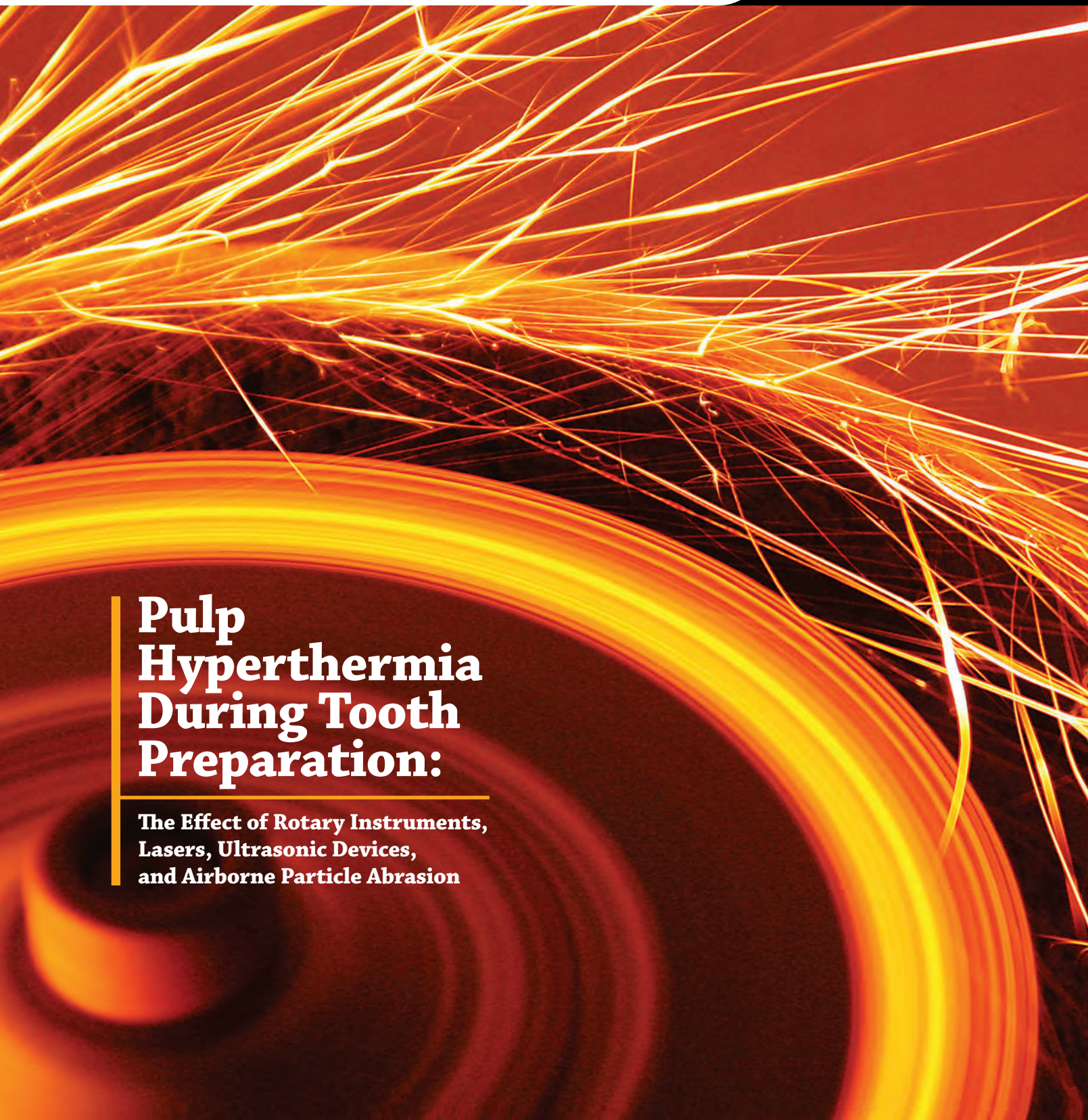
OF THE CALIFORNIA DENTAL ASSOCIATION

Journal

SEPTEMBER 2012



Pulp Hyperthermia During Tooth Preparation:

The Effect of Rotary Instruments, Lasers, Ultrasonic Devices, and Airborne Particle Abrasion

Getting all of your insurance through the most trusted source?

Good call.

Protect your business:

TDIC Optimum bundle

- Professional Liability
- Office Property
- Workers' Compensation

Protect your life:

- Life/Health/Disability
- Long-Term Care
- Business Overhead Expense
- Home and Auto

Protecting dentists. It's all we do.®

800.733.0633 tdicsolutions.com CA Insurance Lic. #0652783

Coverages specifically written by The Dentists Insurance Company include Professional Liability, Office Property and Workers' Compensation. Life, Health, Disability, Long-Term Care, Business Overhead Expense and Home and Auto products are underwritten by other insurance carriers and offered through TDIC Insurance Solutions.

tdic®

DEPARTMENTS

FEATURES

OF THE CALIFORNIA DENTAL ASSOCIATION

Journal

CDA Journal
Volume 40, Number 9
SEPTEMBER 2012

Journal of the California Dental Association

published by the California Dental Association
1201 K St., 14th Floor
Sacramento, CA 95814
800.232.7645
cda.org

Reader Guide:

Upcoming Topics
OCTOBER: *General Topics*
NOVEMBER: *General Topics*
DECEMBER: *University Research*

Classified Advertising
cda.org/classifieds

Display Advertising
Corey Gerhard
ADVERTISING MANAGER
Corey.Gerhard@cda.org
916-554-5304

Letters to the Editor
Kerry K. Carney, DDS
Kerry.Carney@cda.org

Permission and Reprints
Jeanne Marie Tokunaga
PUBLICATIONS MANAGER
JeanneMarie.Tokunaga@cda.org
916-554-5330

Manuscript Submissions
www.editorialmanager.com/jcaldentassoc

Subscriptions
The subscription rate is $18 for all active members of the association. The subscription rate for others is as follows:
Non-CDA members and institutional: $40
Non-ADA member dentists: $75
Foreign: $80
Single copies: $10
Subscriptions may commence at any time. Please contact:
Crystan Ritter
ADMINISTRATIVE ASSISTANT
Crystan.Ritter@cda.org
916-554-5318

Journal of the California Dental Association (ISSN 1043-2256) is published monthly by the California Dental Association, 1201 K St., 16th Floor, Sacramento, CA 95814, 916-554-5330. Periodicals postage paid at Sacramento, Calif. Postmaster: Send address changes to *Journal of the California Dental Association*, P.O. Box 13749, Sacramento, CA 95853.

The Journal of the California Dental Association is published under the supervision of CDA's editorial staff. Neither the editorial staff, the editor, nor the association are responsible for any expression of opinion or statement of fact, all of which are published solely on the authority of the author whose name is indicated. The association reserves the right to illustrate, reduce, revise, or reject any manuscript submitted. Articles are considered for publication on condition that they are contributed solely to the *Journal*.

ASSOCIATION MEDIA & PUBLISHING

AADE American Association of Dental Editors

CDA JOURNAL, VOL 40, Nº9

Passion Smassion

KERRY K. CARNEY, DDS

I have grown tired of the proliferation of the word "passion." It is so overused now that it has lost its impact and clarity of meaning. I am nostalgic for the "passion" of bygone days. It used to be reserved for the description of great emotional fervor like the emotion involved with a heated and reckless love affair. Now it is used to describe a decided preference for something, as in "she has a passion for chocolate."

Or it can mean that the individual who is passionate is unable to focus on the mundane duties of everyday living. This meaning was related to me by a friend who said whenever someone tried to set her up with a blind date and described the guy as "passionate" she found that usually meant he did not even hold a job at the coffee shop where they were to meet.

Of late, I find that when the word is used to describe someone, it is frequently meant to explain why he/she is unwilling to entertain facts or logical arguments contrary to his/her own view. I asked a third party why a mutual acquaintance was so rigid and close-minded. I was advised that he is very "passionate" about the topic.

What got me started on the overuse of the word "passion" was its appearance on the banner over the website page about careers with American Dental Partners (ADP). They are looking for dentists who have a "passion for people and a passion for excellence." Exactly what does that mean and who are these guys?

ADP of Wakefield, Mass., is a dental service organization (DSO) that manages more than 280 dental centers in 21 states.[1] I came across them while reading about the recent scuffle over legislation under consideration in North Carolina. Legislation is in play there to address concerns that corporate entities may be influencing the dentist/patient relationship. ADP might make a good example to illustrate the debate.

Passionate and good-looking, this is beginning to sound a little too good to be true.

In February of this year, ADP was bought out by a New York-based private equity firm called JLL Partners to the tune of $390 million. That indicates some folks think there is a lot of money to be made in managing dental offices.

ADP claims, "We help dentists with the business side so they can focus on providing the best patient care."[2] On their website, ADP includes in its core values, "Fiscal Responsibility: Act in a financially prudent manner for the benefit of our affiliates, employees, and shareholders as well as the patients of our affiliated dental groups."[3]

Among their seven strategic goals they include, "Partnership in Management, Operating Excellence, Continuous Growth and Financial Performance."[3] All this fits together to produce their "culture" or as they say, "At American Dental Partners, we believe a common purpose, core values, and strategic goals help create our 'Healthy Organization' culture along with passionate professionals committed to service and care excellence."[4]

There is that word "passionate" again.

ADP also includes "testimonials" by passionate people who decided to sell their practices to ADP. In the three examples provided, the individuals sound very happy and pleased. One goes so far as to say, "Within one year, I started to feel better about practicing dentistry. In fact, some of my friends asked me what I did, because I was looking great."[5]

Passionate and good-looking, this is beginning to sound a little too good to be true.

Last year, ADP was sued in both Michigan and California "by dentists who claimed the company interfered with their delivery of care to patients."[1] And therein lies the problem. These DSOs are supposed to reduce the administration hassles of running a small business that the private practice dentist normally has to assume, but at what cost?

The idea is to offload the onerous business administration and regulatory part of being a dentist thereby freeing the dentist to spend more of his/her time providing patient care and enjoying quality personal time. That sounds idyllic, but, of course, there is a catch.

You cannot really offload a responsibility without abdicating some of your authority or autonomy as well. One of the great things about private practice is exactly that authority and autonomy. Of course, it may not feel like such a great thing when you are working late, catching up on administrative chores or when you have to deal with equipment breakdowns on a busy day, or when you have to manage a personnel problem that comes out of the blue.

But on the other hand, no one is standing over your shoulder telling you to audit your charts to see what treatment plans can be upgraded to include reimburse-

ment-rich procedures. No one is setting production goals that you have to meet in order to enjoy a bonus in your base pay.

In the reimbursement arena, we are all familiar with the trends of shifting risk. Capitation plans are the classic example of shifting financial risk from the third-party payer to the dentist. The DSO appears to be shifting the authority and autonomy from the dentist to the corporation representing its shareholders.

According to a recent ADA communiqué, the North Carolina Legislature has passed the final version of SB 655. With this bill, the North Carolina Board of Dental Examiners will have "additional safeguards and tools to enforce long-standing North Carolina law prohibiting corporations from owning or controlling dental practices."[6] DSOs are increasing in number and size. They are a trend in dental care practice models. As the cost of dental education rises, models like the DSO may become increasingly appealing to the new graduate burdened by crushing debt. As the market place for dental care changes and the downward forces on reimbursement continue, the DSO may become increasingly appealing to the established dentist looking for a way to get the equity out of the practice and retire.

It looks like a future where shareholder passion for profit might trump the dentist's compassion for the patient and that is a dispassionate perspective. ■■■■

REFERENCES

1. bloomberg.com/news/2012-05-31/republicans-target-dental-bill-that-private-equity-hates.html. Accessed July 11, 2012.
2. amdpi.com/. Accessed July 11, 2012.
3. amdpi.com/WhatWeDo/WhoWeAre.aspx. Accessed July 11, 2012.
4. amdpi.com/Careers/culture.aspx. Accessed July 11, 2012.
5. amdpi.com/PracticeAffiliation/AffiliateStories/1stAdvantageDentalofNewYork.aspx. Accessed July 11, 2012.
6. ADA Leadership Update, June 29, 2012.

Encouraging Home Care

I was very impressed with the letter from Scott Thompson in the July *Journal of the California Dental Association*. It was called "Access to Care! Missing the Point" (40(7):553). He was right on target. Most of the papers I read seem to imply that dental care is about fixing problems after they have occurred. Dental coverage does not pay for prevention. They treat dental care as if we are selling products and services like retail marketing. We know that prevention is more desirable than expensive repairs. We know that if a person cannot afford expensive repairs, it makes sense to prevent them in the first place. Dr. Thompson pointed out that we know how to prevent dental disease. Although he was talking about caries, we must not forget that periodontal disease is also preventable.

From my experience in close to 50 years of working with patients, I have concluded that the health of the patient will be in proportion to their participation with the care provider in matters of their own health. In other words, they have to do their home care.

The problem is to work with our patients in a way that they will be willing to consistently take responsibility for their own health by doing their home care. The weak spot in our dental education is that most of us do not get sufficient training in the behavioral aspects of dentistry.

None of the prevention protocols will work if the patient does not follow them. The question then becomes: How do we get our patients to follow them? Dr. Thompson hinted at this when he said "We must address the disease before we address the devastation." If a patient asked me to repair their teeth before they got their mouth healthy, I would ask them: "If your house is on fire, who do you call first, a carpenter or the fire department?" They would laugh because they understood that you have to first put out the fire.

I want to thank Dr. Thompson for his very clear exposition on this issue and for acknowledging the many teachers who helped us get to this place.

PHILIP HORDINER, DDS
Mill Valley, Calif.

You've built a practice as exceptional as you are. Now choose the optimum insurance to protect it.

TDIC Optimum

Anything but ordinary, Optimum is a professional bundle of products that combines TDIC's singular focus in dentistry, thirty years of experience and competitive multipolicy discounts. Creating the ultimate coverage to protect your practice, perfectly. And you wouldn't have it any other way.

TDIC Optimum Bundle
Professional Liability
Office Property
Workers' Compensation

Protecting dentists. It's all we do.®

800.733.0633
tdicsolutions.com
CA Insurance Lic. #0652783

tdic®

CDA JOURNAL, VOL 40, Nº9

Rule of Double Causes

DAVID W. CHAMBERS, PHD

The connection between what we do and the reasons we give for doing it are sloppy. As William Jennings Bryan observed, "It is a sorry mind that can't think up some reason for what we want to do." The big problem is that there is no one-to-one correspondence between actions and justifications. Most actions go without justification. They just do not need to be explained. But there are some actions that have multiple explanations. That is where the concern for the Rule of Double Cause comes in.

You make a donation to a charitable cause in the name of a revered colleague. You feel good about it until you see in the publication of the organization you supported that the list of donors omitted your name and your contribution,

CONTINUES ON 707

Correction

In the article, "Idiopathic Synchronous Central Giant Cell Granulomas Involving Both the Maxilla and Mandible: A Case Report and the Review of the Literature," published in the *Journal of the California Dental Association*, (40[8]:657-60, August 2012), there was an error in the biography of Necdet Dogan, DDS, PhD. Dr. Dogan is a professor at Gülhane Military Medical Academy, Department of Oral and Maxillofacial Surgery, Etlik Ankara, Turkey. *Conflict of Interest Disclosure: None reported.*

The *Journal* deeply regrets the error.

Pain Sensitivity May Be Controlled by Biological Factors

Different anatomical, physiological, and hormonal features in women and men provide insight as to how their pains might be controlled by a number of biological factors, according to a clinical review in the *Journal of the American Dental Association.*

The allegation that some pain in female patients is of "psychosomatic origin" could be due to a difficulty substantiating "by means of any objective signs or measures," according to author Thuan Dao, DMD, MSc, PhD.

The clinical review also explained that "many recurrent pain disorders, especially those with a higher female prevalence, are of unknown origin, and sex-specific pains due to anatomical and hormonal differences (for example, pains associated with menstruation, ovulation, pregnancy, and childbirth) more often are nonpathological in women."

A number of chronic pain conditions are more prevalent in women than they are in men, including temporomandibular disorders, Thuan wrote.

"Other disorders affecting mainly women vary with biological development and intake of exogenous sex hormones. For instance, sex differences in orofacial pain emerge at puberty, peak during reproductive years, and decline at menopause," Thuan wrote.

"These observations should help counteract prejudicial attitudes toward female patients, which can lead to inadequate care," she concluded.

Ability to Smile Restored in Patients With Facial Paralysis

A recent study, published in the special *Operative Neurosurgery*, a supplement to *Neurosurgery*, reported that a surgical technique using a muscle flap from the thigh can restore facial animation, including the ability to smile, in patients with facial nerve paralysis resulting from neurofibromatosis type 2 (NF2).

NF2 is an inherited condition that causes patients to develop noncancerous tumors, which typically occur along the auditory nerve, with the potential to cause hearing loss. When the facial nerve is affected, by either tumors or surgery to remove them, facial paralysis commonly results, according to a news release from the journal's publishing company.

The researchers studied five patients, ranging in age from 12 to 50, with NF2 and complete unilateral facial paralysis who had been referred to the facial nerve center at their institution. According to the news release, all patients had "severe paralysis of one side of the face, with drooping and lack of motion at the corner of the mouth (oral commissure) on the paralyzed side."

Surgeons transplanted a small flap of muscle from the inner thigh — the gracilis muscle — to the damaged area causing facial paralysis. "The gracilis flap procedure was successful in restoring the patients' ability to smile," the news release stated.

"Management of facial paralysis is oftentimes overlooked when defining a care plan for NF2 patients who typically have multiple brain and spine tumors. The paralyzed smile may be treated successfully with single-stage free gracilis muscle transfer in the motivated patient," the authors of the study concluded in their report.

See the full report in the June *Neurosurgery* supplement *Operative Neurosurgery*.

Researchers Nearing Ability to Grow Teeth

A marker for dental stem cells has been found by researchers in the group of Professor Irma Thesleff at the Institute of Biotechnology in Helsinki, Finland, according to a news release from the institute.

"To build a tooth, a detailed recipe to instruct cells to differentiate toward proper lineages and form dental cells is needed," the news release stated, and the research team showed that "the transcription factor Sox2 is specifically expressed in stem cells of the mouse front tooth."

According to the study, published in the online edition of *Developmental Cell*, the mouse incisor continuously grows throughout life and provides "a valuable model to study stem cell regulation during organ renewal," the authors wrote.

