OF THE CALIFORNIA DENTAL ASSOCIATION

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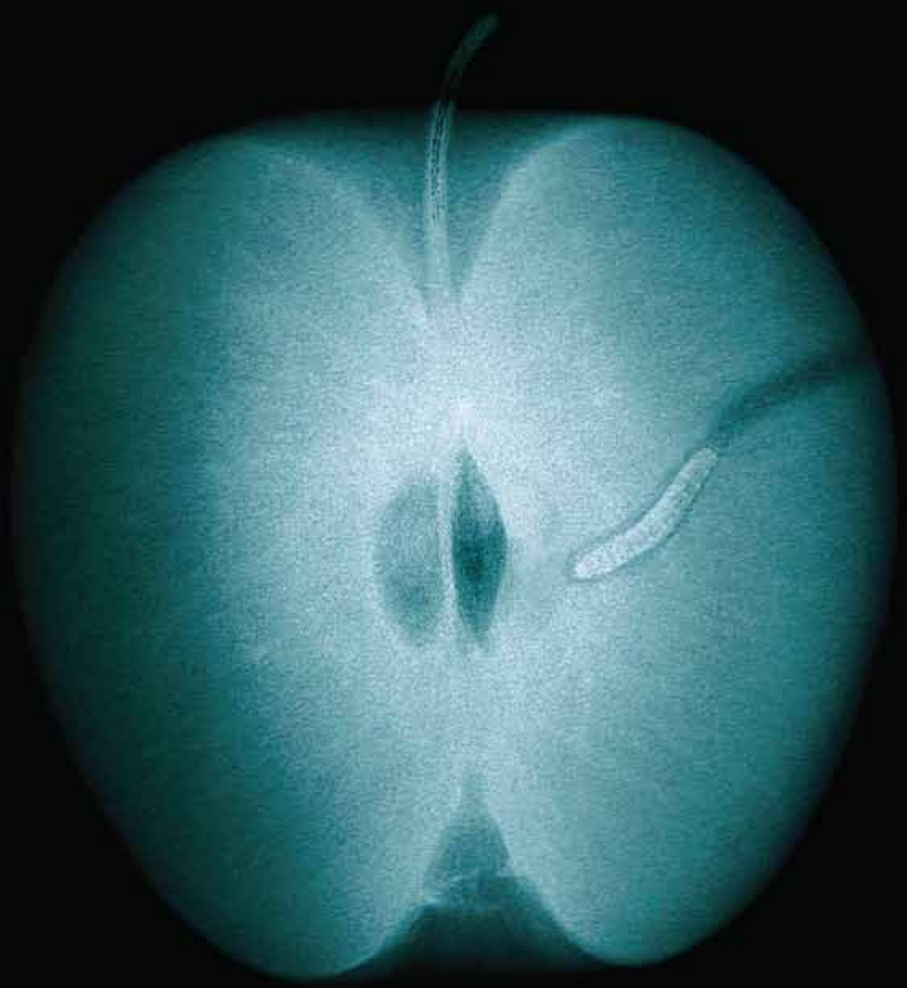

UNDETECTED MICROSCOPIC PULP EXPOSURES

in Deep Class II Cavities

OF THE CALIFORNIA DENTAL ASSOCIATION
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DEPARTMENTS

FEATURES

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Yet Another Test?

ALAN L. FELSENFELD, DDS

Continued competency creates significant confusion in the minds of our colleagues. Most of us remember the days of taking state board examinations for licensure with the commensurate stress of finding a perfect lesion, performing at the highest standards of treatment, worrying that the examiner would see something we missed, or fearing that the patient would not show up for the exam. Most of us worried about these and similar things but managed to pass our examinations without too much difficulty.

How do we assess whether we are evolving in our practices to incorporate the improvements in our profession? This is a difficult question at best. That something is new or different inherently does not make it better, only new or different. Scientific validation will support the need to change the way we do things based on these newer materials and techniques. There is the compulsory requirement for continuing education as we renew our licenses, but one has to question whether this is a good indicator we have learned to be contemporary and practice at the highest level.

We are not in favor of retesting as in the initial licensure process, but is there a way we can assure ourselves and our patients we are performing at a competent level by incorporating appropriate advances in the profession?

As one looks to our society, the need for continued competency is rife. Pilots are required to have proficiency checks every six months to be able to fly in the clouds. Would you like to fly with a pilot who was not current and needed to be flying strictly by the instruments? Discussions have focused on elderly individuals maintaining driving privileges after a certain age. Several recent automobile accidents where an elderly driver was responsible for the death of innocent victims have stimulated this interest.

How do we assess whether we are evolving in our practices to incorporate the improvements in our profession?

Board-certified physicians and oral and maxillofacial surgeons are now required to recertify on a time-dependent basis. This is becoming more common for health care providers. Those who are ACLS-certified need to be proven current every two years. BLS providers have similar obligations. Dentist providers of intravenous sedation or anesthesia undergo re-evaluation every five years. These are required competency checks. Are they tests? Yes. Do we take them and pass? Yes. Why, then, do we worry about continued competency?

Physician performance and treatment outcomes in hospitals are monitored by accreditation-mandated quality assurance committees with particular attention to poor results. Volume credentialing may be applied in instances where surgeons who do specified procedures infrequently may need proctoring to assure competence or may have the privilege eliminated.

This is a complex system that works slowly but ultimately has the ability to identify those physicians who are not practicing at acceptable standards and discipline them accordingly. At the extreme, the legal system may serve as an arbiter of quality of care and could have an impact on the licensing of health care professionals. None of us want that to be the mechanism by which we self-evaluate or assure continued competence.

It is not a mandate to have the same level of examination that the state or regional boards of dentistry seek on initial licensure to assure continued competence. It is reasonable to expect that continuing education requirements with some form of assessment, perhaps by a brief examination, likely written but potentially practical, might be sufficient to demonstrate our prowess. Enactment of this process from a pragmatic standpoint may not be achievable but the importance is there.

There is concern that third-party payers will be demanding continued competency to pay claims for procedures performed. There is precedent for this in that

Would you like to fly with a pilot who was not current and needed to be flying strictly by the instruments?

some medical insurance companies have developed profiles of numbers of designated procedures done and outcomes by physicians. The rates for reimbursement are better for those who do these procedures frequently and with good results. This may be reprehensible to dentists, and we may fight to prevent it, but it may be out of our control.

It might make sense to take ownership of the process and assure continued competency on behalf of our members. This is an onerous task and not one that would generate much enthusiasm but, politically, a strategy worth considering as we contemplate fair reimbursement of our members.

If you are proud of the way you practice and not ashamed of your treatment of patients, then you should have no qualms about peer assessment, whatever the format, on an intermittent basis. If you are not, then why would you be practicing that way? ■■■■

Address comments, letters, and questions to the editor at kerry.carney@cda.org.

Thank You to the *Journal* Reviewers

Authors have their names on their articles. Contributing editors, staff members, and outside vendors have their names in the masthead. But there are more people involved in putting out the *Journal* than those whose names are printed in each issue. There are also the professionals who formally review manuscripts and offer their recommendations. This is a list of the people whose reward comes in the form of a thank you letter and a listing here. In addition, there are many others who have provided information counsel to the *Journal*. It is impossible to list them all. The *Journal* extends its thanks to the following people and everyone else who assists us in our endeavor.

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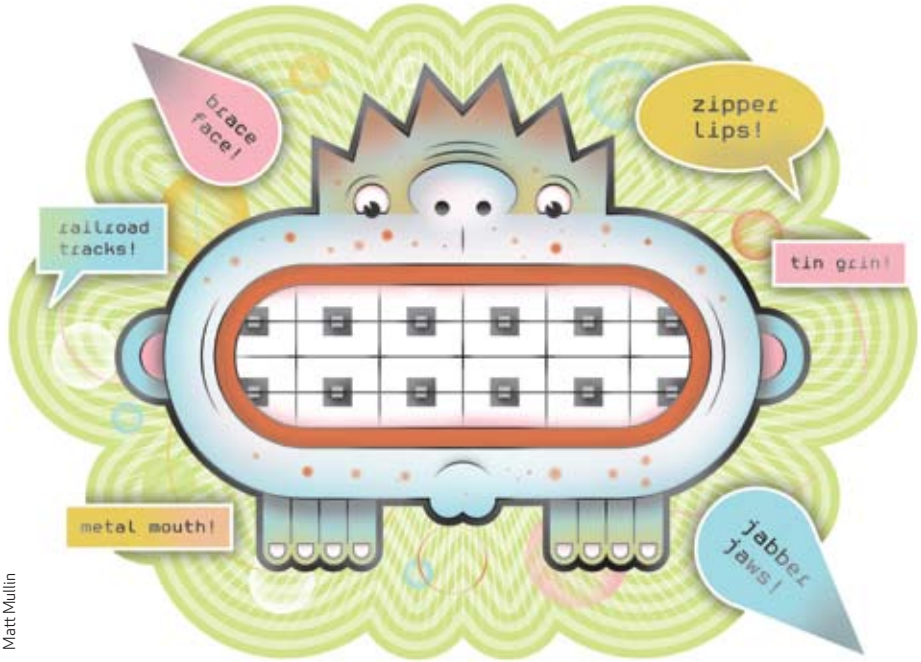

Matt Mullin

Prettier Braces Not Necessarily More Effective, Faster

In the world of braces, it is the ugly duckling variety — stainless steel — and not the swan — nearly invisible — that are most effective. But the problem is the prettier the appliance, the more challenging they are for orthodontists to manage.

