer by use of altered fractionation schedules or concomitant chemotherapy has resulted in substantially improved locoregional control and survival. However, these improvements have come at the cost of increased acute and late toxic effects. The application of technological advances, such as intensity-modulated radiotherapy (IMRT), is expected to further improve the therapeutic index of radiotherapy for head and neck cancer by limiting toxicity and, possibly, by increasing locoregional control. However, the organ-sparing potential of such highly conformal radiotherapy techniques relies heavily on the appropriate selection and accurate delineation of the crucial organs at risk, with the application of rigorous dose constraints during planning.[46]

The use of IMRT has been shown to significantly reduce the incidence of late grade 2 or 3 xerostomia in stage IV HNC.[47] A randomized controlled trial comparing conventional radiotherapy (control) with parotid-sparing IMRT was recently published by Nutting et al. Ninety-four patients with pharyngeal squamous-cell carcinoma (T1-4, N0-3, M0) were randomly assigned to the two RT techniques. The authors assessed the proportion of patients with grade 2 or worse xerostomia. At 12 and 24 months post-treatment, grade 2 or worse xerostomia was significantly lower in the IMRT group than in the conventional radiotherapy group. In addition, significant benefits were reported in recovery of saliva secretion, dry mouth-specific and global QoL scores with IMRT compared with conventional radiotherapy. At 24 months, no significant differences were seen between randomized groups in nonxerostomia late toxicities, locoregional control, or overall survival.[48] Primary tumor site and salivary gland mean doses and volumes, total gland mean dose and pretreatment stimulated salivary flow have all been shown to be factors for predicting xerostomia.[49] Also, ipsilateral radiotherapy rather than bilateral radiation along with surgery in selected patients with oral or oropharyngeal cancer may decrease the incidence of xerostomia.[50]

CHEMOTHERAPY, in addition to radiotherapy and surgery, is associated with improved overall survival in patients with oral cavity and oropharyngeal cancers.

Concurrent Chemotherapy

According to a recent Cochrane systematic review, chemotherapy, in addition to radiotherapy and surgery, is associated with improved overall survival in patients with oral cavity and oropharyngeal cancers. Induction chemotherapy is associated with a 9 percent increase in survival and adjuvant concomitant chemoradiotherapy is associated with a 16 percent increase in overall survival following surgery. In patients with unresectable tumors, concomitant chemoradiotherapy showed a 22 percent benefit in overall survival compared with radiotherapy alone.[51]

Submandibular Gland Surgical Transfer

The salivary gland transfer procedure involves the transfer of the submandibular salivary gland to the submental space before radiotherapy so it is shielded. Salivary gland functions were evaluated by the amount of saliva and a QoL questionnaire before and after radiotherapy and at three and 60 months after radiotherapy. The results showed that this procedure prevented radiotherapy-induced xerostomia and improves QoL for patients with nasopharyngeal cancer.[52] Minimally invasive techniques have been reported for the transfer of the submandibular gland to the submental space that can eventually reduce the exposure of these glands to therapeutic radiotherapy and hence reduce the morbidities associated with it.[53] A prospective randomized study compared pilocarpine and the submandibular salivary gland transfer procedure during and three months after radiotherapy. This study showed that the submandibular salivary gland procedure increased salivary flow compared to pilocarpine in the management of radiation-induced xerostomia. In addition, the QoL measures were better in the patients who underwent submandibular salivary gland transfer.[54]

Hyperbaric Oxygen Therapy

Hyperbaric oxygen (HBO) therapy is clinically used to prevent or treat the hypoxic, hypocellular, and hypovascular environment that leads to injury of surrounding normal tissue, both acute and chronic, ranging from xerostomia to osteoradionecrosis seen in HNC patients. Most studies suggest a beneficial role for HBO in previously irradiated tissue. However, the mechanism of action is not understood well.[55]

Stem Cell Therapy

Stem cell therapy may in the future be used for the prevention or treatment of radiation-induced hyposalivation and, hence, improve the QoL for patients.[56]

Neuromuscular Stimulation

Noninvasive neuromuscular electrical stimulation (E-stim) of pharyngeal muscles may improve symptoms of dysphagia and probably have some effect on xerostomia though more studies are needed.[57]

Conclusion

Though xerostomia and salivary gland hypofunction continue to affect the QoL of HNC patients, significant strides are being made in their prevention and management. If advanced treatment modalities such as IMRT are available to more patients, the overall incidence of xerostomia and salivary gland hypofunction could substantially decrease over time. ■■■■

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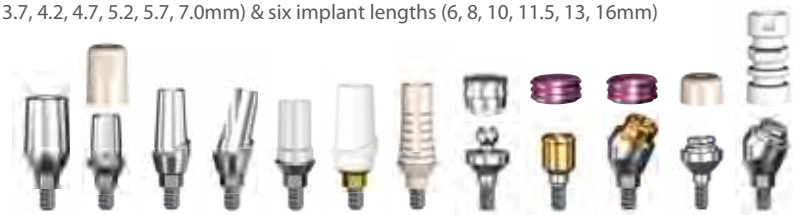

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CDA JOURNAL, VOL 39, Nº9

Salivary Gland Imaging

CAROL ANNE MURDOCH-KINCH, DDS, PHD

ABSTRACT Dry mouth, facial swelling, and pain are common signs of salivary gland disorders that may be encountered in the dental practice. Diagnostic imaging can facilitate assessment of patients with these problems. The purpose of this review paper is to discuss the imaging modalities available for assessment of the major salivary glands, their indications, and limitations to assist the dentist managing patients with salivary gland disorders.

AUTHOR

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Patients with dry mouth, pain, and facial swelling often seek dental treatment. These problems can be caused by diseases of the major salivary glands for which diagnostic imaging can help facilitate diagnosis and management. Depending on the goals of imaging, different techniques may be indicated. Imaging can help detect an abnormality, demonstrate anatomic features and extent of disease, visualize tissue changes that correlate to underlying histologic features for diagnosis or staging of disease, or assess functional status of the gland. The purpose of this review paper is to discuss how imaging of the major salivary glands can play a role in the diagnosis and management of the more common salivary gland disorders that may present in the dental practice.

Depending on the presenting clinical problem and the technology available, the clinician may choose one or more of the following techniques to demonstrate the features of interest: occlusal intraoral radiographs, conventional sialography, computed tomography (CT) with or without contrast, magnetic resonance imaging (MRI) with or without enhancement, MR sialography, salivary scintigraphy or diagnostic ultrasound (US).[1-11] Each has its own specific capabilities and limitations, and the suspected diagnosis will dictate the most appropriate imaging study. For example, an intraoral mandibular occlusal radiograph may demonstrate a calcified sialolith in the submandibular duct along its path in the anterior floor of mouth, but obstructions that are not calcified or are located more proximal to or within the gland itself may not be visible on this image. Therefore, CT without contrast would be indicated here, or when sialolithiasis of the parotid is suspected in a patient with painful facial swelling. Iodine-containing contrast may mask radiopaque images of calcifications on CT; on MRI, calcifications may be missed because of the signal void associated with them.[1,12,13] When a space-occupying mass is suspected, MRI before and after gadolinium enhancement may be preferred to a CT because of its superior demonstration of perineural, meningeal, and skull base invasion.[1,13,14]

FIGURE 1. Conventional X-ray sialography of right submandibular gland. Main duct shows alternating dilation and strictures, consistent with chronic sialodochitis. Mild dilation of branches of main duct and sialectasis. Reduced opacification of gland due to chronic sialadenitis and fibrosis. Patient presented with recurrent pain and swelling in right floor of mouth. *(Image courtesy of Todd Stultz, MD, DDS, Cleveland, Ohio.)*

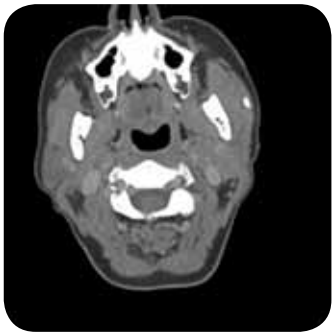

FIGURE 2. Axial CT, soft-tissue window, without contrast showing ovoid radiopacity consistent with sialolith in the main duct of the left parotid, which is enlarged compared to the right side. Patient's right side is on left side of photo. *(Image courtesy of Todd Stultz, MD, DDS, Cleveland, Ohio.)*

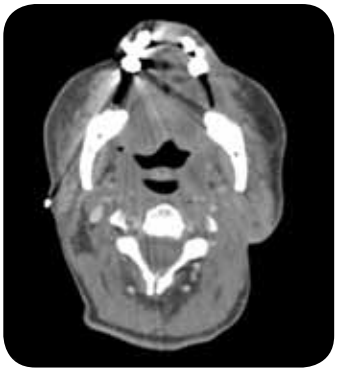

FIGURE 3. Axial CT with contrast, soft-tissue window, showing swelling of the left parotid with mass in the tail of the parotid. Biopsy confirmed adenocarcinoma. *(Image courtesy of Todd Stultz, MD, DDS, Cleveland, Ohio.)*