Human teeth do not grow continuously, but the mechanisms that control their growth are comparable to those in mouse teeth.

The research team created a process of recording the cells' division, movement, and specification. "By tracing the descendants of genetically labeled cells, they also showed that Sox2 positive stem cells give rise to enamel-forming ameloblasts as well as other cell lineages of the tooth," the news release stated.

"The identification of Sox2 as a marker for the dental epithelial stem cells will facilitate further studies on their lineage segregation and differentiation during tooth renewal," authors concluded.

See the study, "Sox2 Stem Cells Contribute to All Epithelial Lineages of the Tooth via Sfrp5 Progenitors," in the August issue of *Developmental Cell*.

Tooth Sensitivity Heightened by Light Activation During Bleaching

Authors of a recent study have found the use of light activation increases the risk of tooth sensitivity during in-office bleaching. In addition, researchers of the systemic review and meta-analysis, published in the *Journal of Dentistry*, determined light activation may not improve the bleaching effect with high concentrations of hydrogen peroxide (25-35 percent).

The team, investigating the effects of light on bleaching efficacy and tooth sensitivity during in-office vital bleaching, used "all randomized controlled trials (RCTs) or quasi-RCTs comparing the light-activated bleaching system with nonactivation bleaching system," according to the study.

Eleven studies were included in the meta-analysis and the researchers found that a light-activated system produced "better immediate bleaching effects than a nonlight system when lower concentrations of hydrogen peroxide (15 percent to 20 percent HP) were used." However, "when high concentrations of HP (25 percent to 35 percent) were employed, there was no difference in the immediate bleaching effect or short-term bleaching effect between the light-activated system and the nonlight system," the authors wrote.

The meta-analysis also demonstrated a higher likelihood of tooth sensitivity with the light-activated system than with the nonlight system.

Authors suggested dentists use the light-activated system "with great caution or avoid its use altogether," but noted that further studies are needed "to explore the advantages of this light-activated system when lower concentrations of HP (15–20 percent) are used."

Read the full report in the *Journal of Dentistry*, 40(8):644-53.

DOUBLE CAUSES, CONTINUED FROM 705

which would have been regarded by all who saw it as generous. Should you say something? This situation uncovers a "double cause." Was the contribution made out of respect for your colleague and the cause or out of a desire for personal recognition? If both motives were involved, what is the relative weight of each, and was the charitable motive strong enough to have carried the day by itself?

A dentist has just invested thousands of dollars on courses and equipment to add a new service line to the practice. The dentist has been advised by their advocates that a move to state-of-the-art procedures will boost a dentist's earnings from the 30th to the 70th percentile compared with dentists who only provide services that patients are most in need of. A patient presents who may very well be a good candidate for the new service. There is no doubt that, if performed successfully, the procedure would be beneficial. There is also no doubt that the dentist would gain financially and in terms of professional self-fulfillment. This is a case where the Rule of Double Cause applies.

Both motives (service and self-fulfillment) are part of the decision about the new procedure. In order to minimize the threat of self-dealing, the dentist should (a) honestly acknowledge all motives and engage the patient in a fully-informed decision, (b) make certain that the competence level in this never-before-attempted technique is high enough that success is assured, and (c) be prepared to stand by the outcomes of the procedure – including diminished service to traditional patients.

It may not be obvious, but the rules for untangling double causes are all about actions one takes and not about what one says. No one can argue his or her way to a moral position.

The Nub:

❶ Consider all the consequences of your choices, not just enough of them to justify what you want to do.

❷ Double causes can be untangled by imagining how one would respond if things did not work out as planned.

❸ It is inherently unethical to claim that one is acting only out of the most laudable of the multiple causes for a choice.

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*.

Administering local anesthesia is easy.

Honor

John S. Greenspan, BSC, BDS, PhD, FRCPath, ScD (hc), FDSRCS (Eng), distinguished professor of oral pathology in the Department of Orofacial Sciences, and associate dean for Global Oral Health, University of California, San Francisco, School of Dentistry, has been honored with the 2012 American Dental Association Gold Medal Award for Excellence in Dental Research.

Dr. John S. Greenspan

Gene Identified in Development of UCLA School of Dentistry Gets Multimillion-Dollar Grant to Train Future Leaders in Oral Health Research

The University of California, Los Angeles, School of Dentistry received $5 million from the National Institutes of Health to create a comprehensive research training program for oral health.

In the past few years, the UCLA School of Dentistry faculty have worked to expand traditional boundaries of dentistry through "groundbreaking multidisciplinary research that has led to major advances in everything from stem cell science to saliva diagnostics," according to a news release from the university.

The new five-year grant will allow the school to continue its pioneering efforts by creating the training program to help cultivate the next generation of dentist-scientists and oral health researchers, the news release said. This is the third time the grant has been renewed, but, according to the school, the newest funds will cover the participation of foreign students.

"This grant renewal is exciting because it allows us to open up the trainee positions to an international pool of dentists," David Wong, DMD, the school's associate dean of research and the Felix and Mildred Yip Endowed Professor in the division of oral biology and medicine, said in the statement. "This grant echoes the overall culture and environment of the UCLA School of Dentistry, as we are known throughout the world as a leader in academic excellence, and many talented foreign dentists come here to obtain a PhD or do postdoctoral training."

Trainees accepted into the programs will be mentored by current UCLA School of Dentistry faculty members in four areas: oral cancer and cancer biology; bone biology and bioengineering; microbiology and immunology; and stem cell and regenerative medicine, the school noted.

Periodontists' Use of IV Sedation: A National Survey

Approximately half of all periodontists provide intravenous sedation, according to a recent study published in the *Journal of Periodontology*.

Researchers from the University of Iowa School of Dentistry evaluated the trends in the training of IV sedation in residency and its use in periodontal practice. The team of researchers mailed a survey, consisting of 18 questions, to a sample of 1,956 active periodontists throughout the United Sates and Canada.

More than 49 percent of those who responded to the survey reported they offer IV sedation in their practices, according to the study. Among respondents who completed residency prior to 1996, 42.6 percent offer IV sedation compared to the 64.2 percent who completed their residency in 1996 or later, the authors wrote.

The study noted that regional differences exist in the training and use of IV sedation, with the largest percentage of periodontists using IV sedation (74 percent) reported from the south central area of the United States while the New Jersey and New York reported the lowest usage (15.6 percent).

"Approximately half of all periodontists provide IV sedation, with more recent periodontal graduates more likely to personally offer and administer IV sedation services for their patients," the authors concluded.

For more details, see the study in the *Journal of Periodontology* 83(7):830-5.

Study: Racial Gap Narrowing in Children's Dental Care

Between 1964 and 2010, the disparity between black and white children's dental care has nearly disappeared, according to a new study. Researchers said the dramatically narrowed gap is now statistically "nonsignificant."

According to the report, published in the print edition of *Pediatrics*, the objective of the study was "to examine the impact of national health policies on African-American and white children's receipt of dental care from 1964 to 2010 — analyzing data on race and "dental care utilization" for children between the ages of 2 and 17.

The data came from the 1964, 1976, 1989, 1999, and the 2010 National Health Interview Survey, according to the study.

The researchers found that the percentage of black and white children in the United States who had not visited a dentist in the previous 12 months decreased from 52.4 percent in 1964 to 21.7 percent in 2010.

Roughly 50 years ago, "about 60 percent of African-American children had never been to a dentist, compared with 30 percent of white children. By 2010, this gap had completely disappeared as did the gap in yearly dental visits," said lead author Inyang Isong, MD, an instructor in pediatrics at Massachusetts General Hospital, in an article from *HealthDay News*.

"The good news is that African-American and white kids are accessing dental care at equal rates, but the bad news is that African-American kids still have higher rates of cavities," Isong added.

Mouthwash, Risk of Oral Cancer: No Significant Association

A new quantitative analysis of mouthwash use and oral malignancy revealed no statistically significant associations between mouthwash use and risk of oral cancer, according to a report published in the journal *Annals of Agricultural and Environmental Medicine*.

Researchers from the European Institute of Oncology, the International Prevention Research Institute, and the Istituto di Ricerche Farmacologiche Mario Negri conducted a meta-analysis of epidemiological studies of mouthwash and oral cancer and, specifically, mouthwash containing more than 25 percent alcohol.

Use of mouthwash and an increased risk of oral cancer has been a source of controversy for decades, the authors wrote, and "this study set out to examine in a quantitative manner the potential effect of mouthwash use, and particularly use of mouthwash containing a high alcohol content, on the risk of oral cancer."

Eighteen studies were included in the meta-analysis and researchers reported there were no statistically significant associations found between regular use of mouthwash and risk of oral cancer. In addition, the researchers found no significant trend in risk of oral cancer associated with increased daily usage of mouthwash ($p = 0.11$), and no association between reported use of mouthwash specifically containing alcohol and risk of oral cancer, the report concluded.

"It remains clear that more epidemiological studies are needed, which will have a greater focus on certain aspects of mouthwash use and the development of oral cancer," the authors added.

For more details, see the full report in *Annals of Agricultural and Environmental Medicine* 19(2):173-80.

White-Spot Lesions Could Create Negative Perception of Treating Orthodontist

White-spot lesions (WSLs) are a common complication of orthodontic treatment and, unfortunately, their presence can result in a negative perception of the treating orthodontist by the patient's general dentist, according to a new study in the *Journal of the American Dental Association*.

The team of researchers, from Virginia Commonwealth University, utilized a cross-sectional survey — analyzing the responses of 191 general dentists and 305 orthodontists in Virginia, Maryland, and North Carolina. Researchers created two different surveys, one for the general dentists and one for the orthodontist, to evaluate the "modalities used to treat WSLs during and after orthodontic treatment."

The survey for general dentists asked how often, in the previous year, they had treated WSLs associated with braces, as well as method of treatment. This survey also asked general dentists if their perception of the orthodontist at the end of orthodontic treatment is negatively affected by the presence of multiple WSLs.

The survey asked orthodontists how often, in the previous year, they had removed braces because of a patient's poor oral hygiene. This survey also "asked orthodontists what they recommend that patients do immediately when they have severe WSLs at the debonding appointment, as well as what precautions they take to help prevent WSLs from developing."

"Sixty-nine percent of general dentists and 76 percent of orthodontists recommended in-office fluoride treatment for patients with severe WSLs immediately after orthodontic treatment," the authors wrote. Nearly 40 percent of orthodontists reported they had removed braces because of a patient's poor oral hygiene, and 60 percent said they referred patients with WSLs to general dentists for treatment.

More than 30 percent of general dentists indicated that severe WSLs after orthodontic treatment could have a negative effect on their perception of the treating orthodontist, according to the researchers.

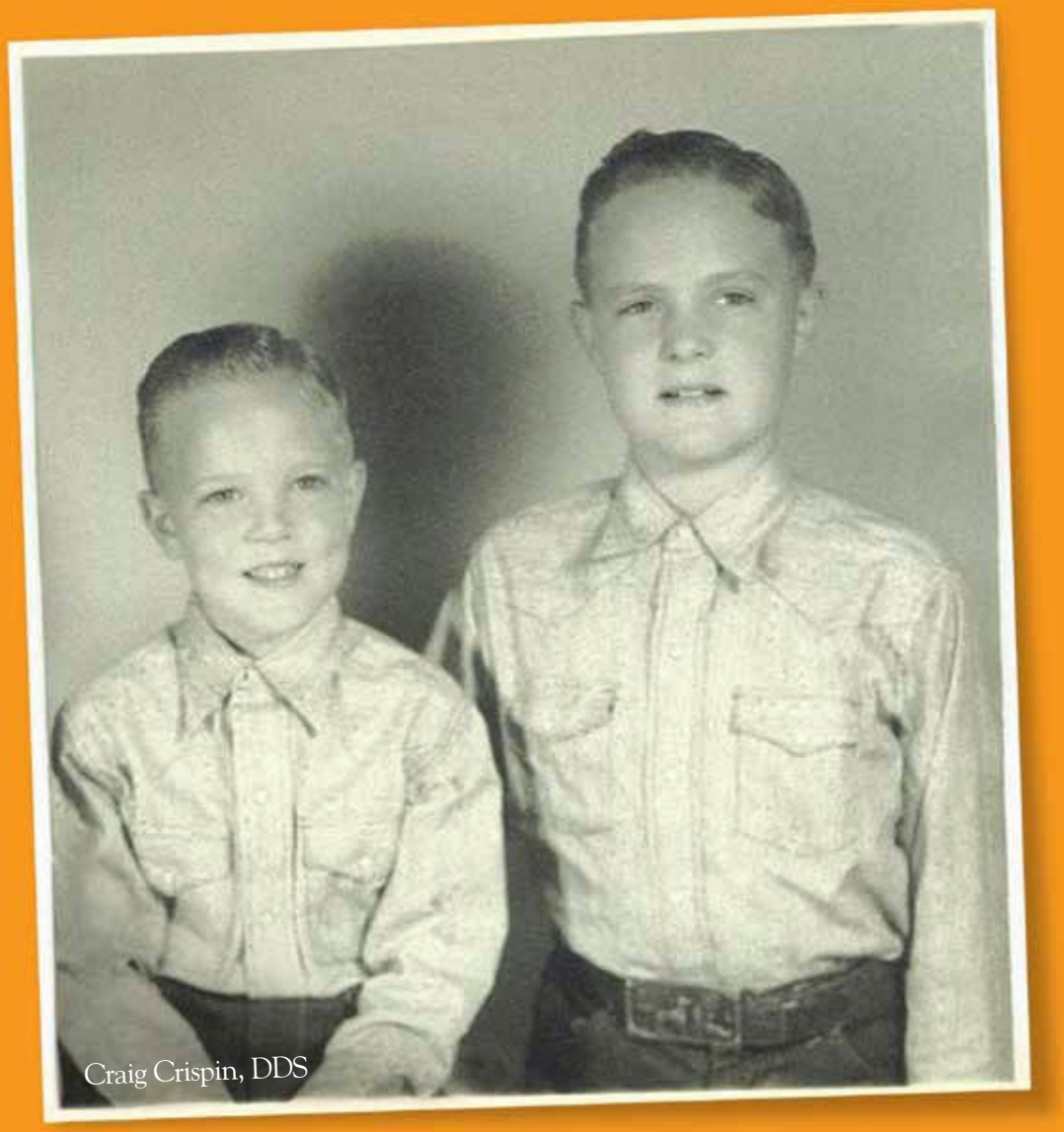
"General dentists and orthodontists should work together to prevent the development of WSLs in their patients," authors wrote, adding that "treatment with fluoride supplements and motivating and training patients to practice good oral hygiene will help achieve this goal."

See the study in its entirety in the *Journal of the American Dental Association*, 143(7).

UPCOMING MEETINGS

2012	
Sept. 30–Oct. 3	National Primary Oral Health Conference, La Jolla, Calif., nnoha.org/conference/npohc.html
Oct. 18–23	ADA 153rd Annual Session, San Francisco, ada.org
Oct. 26–28	California State Association of Endodontists biennial meeting, Newport Beach, Calif., 415-577-2760
Nov. 4–10	U.S. Dental Tennis Association, Tuscon, Ariz., 800-445-2524 or dentaltennis.org
2013	
Feb. 7–9	20th anniversary Conference and Exhibition, Academy of Laser Dentistry, Palm Springs laserdentistry.org
April 7–13	U.S. Dental Tennis Association, TOPS'L Resort, Destin, Fla., 800-445-2524 or dentaltennis.org
April 11–13	*CDA Presents the Art and Science of Dentistry, Anaheim*, 800-CDA-SMILE (232-7645), cdapresents.com
Aug. 15–17	*CDA Presents the Art and Science of Dentistry*, San Francisco, 800-CDA-SMILE (232-7645), cdapresents.com
Oct. 31–Nov. 5	154th Annual Session, New Orleans, ada.org/session
Nov. 3–9	U.S. Dental Tennis Association, Big Island, Hawaii, 800-445-2524 or dentaltennis.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.



Craig Crispin, DDS

He nearly lost a tooth, but gained a profession.

When Craig Crispin was 6, his older brother tied his hands behind his back and took him prisoner. What happened next changed the rest of his life. As he walked up some steps, he tripped and landed on his front teeth. He didn't knock them out, but it wasn't good. His parents took him to a dentist, who advised that because the root hadn't formed, they should wait and see. Maybe the tooth would heal. Almost a year later, his tooth turned white again. It was magic. And Crispin was hooked.

Every dentist has a unique story behind why they chose this profession, but the reasons to join CDA are clear—advocacy, protection, education, support and being part of an organization dedicated to improving the oral health of all Californians.

Join. Share.
cda.org/member

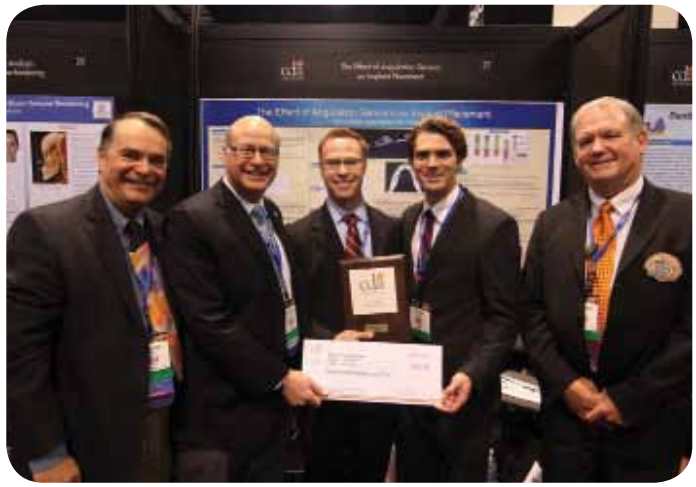
cda®

CDA JOURNAL, VOL 40, Nº9

Winners of the 2012 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 4–5 contests were invited to write an abstract of their work to appear in the *Journal of the California Dental Association*. CDA entered into collaboration with the California Dental Hygienists' Association for the RDH portion of the table clinics this year. The CDHA Student Table Clinic Competition was held at the Sheraton Park Hotel on May 4.

CLINICAL DENTAL STUDENT WINNERS



Drs. Donald Rollofson, Daniel Davidson and James Van Sicklen congratulate the clinic dental student category winners. The winners were Brian Goodacre, Jason Mashni, and John Yankee of Loma Linda.