"The paradox is that the more esthetic these dental appliances are, the more difficult they are to manage for the orthodontist," said senior study author Henry Fields, professor and division chair of orthodontics at Ohio State University. "But those are what people like the most."

The study recently was published in the *American Journal of Orthodontics and Dentofacial Orthopedics*, and the work was supported by Delta Dental.

Respondents were not queried about the attractiveness of decorative and colorful elastic modules that attach the wires

CONTINUES ON 15

Venus White

→

The Venus Smile complete esthetic system offers a range of cosmetic products, both for direct and indirect application. Venus integrates direct composite solutions and indirect porcelain solutions. The fully integrated system, designed to

provide a natural-looking esthetic outcome, includes Venus Composite, Venus Flow, Venus Temp C&B, Venus Porcelain and now Venus White. The purchase of Venus White will benefit breast cancer research. For more information go to www.smilebyvenus.com.

New Program Reaches Out to Special Needs Community

The Arthur A. Dugoni School of Dentistry has embarked on a project to use nondentist oral health professionals to reach out to people with special needs in community locations where they reside of or receive general health or social services.

Paul Glassman, DDS, professor at Dugoni School of Dentistry and project director for this new initiative, said "The number of people who have difficulty having good oral health or accessing oral health services because of a disability or medical condition is rising dramatically in the U.S."

This is validated by the U.S. Census. Eight years ago, 49.7 million people, an estimated 1 in 5, had a long-standing disability or condition.

"We are attempting to find a workable solution to provide the growing number of underserved people with oral health care," said Glassman.

The nondentist oral health professionals will gather electronic records, i.e., digital photographs, charts and X-rays, and subsequently collaborate — via the Internet — with licensed dentists. Once a treatment plan is devised, the approach to that treatment, including the details of when and where, can be settled.

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"A good understanding of a few behavioral science theories can enhance our ability to assess and treat our patients."

RONALD KULICH

Getting Into Your Patient's Mind

How important is it for a dentist to understand a patient's psychology before delivering care? Utilizing behavioral science techniques to get a "snapshot" of a patient's mind is every bit as important as taking an X-ray, according to an article in an issue of *Tufts Dental Medicine*.

In fact, both are necessary to prepare for a successful dental procedure. It's one reason all dental schools are required to have behavior science programs to maintain their accreditation, said Julie Flaherty, the article's author.

Ronald Kulich, an attending psychologist at the Craniofacial Pain Center at Tufts, said "A good understanding of a few behavioral science theories can enhance our ability to assess and treat our patients."

The key to understanding a patient's needs is communication, and more specifically, asking questions. Many questions that schools require students to ask patients have nothing to do with dentistry, whether they deal with diet, alcohol, or various phobias. A big part of getting patients to better accept treatment is to help them deal with anxiety, including their fear that their dentist is too rushed to fully understand what the patient expects from the visit.

Getting inside a patient's brain helps prepare a dentist for the provision of treatment, according to the article. Whether it's depression, fear of needles or a more serious psychological problem, what's going on inside a patient's head helps a dentist reduce the patient's anxiety level.

UPCOMING MEETINGS

2009	
April 20-22	National Oral Health Conference, Portland, Ore., nationaloralhealthconference.com.
May 14-17	*CDA Presents The Art and Science of Dentistry*, Anaheim, 800-CDA-SMILE (232-7645), cda.org.
Sept. 11-13	*CDA Presents The Art and Science of Dentistry*, San Francisco, 800-CDA-SMILE (232-7645), cda.org.
Sept. 30-Oct.-4	American Dental Association 150th Annual Session, Honolulu, Hawaii, ada.org.
Nov. 8-14	United States Dental Tennis Association fall meeting, Scottsdale, Ariz., dentaltennis.org.
2010	
April 26-28	National Oral Health Conference, St. Louis, Mo., nationaloralhealthconference.com.
May 13-16	*CDA Presents the Art and Science of Dentistry*, Anaheim, 800-CDA-SMILE (232-7645), cda.org.
Sept. 24-26	*CDA Presents the Art and Science of Dentistry*, San Francisco, 800-CDA-SMILE (232-7645), cda.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.

Honors

At the National Oral Health Conference held in Miami, **Jared I. Fine, DDS, MPH**, of Oakland, received a national award recognizing his contributions and efforts with community dental programs. He is a dental health administrator, Alameda County Public Health Department.

Irvin B. Silverstein, DDS, of La Mesa, was given the humanitarian award by the American Academy of Periodontology for his work with the University of California at San Diego Free Dental Clinic, which he both organized and currently directs. The clinic provides free services to the underserved population in San Diego, and is staffed by 60 volunteer dentists and more than 150 predental students who function as assistants.

The International Association of Student Clinicians, American Dental Association, recently honored **Arthur A. Dugoni, DDS,** dean emeritus of Arthur A. Dugoni School of Dentistry, with its Alan J. Davis/SCADA Achievement Award. Named after the first corresponding secretary of SCADA, the award recognizes dedication to the dental profession and efforts to promote the aims and objectives of the organization. Dugoni currently is president of the American Dental Association Foundation, the philanthropic branch of the ADA.

Arthur A. Dugoni, DDS

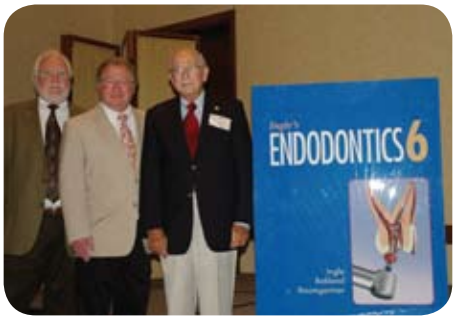
New Endodontic Textbook Released

More than 130 endodontists from all over California met last fall in Santa Barbara for the largest-ever biennial session of the California State Association of Endodontists.

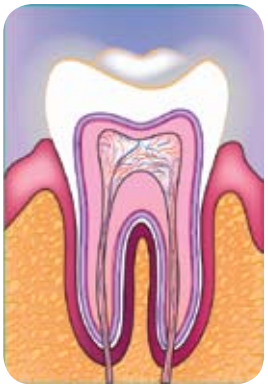
Three of the world's most popular endodontic textbooks: *Ingle's Endodontics*, *Pathways of the Pulp and Principles*, and *Practice of Endodontics* were coincident with the recent release of the sixth edition of *Ingle's Endodontics*. The textbook's 89-year-old author recounted some of the history of the development of the specialized discipline of endodontics and the story of how he obtained Walt Disney's first film, "Tommy Tucker's Tooth."

A chance encounter with Walt Disney led to a lifelong friendship between the two men. Disney told Ingle how his own personal dentist had asked him in 1922 to produce a film on the importance of good oral health and toothbrushing. Disney said the film's $250 profit saved him from bankruptcy. The film was the only one not in the Disney Film Library.

Ingle finally located the film at the National Library of Medicine in Bethesda, and presented a copy to Disney's widow via her dentist.



Drs. Munce, Glickman, and Ingle stand next to the giant proportionately accurate mock-up of the sixth edition of Ingle's Endodontics handmade by Dr. Munce that served to introduce the newly released textbook.



More Follow-up Treatment Required for Dental Implants Versus Root Canals

After studying the success and failure rates of teeth treated with a root canal or extracted and replaced with a dental implants, researchers concluded that while the success rate of each treatment was similar, data indicated that dental implants required additional treatment or surgical intervention after the procedure compared to endodontically treated teeth, 12.4 percent versus 1.4 percent, respectively.

"Many dental professionals today are faced with the dilemma of whether root canal treatment or dental implants are the best option for their patients," said lead investigator James Porter Hannahan, DMD, of the University of Alabama at Birmingham. "While the success of both procedures is similar, saving the natural tooth through a root canal rarely requires follow-up treatment and generally lasts a lifetime; implants, on the other hand, have more postoperative complications and higher long-term failure rates."

Poor oral health and tooth loss may lead to serious medical conditions, such as diabetes, heart disease, stroke, and certain cancer types.

"Considering these results in light of the growing body of evidence on the impact of oral health on overall health, it is imperative for dental professionals to partner with endodontists who have advanced training in examining whether a natural tooth can be saved through root canal treatment," said Louis Rossman, DMD, an endodontist and president of the American Association of Endodontists.

New Guidelines Released by CDC

The U.S. Centers for Disease Control and Prevention recently issued its "Guidelines for Disinfection and Sterilization in Healthcare Facilities, 2008."

The 158-page document presents evidence-based recommendations on the preferred methods for cleaning, disinfection and sterilization of patient-care medical devices and for cleaning and disinfecting the health care environment.

In short, according to a press release, new guidelines include:

1. Formaldehyde-alcohol has been deleted as a recommended chemical sterilant or high-level disinfectant;
2. Several new chemical sterilants have been added;
3. 3 percent phenolics and iodophors have been deleted as high-level disinfectants;
4. Isopropyl alcohol and ethyl alcohol have been excluded as high-level disinfectants;
5. A 1:16 dilution of 2 percent glutaraldhyde-7.05 percent phenol-1.2 percent sodium phenate has been deleted as a high-level disinfectant; and
6. Many new subjects have been added including:

- the inactivation of emerging pathogens,
- bioterrorist agents and bloodborne pathogens,
- toxicologic, environmental, and occupational concerns associated with disinfection and sterilization practices,
- disinfection of patient-care equipment used in ambulatory and home care,
- inactivation of antibiotic-resistant bacteria, and
- new sterilization processes.