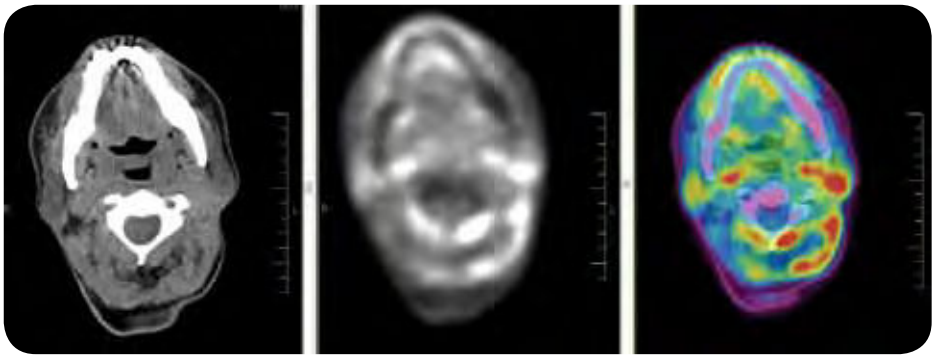

FIGURE 4. Left -Axial CT at level of body of mandible, soft-tissue window. Middle- FDG/PET showing increased uptake on left parotid and cervical lymph nodes. Right– FDG/PET/CT merged images, helps to localize the areas of increased uptake, in left parotid tail adenocarcinoma. *(Image courtesy of Todd Stultz, MD, DDS, Cleveland, Ohio.)*

Conventional sialography or MR sialography is indicated for the visualization of the ductal system and to demonstrate chronic sialadenitis with and without sialolithiasis. Salivary scintigraphy is a functional imaging study used to diagnose or stage patients with systemic diseases such as Sjögren's syndrome (SS) that affect salivary gland function, or to monitor function following head and neck radiotherapy, and other cancer therapy.[7] Diagnostic ultrasound is also useful as an initial screening tool for salivary stones or infection, to diagnose SS, and monitor for development of lymphoma. There is emerging evidence that US may be useful in staging of disease in SS as well; however, its use may be limited by availability of technical expertise. It cannot be used to image the portions of the gland deep to the mandible.[13]

These imaging techniques are discussed in context of their strengths and weaknesses in the diagnosis of disease of the major salivary glands.

Imaging Modalities:

Conventional X-ray Sialography

Conventional X-ray sialography is a diagnostic technique in which an iodine-containing contrast agent is injected into the ductal system and then imaged with plain films, panoramic radiographs, fluoroscopy, tomography, or CT. Sialography is used most often to demonstrate an obstruction such as a sialolith and/or inflammatory conditions such as SS in the parotid and submandibular glands. A scout film is taken first to assist with injection of the contrast agent. The duct is cannulated with a lacrimal probe, and then the contrast is slowly injected until the patient feels that the gland is full, then another radiograph is taken. The goal is a fully opacified ductal system (**FIGURE 1**) The gland is allowed to empty, for about five minutes, and then a sialogogue can be administered to encourage secretion of saliva and further emptying of the gland. A final radiograph is taken to confirm no retention of dye.[14] Conventional sialography is indicated for evaluation of chronic inflammatory disease and pathology of the ductal system. It is contraindicated in acute infection, and sensitivity to iodine. Technical skill is needed to cannulate the duct. Another limitation is the potential for displacement of salivary stones deeper into the gland during the injection of the contrast.[1,4,6,9,13]

Computed Tomography

CT can be used to demonstrate structures within and adjacent to the major salivary glands, including masses suspicious for neoplasm. It can demonstrate both hard and soft tissues; therefore, it is superior to MRI for demonstrating calcifications, (**FIGURE 2**) or for visualizing extension of a salivary gland neoplasm

FIGURE 5.

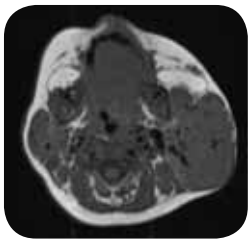

FIGURE 6.

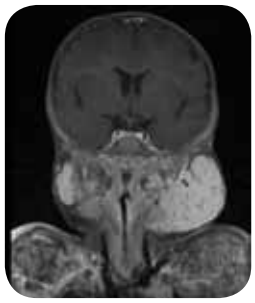

FIGURE 7.

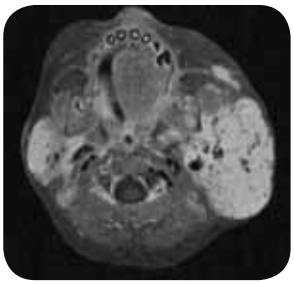

FIGURE 8.

FIGURE 9.

FIGURES 5-9. Figures 5-9 show an intraparotid hemagioma in an infant as seen on MRI. **FIGURES 5 AND 6.** T1-weighted, fat-suppressed coronal lweighted, fat-suppressed coronal (**FIGURE 5**) and nonfat-suppressed axial (**FIGURE 6**) images showing enlargement of the left parotid gland. Note the high signal associated with fat in Figure 6. **FIGURES 7 AND 8.** T1-weighted, post enhancement, fat-suppressed coronal (Figure 7) and axial (Figure 8) images showing swelling and enlargement of the left parotid, with bilateral high signal regions in both parotids. **FIGURE 9.** MR angiography of bilateral intraparotid hemangiomas demonstrates significant vascularity of the mass in the left parotid. These images were obtained to assist in assessment of flow, vascular supply and diagnosis of this large lesion. *(Images courtesy of Todd Stultz, MD, DDS, Cleveland, Ohio.)*

into bone. Both CT and MRI can be used to assess acute inflammatory processes and infections, as well as cysts and mucoceles. The addition of a contrast agent can help to demonstrate inflammatory, infectious or vascular processes within the tissues. Thin section axial and coronal scans with contrast and the use of a soft-tissue algorithm are usually performed.[12] Streak artifacts from metallic dental restorations can obscure images on CT.[14]

On CT soft-tissue algorithm images, glandular tissue is easy to differentiate from surrounding muscle and fat. The normal parotid gland is more radiopaque than fat but less radiopaque than the muscles. The submandibular and sublingual glands have a similar density as muscle but they can be differentiated on the basis of shape and location.[12] Contrast-enhanced coronal CT scans are best for identifying the submandibular and sublingual glands. When a neoplasm is visualized on CT, a specific diagnosis may be suspected based on the radiographic features and associated clinical symptoms; however, definitive diagnosis requires tissue sampling, either through CT-guided aspiration or incisional biopsy[1,15] (**FIGURE 3**). The addition of fluorodeoxyglucose positron-emission tomography (FDG-PET) to CT images can help differentiate malignant from benign neoplasms and assist with staging of malignant tumors of the salivary glands[16-18] (**FIGURE 4**).

Magnetic Resonance Imaging

MRI has superior soft-tissue contrast resolution compared to CT and does not use ionizing radiation. MRI is good for demonstrating salivary gland masses, internal structures such as nerves and ducts, regional extension of lesions into soft tissue or spaces, especially the submandibular glands. MRI is also the best method for imaging the parapharyngeal space.[13] Bone and calcified material have a negative signal and appear black on T1- and T2-weighted images. T1-weighted images help identify most parotid tumors against the hyperintense image of the normal fatty gland tissue, and are good for assessing the tumor margins, pattern of infiltration and depth of extension (**FIGURES 5 AND 6**). MRI is the best method for visualizing the facial nerve, which is extremely important when planning surgery in and around the parotid gland. Modified MRI imaging sequences such as gradient-recalled acquisition in the steady state (GRASS) and balanced field echo (BTFE), and diffusion weighting show the facial nerve with better definition, spatial resolution and signal to noise ratio than standard T1- and T2-weighted images.[1,3,19]

Gadolinium contrast is used to distinguish between cystic and solid masses, enhancing the image resolution of neoplasm, and evaluating perineural spread of malignancy.[12] In general, enhancement on T2-weighted images is associated with benign neoplasms (**FIGURES 7 AND 8**) and low-to-intermediate signal on enhanced images is associated with malignancy, but there are exceptions. For example, pleomorphic adenoma is a benign neoplasm that tends to have high signal intensity on T2-weighted images. The administration of contrast can help differentiate cysts from pleomorphic adenomas, because cysts usually enhance around their periphery but pleomorphic adenomas enhance in a more solid pattern. Definitive diagnosis requires tissue sampling.[1] MRI is also the preferred method when assessing diffuse enlargement in the region of the parotid, for example, to differentiate masseter muscle hypertrophy from parotid parenchymal changes. Chronic sialadenitis, including SS and postradiation sialadenitis, may also appear hypointense on MRI T2-weighted images.[20]

Noncontrast T1- and T2-weighted sequences, as well as T1-weighted postcontrast fat-suppressed images, are usually performed when evaluating the major salivary glands. The abundance of fat in the parotid space requires the uses of fat suppression techniques in T2-weighted images in order to provide contrast between intraparotid lesions and the normal glandular tissue.[21] When

highly vascular lesions are suspected, MR angiography can help visualize the vascular supply to assist with diagnosis and surgical treatment planning (**FIGURE 9**). Axial scans are acquired for all studies; sagittal and coronal views can be displayed as needed. Contraindications to MRI include the presence of implanted ferro-magnetic materials such as vascular clips or pacemakers, and claustrophobia. Open scanners, if available, can be an option for patients with claustrophobia.[12]

In the past, MRI was often used to assess the gland parenchyma but not the ductal system. With the introduction of MR sialography, visualization of the ductal system is possible without the use of ionizing radiation or iodine-containing contrast agents. In MR sialography, the patient's own saliva serves as the contrast agent. Because it does not require injection of contrast into the ductal system, it can be used during acute infection, which is an advantage over conventional sialography. One limitation is its low spatial resolution. The addition of constructive interference in steady state (CISS) and half-Fourier acquisition single-shot turbo-spin-echo (HASTE) sequences may address this limitation and enhance the diagnostic utility of MR sialography.[5] Another limitation is that tiny calculi within the gland or ductal system may be missed because of the signal void associated with calcified material.[13]

Salivary Gland Scintigraphy

Salivary gland scintigraphy is a nuclear imaging technique that is used to assess function of diseased salivary glands. This technique takes advantage of the selective concentration of specific radioactive pharmaceuticals in the salivary glands.[19] During salivary scintigraphy, ^{99m}Tc-pertechnetate is injected intravenously. Eventually it becomes concentrated in and excreted by the salivary, thyroid, and mammary glands. It appears within the ducts of the salivary glands within minutes of administration and reaches maximum concentration within 30-45 minutes. In the second stage of the study, a sialogogue is administered to stimulate salivary flow and evaluate secretory function.[14] Salivary scintigraphy has high sensitivity for detecting diminished function; however, it has low specificity for any single disease associated with reduced function, and does not demonstrate the anatomy well.[1,12-14] Some salivary gland neoplasms such as Warthin's tumors or oncocytomas show increased uptake of the drug and may be suspected on the basis of scintigraphy for definitive diagnosis CT and/or MRI plus tissue sampling (biopsy or fine-needle aspiration) are required.[1,14,22,23] Decreased uptake is seen in patients with Sjögren's syndrome, graft versus host disease and post head and neck radiation.[7,24-29]

WITH THE introduction of MR sialography, visualization of the ductal system is possible without the use of ionizing radiation or iodine-containing contrast agents.