The Effect of Angulation Sensors on Implant Placement

Brian Goodacre, Jason Mashni, and John Yankee, Loma Linda University School of Dentistry

PURPOSE: To determine if the use of an angulation sensor could improve alignment accuracy when placing multiple dental implants.

INTRODUCTION: Accuracy in implant placement is crucial for the biomechanical and esthetic success of dental implants. One method of improving alignment accuracy has been the use of guided surgical templates, but they are costly and time-consuming to plan and design.

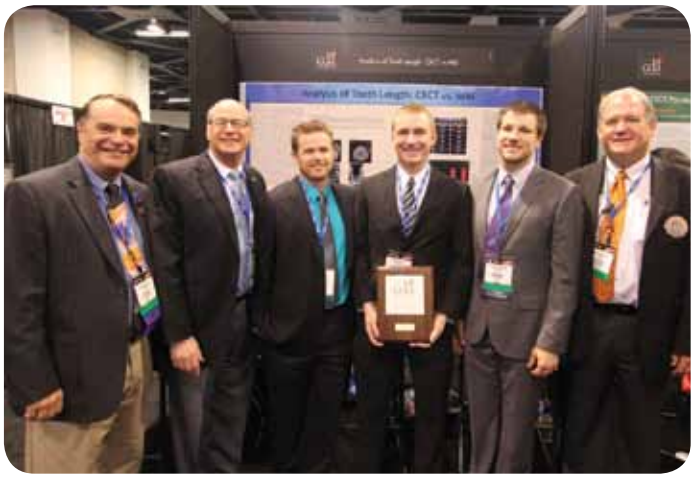
METHOD: Twenty dental students in their third-year of training and five experienced clinicians were involved in the study. Each participant completed a survey and perceptual ability test (PAT) scores were obtained for the student participants. Each individual created four osteotomies in a simulated mandible with and without the computer-assisted angulation sensor. The difference in angulation of the osteotomies between the two groups was analyzed using cone beam computed tomography (CBCT) scans and 3-D analysis software.

RESULTS: Without the sensor, five students drilled at least one osteotomy that varied from the guide pin by more than 10 degrees with a maximum deviation from the guide pin of 13.5 degrees. With the sensor, only one student produced an osteotomy that varied from the guide pin by more than 10 degrees. The average error with the sensor was 4.1 degrees, and 62.5 percent of students showed improved accuracy when using the sensor-guided handpiece. Experienced clinicians did not show a significant difference in angulation with or without the use of the sensor. No statistical correlations were found between angulation accuracy and PAT scores. According to the survey, students reported improved confidence, while experienced faculty reported decreased confidence levels with the use of the sensor.

CONCLUSION: When using the angulation sensor, most students improved their accuracy when aligning multiple implant osteotomies. Experienced clinicians did not receive substantial benefit from using the sensor-guided handpiece.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Brian Goodacre at bgoodacre@llu.edu.

SCIENTIFIC DENTAL STUDENT WINNERS



Drs. Donald Rollofson, Daniel Davidson and James Van Sicklen congratulate the scientific dental student category winners, who were Kevin Murray, Robert Judd and Timothy Mathews of Loma Linda.

Analysis of Tooth Length Using CBCT Versus MRI

Robert Judd, Kevin Murray, and Timothy Mathews, Loma Linda University School of Dentistry

PURPOSE: To determine if magnetic resonance imaging (MRI) is comparably effective in determining tooth length as cone beam computed tomography (CBCT).

METHOD: Using 3-D software, researchers measured the maxillary anterior tooth length of 15 patients, each of whom had MRI and CBCT cranial images.

RESULTS: The intraclass correlation coefficient (ICC) for single-tooth measures using MRI and CBCT are as follows: right canine = 0.573, right lateral = 0.787, right central = 0.765, left central = 0.699, left lateral = 0.827, and left canine = 0.528. ICC can be interpreted as follows: 0.5-0.6 indicates moderate agreement; 0.7-0.8 indicates strong agreement; and >0.8 indicates almost perfect agreement.

CONCLUSION: MRI produces statistically similar measurements to CBCT when measuring tooth length. Given this and the fact it uses nonionizing radiation and more research is demonstrating the long-term negative effects of radiation exposure, MRI could be a valuable alternative to CBCT for measuring tooth length, and, perhaps, could be used for other orthodontic analysis.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Kevin Murray at kgmurray@llu.edu.

RDH INFORMATIONAL STUDENT WINNERS

Drs. Donald Rollofson and Andrew Soderstrom congratulate the RDH informational student category winners: Mizuho Sato, Christopher Johnson, Jennifer Kuo, and Samantha Nebel of West Los Angeles College. With them are Dental Hygienist Lisa Okamoto, president of the California Dental Hygienists' Association, as well as Dental Hygienist Mary Lontchar from Crest/Oral-B, Table Clinic Competition sponsor.

Go Green!

Christopher Johnson, Jennifer Kuo, Samantha Nebel, and Mizuho Sato, West Los Angeles College

BACKGROUND: Green tea is one of the most commonly consumed beverages worldwide. Recent research demonstrates that catechins in green tea can inhibit the growth of periodontal pathogens. Its potential as an ingredient in adjunctive periodontal treatment is currently being evaluated in the field of dentistry.

METHODS: A review of literature to examine the effects of catechins on the host and the periodontium.

RESULTS: Experimental results demonstrated an inverse correlation between catechin exposure and periodontal indicators. It also further affirmed the positive systemic effects of catechins on the host defense system.

CONCLUSION: Green tea is a natural, convenient, and effective treatment for those patients seeking an alternative method to maintaining their oral health. The effectiveness of catechins against periodontitis offers a promising possibility for developing innovative treatment modalities to arrest its course. Further research is necessary to establish new delivery modalities.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Jennifer Kuo at kuojdh2012@gmail.com.

RDH RESEARCH STUDENT WINNERS

Drs. Donald Rollofson and Andrew Soderstrom congratulate RDH research student category winners Jeanne Gustafson, Debra Gruzensky, and Julianne Souza. With them are Dental Hygienist Lisa Okamoto, president of the California Dental Hygienists' Association, as well as Dental Hygienist Mary Lontchar from Crest/Oral-B, Table Clinic Competition sponsor.

A Comparison of Three Surface Disinfectants

Julianne Souza, Debra Gruzensky, and Jeanne Gustafson, Loma Linda University School of Dentistry

BACKGROUND: Two commercially available surface disinfectant wipes were compared with a new surface disinfectant wipe.

METHODS: Three surface disinfectants were randomly assigned either Product A, B, or C. Vinyl, formica, and stainless-steel surfaces were divided into 56 test squares. *Enterococcus faecalis* was spread on all squares, except for negative controls. Squares were disinfected with test wipes from each group using a one-wipe and two-wipe technique and air-dried. A sterile cotton-tipped applicator swabbed the center of each square and the tip was placed in a 3 mL sterile brain-heart infusion broth tube, incubated at 37 degrees Celsius for 24 hours and then checked for turbidity.

RESULTS: Product B had no growth on any of the surfaces using a one-wipe or two-wipe technique. Products A and C had statistically significant growth on vinyl and stainless-steel using the one-wipe technique.

CONCLUSION: A one-wipe technique can achieve surface disinfection if using Product B.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Julianne Souza at jsouza@llu.edu

RDA STUDENT WINNERS

Drs. Donald Rollofson and James Van Sicklen congratulate RDA student category winners. The winners were Katherine Lee, Brittany Donohoo Norwood, Erika Ortiz, and Liz Ochoa of Citrus College.

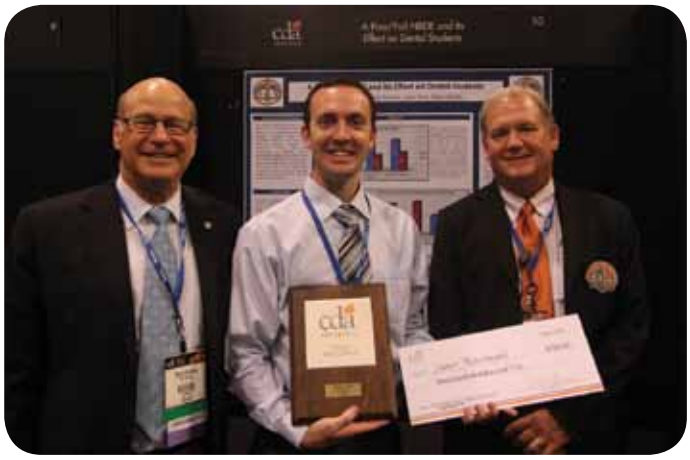
Rinse Away Your Worries

Katherine Lee, Brittany Donohoo Norwood, Erika Ortiz, and Liz Ochoa, Citrus College

Although enamel is the hardest element in our body, the strong and durable structure can easily deteriorate without the practice of proper oral hygiene. The contents in our drinks, such as coffee, juice, and soda, can drastically affect our oral health. By simulating the power of fluoride on our enamel through the use of hard-boiled eggs, fluoride and fluoride-free rinses, and various beverages, we can educate members of diverse communities whether fluoride can protect our teeth by reducing discoloration and decay.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Katherine Lee at kjlee421@gmail.com.

COMMUNITY/EDUCATION DENTAL STUDENT WINNERS



Drs. Daniel Davidson and James Van Sicklen congratulate one of the community/education dental student category winners, James Blackburn. The other winners were Daniel Johnson, Jason Scott, and Parker Shiffler of UCLA.

A Pass/Fail NBDE and Its Effect on Dental Residency Admissions

James Blackburn, Daniel Johnson, Jason Scott, and Parker Shiffler, University of California, Los Angeles, School of Dentistry

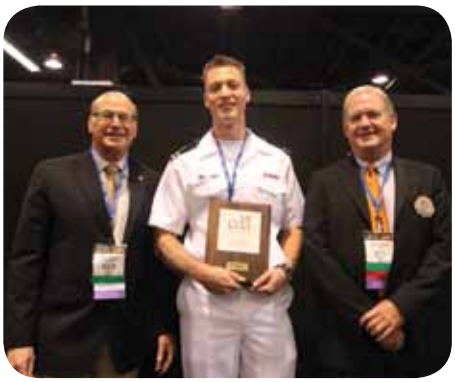
OBJECTIVE: The National Board Examination Part I (NBDE) standard score has been an integral part of admission to postgraduate specialty programs for many years. Now, NBDE is transitioning from a quantitative grading scale to pass/fail. This study examines the potential impact of this transition on specialty admissions and applicants.

METHODS: 1,175 dental students from 16 dental schools responded to a 24-item survey.

FINDINGS: Students interested in specializing were less favorable of a pass/fail NBDE; significantly more students would be interested in applying to a residency under a pass/fail system; applicants plan more time allocation to extracurricular activities and clinic to distinguish themselves; and students support a unique admissions examination for each specialty to replace the NBDE quantitative score. Both specialty programs and applicants will need to accommodate to this change.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT James Blackburn at jblackburn@ucla.edu.

MILITARY/RESIDENT WINNER



Drs. Daniel Davidson and James Van Sicklen congratulate military/resident category winner Dr. Eric Fredericksen, U.S. Navy.

Custom Staining for the Color-Blind Dentist

Eric Fredericksen, DDS, United States Navy

If you have ever been disappointed in the esthetic outcome of your porcelain restorations, you are not alone. Fabricating fixed dental prostheses that blend seamlessly with the adjacent dentition can be a difficult and sometimes intimidating process, especially for a dentist with a color-vision deficiency. However, by better understanding the properties of light and color perception, it doesn't have to be. This presentation is designed to teach dentists, color blind or not, how to select a proper shade, better communicate with their laboratory technician, and use custom-staining techniques to achieve a close-to-perfect color replication.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Eric Frederiksen, DDS, at 2011Dent@gmail.com.

Following are the judges for the annual table clinics competition held May 4–5 during *CDA Presents* in Anaheim:

RDA JUDGES
Shari Becker, RDA
Maleah Brooks, RDA
Jennifer Broyles
Benson Dimaranan, RDA
Evangeline Enriguez, RDA
Melrose Nabua, RDA
Maria Ochoa, RDA
Tobi Trotta, RDA
Georgie Vargas-Burket

RDH JUDGES
Bruce Coye, DDS
Howard Richmond, DDS

DENTAL STUDENTS/CLINICAL JUDGES
Jaymie Coria, DDS
Marileth Coria, DDS
Ramesh Gowda, DDS
Al Ochoa, DDS
Zaw Thu, BDS
Dale F. Wagner, DDS

DENTAL STUDENTS/COMMUNITY JUDGES
Carole Murphy, DDS
R. Jerry Smith, DDS

DENTAL STUDENTS/SCIENTIFIC JUDGES
Samuel Demirdji, DDS
Donna Klauser, DDS
Mei Lu, DDS
Peter S. Young, DDS

MILITARY/RESIDENT JUDGES
Stephen Alfano, DDS
Andrew Avilo, DDS
Steve Chartier, DDS
Tony Daher, DDS, MSEd, FACP
Jody Harrison, DDS
Ann L. Steiner, DMD
Stephen Sterlitz, DDS
Arnold Valdez, DDS
Kenneth Yaros, DDS

cda® PRESENTS

The Art and Science of Dentistry

Save the dates

CDA Presents. The nation's premier dental convention.

- Nearly 600 exhibiting companies
- More than 100 new product introductions
- Dynamic speakers
- Exciting attractions in Anaheim and San Francisco

▶ **cdapresents.com**

Like us
facebook.com/cdafan

#cdaSF
#cdaOC

Download the new show app!

San Francisco, California
No meeting in 2012
due to ADA Meeting
August 15-17, 2013
September 4-6, 2014

Anaheim, California
April 11-13, 2013
May 15-17, 2014

CDA JOURNAL, VOL 40, Nº9

Pulp Hyperthermia During Tooth Preparation: The Effect of Rotary Instruments, Lasers, Ultrasonic Devices, and Airborne Particle Abrasion

MANUEL S. THOMAS, MDS, AND M. KUNDABALA, MDS

ABSTRACT The rise in pulp temperature during restorative therapy can compromise vitality of the dental pulp. Of the various reasons for the increase in intrapulpal temperature, tooth preparation is considered to be the primary cause. This article describes the reasons for the rise in pulp temperature during various modalities of tooth preparation. The article also comments on the measures that need to be taken to avoid the risk of pulp hyperthermia during tooth preparation.

AUTHORS

Manuel S. Thomas, MDS, is an associate professor, Department of Conservative Dentistry and Endodontics, Manipal College of Dental Sciences, Mangalore, Manipal University, Karnataka, India.
Conflict of Interest Disclosure: None reported.

M. Kundabala, MDS, is a professor and head, Department of Conservative Dentistry and Endodontics, Manipal College of Dental Sciences, Mangalore, Manipal University, Karnataka, India.
Conflict of Interest Disclosure: None reported.

Due respect to the dental pulp needs to be paid when restoring a vital tooth, as it can affect the long-term prognosis of the tooth. In a tooth undergoing restorative treatment, the adaptability of the dental pulp to a new irritant can be compromised because of the previous insults to the tooth by dental caries, old restorations, occlusal trauma, wasting diseases, or periodontal diseases.[1] Therefore, any additional trauma during restorative procedures to the stressed pulp should be minimized to maintain the pulp cell function and viability. The need to maintain the health of the dental pulp is to reduce the probability of postoperative pulp complications.[2] Various irritants that can compromise the health of the dental pulp during restorative treatment are microbial, thermal, mechanical, electrical, and chemical irritants.[3] The most-common cause for iatrogenic pulp damage among these irritants is the rise in pulp temperature during restorative therapy.[4] This article describes the reasons and the precautions that need to be taken to avoid pulp hyperthermia during caries removal and tooth preparation.

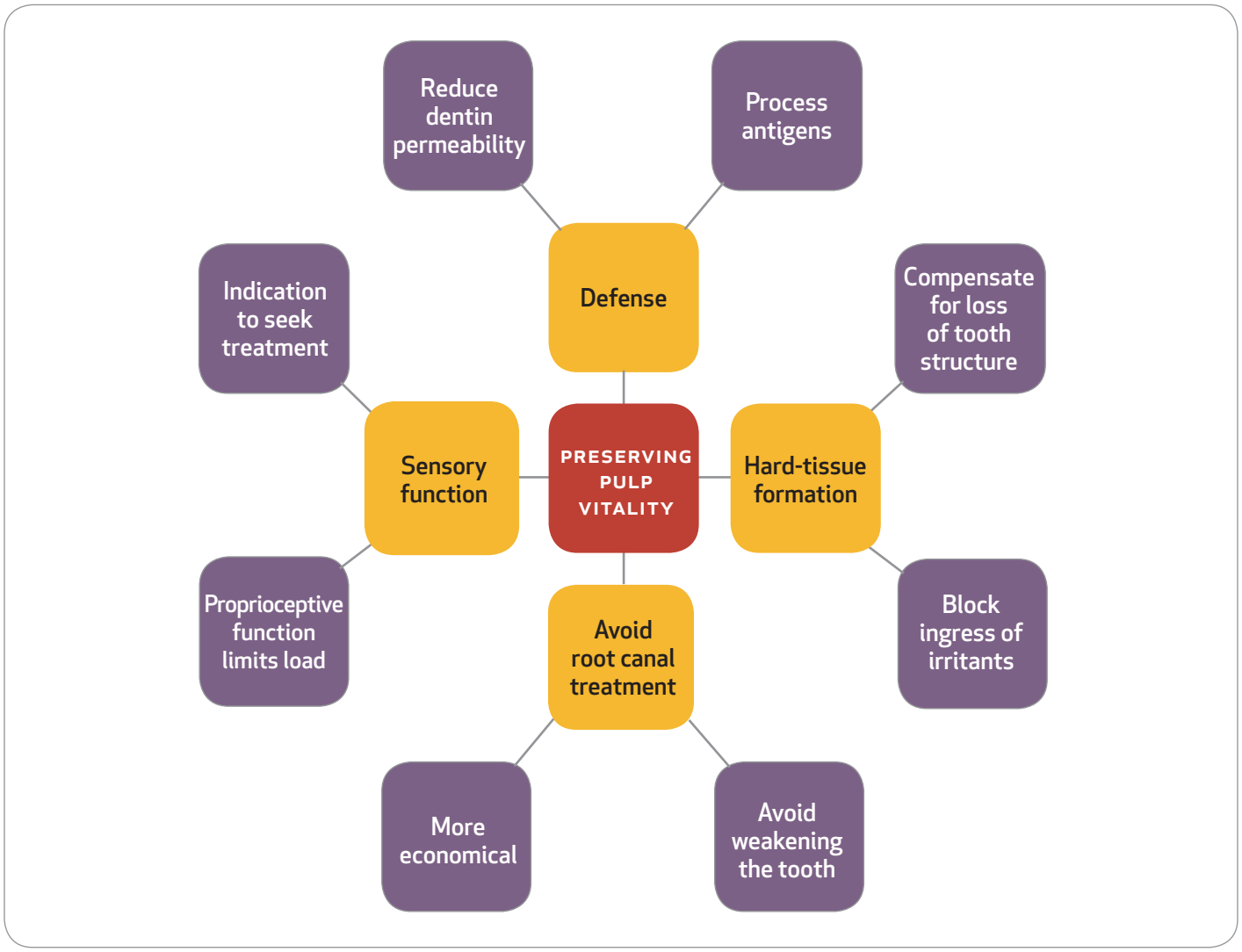


FIGURE 1. Need to maintain tooth vitality.