OSAP, according to a press release, will continue to study the complete document and provide insights appropriate for dental workers. The new guidelines may be downloaded at the OSAP Web site, http://www.osap.org.

Dental Implants Provide Good Anchor for Orthodontic Treatment

The use of dental implants as orthodontic anchors, appears to be expediting treatment times and expanding possibilities for previously untreatable cases, according to research presented at the American Academy of Implant Dentistry Annual Scientific Meeting.

"Dental implants are changing the way orthodontics is being practiced," said Frank Celenza, DDS, associate clinical professor, New York University College of Dentistry. "In conventional orthodontics, teeth are used to move other teeth, but implants can serve as excellent anchors from which force is applied to move the targeted teeth without causing shifts in other teeth."

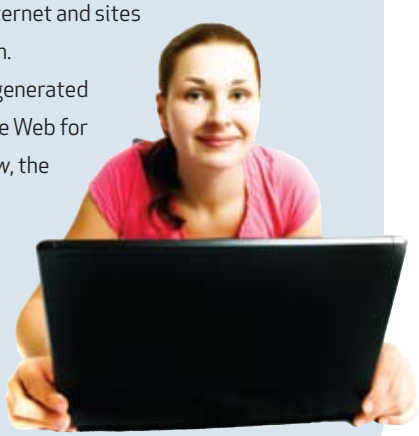
Celenza said the use of implants as sources of orthodontic anchorage is a powerful technique that has just begun to be explored. "In our studies, we're already seeing cases in which implants simplify and streamline orthodontic therapy, decrease treatment times, and eliminate dependence on patient compliance in making adjustments and wearing orthodontic appliances," said Celenza. "Because the anchor systems are so much more predictable and stronger when implants are incorporated, the temporal sequencing of tooth movements is eliminated and teeth can be moved en masse or all together. Consequently, treatment times easily can be reduced by a third."

He also noted that implants can be used in any orthodontic case that requires tooth replacement, as well as for fully dentate patients. "Cases progress faster when implants are used as anchorage, but not because teeth are subject to higher force levels. Rather, it's is the result of a more efficient appliance design that provides the ability to move multiple teeth simultaneously rather than individually, as is necessary in conventional orthodontics."

What Are Patients Saying About You Online?

While word of mouth still is the most powerful advertising a dentist or other health care provider can have, today's person-to-person method is now via the Web. Patients are using the Internet and sites such as Angie's List, Doctoroogle, and yelp.com to voice their praise or criticism.

Matt Moog, CEO of Viewpoints Network, a company that launched a user-generated review site, viewpoints.com, said a large segment of dental patients goes to the Web for referrals. Moog is quoted in the September/October 2008 issue of *CDS Review*, the publication of the Chicago Dental Society.



"There is tremendous evidence that consumers trust the opinions of other consumers more than they trust traditional media sources," said Moog.

Obviously, there will always be patients who badmouth their dentists, no matter how unjustly, but there are things dentists can do to minimize the negative impact online ratings sites might have on one's practice.

BRACES, CONTINUED FROM 11

to the braces, which, in the past few years have become popular among the teen set.

Two hundred adults used a computer-based survey that presented standardized images of teeth with a variety of orthodontic appliances. The images did not show the faces of the patients so the attractiveness of the person wearing the appliances was not a factor. Respondents were asked to rate the appliances using a range from "extremely attractive" to "extremely unattractive" on a scale of 1 to 100.

The responses fell into three clear categories, said Fields, according to an article in *Science Daily*. Topping the list of the most attractive was clear tooth trays and teeth with no visible appliances, aka lingual braces, with the average of most scores exceeding 90. Lingual braces are invisible because they are applied behind the teeth, creating the appearance of appliance-free teeth.

Next on the list were ceramic appliances, often clear or tooth-colored and less visible than metal. This type of orthodontia received average ratings of between about 55 and 70 on the scale.

Ceramic brackets with white or clear wires were considered more attractive than ceramic brackets with metal wires.

Rated the least attractive, despite its effectiveness, were stainless-steel appliances, with average ratings hovering between about 25 and 40 on the 100-point scale.

Researchers collected demographic information on the adult respondents but any differences in demographic influences were insignificant in the overall analysis.

"The general trends of appliance attractiveness are universal," said Fields. "The stainless steel that we like to use, which is the most durable and efficient, is often ranked the lowest in attractiveness. These braces don't wear out and you can get total control with them.

"The most esthetic ones, the trays, have limitations on the types of movements you can make and forces you can deliver, and the efficiency," he said. "And the ceramics sometimes have breakage problems, and they tend to just be a little bit more delicate."

Each kind of correction requires specific manipulation of the wires in the brackets, and some require specially shaped wires to perform the task. Moving teeth about 1 millimeter, a little less than the thickness of a dime, every four weeks, is the ideal.

Clear tray appliances reposition multiple teeth in tiny increments of about a quarter of a millimeter every two weeks, he said. Patients receive an assortment of trays that are to be changed every two weeks. The trays are worn all day and night, the wearer only removing them to eat and brush.

One in four patients being fitted with braces are adults, Fields said, with adults perhaps being more concerned about esthetics of braces than their adolescent counterparts. Fields said some children opt for different route, viewing their braces as accessories that should be enhanced instead of hidden.

"Some of the kids are going for braces made in the shape of a star, or have colors put on the ties that hold the wires to their brackets," he said. "Some people are decorating their braces."

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Undetected Microscopic Pulp Exposures in Deep Class II Cavities

MAJID MOUSAVINASAB, DMD, MSD; M. SADEGH NAMAZIKHAH, DMD, MSED; JALIL MODARESI, DDS, MSC; AND AHMAD BEHZADI, DDS

ABSTRACT Exposure of the pulp may act as a great insult during preparations, so this study investigated the probability of clinically undiagnosed pulp microexposures. The axial wall of 30 deep class II preparations in human premolars were searched for any microexposure after extraction. Seven teeth (23.7 percent) showed some kind of exposure. It is concluded that approximately 1/5 of class II preparations with the RDT less than 0.5 mm may have a pulpal microexposure.

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When the external cap of enamel or cementum is lost from the periphery of the dentinal tubules through caries or preparation with burs, the exposed tubules become conduits between the pulp and the external oral environment. Restored teeth are also at risk of toxic seepage through the phenomenon of microleakage between the restorative material and the cavity wall. Through capillary action, differential thermal expansion and diffusion, fluids containing various acidic, and bacterial products can penetrate the gap between tooth and restoration. [1,2] In fact, in many cases the most severe tissue trauma is not a direct result of caries, attrition or abrasion, instead, it results from the surgical techniques and materials used to restore tooth structure following these events.[3] The remaining dentinal thickness, RDT, is the key determinant of the diffusion gradient and serves as an excellent barrier to both pathological and iatrogenic insults.[1,2]

Evidence suggests that reduction in the RDT of cavity preparation increasingly make the pulp susceptible to traumatic injuries caused by cavity preparation and restoration events.[4] It is shown that the most important cavity variables in deep unexposed cavities for maintaining healthy pulp is remaining dentin thickness.[5]

The greatest insult to the pulp is in the case of the pulp exposure, which often goes undiagnosed.[2] Evidence showed a high degree of undiagnosed pulp exposures in patients with sign and symptoms of irreversible pulpitis.[6]

Knowledge of RDT and these undiagnosed pulp exposures allows the clini-

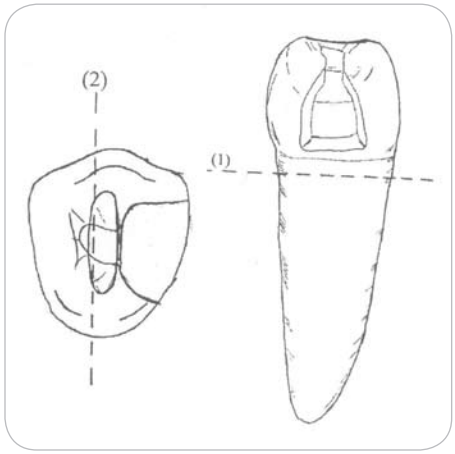

FIGURE 1. Schematic representation of the lines used for sectioning the teeth after extraction.

cian to undertake appropriate protective measures to limit pulpal damage. In the case of questionable prognosis for the future of the pulp, knowing that the remaining dentin thickness is minimal and an undiagnosed pulp exposure have occurred, could indicate a need for prophylactic endodontic therapy.[2]

Although, the pulp inflammation following surgery is largely uncharacterized, the advantage of the improved management of pulpal inflammation is that it may reduce the incidence of post operative pulpal complications. Furthermore, once the pulp becomes inflamed, it becomes hypersensitive so that thermal, mechanical or osmotic stimuli encountered in normal function can cause pain. Consequently, a more complete understanding of the relationship between pulpal inflammation and cavity restoration events may also lead to further improvement in clinical management of pain.[10] Some investigations have been performed on nonexposed cavities in human teeth.[7-10] These studies focused on the pulpal effects of restorative materials and other cavity variations in class V cavities. Although the importance of remaining dentinal thickness have been emphasized by previous studies to date, undiagnosed pulp exposure and remaining dentinal thickness have not been investigated.[5,8]

The aim of this study was to assess the undiagnosed pulp exposures in human deep class II preparations using light microscopy.