Ultrasound

Diagnostic ultrasound (US) is a very useful technique for seeing superficial masses of parotid and submandibular glands. Because it is relatively inexpensive and safe, in many countries it is the imaging modality of choice for initial assessment of the major salivary glands. It has also been shown to be nearly 90 percent accurate in differentiating benign from malignant neoplasms, confirming the presence of a mass, and distinguishing intraglandular from extraglandular masses.[11,13] Tissue sampling through fine-needle aspiration (FNA), core-needle biopsy, or incisional biopsy is needed for diagnosis.[1,13] Recent studies have confirmed the utility of a US scoring system for the diagnosis of primary SS.[30,31] It is used for image-guided fine-needle aspiration cytology and US-guided core needle biopsy of masses.[11] US has also been shown to be accurate in the assessment of sialoliths or abscesses. US cannot visualize portions of the parotid or submandibular glands that are deep to the mandible, and cannot be used to demonstrate the facial nerve or other deep structures in the head and neck. Unfortunately, the technical expertise for the interpretation of US images of the salivary glands is not as readily available in North America as it is in other parts of the world, and so other imaging modalities are often used instead.[1,13]

Conclusions

There are several options available for imaging of the major salivary glands, depending on the clinical presentation and suspected diagnosis.

Obstructive and inflammatory diseases are the most-common diseases of the major salivary glands and primarily affect the ductal system; therefore, when diagnosis cannot be made on the basis of clinical features and history alone, conventional sialography is often the first choice. If the patient is allergic to iodine contrast agents, MRI, MR sialography,

US, or CT without contrast are all good alternatives. In patients with suspected salivary stones, CT without contrast should be performed before CT with contrast. MR sialography can also be used to demonstrate the ductal system, but may not demonstrate small stones within the gland or duct. Conventional sialography or CT is best for demonstrating sialoliths.

If a neoplastic or cystic process is suspected, CT with contrast or MRI is indicated. PET/CT can be used to stage malignant salivary gland neoplasms and plan treatment. Diagnosis depends upon sampling of the tissue, either through image-guided FNA or core biopsy, or incisional biopsy. Salivary scintigraphy and sialography are two techniques that can be used to assess function in patients with autoimmune disease and other systemic conditions affecting the salivary glands. There is emerging evidence that salivary scintigraphy can provide clinical and prognostic information for patients with primary SS. Findings are nonspecific, however. Currently, diagnosis of SS is made on the basis of clinical features including salivary flow measurements, ocular findings, serology or labial salivary gland biopsy, and the value of diagnostic imaging is evolving. Diagnostic US also shows promise in the diagnosis of lesions of the superficial parotid and submandibular glands including SS. More research is needed. In the United States, more widespread use of US will also depend upon increasing availability of technical expertise.

Dentists should be aware of the available imaging modalities and their indications for the diagnosis of common diseases of the salivary glands, because patients with salivary gland disorders or facial swelling often present to the dentist for diagnosis and management. Salivary gland imaging may not always be useful; however, when indicated, the selection of the most appropriate imaging study depends on the suspected diagnosis. ■■■■

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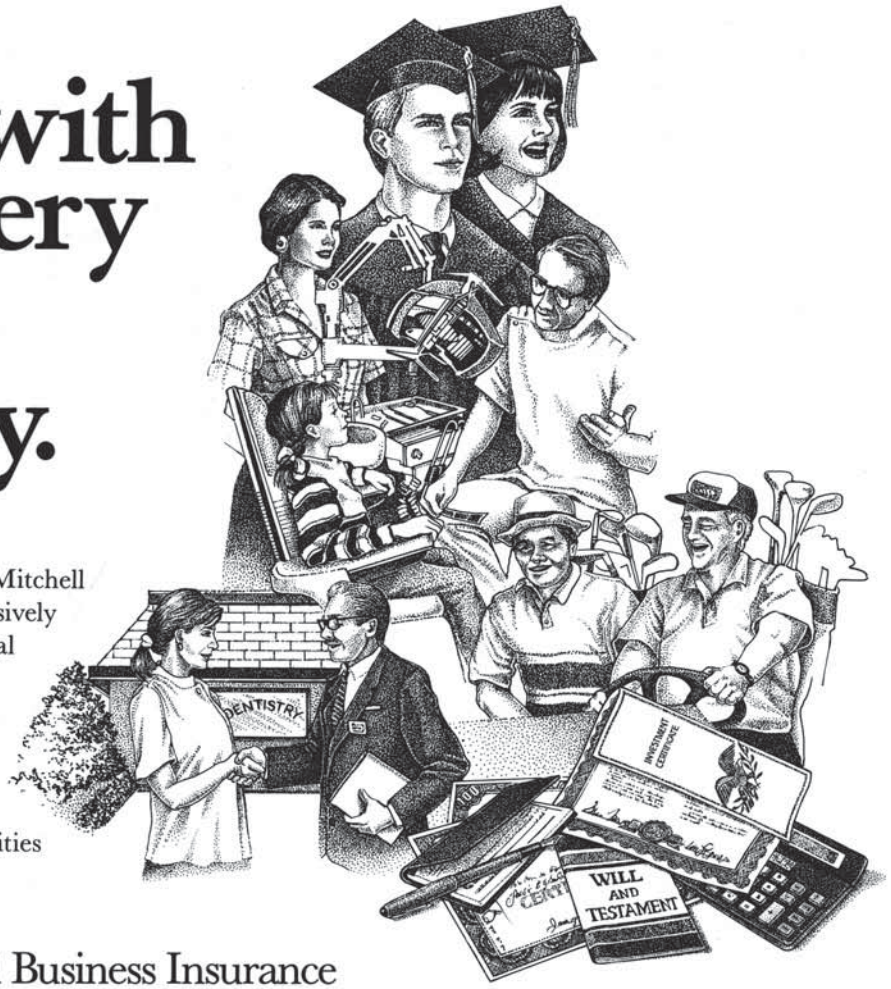

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Management of Xerostomia and Salivary Gland Hypofunction

SARAVANAN RAM, DDS, MS; SATISH KUMAR, DDS, MDSC; AND MAHVASH NAVAZESH, DMD

ABSTRACT Xerostomia and salivary gland hypofunction are conditions that have been associated with increased prevalence of caries, periodontitis, and candidiasis. Oral health care providers must be aware of the etiologies and clinical manifestations of salivary gland hypofunction in order to identify patients with this condition and to prevent its potential complications. The various modalities available to manage this condition range from frequent sips of water to the intake of systemic medications like pilocarpine or cevimeline.

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The term xerostomia or "dry mouth" refers to a subjective complaint of dryness involving the oral mucosa and oropharynx that may or may not be accompanied by salivary gland hypofunction, an objective decrease in salivary flow. The prevalence of xerostomia in population-based samples has been reported to vary from 0.9 percent to 64.8 percent.[1] The majority of these studies were performed in Scandinavia. A majority of the studied samples were 50 years and older. None of the studies evaluated the prevalence xerostomia among individuals younger than 18 years. Based on these observations, it can be concluded that there is a need for population-based studies on prevalence of xerostomia in regions other than Scandinavia. Dry mouth is a more common complaint in the elderly. The prevalence of xerostomia and salivary gland disorders is difficult to ascertain because of methodological differences in study populations and diagnostic criteria. The majority of patients treated for salivary disorders are those with Sjögren's syndrome (SS), adults being treated for head and neck cancer and those taking medications with dry mouth as a side effect. Combining these populations, the prevalence of xerostomia increases with age, and is probably ~30 percent of the population aged 65+ years.[2]

Etiologic Factors

Many factors have been listed as possible etiologies for xerostomia (**TABLE 1**). The most common of these etiologic factors are medications and radiation therapy to the head and neck. Other, less-common causes that have been reported include salivary gland tumors, infectious processes, endocrine and renal disorders, dementia, cystic fibrosis, and amyloidosis.[3] Several medications have xerostomia listed as a side effect in the drug monograph, and the most common medications that cause xerostomia are listed in **TABLE 2**.