Benefits of Preserving Pulp Vitality

The dental pulp is a unique tissue as it has inflexible walls encasing it, has a confined circulation supplied by an arteriole through narrow foramina, and it has a high sensory nerve innervation. The periphery of the pulp is surrounded by a layer of highly specialized cells called odontoblasts. The preservation of pulp vitality following restorative intervention is dependent on the degree to which the odontoblasts can survive and initiate an appropriate repair response.[5,6] Circulation disarray that are shown to determine the reversibility limit for pulp disorders are precipitated by physical, chemical, thermal, or microbial irritants.[7]

The need to maintain the health of the dental pulp against these irritants is important since the vital pulp performs certain functions which a root filling cannot[7] (**FIGURE 1**). The pulp plays an important role in the defense process. A study by Nagaoka et al. showed that teeth with pulp are much more resistant to microbial invasion than teeth with root canal fillings.[8] The pulp's specialized cells, the odontoblasts, and perhaps undifferentiated mesenchymal cells (which may differentiate into dentin-forming cells if stimulated), retain the ability to form dentin throughout life. The pulp is also a sensory organ that registers the different stimuli as pain. This pain-registering ability tends to make the patient seek dental treatment early.[7] In addition, the proprioceptive function of the pulp limits the load imposed on teeth by the masticatory muscles, thus further protecting the tooth from injury.[9] Moreover, root canal treatment can compromise the structural integrity of the tooth resulting in increased susceptibility to fracture.[10] Hence, whenever possible the vitality of the dental pulp should be preserved.

Reaction of the Pulp to Increased Temperature

Temperature increase can cause severe injury to the dental pulp.[11,12] The changes associated with it are the structural changes seen in the odontoblastic zone and the vascular changes.[13] The extent of damage to the dental pulp is correlated with the remaining dentin thickness (RDT) and the degree of injury.[2,5,14] Mild irritation usually results in localized subodontoblastic hemostasis and hemorrhage. Even though there can be disorganization in the organelles of the odontoblasts, the normal multilayered odontoblastic cell distribution is not disturbed.[15] Moderate irritation can cause major changes in the pulp microcirculation, including extensive plasma extravasation. Disruption and vacuolation of the odontoblastic layer as well as the irregular placement of the cells, without the normal palisading appearance can be noticed.[16] The displacement of odontoblasts and of the tubular contents into the dentinal tubules can also be observed.[17] Thermally induced fluid shifts across the tubules could be the possible mechanism for this phenomenon.[3] Severe irritation can result in complete destruction of the odontoblastic layer and localized microabscess formation.[18]

Additional dentin that may be deposited on the pulpal surface underlying the injury is termed as tertiary dentin. This can be subclassified into reactionary or reparative dentin. Depending on the severity of the injury, the odontoblasts may survive to deposit reactionary dentin, the tubules of which are continuous with those of the overlying primary and secondary dentin. If odontoblasts are irreversibly damaged, reparative dentin is laid down following the differentiation of new odontoblast-like cells from the dental pulp.[2,19]

Various Methods to Measure the Temperature Rise and Its Effects

Intrapulpal temperature (IPT) changes can be studied either by in vivo or in vitro experimental characterization. Even though in vivo experimental investigations are desirable as they mimic the clinical scenario, there are several challenges associated with it. Therefore, in vitro studies are widely used for evaluating the IPT changes.[20] A number of methods have been described when quantifying temperature changes in vitro, which includes finite element method, infrared thermography, and thermocouple (TC) measurements.[21-42]

THE TEMPERATURE values measured by in vitro studies cannot be directly applied to temperature changes in vivo.

Most studies of IPT change employ TC measurements. The studies utilizing TC can be performed on pulp chamber models, bovine teeth, dentin disc of human teeth, sectioned pulp chamber of human teeth, or the entire pulp chamber of human teeth.[24-41] When utilizing the whole tooth, the TC can be placed into the pulp chamber either through a preformed channel in the root, or via coronal access, or by a split-tooth technique.[30,36,37,39-42] In the former two methods of placement of the TC, the position of the electrode is not controlled and the RDT above the TC is unknown at the time of recording temperature change, and is not standardized. Whereas in the split-tooth technique, the tooth is sectioned to allow for standardization of cavity and TC placement.[39] This design permits the precise placement of the TC, just contacting the roof of the pulp chamber at the area occupied by the odontoblasts.[42]

The temperature values measured by in vitro studies cannot be directly applied to temperature changes in vivo. The reason for this is because, most of the in vitro studies do not consider the flow of dentinal fluid in the dentin tubules and the perfusion of blood, which is thought to play a vital role in the temperature regulation of the dental pulp.[13] In addition, the surrounding periodontal tissues that could promote heat convection in vivo, restricting the IPT rise are usually not taken into consideration.[36] The in vitro studies utilizing the entire pulp chamber of human teeth can be further categorized depending on how the contribution of the pulp tissue has been modeled.[11] It could either be with empty pulp chamber, with simulated pulp tissue (i.e., with a thermal conducting media), or with consideration of intrapulpal fluid flow.[30-41] In vitro studies with an infusion pump attached to the root end and immersed into a water bath up to the cementoenamel junction, which takes into consideration the blood supply in the pulp chamber and the heat transfer through pulp soft tissue and periodontal ligament, are more applicable in a clinical scenario.[40]

Another influencing factor that needs to be considered in vivo is the stress proteins. Cells exposed to hyperthermia responded with an increased synthesis of proteins, called the heat shock proteins. The presence of stress proteins has been shown to confer resistance to further stress. Therefore, heat shock proteins might have an impact on in vitro temperature studies.[43,45] A study by Morotomi et al. showed that rat clonal odontoblast-like cells have the ability to

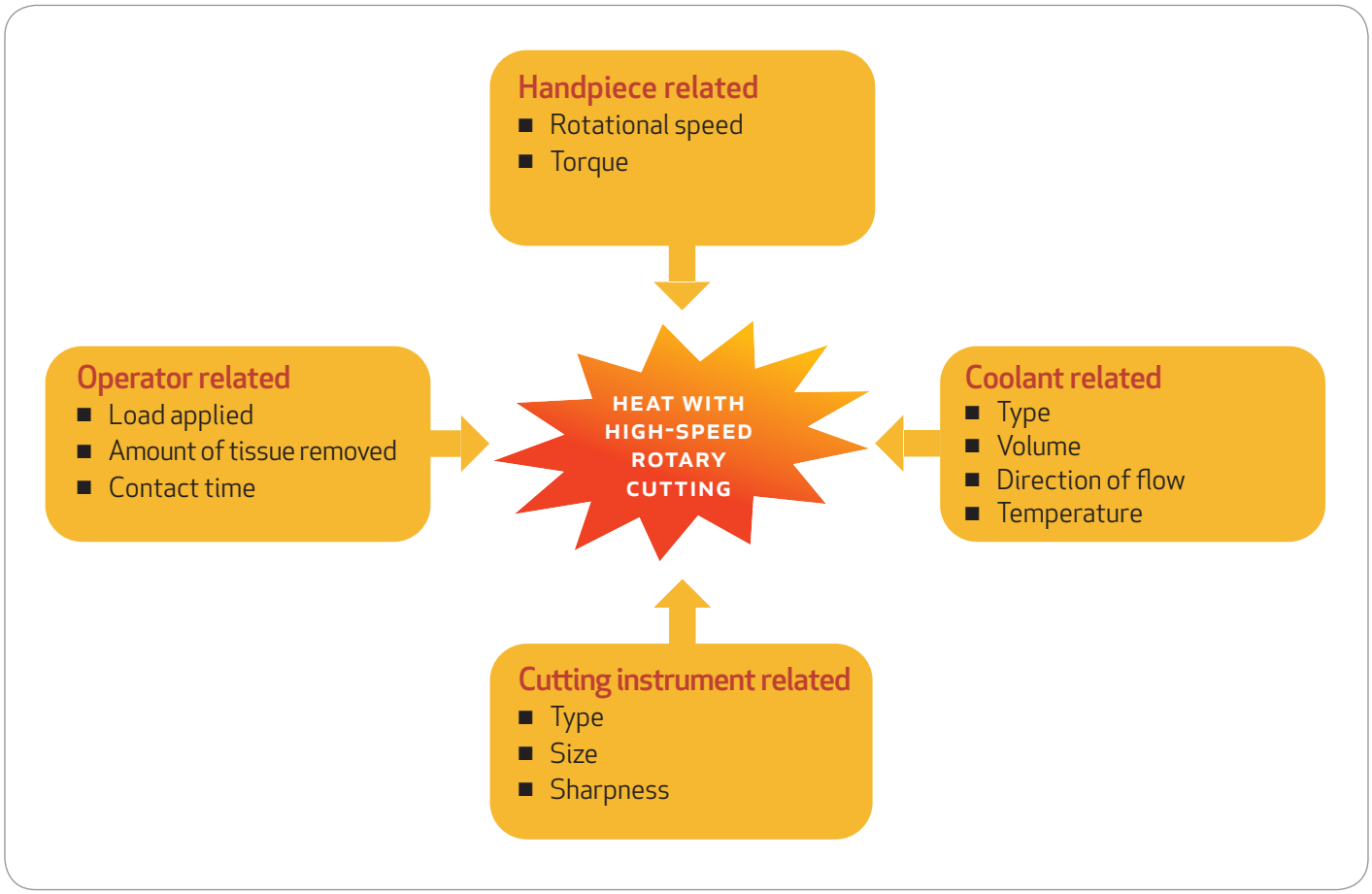


FIGURE 2. Factors that affect heat generation with the use of high-speed rotary cutting instruments.

resist heat stress through regulation of the cell cycle and the induction of heat shock proteins and that the cytotoxic effects of heat stress were enhanced under starved or hypoxic conditions.[46]

In vivo studies on human subjects usually face ethical problems. The studies are usually performed on teeth that are to be extracted for orthodontic reasons.[15,16,47] Most of the in vivo investigations are performed in animals.[48,49] The extension of these results to human teeth is questionable.[20] The histological changes associated with pulp trauma can be evaluated with microscopic techniques. The physiological changes can be assessed with techniques such as histochemical demonstration of neurogenic components, blood flow measurements, or by recording the interstitial tissue fluid pressure.[11]

Critical Temperature for Pulp Damage

The IPT beyond which pulpal necrosis can occur in human teeth is not completely understood. Most of the investigations on IPT rise refer to a study carried out by Zach and Cohen more than 45 years back.[41,48] In that classic animal study, the teeth in five Rhesus monkeys were heated using a soldering gun. The results showed that, a 5.5-degree Celsius IPT increase induced necrosis in 15 percent of the tested pulps, an 11-degree Celsius increase induced 60 percent, and a 16-degree Celsius increase induced 100 percent irreversible pulp damage after three months. Most of the studies consider a temperature rise of above 5.5-degree Celsius as the maximum that the dental pulp can withstand.

However, it is highly questionable as to whether the values obtained in monkeys are also valid for human beings.[41] A clinical study in volunteers indicated that even a temperature rise of 8.9 degree Celsius to 14.7 degree Celsius did not cause histologically verified pulpal necrosis after three months.[47] In that study, heat was applied to the occlusal surface of six premolars and six molars until the subject complained of toothache. The contralateral tooth was extracted and the rise in IPT was measured using the same parameters as those used in vivo. After three months, the other teeth were extracted and examined histologically. The results indicated that the pulpal tissues could tolerate a temperature rise of >5.5 degree Celsius without damage. The lower rate of heat applica-

tion could be the reason for the contradictory results of this study as compared to the study by Zach and Cohen.[3]

However, a study by Pohto and Scheinin on the living dental pulp of rats showed an increased capillary permeability, which is the first sign of heat-related pulp damage, when the temperature was increased between 5 and 7 degrees Celsius.[49] A study by Zezell et al. also found that with an increase of 5.5 degree Celsius, odontoblast destruction begins in the pulp tissue.[50] In any case, it is best to keep the pulpal temperature changes as minimal as possible. Moreover, it is very difficult to predict temperature rise in any particular tooth due to multiple variables.[35]

Tooth preparation using various modalities can impose detrimental temperature levels within the pulp, resulting in additional trauma to an already compromised pulp. Thus, the knowledge of temperature rise and rate of that rise in the pulp chamber during these procedures can help the clinicians to make treatment decisions that will reduce iatrogenic trauma to the dental pulp and exploit the natural repair responses of the tooth.[6]

Temperature Rise During Tooth Preparation Using Rotary Instruments

Tooth preparation is usually necessary to remove caries and/or to provide adequate shape to receive a restoration. It is usually carried out with high-speed rotary instruments. Tooth preparation is potentially one of the most hazardous procedures for the dental pulp because the heat generated during the procedure can damage the tissue irreparably if uncontrolled.[26] Frictional heat produced during tooth preparation can result in vascular injury in the pulp and this can soon cause the dentin to take on an underlying pinkish hue, referred to as blushing of dentin.[19]

Factors that could influence the heat generation with the use of high-speed rotary instruments are given in **FIGURE 2**. These aspects should be routinely observed and controlled by the dentist to eliminate heat production.[51]

Temperature as high as 417 degrees Celsius was reported on the surface of a rotating bur in contact with dentin.[52] Hence, high-speed rotary handpieces require some method of cooling the tooth, such as air-cooling alone or air-water spray, for it to be used safely.[53] Use of air-cooling alone is ineffective in preventing damage to the dental pulp as it cannot effectively control the IPT rise. It can also result in the displacement of odontoblasts into the dentinal tubules due to desiccation of dentin.[54] Whereas the use of air-water spray for cooling is shown to control the temperature rise, to prevent excessive drying and to promote drilling efficiency.[55,56] Hence, air-water spray cooling is essential in high-speed procedures, irrespective of the load applied or the type of rotary instrument being used.[26,31,51,60]

WATER AT ROOM temperature is actually shown to produce a decrease in the pulp temperatures, regardless of the thickness of the residual dentin.

A study by Cavalcanti et al.[51] demonstrated an IPT rise above the critical limit irrespective of the amount of water coolant used when high load (150 to 246 g, with no rest period and no layer cutting) was used during high-speed tooth preparation. Hence it is advisable to use light intermittent cutting strokes during tooth preparation to minimize the IPT rise. In contrast, the study by Oztürk et al.[31] showed that cavity preparation with high water cooling (40 mL/min) never exceeded the critical value irrespective of the air pressure or the applied loads. However, the authors suggested the clinicians use lower handpiece air pressure and lower applied pressure to control the temperature rise, when the rate of water coolant flow is decreased.

Other factors that should be observed are the number of coolant apertures on the handpiece and their direction, which should be toward the tip of the rotary instrument.[51,57] Care must be exercised to ensure that the water spray actually reaches the cutting edge of the bur at all times and that there is no "shadowing" effect by the tooth, which prevents the water from reaching the cutting part of the bur. The bur-dentin interface should be constantly wet.[11] It has also been demonstrated that the temperature inside the pulp chamber can reach up to 44.4 degrees Celsius if the temperature of the water spray exceeds 35 degrees Celsius. This rise in temperature is more marked as the thickness of remaining dentin is reduced.[58] Water at room temperature is actually shown to produce a decrease in the pulp temperatures, regardless of the thickness of the residual dentin. Therefore the water spray temperature should not exceed 35 degrees Celsius.[57,59]

In the study by Ercoli et al., though carbide burs showed statistically superior performance compared to the diamond rotary cutting instruments, tooth preparation with an adequate water flow does not cause harmful temperature changes in the pulp chamber, regardless of rotary cutting instrument type.[60] On the other hand, a study by Ottl et al. demonstrated that the coarser the grit of diamond instrument,

the more pronounced the temperature elevation within a pulp chamber during tooth preparation.[61] Tooth preparation with dull cutting instruments should be avoided as it can lead to increased IPT rise due to the high load needed for effective tooth cutting.[62]

The use of high speeds of rotation (100,000- 250,000 rpm), with light pressure, intermittent cutting and moreover with an efficient water-cooling system, is considered to be the safest way to prepare tooth structure.[63] The use of low-speed handpieces for gross tooth preparation can cause burning of dentin because of the frictional heat produced due to the considerable pressure that needs to be applied for effective cutting.[11] The handpieces should also be kept in good working condition to avoid pulpal damage. Tooth preparation using broken down handpieces causes unavoidable pulpal trauma from vibration of nonconcentric bur rotation and heavy cutting force necessitated by poor torque characteristics.[62] Care should also be taken to avoid iatrogenic removal of excessive dentin to maximize the RDT whenever possible, as the reduction in the RDT makes the pulp more vulnerable to injury from tooth preparation.[6] The precautions that need to be taken to avoid pulp hyperthermia during tooth preparation using high-speed rotary cutting has been summarized in TABLE 1.

TABLE 1

Precautions That Need to Be Taken to Avoid Pulp Hyperthermia During Tooth Preparation Using High-Speed Rotary Cutting

Equipment-related precautions	Use high speed (100,000- 250,000 rpm), with an efficient water-cooling system
	Direction of the coolant should be toward the bur-dentin interface
	Use of high volume of water coolant (40 ml/min) preferred
	Temperature of the water coolant should not be >35°c
Operator-related precautions	Use light intermittent cutting strokes
	Avoid iatrogenic removal of excessive dentin
	Avoid use of dull cutting instruments
	Handpiece should be maintained in good working condition

Temperature Rise During Tooth Preparation by Lasers

The irritating noise, uncomfortable vibration, and sometimes pain during tooth preparation with HSHPs have led to the search for new methods for the removal of dental hard tissue. These include lasers, ultrasound tips, and airborne particle abrasion, which would make treatment less painful to patients, with less need for local anesthesia.[25,38] Of the various alternative methods used for tooth preparation, lasers are perceived by some clinicians to have advantages. One needs to take care when using lasers for cavity preparation, as improper usage can cause pulpal damage due to uncontrolled generation of heat. The extent of thermogenesis or thermal transfer to vital structures primarily is dependent upon two factors: first, the specific wavelength emitted by the laser; and second, the optical absorption characteristics of the tissue exposed. Other parameters such as power density, mode of operation (pulsed versus continuous exposure) and duration of exposure will also affect the magnitude of heat energy transferred to the target tissues.[64,65] The availability of adequate water coolant can also have an effect.