Methods and Materials

Thirty noncarious intact first or second maxillary premolars scheduled for extraction for orthodontic purposes were used. Patients were between the ages of 12 and 16. The proposal of the study was approved by the ethical committee of Yazd University of Medical Sciences. Informed consent was obtained from the parents of patients. After local anesthesia, two layers of matrix bands and a wooden wedge were inserted into the mesial embrasure of the tooth. (For optimum access and lightening only mesial cavities were prepared). Class II MO cavities with a wide buccolingual extension were then cut into the tooth using a dental handpiece with water spray coolant and diamond bur (835/008, Teez Kavan, Iran).

Next, the axial wall of preparation were deepened using a low-speed handpiece and round bur (C1, 204,021 Jota, Switzerland). Deepest cavity without any objective exposure or bleeding was prepared. In some cases, red shade of the pulp was seen. If any obvious exposure was seen, the case was excluded from the study. All the cavity preparations were prepared by one operator (author Majid Mousavinasab) and the teeth were immediately extracted and then the roots and the distal half of crowns were separated using low-speed diamond disks (D+Z, West Germany) (**FIGURE 1**).

Thereafter, the teeth were immersed in methylene blue 2 percent for 24 hours and after withdrawal, were washed under running tap water for complete removal of remnants of the dye. A light microscope (Olympus- CH30, Japan) was used for detection of any clinically undiagnosed pulpal exposures. Distal aspects of samples were settled over glass slide and the axial wall was explored for exposure spots. Any passage of the light through thin layer of dentin (bright spot in the dark field) was considered as an exposure. The minimum remaining dentin thickness of the axial wall was measured using a digital caliper (Mitutoyo-CD-8-CS, Japan) in four areas: near the buccal pulp horn, near the lingual pulp horn, with a one-mm distance from buccoaxiogingival point angle and with a one-mm distance from lingiaxiogingival line angle.

Results

Five teeth (16.6 percent) of all 30 samples showed one exposure spot (**FIGURE 2**), and two samples (6.6 percent) showed an area of cribriform exposure (**FIGURE 3**). Totally, seven teeth (23.3 percent) showed pulp exposure. None of the samples had two or more exposure spots. All seven exposures had been near the lingual or buccal pulp horns. Twenty-three remaining samples (76.7 percent) did not show any exposure (**FIGURE 4**). The average of remaining dentin thickness was 0.44±0.16 mm in the axial wall of the cavities. In the exposed teeth, the RDT was 0.27±0.02 mm and in unexposed teeth, it was 0.49±0.15.

Discussion

RDT underlying cavity preparations is one of the most important cavity factors in maintaining a healthy pulp.[5] RDT may be a surrogate for direct injury to odontoblast process, although it is thought that dentinal permeability also increases with decreasing RDT. Mature dentin is normally approximately 3 mm thick.[11] Over the years, the estimated value of the minimal cavity RDT, which does not cause pulp injury has been a topic of controversy.[7] RDT of 2 mm or more effectively preclude restorative damage to the pulp.[11]

Murray suggested that restoring cavity preparations, carefully cut down to 0.5

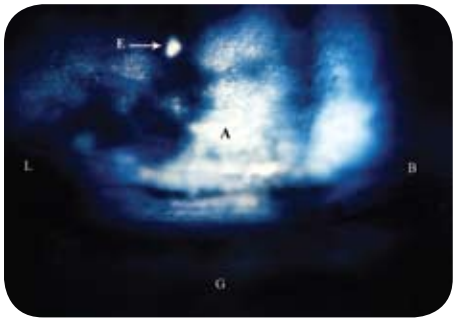

FIGURE 2. A sample showing an *exposure spot* (E) near the pulp horn. Darker areas around the picture are the areas with more RDT that does not permit the light to pass through. B: Buccal wall, L: Lingual wall, G: Gingival wall, A: Axial wall.

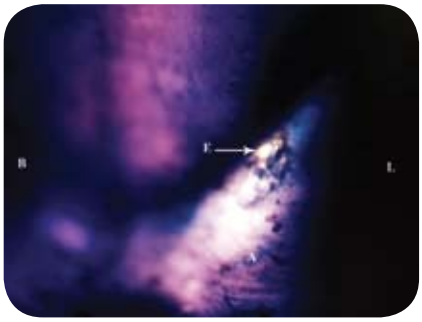

FIGURE 3. A sample showing a *cribriform exposure* (E) exactly on the pulp horn. Darker areas indicate more RDT. Because of different distances from the objective lens of the light microscope, other parts of the axial wall do not seem sharp. (Light microscope is only used to show the passing of the light after mechanical sectioning. In fact; none of the samples have received decalcification process). B: Buccal wall, L: Lingual wall, A: Axial wall.

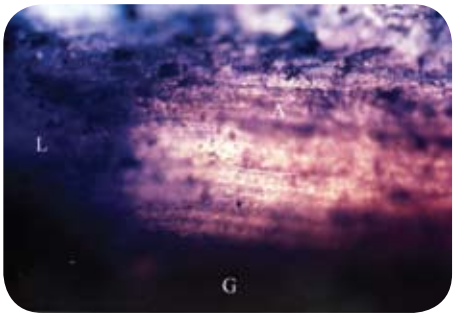

FIGURE 4. A sample without any exposure. There is no obvious microscopic exposure to permit the light to pass through the axial wall. If the distance change between the sample and the objective lens, sharp areas may become dull and dull areas may become sharp. L: Lingual wall, G: Gingival wall, A: Axial wall.

mm, with zinc oxide eugenol, ZOE, intermediate restorative material, IRM, and calcium hydroxide ($Ca(OH)_2$)/amalgam, appeared to have little effect on underlying odontoblast numbers for up to 381 days following treatment in patients.[12]

Deeper cutting (less than .3 mm from the pulp) results in direct odontoblast injury.[11] During cavity preparation the greatest insult to the pulp is in the case of pulp exposure, which often goes undiagnosed.[2] Microbes rapidly reach the surface of the pulp after direct exposure from restorative procedures.[13] Pulpal exposure can promote pulpal edema by evoking an acute inflammatory response and by virtue of the mechanical opening. The development of pulpal edema can have several deleterious effects including extrusion of pulpal tissue, dislodgment of pulp capping materials, loss of an effective seal against bacterial invasion, development of a chronic inflammatory infiltrate, and inhibition of tertiary dentinal formation.[14]

Pashley regarded a RDT of 0.5 mm as a functional exposure and the importance of exposure of the pulp cannot be neglected.[15] Seltzer et al. showed a high degree of undiagnosed pulp exposures in patients with sign and symptoms of irreversible pulpitis.[6] Although some investigators have focused on ultrasonic devices for determining RDT, it seems that it is not an easy or practical method for clinicians.[2]

In the present study, 30 deep class II cavities were prepared in premolars. The mean RDT of the cavities was 0.44±0.16 mm. In Camps' study, only 22 percent of the 317 class V cavities had remaining dentin thickness less than 500 µm.[8] In the other study, 32 of 66 class V cavities had RDT less than 0.5 mm.[7] In yet another study of the authors, the mean RDT of 55 class V cavities was 0.68±.19 mm and 34 percent of the samples had RDT less than 0.5 mm.[9]

Cavities in the present study had less RDT than the previous studies. It seems that the type of preparations (class V or class II) and the difference in operator abilities determine the remaining dentin thickness in such studies.

Ten samples (approximately 10 percent) in the Murray study were exposed, while 23 percent of teeth in the authors' study showed exposure spots.[8] This is due to the type of preparations and method of finding the exposure spots. Determining of RDT and exposure in Murray study was performed using histological sections through experimental area of teeth that may have missed the exposure spots.

In the present study, the direct inspection method was used for detection of the exposures. Furthermore, the probability of exposure near the pulp horns in class II preparations may be more than class V cavities.

Reduction in the RDT of cavity preparations increasingly make the pulp susceptible to traumatic injuries caused by cavity preparation and restoration events.[8] Thus, it is important to avoid needless dentin removal during cavity preparation. Nevertheless, often the RDT of cavity preparations will be determined by the extent of disease progression and treatment regimen.[8]

According to this study, approximately 20 percent of class II cavities with the RDT less than 0.5 mm may have one undiagnosed exposure spot. Thus, in these cases direct pulp capping protocol, including irrigation of the cavity and calcium hydroxide application, should be precisely performed or a prophylactic endodontic treatment should be considered.

Conclusions

Extremely deep preparations with RDT less than 0.5 mm in the axial wall may have a clinically undiagnosed pulp microexposure. These exposures do not have any bleeding and cannot be seen by the operators. According to the findings of this study, exposure may happen in approximately one-fifth of the extremely deep class II cavities. Therefore, the precise direct pulp capping, including irrigating the cavity and calcium hydroxide application or a prophylactic endodontic treatment, should be considered. ■■■■

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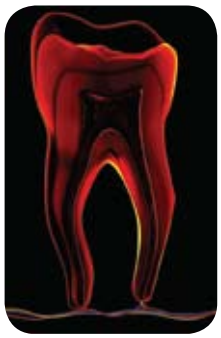

Microleakage of Human Saliva in Coronally Unsealed Obturated Root Canals in Anaerobic Conditions

K. ASHOFTEH YAZDI, DDS, MSC; S. BAYAT-MOVAHED, DDS; M. ALIGHOLI, MSC; S.J. HAYES, BDS; AND M.H. NEKOOFAR, DDS, MSC

ABSTRACT The purpose of this study was to determine the time required for anaerobic bacteria in natural human saliva to contaminate root-filled teeth. Thirty-two single-rooted teeth were cleaned, shaped, filled, and exposed to human saliva for 120 days. Teeth that had not leaked were subjected to polymerise chain reaction examination. Sixty-six percent of the experimental group were totally contaminated. A PCR examination revealed there was no contamination in the apical 3 mm of leakage-free teeth.