TABLE 1

Potential Etiologic Factors for Xerostomia and/or Salivary Gland Hypofunction

MEDICATIONS
- Antihistamines
- Decongestants
- Antidepressants
- Sedatives/anxiolytics
- Anti-hypertensives
- Anti-cholinergics
- Anti-neoplastics
- Anti-psychotics

RADIATION THERAPY

SYSTEMIC DISEASES
- Sjögren's syndrome
- Diabetes mellitus
- Diabetes insipidus
- Sarcoidosis
- Human Immunodeficiency Virus (HIV) infection
- Hepatitis C infection
- Graft versus host disease (GVHD)
- Parkinson's disease

ELECTROLYTE LOSS
- Decreased fluid intake
- Hemorrhage
- Vomiting
- Diarrhea

LOCAL FACTORS
- Smoking
- Excessive caffeine intake
- Mouth breathing
- Alcohol abuse

TABLE 2

Examples of Common Medications Associated With Xerostomia and/or Salivary Gland Hypofunction

ANTIHISTAMINES
- Diphenhydramine
- Chlorpheniramine

DECONGESTANTS
- Pseudoephedrine

ANTIDEPRESSANTS
- Amitriptyline
- Fluoxetine
- Paroxetine
- Citalopram

SEDATIVES/ANXIOLYTICS
- Diazepam
- Lorazepam
- Alprazolam

ANTI-HYPERTENSIVES
- Methyldopa
- Chlorothiazide
- Furosemide
- Metoprolol
- Calcium channel blockers

ANTI-CHOLINERGICS
- Atropine
- Scopalamine

ANTI-PSYCHOTICS
- Haloperidol
- Phenothiazine derivatives

Diagnosis of Xerostomia

Oral health care providers must remain vigilant during initial and periodic evaluations to detect patients with objective evidence of salivary gland hypofunction. Not all patients who complain of xerostomia will have objective signs of salivary gland hypofunction and vice versa. To simplify the process of identifying potential patients who may exhibit salivary gland hypofunction the dentist can use a simple questionnaire (**TABLE 3**).[4]

History and Examination

The dentist must also perform a thorough review of the patient's medical history to identify diseases listed in **TABLE 1** or medications listed in **TABLE 2** that may be a potential etiologic factor for the patient's xerostomia and/or salivary gland hypofunction. If medications are a causative factor the dentist must inquire about the date the medication was started and correlate this information with the onset of xerostomia. The current dose, a change in dose or the addition of new medications may have contributed to the onset or progression of the xerostomia. The history must be followed by a thorough objective head and neck exam including an intraoral examination. The examination must focus on identifying cervical/root and cusp tip caries, which are the most significant hallmark of salivary hypofunction, because they can progress to cervical wraparound caries that can be difficult or impossible to treat, depending on the extent of progression. The next most important examination findings include those associated with chronic erythematous candidiasis, which is reversible with appropriate treatment, in spite of continuing salivary hypofunction. Special attention should be given to the signs listed in **TABLE 4**.

Diagnostic Tests

Diagnostic testing for salivary gland hypofunction may be performed by simply measuring the whole unstimulated and stimulated salivary flow rates. Patients should be instructed to avoid all forms of oral stimulation such as eating, drinking (water exempted), smoking, chewing gum, or performing oral hygiene for 90 minutes prior to testing. To collect whole saliva, the patient is seated upright with eyes open, head tilted forward, and the mouth positioned over a funnel that sits within a test tube. For unstimulated saliva, the patient is asked to minimize the movement of the tongue and lips, to swallow first and then allow saliva to passively flow over the lower lip into the funnel. At the end of the five-minute collection period, the patient is asked to spit any saliva remaining in the mouth into the funnel. Collection of stimulated whole saliva is similar; however, the patient is given a piece of a flavorless gum base, rubber band or paraffin to chew at approximately 45 chews per minute and asked to clear the mouth of saliva by spitting into the funnel every minute for five minutes. The flow rate for each sample is calculated in milliliters per minute by dividing the volume collected by five. An unstimulated flow rate of 0.1 to 0.2 mL/minute and a chewing stimulated flow rate of 0.7 mL/minute or less are generally considered to be abnormally low flow rates.[5] Also, individuals with no complaints of xerostomia may have low flow rates. Saliva flow rates can also be measured

TABLE 3

Questionnaire for Screening Potential Patients With Xerostomia and/or Salivary Gland Hypofunction

1. Do you sip liquids to aid in swallowing dry foods?
2. Does your mouth feel dry when eating a meal?
3. Do you have difficulties swallowing any foods?
4. Does the amount of saliva in your mouth seem to be too little, too much, or you don't notice it?

TABLE 4

Objective Findings That May Be Present in Patients With Salivary Gland Hypofunction*

- Increased cervical or root caries
- High caries rate and increased plaque accumulation
- Enlargement of major salivary glands
- Raised earlobe secondary to enlargement of the parotid glands
- Dry, cracked, or chapped lips
- Dry oral mucosa that adheres to the glove or mouth mirror
- Dry, fissured tongue
- Lack of or decreased salivary flow from the major salivary glands
- White or red patches suggestive of oral candidiasis

*Some of these clinical findings may signify other underlying conditions. For example, bilateral enlargement of major salivary glands may be seen in systemic conditions like Sjögren's syndrome, sarcoidosis, or HIV infection or sialadenosis. Dry, fissured tongue or white or red patches may be suggestive of candidiasis in the absence of salivary gland hypofunction.

in grams per minute. The details of this method have been previously described.[6]

Further tests such as serologic evaluations (anti-nuclear antibodies, e.g., rheumatoid factor, anti-Ro/anti-SS-A, anti-La/anti-SS-B), minor salivary gland biopsy (for detection of lymphocytic infiltration to eliminate systemic diseases, such as Sjögren's syndrome or drug-induced sialadenitis), salivary gland imaging such as sialography and scintigraphy, and sialometric evaluations may be required to confirm the diagnosis and to determine any underlying systemic conditions.[7]

Management of Xerostomia

Management of xerostomia involves: 1. patient education, diet, and lifestyle modifications; 2. management of systemic diseases and medication use; 3. prevention of dental and oral mucosal diseases; 4. palliative management of symptoms; and 5. sialogogues or salivary gland stimulants.

Patient Education, Diet, and Lifestyle Modifications

The patient must be educated about the possible etiology for the xerostomia and/or salivary gland hypofunction. The adverse effects of reduced saliva secretion on oral health should also be emphasized. Patients must be advised to frequently sip water to keep the oral cavity moist and avoid excess consumption of caffeine, sodas, sugary foods, acidic foods, and alcohol. Use of a humidifier, particularly at the bedside during sleep, can alleviate symptoms of xerostomia, dry eyes, and nasal passages.[8]

Manage Systemic Diseases and Medication Use

Consultation with the patient's physician is warranted if the salivary gland hypofunction is due to the use of systemic medications or due to an underlying systemic disease (TABLES 1 AND 2). In either case, the dentist must communicate with the physician about the need to achieve better control of the systemic disease or change the systemic medication or reduce the dosage of the systemic medication if possible. In many cases of medication-induced xerostomia, the patient is taking multiple xerogenic medications, and it may be necessary to make multiple adjustments before any benefits can be seen. Unfortunately, in some cases, medication adjustments cannot be made.[9]

Prevention of Dental and Oral Mucosal Diseases

Preventive care is very important in these patients and the dentist must periodically evaluate the patient (every four to six months) and perform radiographs annually. Daily use of neutral pH sodium fluoride (1.1 percent brush on NaF gel) is the most effective means of preventing rampant hyposalivation-induced caries.[10] Fluorides and remineralizing solutions are available as varnishes, dentifrices, gels, and rinses that can be used with or without applicator trays. Patients with mild reduction in salivary flow rate may be directed to use an over-the-counter fluoride mouthrinse daily. Patients with more significant reduction should use a prescription-strength topical fluoride, which may be delivered in custom fluoride trays (0.5 percent NaF gel) or in a brush-on preparation (1.1 percent NaF gel).

Oral candidiasis is another common complication of salivary gland hypofunction. Topical anti-fungal medications can be prescribed in the form of rinses, ointments, pastilles, and troches. Patients wearing dentures should be reminded to remove the denture before bedtime and clean the inside of the denture with a toothbrush and soak the denture overnight in a nystatin suspension or 0.12 percent chlorhexidine solution.[11]

Palliative Management of Symptoms

There are many palliative measures available to alleviate symptoms. Salivary substitutes and lubricants with moistening properties are designed to provide prolonged mucosal wetting.[12] Products

include saliva substitutes available as oral rinses, gels, and sprays, which may contain carboxymethylcellulose (CMC), a mucopolysaccharide, glycerate polymer gel base, or natural mucins, singly, or in combination. Toothpastes are available that contain a synthetic detergent (sodium lauryl sulfate) and an osmoprotectant (glycine betaine BET). Patients have expressed a mild preference for CMC-based products over mucins.[10]

Sugar-free candies and chewing gums that contain xylitol may reduce caries and are intended to stimulate salivary flow and can provide transient relief of xerostomia. Biotene Dry Mouth Gum (Laclede) contains xylitol and anti-bacterial enzymes normally found in saliva. When selecting sugar-free candy, patients should be cautioned against those with cinnamon or strong mint flavoring that may irritate soft tissues. Lemon-flavored candies are very effective in stimulating saliva flow but the citric acid may irritate soft tissue or cause dental erosion and caries with long-term use. An option for safely stimulating saliva flow is SalivaSure (buffered citric acid lozenges, Scandinavian Formulas). Since they are buffered, they do not irritate intraoral soft or hard tissues. They also are sweetened with xylitol. Oral Balance Gel (Laclede) may be spread on soft tissues or in dentures to provide longer-lasting moisture and also contains anti-bacterial enzymes. Patients with dry mouth often suffer from dry lips. Oral Balance Gel may also be used to relieve dry lips.[9]

Sialogogues or Salivary Gland Stimulants

Parasympathomimetics that are agonists for muscarinic receptors can stimulate salivary flow. Two parasympathomimetic drugs, pilocarpine and cevimeline, are approved by the U.S. Food and Drug Administration for treatment of xerostomia. Pilocarpine is approved for Sjögren's syndrome-induced xerostomia and radiation therapy-induced xerostomia, and cevimeline for Sjögren's syndrome.[13,14] Pilocarpine is a nonselective muscarinic agonist, whereas cevimeline has specific affinity for receptor subtypes not present in cardiac and respiratory tissue. Since the parasympathetic nervous system is stimulated by these medications, adverse effects may include excessive sweating, rhinitis, increased pancreatic secretion, and urinary and gastrointestinal disturbances. Less common and more serious adverse effects of pilocarpine and cevimeline involve the cardiovascular and respiratory systems. The use of pilocarpine and cevimeline is contraindicated in patients with gastric ulcer, narrow angle glaucoma, uncontrolled asthma, hypertension, and in patients on beta blockers or anti-cholinergics.[15]