The CO_2 (10,600 nm) and Nd:YAG (1,064 nm) lasers that were initially used in dental applications, are considered unacceptable for cavity preparation because of their adverse thermal effects, due to the lower absorption coefficients in the dental hard tissues.[66,67] In a study by Türkmen et al., use of CO_2 and Nd:YAG laser for 30 seconds on dentin caused a temperature increase of 37 and 28 degrees Celsius, respectively, in the pulp chamber.[68] A temperature rise from 4 to 39 degrees Celsius in the dentinal pulp walls were noticed after Nd:YAG laser irradiation at the power settings of 80 mJ, 1W, 2W, and 3W in a study by Allen.[69] The application of CO_2 laser in an energy dependent manner demonstrated a temperature elevation of 0.25 to 32.12 degrees Celsius in a study by Miserendino et al. and between 3.5 to 14.5 degrees Celsius in a study by Anic et al.[66,70] White et al., measured a Nd:YAG laser-induced IPT increase between 9.3 and 43.2 degrees Celsius (power output of 0.3 W and 0.7 W; irradiation time of 10 seconds and 30 seconds, respectively) at a RDT of 0.2 mm and between 1.1 and 5.8 degrees Celsius (power output of 0.3 W and 0.7 W; irradiation time of 10 seconds and 30 seconds, respectively) at 2.0 mm.[71] The results of the above-mentioned study underlines the significance of the thickness of hard-tissue layer between the spot of irradiation and the pulp.

The erbium family of lasers [Er:YAG (2,940 nm) and Er,Cr:YSGG (2,780 nm)] have offered new perspectives for enamel and dentin removal without significant adverse thermal effects. This is because of its good absorption characteristics in the dental hard tissues resulting in mechanical ablation process by microexplosions.[72-75] Nevertheless, these two lasers

differed in terms of their absorption characteristics in water and hydroxyapatite. Coluzzi stated that Er:YAG's ability to absorb hydroxyapatite is 20 percent higher than Er,Cr: YSGG.[76] The absorption of Er,Cr:YSGG in water was shown to be only 50 percent of the Er:YAG wavelength.[77,78] The absorption coefficient for the Er:YAG laser was shown to be approximately 150 mm-1 in enamel, and 200 mm-1 in dentin.[79] The corresponding absorption coefficients for the Er,Cr:YSGG laser were reported to be approximately three times lower. Therefore, Er:YAG laser penetrates lesser into the tooth structure as compared to Er,Cr:YSGG laser.[80]

When the pulse duration is shorter than the tissue relaxation time, there is no heating of the surrounding tissues. This kind of ablation is referred to as "cold ablation."[30] To achieve cold ablation while removing enamel, the pulse duration should be shorter than the tissue relaxation time of enamel, which is approximately 100 µsec.[81] Er:YAG laser is at an advantage as it has variable pulse widths down to 50 µsec as compared to the minimum pulse width of approximately 500 µsec of Er,Cr:YSGG laser.[82] Er:YAG laser revealed a much quicker temperature decay compared to Er,Cr:YSGG laser, indicating smaller depth of remaining heated layer. This could be attributed to the shorter pulse duration and smaller optical penetration depth of the Er:YAG laser. Therefore Er,Cr:YSGG lasers have a limited ability to operate in a purely "cold" ablative regime and have lower ablation efficacy. This may result in their reduced safety and comfort for patients compared to Er:YAG lasers.[82]

The presence of water in conjunction with an erbium laser has been shown to attenuate temperature rise and thus decrease the risk of thermally induced pulp damage.[37,83,84] It has also been shown to increase the ablation efficiency and enhance the adhesion to lased dental tissue.[85] Attrill et al., in their study on the thermal effects of Er:YAG laser, recorded a peak temperature increment of 4.0 and 24.7 degrees Celsius with and without water, respectively.[37] This reduction in temperature increment with the use of water spray can be explained by the increased absorption when water is present. The increased absorption leads to a smaller interaction volume with subsequent increased ablation efficiency. But if the volume is kept too high, the vaporization of water can occur without dentin ablation. Burkes et al. showed that the irradiation of the dental hard tissues by an Er:YAG laser with a fine water mist could not only suppress the temperature rise, but also increase the cutting efficiency.[83] It was a water flow rate of 1.6 mL/min that produced the most efficient ablation with negligible thermal effect.[86] It was also recommended to apply the laser in "short bursts," while continuing the water application to allow for on-going dissipation of heat. This strategy would minimize the risks of iatrogenic damage to the dental pulp.[37] The addition of water spray for a second or more after irradiation has also shown to reduce the postirradiation temperature rise, which can lead to thermal damage to the dental pulp.[87]

WHEN THE PULSE duration is shorter than the tissue relaxation time, there is no heating of the surrounding tissues.

In the dental literature, different results can be observed related to the temperature changes during Er:YAG laser tooth preparation. The difference in the values of temperature increase during the use of the Er:YAG laser among the studies that evaluated it could have resulted from the great differences with respect to power settings, frequency, size, and depth of the preparations among these studies. Hoke et al. observed an increase of 2.2 degrees Celsius, Burkes et al. obtained values around 4 degree Celsius, Zanin et al. verified a maximum increase of 3.1 degrees Celsius, Oelgiesser et al. reported a maximum temperature peak of 5.5 degrees Celsius, and Attrill et al. observed a maximum increase of 4.0 degrees Celsius.[37,73,83,88,89] The results of temperature rise with laser were 2.0 degrees Celsius for Visuri et al.[90] Remarkably, all these results were below thresholds outlined by Zach and Cohen.[48]

Studies have shown that the pulp response to cavities prepared with Er:YAG laser using air-water spray was minimal, reversible, and comparable to the response produced by high-speed handpiece burs.[91] In a study by Mollica et al., Er:YAG laser preparation showed the lowest mean temperature rise, even though there was no statistically significant difference between this group and the HSHP group.[28] Cavalcanti et al. found no significant difference among the groups prepared with high-speed burs and Er:YAG laser, under cooling, and mean temperature variation of 0.96 and 2.69 degrees Celsius, respectively.[26] Further in vivo studies demonstrated that with the use of either Er:YAG laser or high-speed burs, there were no significant differences in the histological changes in dentin and pulp tissue.[92,93] Keller and Hibst in their study reported there was no loss of pulp vitality after cavity preparation with Er:YAG laser in

TABLE 2

Precautions That Need to Be Taken to Avoid Pulp Hyperthermia During Tooth Preparation With Er:YAG Lasers

Laser parameter settings should be in accordance with manufacturers' recommendation. (Higher energies are usually needed to ablate enamel; and lower settings are needed to ablate dentin, caries, and soft tissue.)
Laser setting should be adjusted in accordance with the remaining dentin thickness.
Laser tip should be kept in slight continuous motion.
Optimal distance for cutting is in the 0.5- to 2 mm range away from the tooth.
There should be continuous water mist to the ablation site.
Use of laser with very short pulse duration is preferred.
Laser should be applied in short bursts with continuous water cooling.
Additional water spray should be used after irradiation to prevent postirradiation temperature rise.
Preparation of narrow troughs should be avoided to prevent the hindrance of water coolant.
Overaggressive suctioning should be avoided to prevent removal of water mist from ablation site.

humans.[94] Comparison of the temperature changes seen in the pulp chamber induced by Er:YAG laser irradiation with those seen with high-speed drilling was done by Raucci-Neto et al.[95] They observed that only a HSHP with a water flow rate of 100 mL/min had lower temperature increases than did Er:YAG laser irradiation at 300 mJ and 3Hz or 300 mJ and 4 Hz.

The efficiency and safety of Er:YAG laser is related to an adequate setting of the working parameters[3] (TABLE 2). The parameters controlled by the clinician when operating the laser are as follows: 1) the level of applied power (power density); 2) the total energy delivered over a given surface area (energy density/fluence); 3) beam profile; 4) pulse repetition rate; 5) pulse duration; 6) irradiation time; 7) the mode of delivery of the energy to the target tissue (i.e., contact or no contact with target tissue); 8) irradiation distance; and 9) the amount of water spray used.[96,97] Proper power setting, time of application, and use of water spray will alleviate the temperature increase to levels below the critical level of pulpal injury.[98] The laser parameter settings should be in accordance with the device manufacturer's recommendations for safe and effective use. The threshold response for pulp reactions through intact enamel and dentin is thought to occur at energy densities somewhat less than 60 J/m2, although the RDT is an important variable.[99] The clinician must judge the dentin thickness and adjust the laser settings based on clinical experience and other factors, such as size of the tooth and the tissue to be treated. The laser tips always should be kept in slight motion to prevent heat build-up and ablation by-products during cavity preparation. Care must be exercised not to create narrow troughs the approximate width of the laser tip as it can block the water flow to the ablated area and, in turn, create carbonization of the tooth structure, the stalling of the ablation process, and cause pain due to heat build-up.[72,100]

Care must also be taken to ensure that water flow to the ablation site is continuous and is not hindered by inadequate water or air spray that can occur when the tips are not properly attached, improper adjustment of the air/water supply, or through overaggressive suctioning, which can prevent the water coolant from reaching the site of ablation.[72]

Although the erbium family of lasers are useful for caries removal and tooth preparation, they are unable to remove gold and vitreous porcelain, and have only an insignificant interaction with amalgam. For enamel removal, the laser is more time consuming than a rotary instrument. Limited accessibility can also be a problem especially in the posterior teeth. Since lasers produce heat, the clinician must carefully observe and monitor the rate of tissue removal to thermal damage to the tissues. The initial investment for these devices can also be substantial.[101]

Temperature Rise During Tooth Preparation by Alternative Methods

Ultrasonic tooth preparation

Ultrasonic devices can be a good alternative to the previously mentioned modalities of tooth preparation, since they do not produce the high-pitched sound that annoys some patients and are less expensive than lasers. Although ultrasonic devices have been in existence for more than 50 years, this type of device has only become popular in the last decade since the newer systems are more efficient and less traumatic.[102] Associated with the development of ultrasonic devices, a new type of instrument, using chemical vapor diamond deposition (CVD), has shown to be more efficient and durable. Ultrasonic cavity preparation may be a good option since it produces less noise, provides better access to cavities, and results in effective cavity cleaning.[103]

In a study by Mollica et al., even though ultrasonic tips generated significantly higher IPT increase than the use of Er:YAG laser and HSHP for cavity preparation, it remained below the critical value of 5.5 degrees Celsius and may be considered safe for use.[25] Another study by Vanderlej et al. evaluated ultrasonic cavity

preparation with CVD points and found that the ultrasonic instrument increased the mean IPT by 3.82 degrees Celsius, and the highest increase was recorded as 4.9 degrees Celsius, which was below the threshold level to cause pulp damage.[38] Moreover, when compared to a HSHP, it was observed that both devices generated similar amounts of heat, and the greatest value for the HSHP group was also 4.9 degrees Celsius. The IPT produced during cavity preparation by ultrasonic tips versus high-speed bur preparations were similar. However, the above-mentioned study demonstrated that the use of ultrasonic device required four times longer duration for the completion of a cavity preparation as compared to HSHP.

Airborne Particle Abrasion

Airborne particle abrasion that was initially introduced for caries removal and cavity preparation was less favored because of the inability to control the stream of particles used in tooth preparation. It also caused pitting and abrasion of the adjacent teeth and injury to the gingival tissues. Advances in the microabrasion technology allowed for a more precise removal of enamel and dentin than the older systems. The use of airborne particle abrasion for kinetic cavity preparation once again has become popular because of the concept of minimal invasive dentistry.[104-106] Laurell et al. examined the pulpal response of such as system in class V cavity preparation in the posterior teeth of dogs with two pressures (80 and 160 psi) with two aluminum oxide particles sizes (27 and 50 µm).[107] The teeth were removed in 72 hours and sectioned for histopathological examination and was compared to the preparations made by HSHP. They found that higher pressure and smaller particles had significantly fewer pulpal effects than the high-speed treated teeth. Damage to the pulp can occur through heat generated by friction and dentin desiccation. Hence, to avoid most of these risks, short cutting time and cautious control of the device is needed. There are no studies in the literature that have measured the increase in the IPT with the use of airborne particle abrasion for caries removal. Therefore, more work needs to be done to prove its worth in caries removal and to determine the appropriate standards for its use.

Conclusions

The following conclusions can be drawn from this review:

- At most, care should be taken by the clinician to keep the intrapulpal temperature rise as low as possible during tooth preparation;
- Most of the studies consider an intrapulpal temperature rise of 5.5 degree Celsius as the critical limit above which irreversible pulp damage can occur;
- Operator-related and equipment-related precautions need to be followed when using high-speed rotary cutting for tooth preparation to keep the intrapulpal temperature rise below the critical limit;
- Adequate setting of the working parameters with the use of Er:YAG lasers is important to keep the intrapulpal temperature rise below the critical level;
- Even though the temperature rise with the use of ultrasonic devices is below the critical level, it takes a longer time for tooth preparation; and
- The worth of airborne particle abrasion in caries removal needs to be proven. ■■■■

REFERENCES

1. Zollner A, Gaengler P, Pulp reactions to different preparation techniques on teeth exhibiting periodontal disease. *J Oral Rehabil* 27:93-102, 2000.
2. Murray PE, Windsor LJ, et al, Analysis of pulpal reactions to restorative procedures, materials, pulp capping, and future therapies. *Crit Rev Oral Biol Med* 13:509-20, 2002.
3. Goodis HE, Pashley D, Stabholtz A, Pulpal effects of thermal and mechanical irritants in: Hargreaves KM, Goodis HE, eds., Seltzer and Bender's Dental Pulp, Quintessence, Chicago, pages 371-88, 2002.
4. Spierings TA, Peters MC, Plasschaert AJ, Thermal trauma to teeth. *Endod Dent Traumatol* 1:123-29, 1985.
5. Murray PE, About I, Lumley PJ, et al, Human odontoblast cell numbers after dental injury. *J Dent* 28:277-85, 2000.
6. Murray PE, Smith AJ, Saving pulps — a biological basis. An overview. *Prim Dent Care* 9:21-6, 2002.
7. Yu C, Abbott PV, An overview of the dental pulp: its functions and responses to injury. *Aust Dent J* 52(suppl 1):4-16, 2007.
8. Nagaoka S, Miyazaki Y, et al, Bacterial invasion into dentinal tubules of human vital and nonvital teeth. *J Endod* 21:70-3, 1995.
9. Paphangkorakit J, Osborn JW, Discrimination of hardness by human teeth apparently not involving periodontal receptors. *Arch Oral Biol* 43:1-7, 1998.
10. Dietschi D, Duc O, et al, Biomechanical considerations for the restoration of endodontically treated teeth: a systematic review of the literature- part 1. Composition and micro- and macrostructure alteration. *Quintessence Int* 38:733-43, 2007.
11. Mjör IA, Odont D, Pulp-dentin biology in restorative dentistry. Part 2: initial reactions to preparation of teeth for restorative procedures. *Quintessence Int* 32:537-51, 2001.
12. Zach L, Pulp viability and repair: effect of restorative procedures. *Oral Surg* 33:111-21, 1972.
13. Raab WH, Temperature changes in pulpal microcirculation. *Proc Finn Dent Soc* 88(suppl 1):469-79, 1992.
14. Murray PE, Lumley PJ, Smith AJ, Preserving the vital pulp in operative dentistry: 3 thickness of remaining cavity dentin as a key mediator of pulpal injury and repair responses. *Dent Update* 29:172-8, 2002.
15. Murray PE, About I, et al, Postoperative pulpal and repair responses. *J Am Dent Assoc* 131:321-9, 2000.
16. Vițalariu A, Căruntu ID, Bolintineanu S, Morphological changes in dental pulp after the teeth preparation procedure. *Rom J Morphol Embryol* 46:131-6, 2005.
17. Ohsima H, Ultrasructural changes in odontoblasts and pulp capillaries following cavity preparation in rat molars. *Arch Histol Cytol* 53:423-8, 1990.
18. Nyborg H, Brannstrom M, Pulp reaction to heat. *J Prosthet Dent* 19:605-12, 1968.
19. Messer HH, Permanent restorations and dental pulp in: Hargreaves KM, Goodis HE, eds., Seltzer and Bender's Dental Pulp, Quintessence, Chicago, 345-70, 2002.
20. Lin M, Xu F, et al, A review of heat transfer in human tooth — experimental characterization and mathematical modeling. *Dent Mater* 26:501-13, 2010.
21. Takahashi N, Kitagami T, Komori T, Evaluation of thermal change in pulp chamber. *J Dent Res* 56:1480, 1977.
22. Panas AJ, Preiskorn M, et al, Validation of hard tooth tissue thermal diffusivity measurements applying an infrared camera. *Infrared Phys Technol* 49:302-5, 2007.
23. Neev J, Pham K, et al, Dentin ablation with three infrared lasers. *Lasers Surg Med* 18:121-8, 1996.
24. Uhl A, Völpel A, Sigusch BW, Influence of heat from light curing units and dental composite polymerization on cells in vitro. *J Dent* 34:298-306, 2006.
25. Mollica FB, Camargo FP, et al, Pulpal temperature increase with high-speed handpiece, Er:YAG laser and ultrasound tips. *J Appl Oral Sci* 16:209-13, 2008.