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Coronal leakage of saliva has been suggested as being a significant factor in the emergence and persistence of apical disease associated with root-filled teeth.[1] That is, if the coronal portion of the root canal system is exposed to the oral flora, ingress of bacteria can occur with subsequent exposure of the periradicular tissues to their metabolic byproducts.[2] Contamination can occur between the time of obturation and the placement of a definitive coronal restoration.[3]

Recent studies drawing upon advanced microbiological techniques for anaerobic species have revealed that the

composition of root canal microbiota after failed treatment differs from that normally found in untreated teeth and that the polymicrobial flora are predominantly anaerobic and oxygen sensitive.[4-8]

The aim of this experiment was to determine the length of time required for anaerobic bacteria present in natural human saliva to penetrate through the entire root canal system in an ex vivo model.

A variety of materials such as ink and methylene blue have also been used to study microleakage in alloys, resins, root canal filling materials and temporary filling substances.[9-13]

Although the previously mentioned materials may be good tools for comparing relative leakage, they cannot give a true picture of the leakage, which occurs clinically.[14]

Consequently, bacterial or saliva leakage studies could be more meaningful and clinically more relevant.

Most of the articles assessing coronal microleakage by bacteria however, have made use of certain species of bacteria that are not known as being the root canal flora, nor are these bacteria aerobic.[15-17] Furthermore, saliva leakage studies have not been carried out in anaerobic conditions.[2,18]

Materials and Methods

Preparation of the Teeth

Thirty-two extracted human maxillary and mandibular incisors and cuspids with fully formed apices, straight and single-root canals were used in this study. The teeth were collected over a 210-day period, extracted for periodontal or prosthodontic reasons.

The teeth were kept moist by storage in 0.9 percent NaCl solution, throughout the study. The teeth were divided into one experimental group of 22 teeth and two control groups each of five teeth. The teeth were immersed in 2.6 percent sodium hypochlorite solution (NaOCl) for approximately 30 minutes in order to remove organic material from their root surfaces.

Any remaining soft tissue was carefully scraped with a curette to avoid the removal of the cementum from the last 3 mm of the root. The crowns of the teeth were removed and the coronal surface of each root was made perpendicular to the long axis of the root with a high-speed handpiece and a multipurpose bur using air and water spray. Coronal access was made using a No. 245 bur (Dentsply Maillefer, Tulsa, Okla.) in a high-speed handpiece under copious water spray.

Working lengths (WLs) were calculated by subtracting 1 mm from the length at which a size 20 K-File (Dentsply Maillefer, Ballaigues, Switzerland) just exited the apical foramen. The canals were instrumented to size 40 K-File so that a standardized diameter of the apical end of the canals could be obtained. Coronal flaring was accomplished with Gates-Glidden burs, sizes No. 2 and 3. A total of 10 ml of 2.6 percent NaOCl solution was used for irrigation between each file size.

The root canals of the 22 teeth in the experimental group and the five teeth in the negative control group were dried with paper points and the canal walls coated with AH 26 sealer (Dentsply De Trey, Konstanz, Germany). Master gutta percha cones were fitted to 0.5 mm from the working length, nickel-titanium finger spreaders (Dentsply Maillefer, Switzerland) were placed within 1 mm of the working length with the master cone in place, and the canals were obturated using lateral compaction of gutta percha (Coltène/Whaledent, Langenau, Germany).

Accessory cones were added until the spreader could not penetrate more than 1 mm of the working length. Excess coronal gutta percha was removed with a heat carrier before it was vertically condensed using a hand-plugger (M-series, Dentsply/Maillefer, Switzerland).

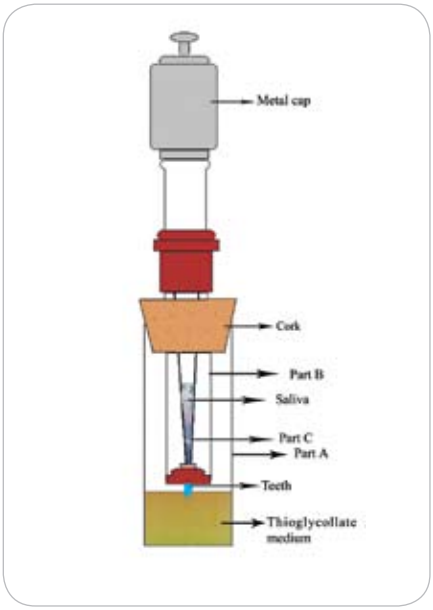

FIGURE 1. The leakage apparatus consisted of three main parts. Part A holds the sterile thioglycollate medium; part B supports the specimens, and part C delivers the fresh human saliva directly to the orifice of the root canal.

The root surface was wiped with gauze and isopropyl alcohol to remove excess sealer. The length of all samples were made equivalent to 10 mm using a high-speed handpiece and a multipurpose bur.

The teeth were wrapped in gauze dampened with sterile saline, enclosed in sealed tubes and placed in an incubator at 37°C for 48 hours to allow the sealer to set.

All the roots were instrumented and obturated by one dentist, with an endodontist supervising all procedures. Five roots, obturated with single gutta percha cones without any root canal sealer, served as the positive control group. The orifices of the negative control teeth were sealed completely with sticky wax (Razi Chemical Co., Tehran, Iran); the other teeth did not receive an interim restorative material.

The external surfaces of the roots were coated with two layers of nail varnish except for the coronal access cavities and the apical 3 mm.

Preparation of Specimens

The apparatus used was a variation based on that used by Gilbert et al. to which several modifications were applied.[17] This model consisted of three main parts (FIGURE 1). Part A was used to hold the sterile thioglycollate medium; part B was used to support the specimens, and part C was used to deliver the fresh human saliva directly to the orifice of the root canal.

First, the teeth were placed in a hole prepared in the plastic head of penicillin vials (Jaber Bin Hayyan Pharmacy, Tehran, Iran) and fixed with chemically active composite resin (Panavia F, Kuray Medical Inc., Kurashiki, Japan). Then, the plastic heads were fixed to the end of part B with the same material. Sticky wax was utilized after Panavia F to seal the sections. The inner section, part C, which fit into the lumen of part B, was advanced to sit directly on the orifice of the tooth. After the construction of the delivery system, the sterile thioglycollate medium was placed into part A to a level of 2 to 3 mm above the apical foramen of each filled root canal.

Fresh human saliva collected every other day from a healthy employee of the Faculty of Dentistry, was carefully placed into the top portion of part C. Every four apparatuses were kept in a jar and then placed in the incubator. Anaerobic conditions in the jars were maintained by the Anoxomat system (Mart Microbiology BV, Lichtenvoorde, Netherlands). The saliva was then replenished every two days under the laminar flow hood.

The opacity of the broth in part A was checked twice a day for 120 days and any changes were recorded as an indicator of entire root canal recontamination. Teeth that had not leaked at the end of the experiment were subject to polymerase chain reaction, PCR, examination to discover the point to which they were contaminated.

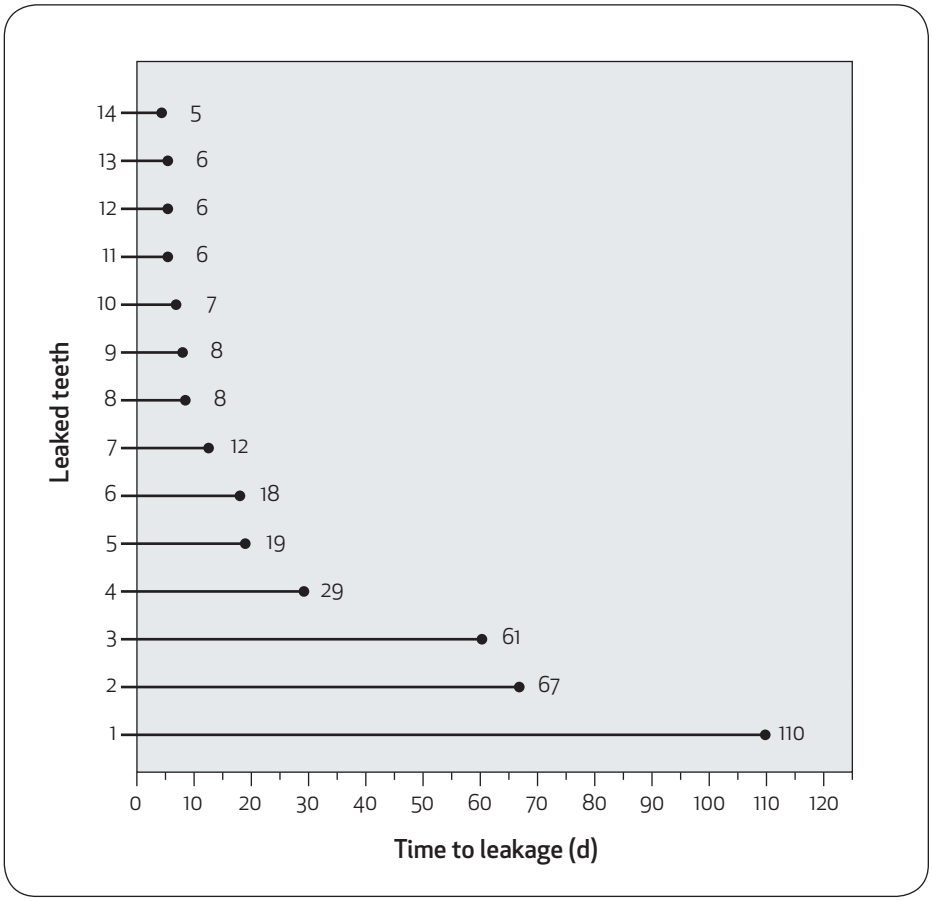

FIGURE 2. The time of leakage in leaked teeth.