Conclusion

Xerostomia and salivary gland hypofunction are common conditions that need to be identified at an early stage in order to initiate preventive measures to control the onset or progression of oral diseases. Patients should be educated about the complications of salivary gland hypofunction and must be provided with a suitable treatment plan tailored to meet the challenges posed by a lack of adequate saliva secretion. ■■■■

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- **APTOS:** *For Sale*-General Dentistry Practice. Highly desirable location. 2008 Gross Receipts over $1Mil. w/adjusted overhead at 51%. 3-operatories in 1,009 sq ft. Dano & Modi computerized software. 9-hygiene days per week. Practice operated for past 33 years in same location. Open 5 days a week. Owner willing to work back for new owner 2 days/wk. SOLD

- **BARSTOW:** *For Sale*-General Dentistry Practice. Gross Receipts $395K with an adjusted net income of $193K. Office consists of 1,100 sq. ft. 4-operatories. Intra-Oral Camera, Dentisoft. There are 3-hygiene days per week. Practice has been in its present location for the past 25 1/2 years. SALE PENDING

- **CORONADO:** *For Sale*-General Dentistry Practice. Gross Receipts in 2010 $405K. Office space 1,400 sq. ft., 4 operatories, Laser, Intra-Oral Camera. 1,000 active patients. 2 hygiene days a week. Practice has operated in its present location for 40+ years. Owner retiring.

- **EL DORADO HILLS:** *For Sale*-General Dentistry Practice. 2009 GR $790,758, adjusted net income of $312K. Intra-oral camera, pano, Softdent software, 4-equipped ops. 6-hygiene days. Practice has been in its present location for past 18 years. Owner retiring. SOLD

- **EL DORADO HILLS:** *For Sale*-General dentistry practice. Gross Receipts of $834K with adj net of $389K, 53% overhead. Office has five equipped operatories in 1485 sq.ft. Pano, Intra-oral Camera, Dentrix, 5 days of hygiene. Owner retiring.

- **FOLSOM:** *For Sale*-General Dentistry Practice. Gross Receipts in 2010 were $703K with an adjusted net income of $300K. 5 days of hygiene and approx. 1500 active patients. Leased Office is 2,000 sq ft with 4 equipped operatories-5 possible. Patient Base software. Owner to retire. SOLD

- **FOLSOM:** *For Sale*-General Dentistry Practice 2009 Collections $513K. Adjusted net income $184K. 4 ops (plumbed for 5), Intra-oral camera, fiber optics in all ops. Patient base software. Owner retiring. SOLD

- **FOLSOM:** *For Sale*-General Dentistry Practice. Gross Receipts in excess of 1.5M the past three years. Adjusted Net of $550K. 2,700 sq. ft. office with 7 ops, Digital, Dentrix, Intra-Oral Camera, Laser, 5+year old equipment, 8 days hygiene. Beautiful office, great location. Owner retiring. #14336 SOLD

- **FRESNO:** *For Sale*-General Dentistry IV Sedation Practice. (MERGER OPPORTUNITY) Owner would like to merge his practice into another high quality general dentistry or IV sedation practice. The merger would be into Buyers office. Seller would like to continue to work as either a partner or associate after the merger. 2010 collections were $993K with a $422K adjusted net income. There are 7 days of hygiene. #14250.

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. 2009 GR of $307,590 (3 days/wk) with adjusted net income of $105K. 3 Ops. refers out most/all Ortho. Perio, Endo, Surgery. Intra-Oral Camera, Diagnodent, EZ Dental Software. Good Location. Owner retiring. #14337.

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. Owner retiring. Gross Receipts $89K. Practice has been in the same location for the past 33 years. 2 equipped operatories, 3-4 available. Panoramic X-ray. Doctor owns building, which is available for purchase. This practice can also be combined with another Grass Valley practice also listed for sale. #14362.

- **GREATER CHICO:** *For Sale*-General Dentistry Practice. Gross receipts in 2010 were $584K, with an adjusted net income of $152K. Approx 1,100 active patients. 4 operatories, Pano, Intra-Oral Camera. Easy dental software. Leased office 1,200 sq. ft. Owner is retiring. #14359.

- **GREATER FAIR OAKS-SUNRISE AREA:** *For Sale*-Gross Receipts in excess of $1.1 Million dollars for the past three years. Adjusted net $450K. 2,400 sq ft office-5 ops. Hygiene days-6, Owner works 32 hours per week. Eagle Soft, Laser, Pano Intra-Oral Camera, fiber optics. Owner retiring. #14343 SOLD

- **GREATER SACRAMENTO:** *For Sale*-Pediatric Practice. 2010 GR of $1,095,914, with a 45% overhead. Prevention oriented practice with 3600 sq. ft. Digital office with Dentrix. Equipment is nine years old. Delta Premier is only insurance. Owner retiring. SOLD

- **GREATER SAN JOSE AREA:** *For Sale*-General Endodontic Practice. 2009 Collections were $1,187MIL with an adjusted net income of $696K. There are 4 ops in this nicely decoreated 1,400 sq ft office space. 4 microscopes. Owner has been in same location for 26 years with long-term employees. Owner is retiring but will continue to work 1 ½ to 2 years through the transition with the buyer. SOLD

- **HAWAII (MAUI):** *For Sale*-General dentistry practice. Gross Receipts of $636K. Office has four equipped operatories in 1198 sq.ft. Pano, Laser, I.O. Camera, Fiber Optics, 2 ½ days of hygiene. Owner retiring: Don't miss this opportunity to live and work in paradise.

- **IRVINE & COSTA MESA:** *For Sale*-General Dentistry practice combined. Gross receipts combined $781K with adjusted net of $396K. Both office spaces are leased with 4-5 ops in each. Both are 1,600 sq. ft. Irvine is equipped with Intra-Oral Camera, Pano & Dentrix. Costa Mesa is equipped with Laser, Intra-Oral Camera, Pano and Dentrix. #14355. SOLD

- **LAGUNA NIGUEL:** *For Sale*-General Dentistry Practice. 2010 gross receipts were $503k. 4 operatories, Pan, computerized with EZ dental software. 1,500 sq. ft. lease. 10 years in present location. Owner retiring. #14352

- **LAKE COUNTY:** *For Sale*-General Dentistry Practice. Gross Receipts 904K with adjusted net $302K. Practice has been in same location for past 23 yrs, and 25 yrs in previous location. 2,600 sq ft with 8 equipped treatment rooms. Intral-Oral Camera, Pano, and Data Con software. Owner to retire. #14338

- **LINDSAY:** *For Sale*-General Dentistry Practice & building. Gross Receipts in 2010 $330K with adjusted net income of $219K. Owner has operated in present location for 27 years. Office space 1,489 sq. ft., 3 operatories available (2 equipped), Intra-Oral Camera, Soft-Dent software. 3-hygiene days a week. Owner retiring. #14363.

- **LIVERMORE:** *For Sale*-General Dentistry Practice. 2009 Collections were $688K with an adjusted net income of $287K. There are 4 ops in this nicely updated 1,082 sq. ft. office space. Dentrix software, 6-days/wk hygiene. Owner has been in same location for 36 years with long-term employees. Owner is retiring. #14326 SOLD

- **LOS ANGELES:** *For Sale*-General Dentistry Practice.1,200 sq ft 4ops, 29 yrs in present location. Gross Receipts $274K with adjusted net income of $89K. Owner to retire. #14348

- **MANTECA:** *For Sale*-General Dentistry Practice. The practice has one of the highest net incomes compared to total collections of any practice we have listed. The total collections were $622,000 and the adjusted net income to the doctor was $413,000. A 33% overhead. The office space is 780 sq. ft. with two operatories, Laser, intra-oral camera, digital x-rays and Easy Dental Software. The practice has operated in its present location for 24 years. Owner relocating to S. CA

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- **MODESTO:** *For Sale*-General Dentistry Practice. 5 operatories, 32-years in practice. Gross Receipts $884K w/adjusted net income of $346. Dentrix, Cerec, and Intra-Oral Camera. Owner to retire. #14308 SOLD

- **NAPA:** *For Sale*-General Dentistry Practice. Gross Receipts $800K, with adjusted net income of $250K. Fee for Service. 1300 sq ft 4 ops 6 hygiene days. 38 yrs in present location, 30 yrs in previous location. Owner to retire. SOLD

- **NEWPORT BEACH:** *For Sale*-General Dentistry Practice. Practice has operated at its present location since 1986. Located in a highly affluent Newport Beach community. Three (3) hygiene days per week. Leased office space with 4 ops. in 1,450 sq. ft. Pano & Practice Works software. #14354.

- **NORTHERN FRESNO:** *For Sale*-General Dentistry Practice. This is a perfect starter or satellite practice. Excellent location in North Fresno. Gross Receipts in 2010 were $173K. Approximately 450 active patients. 3 operatories. Dentrix software. Leased office 1,200 sq. ft. Owner has been accepted to an Endodontic Residency after starting practice 1 1/2 years ago. SOLD

- **NORTHERN CALIFORNIA:** *For Sale*-Endodontic Practice. This Endodontic practice is located in an upscale professional office complex. The owners condominium occupies 1,770 sq ft, There are 4 equipped treatment rooms with an additional 5th room available. Gross Receipts were $638K with $239K adjusted net income. Owner will stay for transition to introduce buyer. Owner is retiring.