26. Cavalcanti BN, Lage-Marques JL, Rode SM, Pulpal temperature increases with Er:YAG laser and high-speed handpieces. *J Prosthet Dent* 90:447-51, 2003.
27. Guiraldo RD, Consani S, et al, Influence of the light curing unit and thickness of residual dentin on generation of heat during composite photoactivation. *J Oral Sci* 50:137-42, 2008.
28. da Silva EM, Penelas AG, et al, Influence of the degree of dentin mineralization on pulp chamber temperature increase during resin-based composite (RBC) light-activation. *J Dent* 38:336-42, 2010.
29. Michida SM, Passos SP, et al, Intrapulpal temperature variation during bleaching with various activation mechanisms. *J Appl Oral Sci* 17:436-9, 2009.
30. Krmek SJ, Miletic I, et al, The temperature changes in the pulp chamber during cavity preparation with the Er:YAG laser using a very short pulse. *Photomed Laser Surg* 27:351-5, 2009.
31. Oztürk B, Uşümez A, et al, In vitro assessment of temperature change in the pulp chamber during cavity preparation. *J Prosthet Dent* 91:436-40, 2004.
32. Sulieman M, Addy M, Rees JS, Surface and intrapulpal temperature rises during tooth bleaching: an in vitro study. *Br Dent J* 199:37-40, 2005.
33. Hatton JF, Holtzmann DJ, et al, Effect of hand-piece pressure and speed on intrapulpal temperature rise. *Am J Dent* 7:108-10, 1994.
34. Linsuwanont P, Palamara JE, Messer HH, Thermal transfer in extracted incisors during thermal pulp sensitivity testing. *Int Endod J* 41:204-10, 2008.
35. Leprince J, Devaux J, et al, Pulpal-temperature rise and polymerization efficiency of LED curing lights. *Oper Dent* 35:220-30, 2010.
36. Hannig M, Bott B, In-vitro pulp chamber temperature rise during composite resin polymerization with various light-curing sources. *Dent Mater* 15:275-81, 1999.
37. Attrill DC, Davies RM, et al, Thermal effects of the Er:YAG laser on a simulated dental pulp: a quantitative evaluation of the effects of a water spray. *J Dent* 32:35-40, 2004.
38. Vanderlei AD, Borges AL, et al, Ultrasonic versus high-speed cavity preparation: analysis of increases in pulpal temperature and time to complete preparation. *J Prosthet* Dent 100:107-9, 2008.
39. Santini A, Watterson C, Miletic V, Temperature rise within the pulp chamber during composite resin polymerisation using three different light sources. *Oper Dent J* 2:137-41, 2008.
40. Daronch M, Rueggeberg FA, et al, Effect of composite temperature on in vitro intrapulpal temperature rise. *Dent Mater* 23:1283-8, 2007.
41. Park SH, Roulet JF, Heintze SD, Parameters influencing increase in pulp chamber temperature with light-curing devices: curing lights and pulpal flow rates. *Oper Dent* 35:353-61, 2010.
42. Millen C, Ormond M, et al, A study of temperature rise in the pulp chamber during composite polymerization with different light-curing units. *J Contemp Dent Pract* 8:29-37, 2007.
43. Kodonas K, Gogos C, Tziafas D, Effect of simulated pulpal microcirculation on intrapulpal temperature changes following application of heat on tooth surfaces. *Int Endod J* 42:247-52, 2009.
44. Amano T, Muramatsu T, et al, Responses of rat pulp cells to heat stress in vitro. *J Dent Res* 85: 432-5, 2006.
45. Kitamura C, Nishihara T, et al, Thermotolerance of pulp cells and phagocytosis of apoptotic pulp cells by surviving pulp cells following heat stress. *J Cell Biochem* 94:826-34, 2005.
46. Morotomi T, Kitamura C, et al, Effects of heat stress and starvation on clonal odontoblast-like cells. *J Endod* 37:955-61, 2011.
47. Baldissara P, Catapano S, Scotti R, Clinical and histological evaluation of thermal injury thresholds in human teeth: a preliminary study. *J Oral Rehabil* 24:791-801, 1997.
48. Zach L, Cohen G, Pulp response to externally applied heat. *Oral Surg Oral Med Oral Pathol* 19:515-30, 1965.
49. Pohto M, Scheinin A, Microscopic observations on living dental pulp. II. The effect of thermal irritants on the circulations of the pulp in the lower rat incisor. *Acta Odontol Scand* 16:315-27, 1958.
50. Zezell DM, Cecchini SM, et al, Temperature changes under Ho:YLF irradiation. *Proc SPIE* 2672:34-9, 1996.
51. Cavalcanti BN, Otani C, Rode SM, High-speed cavity preparation techniques with different water flows. *J Prosthet Dent* 87:158-61, 2002.
52. Lisanti VF, Zander HA, Thermal injury to normal dog teeth: in vivo measurements of pulp temperature increases and their effect on the pulp tissue. *J Dent Res* 31:548-58, 1952.
53. Carlton ML Jr, Dorman HL, Comparison of dentin and pulp temperatures during cavity preparation. *Tex Dent J* 87:7-9, 1969.
54. Marsland EA, Shovelton DS, Repair in the human dental pulp following cavity preparation. *Arch Oral Biol* 15:411-23, 1970.
55. Laforgia PD, Milano V, et al, Temperature change in the pulp chamber during complete crown preparation. *J Prosthet Dent* 65:56-61, 1991.
56. Eames WB, Reder BS, Smith GA, Cutting efficiency of diamond stones: effect of technique variables. *Oper Dent* 2:156-64, 1977.
57. Siegel SC, von Fraunhofer JA, Irrigation rates and handpieces used in prosthodontic and operative dentistry: result of a survey of North American dental school teaching. *J Prosthodont* 9:82-6, 2000.
58. Lauer HC, Kraft E, et al, Effects of the temperature of cooling water during high-speed and ultrahigh-speed tooth preparation. *J Prosthet Dent* 63:407-4, 1990.
59. Galindo DF, Ercoli C, et al, Tooth preparation: a study on effect of different variables and a comparison between conventional and channeled burs. *J Prosthodont* 13:3-16, 2004.
60. Ercoli C, Rotella M, et al, In vitro comparison of the cutting efficiency and temperature production of 10 different rotary cutting instruments. Part I: turbine. *J Prosthet Dent* 101:248-61, 2009.
61. Ottl P, Lauer HC, Temperature response in the pulpal chamber during ultrahigh-speed tooth preparation with diamond burs of different grit. *J Prosthet Dent* 80:12-9, 1998.
62. GJ Christensen, Tooth preparation and pulp degeneration. *J Am Dent Assoc* 128:353-4, 1997.
63. Holland GR, Davis SB, Pulpal pathosis in: Ingle JI, Bakland LK, Baumgartner JC, eds., Ingle's Endodontic, sixth edition, BC Decker, Ontario, pages 468-93, 2008.
64. Armengol V, Jean A, Marion D, Temperature rise during Er:YAG and Nd:YAG laser ablation of dentin. *J Endod* 26:138-41, 2000.
65. Miserendino LJ, Abt E, et al, Evaluation of thermal cooling mechanisms for laser application to teeth. *Lasers Surg Med* 13:83-8, 1993.
66. Anic I, Vidovic D, et al, Laser-induced molar tooth pulp chamber temperature changes. *Caries Res* 26:165-9, 1992.
67. Gow AM, McDonald AV, et al, An in vitro investigation of the temperature rises produced in dentin by Nd:YAG laser light with and without water-cooling. *Eur J Prosthodont Restor Dent* 7:71-7, 1999.
68. Türkmen C, Günday M, et al, Effect of CO2, and Nd:YAG and ArF excimer lasers on dentin morphology and pulp chamber temperature: An in vitro study. *J Endod* 26:644-8, 2000.
69. Allen DJ, Thermal effects associated with the Nd:YAG dental laser. *Angle Orthod* 63:299-304, 1993.
70. Miserendino LJ, Neiburger EJ, et al, Thermal effects of continuous wave CO2 laser exposure on human teeth: an in vitro study. *J Endod* 15:302-30, 1989.
71. White JM, Fagan CF, Goodis HE, Intrapulpal temperature during pulsed Nd:YAG laser treatment of dentin in vitro. *J Periodontol* 21:255-9, 1994.
72. van As G, Erbium lasers in dentistry. *Dent Clin North Am* 48:1017-59, 2004.
73. Oelgiesser D, Blasbalg J, Ben-Amar A, Cavity preparation by Er:YAG laser on pulpal temperature rise. *J Dent* 16:96-8, 2003.
74. Hibst R, Keller U, Experimental studies of the application of the Er:YAG laser on dental hard substances. I. Measurement of the ablation rate. *Lasers Surg Med* 9:338-44, 1989.
75. Eversole LR, Rizoiu I, Kimmel AI, Pulpal response to cavity preparation by an erbium, chromium:YSGG laser-powered hydrokinetic system. *J Am Dent Assoc* 128:1099-106, 1997.
76. Coluzzi DJ, An overview of laser wavelengths used in dentistry. *Dent Clin North Am* 44:753-66, 2000.
77. Hibst R, Lasers for caries removal and cavity preparations: state of the art and future directions. *J Oral Laser Appl* 2:203-12, 2002.
78. Walsh LJ, The current status of laser applications in dentistry. *Aust Dent J* 48:146-55, 2003.
79. Majaron B, Sustersic D, et al, Heat diffusion and debris screening in Er:YAG Laser ablation of hard biological tissues. *Appl Phys* B 66:479-87, 1998.
80. Perhavec T, Diaci J, Comparison of heat deposition of Er:YAG and Er,Cr:YSGG lasers in hard dental tissues. *J Laser Health Acad* 2:1-6, 2009.
81. Lukac M, Marincek M, et al, Dental laser drilling: state of the art with the latest generation of variable square pulse erbium dental laser system. *J Laser Health Acad* 2:1-5, 2007.
82. Perhaveca T, Diaci J, Comparison of Er:YAG and Er,Cr:YSGG dental lasers. *J Oral Laser Appl* 8:87-94, 2008.
83. Burkes Jr EJ, Hoke J, et al, Wet versus dry enamel ablation by Er:YAG laser. *J Prosthet Dent* 67:847-51, 1992.
84. Hibst R, Keller U, Effects of water spray and repetition rate on the temperature elevation during Er:YAG laser ablation of dentin. *Proc SPIE* 2623:139-44, 1996.
85. Staninec M, Xie J, et al, Influence of an optically thick water layer on the bond strength of composite resin to dental enamel after IR laser ablation. *Lasers Surg Med* 33:264-9, 2003.
86. Kim JM, Kim ME, Kim KS, Ablation rate and intrapulpal temperature by irradiation with Er:YAG laser. *Korean J Oral Med* 9:375-81, 2005.
87. Park NS, Kim KS, et al, Changes in intrapulpal temperature after Er:YAG laser irradiation. *Photomed Laser Surg* 25:229-32, 2007.
88. Hoke J, Burkes E, et al, Er:YAG (2,94µm) lasers effects on dental tissues. *J Laser Appl* 6:61-5, 1990.
89. Zanin F, Brugnera-Júnior A, et al, Heat generated by Er:YAG laser in the pulp chamber of teeth submitted to removal of

dental tissue and composite resin. *Proc SPIE* 5313:109-13, 2004.
90. Visuri SR, Walsh JT Jr, Wigdor HA, Erbium laser ablation of dental hard tissue: effect of water cooling. *Lasers Surg Med* 18:294-300, 1996.
91. Sonntag KD, Klitzman B, et al, Pulpal response to cavity preparation with the Er:YAG and Mark III free electron lasers. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 81:695-702, 1996.
92. Cozean C, Arcoria CJ, et al, Dentistry for the 21st century? Erbium:YAG laser for teeth. *J Am Dent Assoc* 128:1080-7, 1997.
93. Miserendino LJ, Cozean CD, Histological results following in vivo cavity preparation with an Er:YAG laser. *Proc SPIE* 3248:46-50, 1998.
94. Keller U, Hibst R, Effects of Er:YAG laser in caries treatment: a clinical pilot study. *Lasers Surg Med* 20:32-8, 1997.
95. Raucci-Neto W, De Castro LM, et al, Assessment of thermal alteration during class V cavity preparation using the Er:YAG laser. *Photomed Laser Surg* 25:281-6, 2007.
96. De Moor RJ, Delmé KI, Laser-assisted cavity preparation and adhesion to erbium-lased tooth structure: part 1. Laser-assisted cavity preparation. *J Adhes Dent* 11: 427-38, 2009.
97. Kim ME, Jeoung DJ, Kim KS, Effects of water flow on dental hard tissue ablation using Er:YAG laser. *J Clin Laser Med Surg* 21:139-44, 2003.
98. Rizoiu I, Kohanghadosh F, et al, Pulpal thermal response to an Erbium, Chromium:YSGG laser hydrokinetic system. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 86:220-3, 1998.
99. Acroria CJ, Miserendino LJ, Laser effects on dental pulp in: Miserendino LJ, Pick RM, eds., Lasers in dentistry, Quintessence, Chicago, pages 17-25, 1995.
100. Geraldo-Martins VR, Tanji EY, et al, Intrapulpal temperature during preparation with the Er:YAG laser: an in vitro study. *Photomed Laser Surg* 23:182-6, 2005.
101. Dederich DN, Bushick RD, Lasers in dentistry: separating science from hype. *J Am Dent Assoc* 135:204-12, 2004.
102. Banerjee A, Watson TF, Kidd EA, Dentin caries excavation: a review of current clinical techniques. *Br Dent J* 188:476-82, 2000.
103. Predebon JC, Flório FM, Basting RT, Use of CVDentUS diamond tips for ultrasound in cavity preparation. *J Contemp Dent Pract* 7:50-8, 2006.
104. Rainey JT, Air abrasion: an emerging standard of care in conservative operative dentistry. *Dent Clin North Am* 46:185-209, 2002.
105. Christensen GJ, Cavity preparation: cutting or abrasion? *J Am Dent Assoc* 127:1651-4, 1996.
106. Hegde VS, Khatavkar RA, A new dimension to conservative dentistry: Air abrasion. *J Conserv Dent* 13:4-8, 2010.
107. Laurell KA, Carpenter W, et al, Histopathologic effects of kinetic cavity preparation for the removal of enamel and dentin. An in vivo animal study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 80:214-25, 1995.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Manuel S. Thomas, MDS, at manuel2dr@gmail.com.

Timothy G. Giroux
DDS/Broker

ASK THE BROKER

Question:

I am thinking of hiring an associate. What is the best structure of remuneration?

First of all, anything I opine on must be verified with your attorney. A bill passed in California last year puts the "Independent Contractor" status for dentists in the "deep freeze". It was always stretching the IRS rules to classify associate dentists as independent contractors, but this last law pretty much puts associate doctors squarely in the employee category.

The next debate is about paying an associate on production or collection. I was sole proprietor/owner and had associates. I firmly believe that paying on NET PRODUCTION is the only way to go. Of course some owner's CPA's will insist on collections, but here are my reasons below:

1) Associates have no say in the front desk operations and no control over the collections. Therefore, it is unreasonable to base their pay on what they have no control over.

2) How does the associate know he was paid properly after termination? Is the associate really supposed to "trust" that the employer will be diligent on separating all future payments to properly credit all collections and then send a final check to the associate? Should there be language in the agreement that allows the associate to continuously inspect the owner's books, including 90 days after termination to make sure they get paid**?**

I understand the issues well and it is BEST for both parties to work out a proper percentage of NET PRODUCTION. That way, both parties know where they stand at the end of each day worked and termination paychecks are not disputed. The accounting work is infinitely easier for the owner this way under all circumstances.

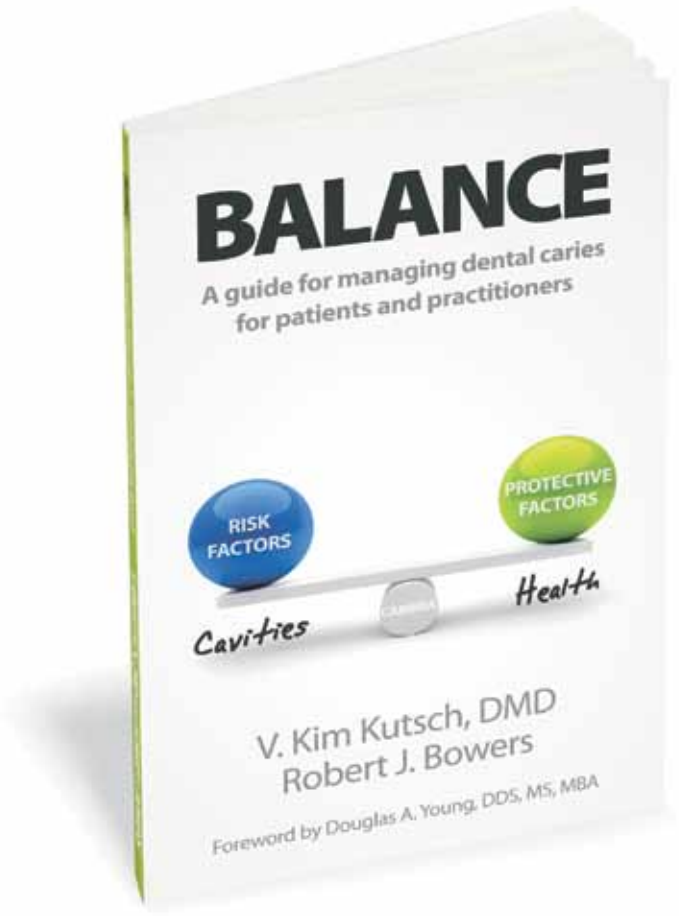
Let's say that the proper percentage to pay an associate in an office which collects 100% of production is 30%. If the office is a PPO office that adjusts the production after collections and ends up collecting only about 80% of production, then a fair compensation to an associate might be 24% of production. This refers to the term "net production". Net production takes into account discounts and fee schedule adjustments. A PPO office with Trojan software can update all PPO fee schedules everyday to eliminate this UCR vs PPO fee schedule discrepancy.

Paying on COLLECTION in a contract always implies that an associate needs to wait until the money trickles in before they get paid. NET PRODUCTION is **NOT** the same as COLLECTIONS. Net production means the business owner makes the adjustment at the time of service on what he expects to get paid. The collection process then becomes his responsibility, as it should be!

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**

A simple guide for a complex problem.

GET IT FREE FOR A LIMITED TIME.



"***Balance*** *is an excellent guide for managing dental caries that belongs in each and every dental practice.*"

Douglas A. Young, DDS, MS, MBA

Visit **balance.carifree.com** or call 866.928.4445 to get your free copy.