Before PCR was performed, the last 3 mm of the aforementioned teeth was cut with a sterile DFS disk bur (TUV, Germany) so that the gutta percha could be extracted using a size 20 K-file.

The broth of the negative control teeth and from the teeth in the experimental group that had not leaked, was removed from part A and mixed with several drops of saliva from part C so that the capability of the system could be confirmed in a separate evaluation.

DNA Extraction and PCR

Total DNA was extracted in the same manner as described by Mullis.[19] 16s rRNA gene was detected by PCR using specific primers (5'-CCA GCA GCC GCG GTA ATA CG-3' and 5'- ATC CGY TAC CTT GTT ACG ACT TC-3'). PCR reactions were performed in a 50 µL volume comprising 1X PCR buffer, 2.5 mM $MgCl_2$, 0.5 µg/mL of each primer, 1.5 U Taq DNA polymerase and 0.2 mM dNTP mix. The PCR conditions consisted of a predenaturation step at 94-degrees Celsius for 10 minutes, followed by 30 cycles of 1 min at 94 degrees, 40 seconds at 63 degrees, and 40 seconds at 72 degrees. A final extension step was performed at 72 degrees for five minutes.

The amplified products were analyzed by electrophoresis on 1.5 percent agarose gel, and the DNA bands stained with ethidium bromide, were photographed under ultraviolet illumination. The results from the coronal leakage were analyzed using Kaplan-Meier survival analysis. All analyses were performed by the Statistical Package of Social Science (SPSS Inc., Chicago, Ill.) for Windows version 13.

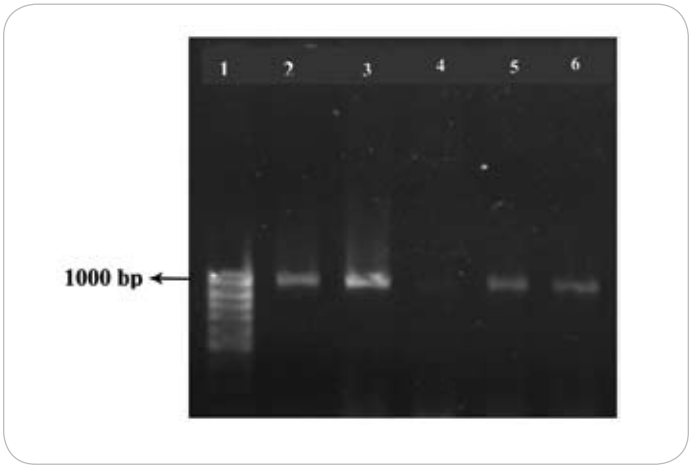

FIGURE 3. The image of PCR products by 16S rRNA gene on electrophoresis gel.

Results

One of the specimens was discarded because of the appearance of some cracks in part A in the first days of the experiment. The results revealed that seven (33 percent) teeth did not cause broth turbidity within 120 days. The time to leak in 14 leaked teeth is presented in **FIGURE 2**.

The time of contamination ranged from five to 110 days. The median time to leakage was 29 days (CI 95 percent, 0 to 93 days). In this period, 11 teeth leaked (79 percent of all leaked teeth in the study duration). Twenty-five percent of these teeth caused broth turbidity within eight days.

All the roots in the positive control group caused broth turbidity within 24 hours. In contrast, the broth in the negative control group remained clear throughout the experimental period. The broth with negative growth, inoculated with saliva from part C, showed turbidity within 24 hours. **FIGURE 3** shows the result of leakage-free teeth PCRs. It demonstrates there was no contamination in the last 3 mm of those teeth.

Discussion

One of the main principles of successful root canal treatment is the prevention of microorganisms and toxins from the oral flora penetrating through the root canal into the periapical tissues. This is achieved by complete filling of the root canal system, including the coronal and apical ends, using materials (sealers) that will prevent proliferation and/or diffusion along the interface between root canal surface and filling material, and through the root filling. Information on the rate of contamination of root canals would be useful for clinicians trying to decide whether or not to revise existing root fillings that have been exposed to the oral environment, e.g., by loss of the coronal restoration.

The ability of various root filling techniques and materials to prevent both coronal and apical microleakage (so-called "sealability") has been evaluated by many in vitro methods based on the assessment of the penetration of various tracers along filled root canals. The tracers most often used are dyes, radioisotopes, or bacteria.[20] However, although isotopes and dyes may be good tools for comparing relative leakage, they do not simulate the types of microbial leakage that may occur clinically.[21,22] In addition, the media used in such studies lack the proteins, enzymes, bacterial populations and their byproducts, which are normally found in natural saliva.

Subsequently, several authors have questioned the relevance of leakage studies in general, citing wide variation in results despite similar methodologies, poor (absent) controls, and no evidence of a link between leakage and presence of disease.[23,24] Even in those studies where bacteria have been used as tracers, it is noteworthy that the species used were not necessarily regarded as representative of bacteria playing a key role in root canal recontamination.[4,8,15,17]

The model used in this study was accurate, simple and practical; initial problems with leakage at the tooth/part B and tooth/plastic interfaces was resolved in two pilot studies. The main advantage of the present experiment over previous studies seeking to assess the time required for bacterial leakage to cause coronal leakage is the employment of natural saliva in anaerobic conditions.[4,8]

Consequently, it is considered that findings are more realistic assessment of the rate of leakage along root fillings in the coronal-apical direction.

Where attempts have been made to quantify the amount of leakage, some authors have suggested it is necessary to remove entrapped air from the obturated root canals, although others have questioned this view.[25-27]

Since, in the present study, the authors were measuring only the presence or absence of leakage, and because the removal of entrapped air from root fillings is not a practice attempted in the clinical environment, no attempt was made to remove entrapped air from the specimens.

The results of this study are similar to those reported by Khayat et al., who found that the median time to contaminate canals obturated, with a lateral compaction technique was 30 days, as compared with 29 days in the present study.[2] It is possible that the additional assessment of contamination by anaerobic bacteria explains the shorter time for leakage to be observed. Some teeth did not leak throughout the study. Presumably, aspects of the root canal structure and subsequent root filling in these teeth lead to this ideal observation, although it

is possible that leakage would have been observed if they had been kept longer than the 120 days of the experiment.

The results of the present study suggests that canals that have been exposed to the oral cavity for more than 10 days should be retreated. In vivo animal studies simulating the clinical situation are suggested in order to determine the exact rate of bacterial leakage in unsealed and exposed root filled teeth because in vitro studies are inherently limited by the lack of any host response to the microbial challenge.

Conclusions

Under the conditions of this study a third of all root canals with 10 mm length of root filling were recontaminated in less than 10 days. ■■■■

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The Prognosis for Dental Implants Placed in Patients Taking Oral Bisphosphonates

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ABSTRACT The success rate of dental implants placed in female patients taking oral bisphosphonates, before the risks became known in 2003, were compared with a control group of females receiving implants and not taking bisphosphonates. The bisphosphonate group had an overall success rate of 86 percent versus a success rate of 95 percent in the control group. This suggests that the failure rate of implants placed in patients taking oral bisphosphonates may be higher unless suggested safeguards are taken.

AUTHORS

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Purpose: To monitor the outcome of patients who had osseointegrated implants inserted, without any special precautions while taking oral bisphosphonates.

Materials and Methods: A retrospective chart review was carried out in the Department of Oral and Maxillofacial Surgery at the University of California, San Francisco. This covered all female patients over the age of 36 who were having dental implants inserted between 1994 and Dec. 31, 2006. The charts and radiographs were reviewed for any complications.

Results: A retrospective chart review identified 65 female patients over the age of 36 who had dental implants inserted. Review of the medical history revealed that 15 of the patients identified themselves as having osteoporosis and 11 identified themselves as being treated with oral bisphosphonates. In three of the 11 patients osseointegration did not occur. In the other 54 patients who were not receiving oral bisphosphonates, there were seven implant failures. When implants were placed in patients taking oral bisphosphonates (in all cases alendronate, or Fosamax) the success rate for these implants was 86 percent. In the similar group of patients not taking bisphosphonates, the success rate for the implants was more than 95 percent. However, none of the patients in either group developed osteonecrosis.

Conclusions: Oral bisphosphonates may decrease integration of dental implants

and increase their failure rate, but this does not appear to lead to osteonecrosis.

Bisphosphonates are a group of medications that essentially inhibit bone resorption and secondarily inhibit bone deposition, and therefore have the overall effect of decreasing bone turnover. Intravenous forms of the medications are utilized as part of a chemotherapeutic protocol to treat bone pain in patients with metastatic bone disease, particularly from multiple myeloma, carcinoma of the breast, and carcinoma of the prostate. Oral forms are used to treat osteoporosis (most often postmenopausal) and also to treat Paget's disease (usually non-nitrogen containing bisphosphonates taken for periods of six months).