- **NORTHERN CALIFORNIA:** *For Sale*-Pediatric practice. Owner has operated in same location for 32 years. Approx 1,760 active pts, 1,160 sq ft, panoramic X-Ray, Dexis Digital and Dentrix software in this 3–chair office. 2009 Gross Receipts $713K with 48% overhead. Owner retiring. Call for Details. SOLD

- **OCEANSIDE:** *For Sale*-Modern looking office. 4 op, office space and equipment only. Belmont chairs. Gendex x-ray system, intraoral camera, approx 1200 sq ft. Low overhead-Rent is $1,900/month, and it's a 5 year lease. Staff is available for rehire-front desk $15/hr, assistant 13/hr. Update all the computer systems after purchasing the office in 07. Computers and monitors in every room. #14346 SOLD

- **PLEASANTON:** *For Sale*-General Dentistry Practice. Owner has other practice in Bay Area only in Pleasanton 1 day/wk. 300 active patients. Excellent location-beautiful 1600 sq.ft. 5-op office. Equipment like new, intra-oral camera, pano, Easy Dental software. Must See. #14364.

- **PLUMAS COUNTY:** *For Sale*-3 equipped ops. Space available for 4th op. 1,245 sf office in good location. Gross Receipts $475K. Practice in present location over 50 years. Owner is retiring. #14318

- **REDDING:** *For Sale*-Owner looking for Assoc. trans. into Partnership w/Buy-Out. GR $1 Million dollars income $436K. 5.5 days hygiene, 2,200 sq. ft. #14293

- **RENO:** *For Sale*-General Dentistry Practice and Dental Building: 2009 Gross Receipts $517K with adjusted net income of $165K. 4 ½ hygiene days/week. 1, 800 sq. ft. with 6 equipped ops. (7 Avail). Dentrix software, Pano. Practice has been in its present location for 40 years. Owner retiring. SOLD

- **ROCKLIN:** *For Sale*-General Dentistry Practice. Gross Receipts $593K in 2010 with $240K adjusted net income. Office is 1,630 sq. ft., with 4 operatories equipped with fiber optics. Owner has been in present location for the past 13 years. 3 1/2 days hygiene. Intra-Oral Camera, Dentrix software. Owner to retire. SOLD

- **ROSEVILLE:** *For Sale*-General Dentistry Practice. Great Location. 2009 GR $900K with adjusted net income of $300K. 1,975 sq. ft. with 4 ops, 3 days hygiene/wk. Digital, Intra-Oral Camera, Dentrix, Trojan, fiber optics, P & C chairs - all less than 5 years old. Owner is retiring. #14327 SOLD

- **SACRAMENTO/ROSEVILLE:** *For Sale*-One of many partners is retiring in this highly successful General Dentistry Group Practice. Intra-Oral Camera, Digital Pano-Dexis, electronic charts, owner Financing. Call for further information. #14334

- **SAN DIEGO:** For Sale-General Dentistry practice. Gross Receipts $414K. Practice has been operated by the same owner for the past 6 years. Leased 950 sq. ft. office with 3 equipped operatories. Dentix software, Intra-Oral camera, Panoramic X-Ray. Owner to relocate. #14356.

- **SAN DIEGO:** *For Sale*-General Dentistry Practice. 6 ops, Intra-Oral camera, Eagle Soft Software. Office square feet 2,300 with 3 years remaining on lease. 2009 Gross Receipts $1,448,520, with an adjusted net income of $545K. Doctor would like to phase out then retire. #14331

- **SANTA BARBARA:** *For Sale*-General Dentistry Practice. This excellent practice's 2009 gross Receipts $891K with steady increase every year. Practice has 6 days of hygiene. 1,690 sq. ft., 5 ops, Laser, Intra-Oral Camera, Schick Digital X-Ray, Datacon software. Doctor has been practice in same location for the past eleven years of his 31 years in Santa Barbara. Doctor is retiring. #14333 SOLD

- **SAN LUIS OBISPO:** *For Sale*-Two Doctor General Dentistry Practice. Gross receipts $1,537,142 for 2010 with an adjusted net income of $691K. The office has 2,331 sq. ft. with 8 equipped operatories. Pano, E4D, and Dentrix software. Practice started in 1990 and has been in its present location since 1998. Approx. 3000 active patients. Great location with nice views. #14353.

- **SANTA CRUZ:** *For Sale*-General Dentistry practice. Gross Receipts $300K with a 57% overhead. Office is 1,140 sq. ft. 3 equipped operatories. Intra-Oral Camera, Pano, Digital X-Rays, and Dentrix software. Practice has been in its present location since 1980. Owner retiring. SOLD

- **SANTA CRUZ:** *For Sale*-General Dentistry practice. This excellent practice is centrally located in a professional complex. Office is approx. 1,885 sq. ft., 4 operatories with room for one additional. There are approx. 2000 active patients with 6 days of hygiene per week. Practice Pano, Intra-Oral Camera and Easy Dental software. Owner is retiring. Reasonable lease available. #14361

- **TORRANCE:** *For Sale*-General Dentistry Practice: Owner has operated in same location for 20 years. Approx. 1,000 active patients, 1,080 sq. ft., Bruan System, and Camsight software in this 2 equipped, 3 available-chair office. Gross Receipts $434K with 38% overhead. Owner relocating. #14320 SOLD

- **TRACY:** For Sale-Equipment, furnishings, and leaseholds only. In the Central Valley. Fully equipped including 4 Belmont Accutrac chairs, 2 Midmark chairs, 6 DCI rear delivery units, 3 Gendex x-ray units, 1 Soridexdigital x-ray processor, 1 Statim 5000, 1 Harvey autoclave. 2,800 Sq ft, 6 Ops. New lease available from landlord. SOLD

- **VISALIA:** For Sale- General Dentistry Practice. Gross Receipts $616K with an adjusted net income of $ 321K. Office is 1,380 sq ft with 3 equipped operatories. Intra-Oral Camera, Digital X-Rays, Mogo software, equipment & leaseholds look new. 5 years in present location. Owner to relocate. #14347 SOLD

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MODERN FOUR OPERATORY DENTAL BUILDING IN DUNSMUIR FOR SALE OR LEASE — A beautiful mountain setting in Northern California with hunting, fishing and skiing. Building well maintained. Seller motivated, all terms negotiable. Seller would consider forgiving lease/sale payments for first year to help practitioner establish a practice. Present dentist moving out in order to reduce commute driving time. Contact seller at mollyruss@sbcglobal.net or Doris Moss Realty, Brett Waite, Broker, 530-926-3807 or brett@mtshastarealty.com.

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OPPORTUNITY AVAILABLE IN ALBERTA, CANADA — Excellent opportunity in Canada. Full-time, quality minded, detail and patient-oriented associate required for busy practice. State-of-the-art, 3-D digital, offering implants and ortho. Well established, growing practice. Paid on production. New grads welcome. Must have written Canadian NDEB. Email azhrdental@gmail.com.

OPPORTUNITY AVAILABLE IN MONTEREY — Looking for general dentist for unique, multi-specialty dental group (12 partners). Associateship beginning in the Spring of 2012 leading to a partnership

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3060 SACRAMENTO COUNTY GP

General & Cosmetic practice located in the charming, picturesque town known as "The Jewell of Sacramento County". For those who enjoy cycling, running and other outdoor activities. The American River parkway winds through this town and can be ridden all the way to Folsom Lake.

Beautifully & thoughtfully designed, this well appointed office has 6 fully equipped ops with state-of-the-art equipment and facility. The practice is located in a single occupancy, free standing, single story professional building of approximately 2,000 sq. ft. The building's lot has ample on-site parking and is located on a major thoroughfare with fantastic visibility. Approximately 1,500 current/active patients (all fee-for-service) with an estimated 16 new patients a month. 2010 GR $1.6M with an adjusted net income of almost $500K. Asking price $1,105,000.

3059 SANTA CRUZ COUNTY GP & BDG

Charming practice tucked among soaring redwoods in Santa Cruz County. Located in a single level professional building in the heart of town. Well established and part of the small community landscape. 2010 GR $595K+ w/3 doctor days. All fee-for-service. Owner retiring and willing to help for a smooth transition. This is a great turn key practice and opportunity to own a hidden gem. Practice asking price $373K, building is also available.

3006 MONTEREY COUNTY ORTHO

Est. Ortho practice in 2,668 sq. ft. office with 5 open bay chairs in a professional dental complex. Panorex and Cephlometric X-ray machines. Stable and loyal referral base. Annualized GR as of Oct 2009 are $335K+. Owner retiring and willing to help for a smooth transition. Asking 227K.

3061 SAN JOSE ORTHO FACILITY

Located in desirable Evergreen area in a two-story, handicap accessible, high profile, medical and professional building. Gross lease with utilities included expires July 2013 with 5 year option to renew. Modern, tastefully designed, approximately 1,321 square feet. Office space includes: fully-equipped open bay with bay support cabinets and 4 chairs setup for right-handed delivery, exam/consult room with patient chair, reception area, private office, business office, lab area, sterilization area, and bulk storage area. Asking $95K.

3049 SAN JOSE GP

Well-located, across from O'Connor Hospital, general practice in 2,118 sq. ft.state-of-the-art facility w/ 3 fully-equipped ops. 2 pvt. offices (1 can be plumbed for 4th op.). This office is beautifully designed and is stunning. In addition to his general practice, owner treats sleep apnea patients. He is selling just the general operative portion of the practice and is willing to help for a smooth transition. Ideal for an experienced dentists looking to merge an existing practice. Asking $285K.