DISCOUNT CODE: CDA8

PRICE ~~$24.95~~ **FREE**

- Limit one free book per person
- Shipping and handling charges of $5.95 per copy apply
- Discount code limited to 1000 copies

V. Kim Kutsch, DMD received his undergraduate degree from Westminster College in Utah and then completed his DMD at the University of Oregon School of Dentistry in 1979. He is an inventor, holding numerous patents in dentistry, product consultant, internationally recognized speaker, past president of the Academy of Laser Dentistry and the WCMID. He has also served on the board of directors for the WCLI and the AACD. As an author, Dr. Kutsch has published dozens of articles and abstracts on minimally invasive dentistry, caries risk assessment, digital radiography, and other technologies in both dental and medical journals and has also contributed to several textbooks. He acts as a reviewer for several journals including JADA. Dr. Kutsch serves as CEO of Oral BioTech. As a clinician, he is a graduate and mentor in the prestigious Kois Center and maintains a private practice in Albany, Oregon.

CDA JOURNAL, VOL 40, Nº9

Oral Fluid Nanosensor Test: Saliva as a Diagnostic Tool for Oral Health

MALLAYYA PUJARI, MDS; SHRADDHA BAHIRWANI, MDS; P. BALAJI, MDS; RACHNA KAUL, MDS; BINA SHAH, MDS; DEEPAK DARYANI, MDS; AND SIDRA IQBAL, BDS

ABSTRACT High-impact diseases, especially cancer, are challenging to diagnose without supplementing laboratory testing. Even with laboratory tools, definitive diagnosis often remains elusive. The oral fluid nanosensor test technology platform combines cutting-edge technologies — such as self-assembled monolayers, bionanotechnology, cyclic enzymatic amplification, and microfluidics — with several well-established techniques including microinjection molding, hybridization-based detection, and molecular purification. The intended use of the OFNASET is for the point-of-care multiplex detection of salivary biomarkers for oral cancer.

AUTHORS

Mallayya Pujari, MDS, is a senior lecturer, Department of Oral Medicine and Radiology, Dr. Syamala Reddy Dental College Hospital and Research Centre affiliated to Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, India.
Conflict of Interest Disclosure: None reported.

Shraddha Bahirwani, MDS, is a professor and head of department, Dr. Syamala Reddy Dental College Hospital and Research Centre affiliated to Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, India.
Conflict of Interest Disclosure: None reported.

P. Balaji, MDS, is a professor, Dr. Syamala Reddy Dental College Hospital and Research Centre affiliated to Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, India.
Conflict of Interest Disclosure: None reported.

Rachna Kaul, MDS; Bina Shah, MDS; and **Deepak Daryani, MDS,** are senior lecturers, Dr. Syamala Reddy Dental College Hospital and Research Centre affiliated to Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka, India.
Conflict of Interest Disclosure: None reported.

Sidra Iqbal, BDS, is with the Dr Syamala Reddy Dental College Hospital and Research Centre, Bangalore, Karnataka, India.
Conflict of Interest Disclosure: None reported.

Systemic diseases, including cancer and cardiovascular, metabolic and neurological diseases, are challenging to diagnose without supplementing clinical evaluation with laboratory testing. Even with laboratory tools, definitive diagnosis often remains elusive. Three roadblocks have prevented the realization of the potential of clinical diagnostics: 1) lack of definitive disease associated protein and genetic markers; 2) absence of easy and inexpensive sampling methods that involve minimal discomfort; and 3) lack of an accurate, portable and easy-to-use diagnostic platform.

Saliva, a biofluid that is readily accessible via a totally noninvasive method, has long been recognized as addressing the second roadblock. Because

of the visionary investment by the National Institute of Dental and Craniofacial Research (NIDCR), the discovery of salivary biomarkers and the ongoing development of salivary diagnostic technologies will address the first and third roadblocks. It is safe to predict that the use of saliva for disease diagnostics and health surveillance is about five years away. This is an exciting time, as the applications of salivary diagnostics for oral diseases are being seen, which will be followed soon by the application to high-impact systemic diseases, using highly informative panels of salivary proteomic and genomic biomarkers. This will enable researchers to bridge oral health research with systemic disease diagnostics via a biofluid that filters, processes, and secretes itself from the vasculature that nourishes the salivary glands into the oral cavity. Oral fluid is a perfect medium to be explored for health and disease surveillance. The translational applications and opportunities are enormous.

This article reviews current salivary diagnostic, research, and developmental efforts for use in dentistry and medicine.

History of Using Saliva for Oral Cancer Molecular Detection

The use of saliva for oral cancer screening or diagnostics is still in its infancy. Its use began by a report of a small study in Taiwan by Liao et al. in 2000 claiming that exon 4 codon 63 of the p53 gene is mutated in salivary DNA from 5/8 (62.5 percent) of oral cancer patients. Five of the control subjects (18.5 percent) had similar mutations in their p53 gene. El-Naggar et al. in 2001 demonstrated genetic heterogeneity in saliva from patients with oral squamous carcinomas and suggested the use of epithelial cells in saliva from patients with head and neck squamous tumorigenesis for genetic analysis.

More recently, Jiang et al. reported the increase of mitochondrial DNA content in the saliva of head-and-neck cancer patients. Another report from the same group reported that quantitative analysis of HPV 16 DNA in salivary rinses allows for detection of HPV-related head and neck cancer. However, the authors cautioned that specific limitations exist that prevent the application of this as a screening technique for a broad population.[1]

THE ORAL CANCER elevation of salivary IL8 mRNA and protein is significantly higher than in advanced periodontitis patients.

UCLA Approach to Saliva Diagnostic for Oral Cancer

The laboratory at the University of California, Los Angeles, utilizes research platforms toward the global identification of disease signatures in saliva. The premise of the UCLA approach is that since serum contents, such as disease biomarkers, will be largely present in saliva, oral fluid is a logical source to harness disease biomarkers. The lab employed both a proteome-wide as well as a genome-wide approach toward identification of disease biomarkers and signatures.[1]

Human Salivary Proteome as Targets for Human Disease Diagnostics

UCLA is one of the three NIDCR-funded groups to comprehensively decipher human salivary pathogenesis. Three-hundred-and-nine distinct proteins in human whole saliva using 2-DGE/MS and "shotgun" proteomics have been identified. This work was recently published in *Proteomics* and highlighted in *Journal of Proteome Research* in 2005. Using a similar approach, comparative proteome analysis of submandibular (SM) and sublingual (SL) saliva were conducted.[2,3]

To date, two salivary proteins, IL8 and thioredoxin, which can discriminate saliva of oral cancer from control subjects, have been discovered. IL8 was discovered through previous tissue-based expression profiling effort. IL8 is significantly elevated in saliva of oral cancer patients and is highly discriminatory of detecting oral cancer in saliva (n=64) with an receiver operator characteristic value of 0.95, sensitivity 86 percent, and specificity 97 percent at cutoff of 600 pg/ml.

Of interest is that both IL8 protein and RNA are concordantly increased. The concentration of IL8 protein in saliva of oral cancer patient and control subjects are 750± 236 pg/mL and 250± 130 pg/mL, respectively. Similarly, for salivary IL8 mRNA concentration, oral cancer patients are significantly higher than in control subjects. Due to the frequent inflammation association of this cytokine, it has been further demonstrated that the oral cancer elevation of salivary IL8 mRNA and protein is significantly higher than in advanced periodontitis patients.[4,5]

These results allow for the conclusion that while severe inflammation in the oral cavity, as in advanced periodontitis patients, does elevate salivary IL8 protein and mRNA levels, it is not significant. Salivary IL8 protein and mRNA levels in oral cancer patients are elevated significantly above those of control patients as well as advanced periodontitis patients, supporting the use of salivary IL8 as a biomarker for oral cancer detection.[6]

Thioredoxin was discovered as salivary oral cancer biomarkers by a proteomic approach using MALDI-TOF. It has been established as an integrated methodology to sequence candidate protein/peptide biomarkers. Using MALDI-MS profiling of saliva proteins, it was identified that a ~11600 Da protein was present at a significantly higher level in oral cancer saliva than matched control subjects ($p<0.01$). To identify this candidate biomarker, an oral cancer saliva sample was fractionated by reverse-phase LC (C4 column) followed by MALDI-MS of the LC fraction containing the candidate biomarker of ~11600 Da. This fraction was subsequently digested by trypsin for LC-MS/MS analysis.

Mascot database searching indicated that, in total, four peptides were matched to this protein, with a sequence coverage of 31 percent. These results suggested that saliva thioredoxin is a validated biomarker for oral cancer detection.[7]

Human Salivary Transcriptome as Targets for Cancer Diagnostics

The UCLA research group recently found that there are approximately 3,000 human mRNAs in normal subjects' cell-free saliva. Further, there is a core signature of 185 mRNAs present in all normal subjects, which provides the rationale for the use the salivary transcriptome for disease diagnostics. The discovery that a large panel of human RNA can be reliably detected in saliva gives rise to the potential of this novel clinical approach. The diagnostic value of this approach was evaluated by using oral squamous cell carcinoma as the proof-of-principle disease and found that of the ~3,000 mRNAs, seven salivary RNAs were consistently elevated in saliva from oral cancer patients. Of these, four in combination (OAZ-1, SAT, IL8 and IL1-β), have the ability to discriminate saliva from oral cancer patients from that of control subjects, with an receiver operator characteristic value of 0.95, a specificity of 91 percent, and a sensitivity of 91 percent. While the initial study was done on 64 subjects, three additional independent clinical detection studies with 272 subjects have since been carried out, and found that the seven saliva mRNA biomarkers behaved very consistently with an overall accuracy rate of 85 percent. The discovery of RNA biomarkers in saliva that can have oral cancer discriminatory ability is a novel finding. This is now being explored of its translational potential and value.[8,9]

FOR ORAL CANCER detection, saliva RNA biomarkers have a slight edge over serum RNA biomarkers.

One often wonders which bodily fluids (blood, saliva, urine, cerebral spinal fluid) are more clinically diagnostic for a specific disease entity. One of the authors recently made that comparison for oral cancer. The same patients identified with a saliva RNA signature for oral cancer detection were examined for serum RNA signatures for oral cancer detection. Similar to saliva, four RNA biomarkers collectively can mark saliva of individuals with oral cancer with an receiver operator characteristic value of 0.88. While this is very good, the salivary RNA biomarkers have an receiver operator characteristic value of 0.95. Thus for oral cancer detection, saliva RNA biomarkers have a slight edge over serum RNA biomarkers.[9,10]

Saliva Diagnostics for Other High-Impact Systemic Diseases

Saliva has been examined for the detection of a number of systemic diseases ranging from infectious diseases, including HIV to Alzheimer's. The authors' laboratory has begun to explore a number of efforts to identify high-impact systemic diseases and explore their diagnostic signatures in saliva. Breast cancer is the first systemic disease to be explored of the presence of proteomic and genomic signatures.[11-15]

Oral Fluid Nanosensor Test (OFNASET)

While it is clear there is a national agenda to turn saliva diagnostics into a clinical and commercial reality, much work needs to be done before this vision can be realized. There remains the need to identify definitive disease-associated salivary biomarkers (proteins and genetic) that can be used in conjunction with the technology platforms for saliva diagnostics. The UCLA group is set to develop and validate the OFNASET as a point-of-care chairside, portable, and multiplexible device to be used for saliva diagnostics. In addition to the research infrastructure, the UCLA School of Dentistry can fully harness and validate proteomic and genomic biomarkers in saliva for human disease diagnostics. Collectively, technology platform advancement and the identification and validation of robust and discriminatory suites of salivary biomarkers for disease diagnostics represent the necessary marriage to propel saliva diagnostics into a clinical and commercial reality. At the same time, they are building the scientific foundation toward the use of saliva as a diagnostic fluid.[16]

Conclusion

High-impact diseases, including cancer, cardiovascular disease, and neurological disease, are challenging to diagnose without supplementing clinical evaluation with laboratory testing. Even with laboratory tools, definitive diagnosis often remains elusive. The lack of three crucial elements presents a roadblock to achieving the potential of clinical diagnostic tests:

1) Definitive disease-associated protein and genetic markers; 2) easy and inexpensive sampling methods with minimal discomfort for the subject; and 3) an accurate and quantitative diagnostic platform. The OFNASET technology platform combines cutting-edge technologies, such as self-assembled monolayers (SAM), bionanotechnology, cyclic enzymatic amplification, and microfluidics, with several well-established techniques including microinjection molding, hybridization-based detection, and molecular purification.

The intended use of the OFNASET is for the point-of-care multiplex detection of salivary biomarkers for oral cancer. UCLA demonstrated that the combination of two salivary proteomic biomarkers (thioredoxin and IL-8) and four salivary mRNA biomarkers (SAT, ODZ, IL-8, and IL-1b) can detect oral cancer with high specificity and sensitivity. With the use of advanced diagnostic tools like OFNASET, it is possible to diagnose the systemic diseases noninvasively using saliva as a media. ■■■■

REFERENCES

1. Wong DT, Salivary diagnostics for oral cancer. *J Calif Dent Assoc* 34(4):303-8, April 2006.
2. Hu S, Xie Y, et al, Large-scale identification of proteins in human salivary proteome by liquid chromatography/mass spectrometry and two-dimensional gel electrophoresis-mass spectrometry. *Proteomics* 5:1714-28, 2005.
3. Hu S, Denny P, et al, Differentially expressed protein markers in human submandibular and sublingual secretions. *Int J Oncol* 25:1423-30, 2004.
4. Alevizos I, Mahadevappa M, et al, Oral cancer in vivo gene expression profiling assisted by laser capture microdissection and microarray analysis. *Oncogene* 20:6196-204, 2001.
5. St. John M, Li Y, et al, IL-6 and IL-8: potential biomarkers for oral cavity and oropharyngeal SCCA. *Arch Otolaryngol Head Neck Surg* 130:929-35, 2004.
6. Tan W, Li Y, et al, Oral cancer detection from saliva using optical detection of IL-8 protein biomarker; submitted, 2006.
7. Hu S, Yu T, et al, Proteomics analysis to identify saliva biomarkers for human oral cancer; submitted, 2005.
8. Li Y, Zhou X, et al, RNA profiling of cell-free saliva using microarray technology. *J Dent Res* 83:199-203, 2004.
9. Li Y, St John MA, et al, Salivary transcriptome diagnostics for oral cancer detection. *Clin Cancer Res* 10:8442-50, 2004.
10. Li Y, Elashoff D, et al, Serum circulating human mRNA profiling and its utility for oral cancer detection. *J Clin Oncol*, in press.
11. Parry J, Simple and reliable salivary tests for HIV and hepatitis A and B virus diagnosis and surveillance. *Ann NY Acad Sci* 694:216-33, 1993.
12. Nair P, Schroeder H, Duct-associated lymphoid tissue (DALT) of minor salivary glands and mucosal immunity. *Immunology* 57:171-80, 1986.
13. Malamud D, Oral diagnostic testing for detecting human immunodeficiency virus-1 anti-bodies: a technology whose time has come. *Am J Med* 102 (suppl 4A):9-14, 1997.
14. Hodinka R, Nagashunmugam T, Malamud D, Detection of human immunodeficiency virus antibodies in oral fluids. *Clin Diagn Lab Immunol* 5:419-26, 1998.
15. Sayer R, Law E, et al, Association of a salivary acetylcholinesterase with Alzheimer's disease and response to cholinesterase inhibitors. *Clin Biochem* 37:98-104, 2004.
16. Wong DT, Salivary diagnostics powered by nanotechnologies, proteomics and genomics. *J Am Dent Assoc* 137:313-21, 2006.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Mallayya Pujari, MDS, at drpujarimr@yahoo.co.in.

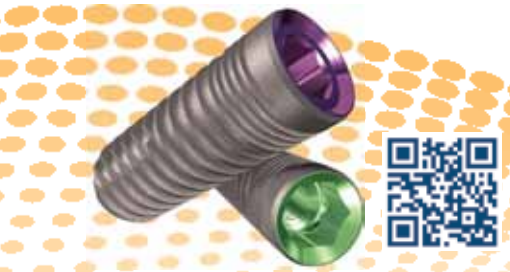
Tired of Price Increases on Over-Priced Implants?

Implant Direct
simply smarter.

It's Time for a Reality Check. Choose Implant Direct for...
Innovative Products. Great Value. Highest Customer Satisfaction[1]

Legacy™3 Implant
All-in-1 Packaging includes implant, abutment, transfer, cover screw & healing collar
$175 vs $621[2] from Zimmer Dental

✓ **Reality Check**
Zimmer Customers
Save $446 with Legacy3

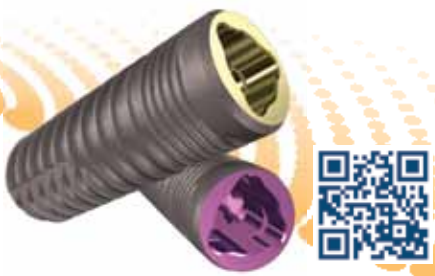


SwishPlant™ Implant
All-in-1 Packaging includes implant, straight abutment/transfer, cover screw & healing collar
$200 vs $705[3] from Straumann®

✓ **Reality Check**
Straumann Customers
Save $505 with SwishPlant

ReActive™ Implant
All-in-1 Packaging includes implant, abutment, transfer & cover screw
$200 vs $694[4] from Nobel Biocare™

✓ **Reality Check**
Nobel Customers
Save $494 with ReActive



Implant Direct's New Las Vegas Training Center

Implant Direct offers an extensive list of educational opportunities at its Las Vegas Training Center with computers at each desk for Image Guided Surgical Training, models/mannequins for hands-on training and a four chair dental office for live surgical demonstrations.

Next Courses: September 13-15 | November 30-December 2

For information on courses and dates, both in Las Vegas and throughout the US, visit Implant Direct's website or use your smart phone to link directly to our Educational Section.

EARN 2 CE CREDITS FREE: View Online Lecture with 3D Graphic Videos & Answer 13 Test Questions

The Changing Reality of Implant Dentistry

Presented by Dr. Gerald Niznick

Technological advances and economic factors have shifted the implant industry toward affordable care.

www.implantdirect.com | 888-649-6425

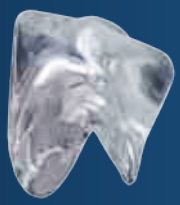
Continuing education credits may not apply toward license renewal in all states.
It is the responsibility of each participant to verify the requirement of his/her states licensing board(s).
Price comparisons based upon US list prices as of February 2012. All trademarks are property of their respective companies.
[1]Satisfied among Current and Former Users, by Company US Q211 Millenium Research Group A Decision Research, Inc. Company
[2]US list price for Tapered Screw-Vent with micro grooves, healing collar & straight abutment
[3]US list price for SLActive Tapered Effect implant, closure screw, healing abutment, solid abutment, transfer and comfort cap.
[4]US list price for NobelActive with cover screw, impression coping & abutment
Live surgical demonstrations not available at all courses

PROTECT YOUR DENTISTRY
WITH KELLER'S BRUXISM SOLUTIONS

Comfort H/S Bite Splint™

Hard exterior & soft interior provide protection and comfort at an economical price.