In the United States, there are three oral bisphosphonates approved for use in osteoporosis. Once patients start taking these medications, it is envisioned that their use may be lifelong. Alendronate (Fosamax) was released in 1994, risedronate (Actonel) was released in 1996, and ibandronate (Boniva) was released in 2005. The first two are taken as a tablet once per week, while ibandronate is taken once monthly. In 2003, reports started to appear in the literature of osteonecrosis of the jaws associated with bisphosphonate use.[1] Since that time, numerous reports have appeared of the widening of the periodontal ligament, tooth loss, and osteonecrosis.[2]

Although these problems normally occur following dental treatment (most often extractions), about 25 percent of the cases appear to be spontaneous.[3]

These complications have been reported most often with the intravenous forms of the medication, but more recently similar complications have been reported with oral medication.[4,5] At the present time, recommendations for the prevention and management of these complications for patients taking the oral form of bisphosphonates are controversial. There may be some evidence that when elective treatment is being carried out, discontinuing the oral bisphosphonates for three to six months may allow bone turnover in the jaws to return to a more physiological state and then elective treatment can be carried out. However, prior to the recognition of these complications of bisphosphonates (in 2003 and 2004), most practitioners took no special precautions in carrying out any form of dental treatment in patients taking bisphosphonates. In fact, in many ways, they were felt to be ideal patients for certain forms of elective treatment since the bisphosphonates were treating osteoporosis, which can be a complicating factor in some dental treatments.

BEFORE THE complications were noted, patients taking oral bisphosphonates were felt to be very suitable implant candidates.

Of particular interest is the insertion of osseointegrated implants in patients taking bisphosphonates, since again before the complications were noted, patients taking oral bisphosphonates were felt to be very suitable implant candidates. Therefore, it is felt that many patients received osseointegrated implants in the mid-to late 1990s and in the early 2000s without any special precautions. The purpose of this study was to monitor the outcome of these patients and see if any adverse incidents were noted.

Materials and Methods

A retrospective chart review was carried out in the Department of Oral and Maxillofacial Surgery at the University of California, San Francisco. This covered all female patients over the age of 36 who were having dental implants inserted between 1994 and Dec. 31, 2006. The charts and radiographs were reviewed for any complications, and where the records were incomplete patients were contacted to supply the necessary information. Where complications were noted, an effort was made to identify any factors that might have contributed to these complications.

All patients having implants inserted received prophylactic antibiotics (usually penicillin VK or amoxicillin) commencing preoperatively and continuing for three to five days postoperatively (depending on clinician preference). The study received IRB approval from the Committee on Human Research.

Results

A retrospective chart review in the Department of Oral and Maxillofacial Surgery at the University of California, San Francisco, between 1994 and Dec. 31, 2006, identified 65 female patients over the age of 36 who were having dental implants inserted (all implants were from only one manufacturer). Review of the medical history revealed that 15 of the patients identified themselves as having osteoporosis and 11 identified themselves as being treated with oral bisphosphonates for longer than three years. There were no current smokers. Implants were placed by faculty only (three different faculty members).

In all cases, the bisphosphonate was alendronate (Fosamax). The age range of the patients taking alendronate was between 52 and 73 years and was matched for gender, age, date of implant inser-

tion, and general number of implants to 40 patients not taking a bisphosphonate. All patients continued to take the alendrenate. The number of dental implants inserted was between two and eight, and all 11 patients received implants in the mandible and three additionally received implants in the maxilla. The mean time for follow-up was 84.3 months, with a range of 64 to 146 months. In three of the 11 patients osseointegration did not occur, and implants were lost or removed.

The first patient with implant failure was a 68-year-old female who received four implants, of which two implants placed in the anterior maxilla did not integrate and required subsequent removal. The second patient requiring implant removal was a 59-year-old who received five implants in the posterior mandible and two implants failed to integrate and were removed after 33 months. In the third case, one implant in the upper right lateral incisor failed after 11 months while one implant in the mandible of the same patient was successful. However, none of these cases developed osteonecrosis, defined as exposed and nonhealing nonvital bone.

In the matched 40 patients who were not receiving an oral bisphosphonate, there were seven implant failures (the implant was lost or removed) out of a total of 161 implants inserted. The results are summarized in TABLE 1.

TABLE 1

Summary of Results Between Bisphosphonate and Nonbisphosphonate Groups

	Patients (cases)	Implants placed	Failed implants
Bisphosphonate	11	35	5 (14.3%)
Nonbisphosphonate	40	161	7 (4.3%)

Discussion

Prior to reports first appearing in the literature of osteonecrosis of the mandible from bisphosphonates in 2003, patients taking oral bisphosphonates were actually felt to be optimal implant candidates since osteoporosis is a known risk factor for dental implantation and bisphosphonates would control the osteoporosis. Since 2003, it has been realized that bisphosphonates also reduce the rate of bone turnover, and particularly inhibit bone resorption. This might well be felt to interfere with the osseointegration of implants and render the patients more liable to osteonecrosis should there be any soft tissue dehiscence over the implants, or should the implants need removing.

NONE OF THESE cases developed osteonecrosis, defined as exposed and nonhealing nonvital bone.

In this particular study, when implants were placed in patients taking oral bisphosphonates (in all cases alendronate, or Fosamax) there was a 14 percent failure rate of osseointegration, meaning that the success rate for these implants was 86 percent (five implants failed in three patients). In the similar group of patients (similar gender, age, and implant numbers) not taking bisphosphonates, the success rate for the implants was more than 95 percent. Although the numbers are small and not statistically significant, and the shortcomings or a retrospective chart review are realized, this study seemed to indicate that the success rate for implants placed in the jaws of patients taking oral bisphosphonates may be reduced. However, none of the patients whose implants failed developed osteonecrosis, nor did any of the other patients taking bisphosphonates in this study.

By comparison, there are two studies suggesting there is no increase in implant failure or cases of osteonecrosis when implants were placed in patients on bisphosphonates before the risk became known. Jeffcoat, in 2006, reported on 50 patients receiving a total of 210 implants, of whom 25 had received bisphosphonate therapy and 25 were age matched controls.[6] No cases of osteonecrosis were observed, and implant success was greater than 99 percent in both groups.

Grant et al., in 2008, reported on 115 patients who had taken oral bisphosphonates who received a total of 468 implants.[7] There were only two implant failures and no cases of osteonecrosis resulted. In comparison, the present study, although without a statistically significant number of patients, suggests that the implant failure rate may be greater in patients taking bisphosphonates for whom no special precautions are taken.

The estimated incidence of orally administered bisphosphonate related osteonecrosis of the jaws for patients treated with weekly alendronate is 0.01 percent to 0.04 percent for spontaneous osteonecrosis, which increases to 0.09 percent to 0.34 percent following extractions, which might be felt to be equivalent to insertion of osseointegrated implants.[8] Recent recommendations for the discontinuation of oral bisphosphonate therapy for three to six months prior to implant insertion, and also for several months following implant insertion may allow bone turnover to recover.[8] Perioperative antibiotics and primary mucosal closure may also be indicated when placing implants in patients taking bisphosphonates.

Conclusions

The authors evaluated the outcome of patients who had osseointegrated implants inserted while taking oral bisphosphonates by means of a retrospective chart review. Oral bisphosphonates may decrease integration of dental implants and increase their failure rate but did not lead to osteonecrosis in this study. ■■■■

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Uncontrollable Distant Effects of Botulinum Neurotoxin Injections

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ABSTRACT Some dentists propose administering botulinum neurotoxin injections to treat orofacial pain. The scientific literature has documented there are dangerous uncontrollable effects of long-distance traveling of botulinum neurotoxin from the injection site. These distant effects are not technique-specific, not predictable, and cannot be controlled by the amount of neurotoxin, nor by the site administered. These uncontrollable distant effects of "off-label" botulinum neurotoxin injections, at the very least, must be thoroughly disclosed to patients.

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Botulinum neurotoxin, BoNT, is a toxin produced by the anaerobic spore-forming bacterium *Clostridium botulinum*.[1] There are seven different types of toxins categorized as BoNT/A through BoNT/G. Ingesting BoNT contaminated food can cause an intoxication called botulism. Infant botulism occurs when the intestinal tract of infants are colonized by *C. botulinum*, which lead to infant intoxication. Wound botulism is the result of production of BoNT by *C. botulinum*.

Mechanism of Action of Botulinum Neurotoxin

Acetylcholine is a neurotransmitter responsible for communication of a signal from a neuron to a postsynaptic structure. In normal physiological transmission of a neuronal signal at a cholinergic synapse, vesicles storing acetylcholine fuse with the membrane and expel their contents to trigger the adjacent structure. Specific proteins embedded in the membrane of the neuron are essential for fusion of the vesicles. It is these proteins that are the target of BoNT. BoNT cleaves these proteins, inhibiting the fusion of the vesicle with the membrane. Specifically, BoNT/A and BoNT/E target SNAP-25 (Synaptosomal-Associated Protein of 25 kDa), one of the proteins that reside in the plasma membrane.[2] Thus, BoNT inhibits the signal from being transmitted to the adjacent structure.

Botulinum Neurotoxin Injections in Dentistry

BoNT injections are being advocated for use in the treatment of orofacial pain. Tan and Jankovic anecdotally reported their use of BoNT injections in the

masseter muscles to treat patients with bruxism.[3] An additional anecdotal report by Kwek et al. stated they have given BoNT injections to relax the sensitivity and pain caused by trigeminal neuralgia.[4]

Uncontrollable Distant Effects of Botulinum Neurotoxin Injections

There have been numerous cases of dysphagia (dysfunction in swallowing) associated with botulinum neurotoxin injections into the facial and cervical regions. Kwek et al. reported that a patient suffered dysphagia after receiving a BoNT injection in the orbicularis oculi.[4] Tan et al. treated 18 patients with BoNT injections for bruxism and one patient experienced dysphagia for an extended period of time.[3]

Rossi et al. even reported dysphagia caused from BoNT injections into the lower limbs and into the lumbar paraspinal muscles.[5] Significantly, there was no correlation between these distant effects and the dosage of the injection. Rossi et al. suggested that the mechanism of the transport of the neurotoxin could be through spinal motor neurons or systemic distribution via the blood circulation.