3045 VACAVILLE GP

Turn-key, traditional dental practice with loyal staff and sense of community. Well maintained 900 sq. ft. tastefully decorated office with 2 fully-equipped ops. 2010 GR 224K+, 2010 projected GR as of Aug. $270K+ with 50% avg. overhead. Owner retiring and willing to help for a smooth transition. Asking $172K.

PENDING

3057 SAN JOSE GP

Priced to sell. Located in 2 story professional building w/3 fully-equipped ops. in 990 sq. ft. office. Part of historic Rose Garden neighborhood, 1 block from the Alameda, & near a well travelled intersection. Seller transitioning due to health reasons. FY 2010 GR $415K. Asking Price $120K.

SOLD

3052 PETALUMA GP

Well-established 3 Dr. day practice in 2,268 sq. ft. office w/6 ops. Avg. gross receipts for past 3 years $315K. Located just a mile from the Petaluma River in the historic town of Petaluma. Centrally located 32 miles north of SF in the Sonoma County Wine Country. Bldg. is available for purchase. Ideal for merging with an existing practice in the area. Owner retiring and wiling to help for a smooth transition. Asking $145K.

SOLD

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interest. This group practice has cared for patients in the Monterey/Carmel area for 32 years. Four operatories, $900K+ production. Business and HR administration allows you to focus on dentistry. Email your resume to mpdg@redshift.com.

OPPORTUNITY AVAILABLE IN NORTHWESTERN WASHINGTON — Seeking experienced dentist for busy, established, rapidly growing, fee-for-service group dental practice. Excellent immediate income opportunity ($180K to $375K + per year) depending on productive ability and hours worked. Secure long-term position. You can concentrate on optimum patient treatment without practice management duties. Newly equipped, modern office with excellent staff and lab services provided. If you are bright, energetic with a desire to be productive, very personable, people oriented and have great general and specialty clinical skills, please fax resume to Otto J. Hanssen at 425-484-2110.

RELOCATION AND SIGN-ON BONUS OFFERED FOR ARIZONA — Immediate need for a FT Dentist willing to relocate to Glendale Arizona. The office has a steady patient flow, FT Hygienist and excellent earning potential. Doctor must have 3-5 years experience and be proficient in molar endo. Benefits package offered including Malpractice coverage. Please contact Kristin Armenta at 714-428-1305 or fax to 714-460-8564.

SEEKING MANAGING DENTISTS — If you're looking for a long-term commitment and desire to be productive the opportunity is yours! Seeking full-time, managing dentists to join large group practice in the following areas: Los Angeles, Orange County, Inland Empire, San Diego and doctors willing to relocate to Arizona. Steady patient flow in high volume HMO environment. Required: 3-5 yrs experience and proficient in molar endo. Benefits include: medical, dental, vision, 401K, malpractice coverage and competitive pay! For available positions please call: 714-428-1305, submit your resume to kristin.armenta@smilebrands.com or fax to 714-460-8564.

CONTINUES ON 670

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5999 **"SOLD" PLEASANTON** Adjacent to Hacienda Business Park. 2011 tracking $900,000. Strong profits. Digital radiography with computers in Ops. Great visibility.

6002 **SAN JOSE'S EVERGREEN VALLEY - FILIPINO PRACTICE** Near Highway 101 and East Capitol Expressway. Housed in new building and suite. Busy Hygiene schedule. 2011 tracking $850,000. Strong profits.

6003 **"SOLD" PINOLE - HERCULES AREA** 4-days of Hygiene. 90%+ effective Recall. Produced $740,000 and collected $709,500. Low AR balance. Endo referred.

6004 **"SOLD" SAN JOSE'S SANTA TERESA AREA** Asking slightly more than what it would cost to replicate this office today. Digital & paperless 3-Op suite. 2010 produced $385,000 with collections of $277,000 and Profits of $190,000+. Gorgeous facility. Lease allows occupancy thru 9/30/2024.

6005 **FAIRFIELD - WEST OF I-80** Seeks full-time Successor. Operating on 2.5 week schedule by Owner with other commitments. Has averaged $470,000 per year last 3-years. 2-days of Hygiene, 20 new patients/month. Attractive 3-Op suite. High visibility location.

6006 **STOCKTON** Beautiful office near intersection of West Hammer & Lower Sacramento. Busy retail location. Ideal for nearby Dentist seeking office upgrade or someone with a Business Plan. 4 Ops, digital radiography, computer charting. No goodwill.

6008 **MENDOCINO COAST - FORT BRAGG** Nestled in desirable cultural haven creates attractive lifestyle. 4-days of Hygiene. 2010 collected $695,000. Owner works 3-day week and states he could work more if desired. Computerized Ops and digital radiography.

6010 **"SOLD" BERKELEY – ALTA BATES MEDICAL VILLAGE** Attractive revenues. Last 2-years Profits have averaged $225,000. 2011 doing better!

6011 **SAN JOSE – WEST OF I-280** Long established practice off Saratoga Avenue. Has averaged $400,000 per year in collections. 3-Ops with 4th available in 1,000 sq. ft. suite.

6012 **FREMONT** Well established practice as evidenced by 6+ days of Hygiene. Fantastic Recall System. Great location. Collects just shy of $900,000 per year. Total Available Profits in 2010 were $360,000. 5-Ops.

6013 **LIVERMORE** Not yet 4-years old, tracking $430,000+ in collections 2011. Attractive 4-Op suite fully networked, employs computer charting and digital radiography.

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"I listed with a competitor for 12 months. Had two people visit my practice. First weekend PPS had my listing, I had 3 people visit and an offer by the end of the first week. Thank you for allowing me to move on to the next step of my life."

"It was a pleasure to work with PPS. I had to sell because of health complications. Mr. Irving listed my practice on Jan 1st, we closed escrow on Feb 27th. It took him less than 60 days to complete the sale as promised."

"When I decided to sell my ortho practice, I sought the services of a large company. Over the 12-month contract, I had one buyer visit. Word was out. It had a devastating effect on my bottom line. Fortunately, I found Ray and Edna Irving! When I finally sold, I choose between two good offers. My regret was the time and money lost with the other guys."

"When I signed the Listing on June 1st, Ray stated he would have the practice sold by Labor Day. The sale was concluded on Sept 1st, two days before Labor Day. Wow!"

"I will always remember your statement when I questioned your contract being only four months. You stated: 'If I can't sell your practice in that time, you should get someone else.' Well, you did with time to spare!"

"Before I called Ray, I had a listing with another prominent Broker. After eleven months without a sale, I called Ray. He sold it in about a month! Would I recommend Ray? Yes!"

"In April, I asked Ray Irving to sell my practice. At the same time my friend decided to sell his practice. He employed another firm. My practice sold June 22. My friend's practice still hasn't sold and he was putting his dreams on hold."

PPS of The Great West's reputation is built upon grounded ethics and effectiveness. Our trademark "client services" include accurate assessments, impeccable marketing plans, complete transparency, generating quick responses, realizing multiple Offers, securing 100%+ financing in days, expert papering of our transactions and sound counsel. Everything is done to protect our Client and to effect a successful transfer. Our intent is simply to provide the best service imaginable for this very important engagement.

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Broker/Owner

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BAKERSFIELD #22 - (5) op G.P. (4) eqt'd. Strip center location with exposure & signage. Collect. ~ $200K/yr p.t. Next to medical clinic & WIC. Can collect. much more w more hours.

BAKERSFIELD #24 - (4) op computerized G.P. 2 ops eqt'd w 2 additional plumbed not eqt'd. Cash/Ins/PPO pt. base. Collect $200K+/yr. 3- 4 days/wk. In a strip ctr. Seller retiring.

CENTRAL VALLEY/So. FRESNO CTY. - (3) op compt. G.P. Newer eqt., digital x-rays & Dentrix s/w. In a smaller town w ltd. competition. Cash/Ins/PPO. New bldg out in 2009.

COVINA DUPLEX BLDG. & PRACTICE - (4) op comput. G.P. & Duplex Bldg. (3) ops eqt'd 4th plumbed. Mixed pt base. 2010 Gross Collect $250K on a 3 day wk. 2,150 sq ft bldg. **NEW**

GLENDALE #6 – (5) op state of the art comput. G.P. 4 ops eqt'd, 5th op plumbed. Digital x-ray & networked. Mixed pt base. In a free stand bldg.. Annual Gross Collect.~ $500K. **NEW**

NORTHRIDGE - (4) op compt. G.P. Mixed pt. base. 2010 Gross Collect. ~ $400K. **SOLD**

No. COUNTY SAN DIEGO - (4) op comput G.P. in a shop ctr. w excell exposure & signage. Cash/Ins/PPO/HMO pts. Dentrix s/w, paperless & digital. Gross Collections $900K+/yr. **NEW**

OXNARD #5 BLDG. & PRACTICE – (4) op comput G.P. in a free stand bldg. w a pole sign. On a very busy main road. Mixed pt base. 2011 Project Gross Collect $447K. **NEW**

RESEDA #6 - (3) op comput G.P. located in a well know, easily accessible prof. bldg. Cash/Ins/PPO pts. Annual Gross Collections ~ $150K on a p.t. schedule.

SANTA BARBARA #2/GOLETA - (4) op computerized G.P. located in a garden style prof. bldg. w St. frontage. (3) ops eqt'd/4th plumbed. Cash/Ins/PPO pt. base. (4) days of hygiene/wk., approx. (20) new pts/mos. Pano eqt'd. Collects. $400K+/yr. on a (4) day wk. **NEW**

SANTA BARBARA #3 - (3) op comput. G.P. in a prof/med/dental bldg. Cash/Ins/PPO. 8-10 new pts/mos Gross Collect. $250K+ on a (4) day wk. Digital x-ray. Seller retiring. **NEW**

SANTA CLARITA - (6) op comput. G.P. (4) ops eqt'd. 2011 Project Gross Collect $340K. Located in a free stand bldg. Mixed pt base. Shares reception w M.D. who refers many new pts.

UPLAND #3 - (5) op comput G.P. & Speciality Pract. in a free stand bldg. Gross Collect $525K-$625K/yr. Some newer eqt. Digital x-ray. Excell opp. for G.P. who likes to do Endo. **PENDING**

WEST HILLS - (3) op compt G.P. in a prof. bldg. Newer leaseholds. Cash/Ins/PPO. Digital x-rays & Dentrix s/w. 2010 Gross Collect. ~ $305K part time. Seller retiring. **BACK on MARKET**

WESTLAKE VILLAGE #2 - (4) op compt. G.P. (3) eqt'd. Gross Collections ~ $629K. **SOLD**

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DR. BOB, CONTINUED FROM 674

clear that a permanent record of things as diverse as Cave Owners Association meetings, scissors-paper-rock disputes and cease-and-desist orders would be essential.

At a summit meeting called to rectify this omission, all parties agreed that it would be a consummately idiotic thing if all developing tribes spoke the same language. They realized that a dilution of their culture at the very least, or a threat to their security at worst, would be forthcoming if tourists and other pillagers and plunderers understood posted street signs and menus. Furthermore, it would be infinitely more difficult to insult each other with impunity if the offensive exchanges were transparent.

Some groups indicated that their written language would consist of oddly shaped ideographs with no clue offered how to pronounce them. The inhabitants of a group of islands (pronounced UK) off the coast of what would come to be termed "Europe," developed their own quaint written language that was quickly adopted by poets and early politicians with no other useful skills. Today — if English teachers insist on it — their durable works can be appreciated with the generous aid of footnotes.

Europe became the nesting place of many different tribes such as Visigoths, der Huns, el Raiders, le Fighting Francos and duh Uncouths. They agreed to disagree on everything except an alphabet and even that was deemed suitable to the Eastern Europeans only after reversing some of the letters and inventing a few new ones they called Cyrillic. Occasionally, it became necessary during incendiary negotiations over border disputes for opposing sides to yell at each during a sulfurous discourse by using the other's native idioms. They did this by adopting comical accents that successfully lowered expectations on both sides.

Slowly, vocabularies expanded to encompass two-syllable words and lengthy four- and five-word sentences that presented the next big hurdle to written communication: punctuation.

Slowly, vocabularies expanded to encompass two-syllable words and lengthy four- and five-word sentences that presented the next big hurdle to written communication: punctuation.

Like spelling that has never attained any degree of relevancy to electronic-bonded generation Xers, much of punctuation remains a mystery today.

The use of the period was readily adopted. This gave writers a chance to ponder briefly before scribing the next thought unless it was in the same vein, then they would hazard the use of the semicolon, a common term used in abdominal surgery. Unfortunately, the period never caught on with verbal communication. Some speakers continue to blather on for ages without a pause until struck by a blunt object.

The written question mark, however, representing the raised eyebrow and the exclamation mark designed to exhibit anger or surprise were accepted without resistance. In fact, Hispanic scriveners went one step farther by placing them inverted at the beginning of a sentence as well as the finish. This thoughtful assistance allowed a reader sufficient time to prepare for the writer's expected response. Or it did if the reader was adept at Spanish, otherwise it was regarded only as a quirky, but memorable part of Victor Borge's phonetic punctuation routine.

Which brings us to the apostrophe, a punctuation mark so sorely abused that it has the appearance of a badly managed comma. Why anything so unassuming should generate so much apprehension and mistreatment is odd, but there it is. Some have placated their anxious neurons by never allowing an "ess" at the end of a word — any word — to be unaccompanied by an apostrophe on its left. Or *it's* left if the portent of omitting the mark distends the nostrils dangerously. Thus, we encounter a sentence like, "It's a shame the car's were late so ten's of thousand's of owner's never got Je's's's bad new's." Possessive case — no problem; plurals and contractions – no problem. "It's always wise to apostrophize" is their motto.

Those stalwarts not intimidated by such nitpicking niceties of punctuation aver that letting "esses" fall where they may — preferably by the wayside along with preferential spelling — is the sensible way to go. Obeying no bidding but their own whim in a society already swamped by rules and regulations not of their making, the Twitterers and Texters may well herald the rebirth of the *Me Tarzan, You Jane, Era*.

Their knuckle-dragging ancestors would have agreed that apostrophes or not, life among the hominoids could frequently be a pain in the ess. ■■■■

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Say What? Write On!

Early Man articulated only a series of grunts, because vowels were not discovered until the beginning of first Ice Age.

Robert E. Horseman, DDS

ILLUSTRATION BY DAN HUBIG

After The Big Bang occurred, nothing much happened for years while unrecorded history was getting underway. Even though there must have been a frightful racket, no formal protests or inquiries were lodged at the time. Eventually, Man drifted down from cosmic dust or crept up out of primordial ooze and exclaimed, "What the heck was *that*?" No, actually he said nothing because there was no language, plus he didn't remember anything so riveting to date worth mentioning. It would have been a perfect time to have posed an original hypothesis of: If a Big Bang blows up the universe and nobody hears it, does it make a noise?

Early Man articulated only a series of grunts, because vowels were not discovered until the beginning of first Ice Age (November 97,576 B.C.). Grunts, displays of teeth and furrowed brows were the basic tools of primitive communication. Bon mots and scintillating repartee were to come later along with the Morse code during what anthropologists term the "Me Tarzan, You Jane" era.

The discovery of the "period" that mandated a full stop if employed was a serendipitous addition to the early development of language. The mounting intensity of monosyllabic grunts, reminiscent of present-day dialogue with teenagers, could quickly escalate a benign encounter to a spear-in-the-brisket dust-up, or at the very least, a time out in your cave.

As language, in terms of auditory expressions gained popularity, it became

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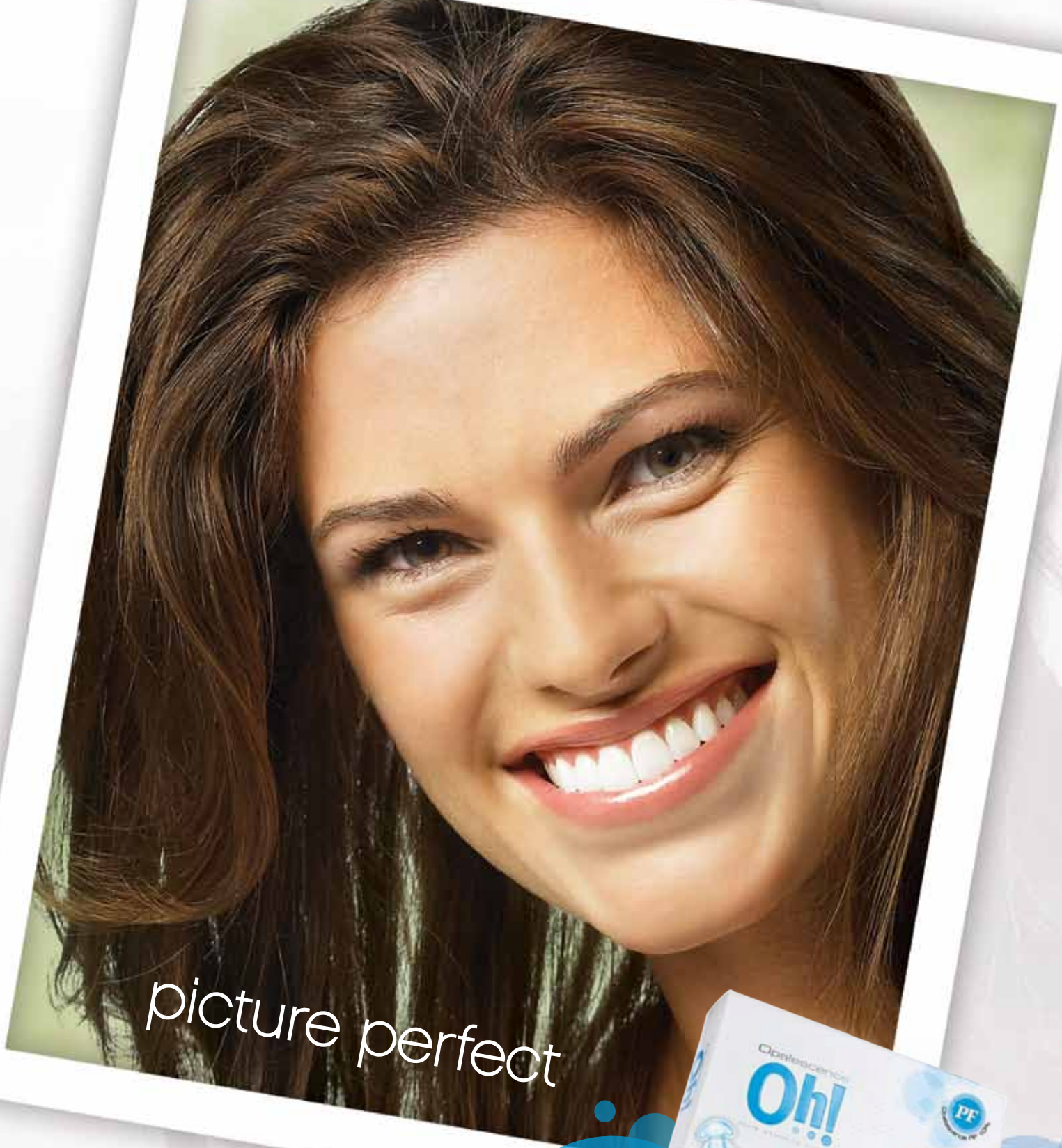

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