In addition, injections into the cervical region can have distant effects on the upper and lower limbs. Garner et al. found that after treatment of focal dystonia with BoNT injections there were increased jitter and blocking in six out of eight patients in distal sites such as in the areas of the extensor digitorum brevis and the tibialis anterior.[6]

Other distant effects of BoNT injections were reported by Ansved et al. where they observed muscle atrophy in the leg muscle even though the BoNT injection was performed in the cervical region.[7]

A recent groundbreaking study by Antonucci et al. has identified that there are long-distant effects of BoNT/A, the most commonly used form of BoNT.[8] They conclusively identified that BoNT does travel far from the injection site and proposed a potential mechanism for this migration. Their study performed on mice showed that BoNT in the injection site of the ipsalateral hippocampus produced the cleaved protein SNAP-25. Within three days, the same cleaved protein was detected on the contralateral side, implying the toxin had traveled. Considerably large quantities of cleaved SNAP-25 remained for up to 120 days. Similarly, toxin injected in the optic tectum was detected in the retina.

IT WAS SHOWN
that it was the toxin that traveled, and not just the cleaved protein.

It was shown that it was the toxin that traveled, and not just the cleaved protein. BoNT/A was injected, and the connection between the injection and distal site was then severed. BoNT/E, which is an agent that removes proteins that are cleaved by BoNT/A, was then administered. BoNT/A remains active for 120 days, while BoNT/E is no longer active after 21 days. After the BoNT/E wash had degraded, the concentration of cleaved SNAP-25 in the distal site still increased significantly. This proved that BoNT/A itself, and not its products traveled to the distal site and continued to cleave SNAP-25 proteins, allowing the increase in SNAP-25 to be detected. This study revealed for the first time that BoNT/A injected into a peripheral site traveled to central circuits, providing a mechanism by which the toxin can travel into the CNS after peripheral administration.

Conclusion

As of 2009, the American Dental Association has not taken an official position regarding the standard of care for a dentist administering BoNT injections to treat orofacial pain. Currently, state dental boards are determining whether this falls within the scope of the practice of dentistry. There have not been any randomized controlled trials for this type of treatment.

The scientific literature has documented there are dangerous uncontrollable effects of long-distance traveling of BoNT from the injection site. These distant effects are not technique specific, not predictable, and cannot be controlled by the amount of neurotoxin, nor by the site administered. These uncontrollable distant effects of "off-label" botulinum neurotoxin injections, at the very least, must be thoroughly disclosed to patients. ■■■■

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Say What?

Frittle (FRIT-uhl) n. The little bit of skin that hangs down behind teeth Nos. 8 and 9 because of having been badly scalded by hot pizza.

Robert E. Horseman, DDS

ILLUSTRATION BY CHARLIE O. HAYWARD

In dentistry, we have literally thousands of terms, definitions and enough jargon to compete with any profession anywhere. True, there are still gaps and gray areas where the exact word to describe a thing, event or feeling is missing or nonexistent. The following is an attempt to increase your understanding and vocabulary to the point where you can hold your head high and proclaim to the world that you're not as dumb as you look:

Resicrud (RESI-crud) *n*. Little bits of cured resin fused to the end of your curing light, which you are afraid to scrape off for fear of altering the optical properties of the light.

Rotoreem (ROTO-reem) *v*. To twirl an endo file between thumb and forefinger of a gloved hand until the instrument is inextricably welded to the folds of the latex. Can also be applied to picking up one bur from a group of others.

Ditherplotz (DITHER-plotz) *n*. An uneasy feeling occurring on the first day of inaugurating a new fee schedule. Diminishes in intensity after 10 months.

Dodgem (DOD-gem) *v*. To alter course enough to avoid meeting face-to-face an oncoming patient whose name escapes you, but who is sure to know you because she just spent $1,500 on dental treatment.

Hideybur (HIDEE-bur) *n*. One of several locations in the innards of your chair where a fortune in lost diamonds lies at this moment. There is another in the U-trap under your sink.

Malosite (MAL-osite) *n*. The loss of visual acuity that makes it impossible to distinguish a new diamond or carbide from a used one until the moment of contact with a tooth.

Loquacient (lo-QUAY-shent) *adj*. Said of a patient's rapid and incessant chatter used solely to postpone the actual entering of the mouth as long as possible.

Lasmile (LAS-mile) *n*. The long walk from the reception room to the operatory when the option of escape is voided because of being bracketed by two assistants with cattle prods.

Frittle (FRIT-uhl) *n*. The little bit of

CONTINUES ON 61

DR. BOB, CONTINUED FROM 62

skin that hangs down behind teeth Nos. 8 and 9 because of having been badly scalded by hot pizza.

Indigoos {INDY-gooz) *n*. The blue marks left on teeth by articulating paper. The counterpart to blancogoos, the white part of the tooth where the blue isn't.

Pratscoot (PRAT-skoot) *n*. The awkward scuttle a patient must make while attempting to settle gracefully into a dental chair.

Nevahred (NEV-ah-red) *n*. The educational pamphlets in the reception room that have been there since 1981 without being picked up or read.

Subaneg (SUBA-neg) *v*. Substitute word used to deflect fear the real word would engender, e.g., recontour for grind. Fools nobody and used only by dentists with ulterior motives.

Spitooey (spit-TOOIE) *n*. Unexpected little fountain of saliva that erupts from mandibular salivary glands, stimulated by Lord knows what.

Flabbergast (FLAB-ber-gast) *n*. The curious combination of profound relief and righteous anger when a patient nobody likes fails to keep appointment.

Radiafoot (RAY-DE-AY-fut) *n*. The length measured in feet required to exit the operatory before the X-ray button is pushed.

Drylpunk (DRILL-punk) *n*. The rogue handpiece that worked fine yesterday, but today will either 1. not spray; 2. refuse to light up; 3. not accept a bur or; 4. eject the bur at speeds exceeding 500 rpm.

Blabadab (BLAB-a-dab) *v*. To engage in the obligatory small talk on unrelated subjects that must be done prior to the actual beginning of treatment.

Eturnatee (ETURN-a-tee) *n*. The length of time that passes between the catching of a gloved finger by a rapidly revolving bur and the removal of the shoe from the foot control.

Eljunko (el-JUNKO) *n*. The bizarre collection of dentally oriented objects every dentist has for which no use has ever been found but that can never be thrown out for fear a use will be found as early as tomorrow.

Spritz (SPRITS) *n*. The sharpest point on a dental light designed to make first contact with the skull when exiting or entering the chair.

Visiblonk (VISI-blonk) *v*. The act of blonking out one's eyes like Little Orphan Annie's when required to concentrate on treatment plans offering more than five options.

Prosodowt (PROS-o-dowt) *n*. The suspicion by the patient that a newly cemented crown or bridge will still feel high/funny/peculiar after 48 hours, even though assured by the dentist that it will be just fine.

Freebie (FREE-bee) *n*. The time spent with a patient delivering a detailed explanation of thermal sensitivity for which there is no procedure code and offering a complimentary sample of Sensodyne.

Digigoop (DIJ-ee-goop) *n*. The mess on one or more fingers of your glove while impatiently testing to see if the polyvinylsiloxane impression material has set yet. Usually purple or some variation thereof.

Ernahernia (erna-HERN-eyah) *v*. To risk moving the average woman's purse from its resting place to a new location without recourse to block and tackle.

Clorp (CLORP) *n*. A condition that results in the end of the floss becoming disengaged from the little cutter on the lid and disappearing into the container. When this happens, the floss is said to have "clorped" and so have you.

Splort (SPLORT) *n*. Detailed list of prophy paste flavors that never quite made it. For example: broccoli, tuna/peanut butter, persimmon and steptic pencil.

Boca Grande (BOCAH GRAHN-day) *n*. A division in the Dental Hall of Fame devoted to recognizing with public appreciation the mouths of celebrities, current or deceased, that the dental profession considers ideal. Criteria for nomination are: capacity for minimum 10 cotton rolls, saliva ejector, minimum two-gloved fingers and head of high-speed handpiece. Further requirement: *boca grande* nominee (if alive) must be able to carry on intelligible conversation while foregoing is present in mouth. Limited listing of honorees includes Martha Raye, Julia Roberts, Nat "King" Cole, Carly Simon, Joe E. Brown and Louis Armstrong.

Mooladay (MOOLA-day) *n*. That day 48 hours after the mailing of 500 monthly statements when one could reasonably expect an avalanche of money to appear in the mail. This has never been known to happen.

Hooseezit (who-SEEZ-it) *n*. Explanation of black line visible at crown margin.

Blackpology (BLAK-pol-ogee) *n*. See hooseezit.

Palatickle (PALA-tickul) *v*. Action of prophy cup on lingual of upper anteriors.

Damnpostdam (dam-POST-dam) *n*. What you remove (along with retention) from gagger's denture.

Omigusher (OMMEY-gushur) *n*. Overactive saliva gland. ■■■■