Only **$59**



NTI tss plus™

Protects teeth, muscles, and joints by reducing muscle contraction intensity nearly 70%.

$119

NTI tss plus™ soft

Reduce chairtime and increase patient comfort.

- Indicated for patients with veneers or crowded teeth
- Extends to bicuspids for retention

$129

crystal clear®

Clinically unbreakable, injection molded full coverage guard for precise fit and exceptional strength. Won't absorb stains or odors.

$114

thermo FIT®

An adaptive, flexible bite guard that reduces chairtime and increases patient comfort.

$129

keller®

Call Today For Your Case Pick-Up!

800-325-3056

160 Larkin Williams Industrial Court • Fenton, MO 63026 • www.kellerlab.com

MADE IN USA

CDA JOURNAL, VOL 40, Nº9

Atypical Odontalgia — An Update

SEENA B. PATEL, DMD, MPH; AUDREY L. BOROS, DDS, MSC; AND SATISH K.S. KUMAR, DDS, MDSC

ABSTRACT Atypical odontalgia is a commonly misdiagnosed condition that frequently leads to unnecessary dental treatments such as extraction and endodontic therapy. These treatments often worsen the pain. Despite greater recognition and understanding of this condition, proper diagnosis and treatment remains a challenge. It is believed that atypical odontalgia is a neuropathic condition. This article updates the current understanding of the etiology and pathophysiology of atypical odontalgia, and provides appropriate diagnostic and management approaches for this condition.

AUTHORS

Seena B. Patel, DMD, MPH, is a resident, Orofacial Pain and Oral Medicine Center, University of Southern California, Herman Ostrow School of Dentistry, in Los Angeles. *Conflict of Interest Disclosure: None reported.*

Audrey L. Boros, DDS, MSC, is a resident, Oral and Maxillofacial Pathology, New York Hospital Queens, Flushing, New York. *Conflict of Interest Disclosure: None reported.*

Satish K.S. Kumar, DDS, MDSC, was formerly an assistant professor of clinical dentistry, Orofacial Pain and Oral Medicine Center, Division of Periodontology, Diagnostic Sciences and Dental Hygiene, University of Southern California, Herman Ostrow School of Dentistry. He presently is a resident in the USC Advanced Periodontology Residency Program and is pursuing his PhD in craniofacial biology at USC. *Conflict of Interest Disclosure: None reported.*

A 52-year-old female patient reported to the Orofacial Pain and Oral Medicine Center at the Ostrow School of Dentistry of University of Southern California with a chief complaint of constant sharp, severe localized pain of her hard palatal mucosa adjacent to tooth No. 4 for duration of two months. Her pain was not responsive to antibiotics and analgesics. The patient associated the onset of her pain two days postpalatal connective tissue graft surgery derived from mucosal tissue adjacent to tooth No. 4 that was performed to correct gingival recession of the anterior mandibular region (**FIGURE 1**).

Previous examination by her physician eliminated sinus pathology as a possible source of her pain. Upon examination by her general dentist, she was referred to an endodontist for evaluation of tooth No. 4. Root canal therapy (RCT) was performed on tooth No. 4. Temporary relief of her pain was reported after the procedure and severe pain returned two days later. Post-RCT, she was referred by her physician for MRI imaging, which revealed negative findings. She was prescribed amoxicillin and methylprednisolone for her symptoms. This drug regimen did not alleviate her pain and she suffered side effects of anxiety and indigestion. The chronicity of her constant, severe pain prompted her to visit a second endodontist who performed a second root canal in tooth No. 4. This was followed by a drug regimen of ibuprofen and hydrocodone/acetaminophen every six to eight hours. Again, the pain briefly subsided but returned with the same severity two days later. Then, a crown was

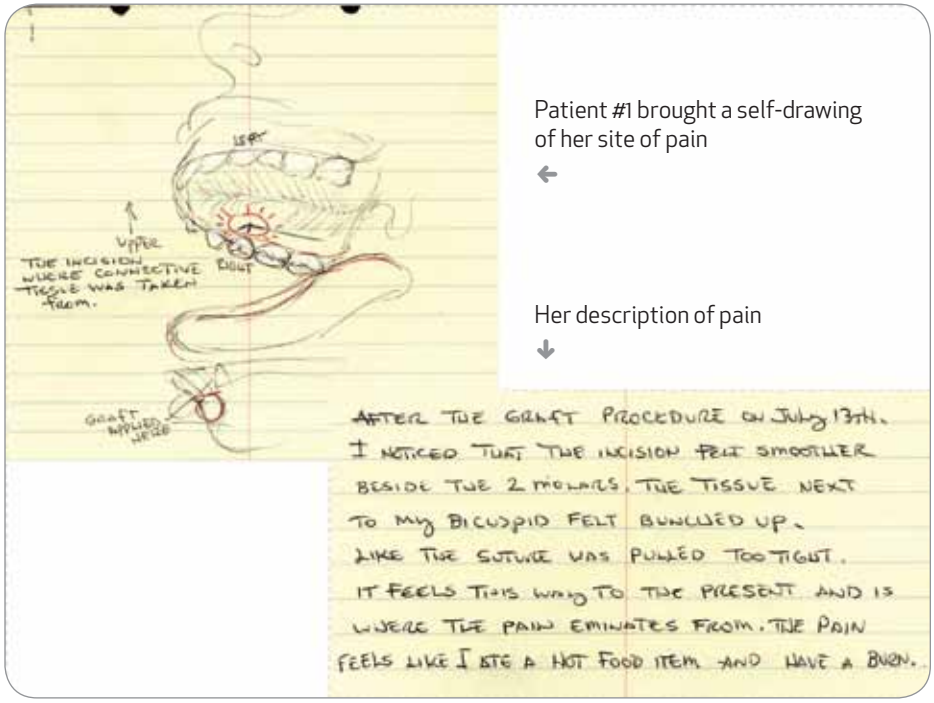


FIGURE 1. Patient's own illustration and explanation of pain that began after a palatal connective tissue graft surgery.

placed on tooth No. 4. Her pain became worse and she was referred to USC by the first endodontist. Her past medical history was noncontributory. Extraoral clinical examination of the patient had negative findings. Intraoral examination revealed no significant findings of the gingiva, mucosa, and alveolar bone. No significant dental attrition was noted.

A well-healed scar tissue was noted in hard palatal mucosa adjacent to tooth No. 4 with no other significant findings of the hard or soft palate. The dorsal, ventral, and lateral tongue was within normal limits, as was the floor of the mouth, pharynx, and salivary glands. Cranial nerve tests were normal. A periapical radiograph of teeth Nos. 2-4 showed a slightly overfilled root canal filling with crown noted in tooth No. 4 (**FIGURE 2**). There was no evidence of dental periapical radiolucencies or root fractures and an intact periodontal ligament width and space was noted. The panoramic radiograph revealed an existing root canal in tooth No. 4, without any evidence of periapical radiolucencies (**FIGURE 3**). There was no evidence of any bony radiolucencies, sinus pathology, or degeneration of the temporomandibular joints. There was a well-defined radiopacity in the No. 17 area, which was diagnosed as idiopathic osteosclerosis. She reported the severity of her pain as VAS 6/10 and that severe pain occurred during contact with food, drink, and cold air. A topical anesthetic test was performed with benzocaine 20 percent in the painful site (palatal mucosa adjacent tooth No. 4). The pain started at 5/10 and was totally resolved after six minutes (0/10). The patient was diagnosed with chronic trigeminal neuropathy with peripheral sensitization.

A comprehensive treatment plan was developed, and this included application of topical anesthetic (20 percent benzocaine) to the painful site up to four times a day (once after meals and once before sleep) for several weeks or until the pain was substantially diminished. A custom, neurosensory stent was fabricated to cover the painful site and maintain the medication applied in the area (**FIGURE 4**). Because the patient's pain and anxiety worsened

FIGURE 2. A periapical radiograph of teeth Nos. 2-4 that reveals a slightly overfilled root canal with an existing crown on No. 4.

over time, her psychiatrist prescribed duloxetine 20 mg BID. At a two-month follow-up, she reported having almost complete pain relief.

Atypical odontalgia (AO) is a subtype of trigeminal neuropathic pain defined as pain in the absence of clinical and radiographic evidence of disease including caries, tooth fracture, periodontal, or osseous pathology.[1,2-5] Multiple synonyms for AO exist, which may contribute to confusion for the clinician. These terms include phantom tooth pain, persistent facial pain, trigeminal deafferentation pain, atypical facial pain, stomatodynia, orofacial idiopathic pain, persistent orodental pain, idiopathic periodontalgia, idiopathic toothache, and, most recently, chronic continuous dental alveolar pain (CCDAP).[6-11]

Definitions of AO vary among individual associations. The International Headache Society (IHS), describes AO as persistent idiopathic facial pain that does not fulfill the criteria of cranial neuralgias and is not attributed to another disorder.[6] The International Association of the Study of Pain (IASP) defines AO as severe, throbbing pain that comes from a tooth without any pathology, and the American Academy of Orofacial Pain describes AO as a subset of continuous neuropathic pain.[12,13]

What Is the Epidemiology of Atypical Odontalgia?

The exact prevalence and incidence of AO has not been determined. Previous reports approximate 3-6 percent of patients undergoing endodontic treat-

FIGURE 3. A panoramic radiograph revealing an existing root canal in tooth No. 4, without any evidence of associated dental or periapical pathology.

FIGURE 4. A custom-made neurosensory stent fabricated to cover the painful site and to hold the topical medication.

ment suffer from AO.[14,15] More recent case series and retrospective studies show conflicting data regarding the incidence and prevalence of AO. An extremely low incidence (less than 0.38 percent) of AO was reported in a study of 1,035 patients undergoing extraction of third molar(s) under local anesthesia.[16] Another study evaluated patients that underwent extractions and reported a prevalence of 20 percent (n=50) and 14 percent (n=251) in patients with cluster and migraine headaches, respectively.[17] Conflicting data between studies may be confounded by the difficulty in diagnosing the condition in addition to sampling errors.[18]

Polycarpou et al. determined the prevalence of persistent pain after endodontic treatment. The postoperative follow-up period was from 12-59 months. A total of 175 patients were included. Of these, 21 patients (12 percent) had persistent chronic pain despite standard endodontic therapy.[19] In a retrospective study by Oshima et al., 271 patients reported persistent pain after endodontic treatment. Of these, 16 patients were diagnosed with neuropathic pain, revealing an incidence of 5.9 percent.[20] Another retrospective study by Ram et al. found that the prevalence of atypical odontalgia was 2.1 percent (n=3,000).[10] Klasser, et al. recently performed a retrospective study to determine the prevalence of neuropathic pain in patients who received nonsurgical endodontic therapy on a single tooth. A total of 18 subjects participated and 7 percent of these patients exhibited neuropathic pain after nonsurgical endodontic treatment.[21] Further, a systematic review by Nixdorf et al. reported a 5.3 percent frequency of persistent pain after endodontic procedures.[22]

Who Is Affected by Atypical Odontalgia?

Atypical odontalgia primarily manifests in the posterior dental and alveolar arches in women over 30 years of age.[1] Certain risk factors have been identified for manifesting chronic pain after endodontic treatment. These include the presence and duration of pain before treatment, percussion sensitivity of the tooth prior to treatment, a history of pain during treatment, a history of chronic pain problems, and the type of treatment rendered.[19] Other reports have also noted that women are affected much more than men.[10,20,23]

What Causes Atypical Odontalgia?

Atypical odontalgia is assumed to be a result of traumatic, peripheral nerve damage in the orofacial region. As a result of nerve damage, deafferentation, which is a partial or total loss of sensory nerve supply to a particular part of the body, occurs in the trigeminal afferent sensory neurons.[2,9] This results in pain that is neuropathic in origin.[2,9] However, in up to 64 percent of cases, a causative agent remains unidentified and therefore, in the majority of instances, the etiology of atypical odontalgia is unclear.[10,24] Mechanical nerve injury (secondary to injection, implant compression, osseous growth compression, neoplastic perineural invasion), metabolic disease (diabetic polyneuropathy, sympathetic nervous system-related neuropathy), neurotropic viral disease (herpes simplex, HIV), neurotoxicity (chemotherapeutic agents), inflammatory and/or immunologic mechanisms (multiple sclerosis), nervous system focal ischemia (thalamic syndrome), neurotransmitter system dysfunction (complex regional pain syndrome), nutritional deficiencies and idiopathic neuropathies have all been implicated in the etiology of neuropathic pain.[1,24-27]

In addition, inadequate use of local anesthetic during dental procedures could also be a risk factor for developing chronic neuropathic pain.[28] When a nerve is injured, there is an increase in spontaneous, afferent activity. This typically occurs several hours after the initial insult.[29] Stimulating the free nerve endings causes a release of inflammatory chemicals that sensitize nociceptors.[30] Blocking the injured nerve with anesthetic prior to the stage of increased afferent activity has been shown to inhibit neuropathic pain behavior (eliminate thermal hypersensitivity and reduce mechanical allodynia) in rats.[29] Pre-emptive analgesia can reduce peripheral and central sensitization, improve postoperative hyperalgesia, and provide optimal physiologic conditions (i.e., heart rate, blood pressure, etc.).[30] Other studies have also shown that injecting local anesthetic in the area of nerve injury (prior to executing the injury) can reduce deafferentation pain and hyperalgesia occurring postoperatively.[31]

What Is the Current Understanding of the Mechanisms Involved in the Development of Atypical Odontalgia?

Atypical odontalgia, as discussed above, is regarded as a neuropathy of the trigeminal nerve.[2,9] Specifically, the neural changes of neuropathic pain result in spontaneous pain that is frequently burning in quality and often exhibits hyperalgesia, allodynia, and/or parasthesia. Traumatic neuropathic pain, by definition, involves nerve damage, and since atypical odontalgia exhibits similar characteristics as that of neuropathic pain, it is considered to be a trigeminal neuropathy.[2] In addition to direct trauma, indirect nerve injury as a result of infection, neoplasms, osseous growth compression, diabetes, alterations in the sympathetic nervous system, medications, and chemical toxins are factors that have been implicated in the development of neuropathic pain. Idiopathic cases have also been reported.[1]

Previous theories regarding the pathophysiology of AO included psychogenic pain and vascular pain. Recent theories consider AO a form of neuropathic pain, specifically, deafferentation pain.[3,4] However, the precise molecular mechanisms of orodental neuropathic pain remain elusive. In each case, a normal sensory signal is translated into neuropathic pain.[1] Damage to the nerves causes somatosensory changes to the innervated area peripherally and/or centrally. In peripheral nerve injury, there is up-regulation of voltage gated sodium (Nav1.3 and Nav1.8) and calcium ($\alpha 2\gamma$ subunit) channels, down-regulation of potassium channels and a reduction in threshold of heat sensitive channels. As a result, peripheral nerves undergo ectopic discharge.[3,24,32] This leads to an increased release of glutamate and activation of N-methyl-D-aspartate (NMDA) receptors on second order neurons, which can then result in central sensitization.[3]

Altered regulation of gene transcripts associated with neuronal regeneration, survival, function, transduction and transmitter properties have also been reported as a potential etiology.[24] Increased excitatory neurotransmitter release or decreased inhibitory neurotransmitter release are other mechanisms that manifest as a heightened neuronal response. Nerve reorganization may play a role in generating neuropathic pain by means of cross-excitation and a loss of inhibitory mechanisms.[1,3,5,10,32-35]

SINCE ATYPICAL odontalgia exhibits similar characteristics as that of neuropathic pain, it is considered to be a trigeminal neuropathy.

Both processes may follow nerve injury. Alterations in the dopaminergic system may also contribute to the pathogenesis of AO.[3] In a given patient, a single mechanism or multiple mechanisms may be responsible, or there may be an evolution from one mechanism to another over the course of the disease.[3,36]

Other systems may contribute to the generation of neuropathic pain. For example, sympathetic nervous system involvement has been reported as a component of neuropathic pain that may result in symptoms of erythema or swelling of the skin.[3] This is consistent with common reports of increased pain during stress. In addition, the opioid- and N-methyl-D-aspartate (NMDA)-receptor linked systems have also been implicated in modulating the manifestations of hyperexcitablity.[9]

As described above, neuropathic pain is classified as centrally or peripherally sensitized. It should be recognized that this categorization is a convenient system in which to describe neuropathy, however, in reality it is likely a continuous spectrum of disease. Sensitization involving both the central and peripheral nervous systems has been determined based on objective findings. Progression results from the extension of involvement from the site of origin to implicate both peripheral and central nervous systems.[18] For example, diagnostic anesthetic blocks are equivocal. Since these blocks do not always relieve pain completely, evidence suggests neuropathic pain may involve both peripheral and central nervous systems simultaneously.[3]

Symptoms of AO may be described as positive or negative. Positive symptoms include pain evoked by normally innocuous stimuli, cold (allodynia) and/or an exaggerated or prolonged pain to noxious stimuli (hyperalgesia/hyperpathia).[2,24] List et al. reported that the majority of patients with AO exhibit somatosensory changes, of which the most common positive symptoms are pain secondary to pin prick, cold, and touch.[4] Negative symptoms, including hyposensitivity, are less commonly reported.[4]

How Does One Identify Patients With Atypical Odontalgia?

Obtaining an accurate and detailed history is an important part of diagnosing AO. Important questions must identify any potential history of trauma, treatment, or disease in the area of pain. If pain is reported, the duration, quality, pattern (continuous or episodic), specific triggers, and any potential association with stress must be elucidated. This information obtained through these questions can help the clinician determine the nature of the pain, identify whether it is neuropathic in origin, and rule out other differential

diagnoses. The differential diagnoses for AO would include dental-related pain (i.e., caries, pulpitis, dentin hypersensitivity), periodontal disease, trigeminal neuralgia, and pretrigeminal neuralgia. Questionnaires such as the Self-Administered Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS) may be of use in identifying patients with AO.[21]

How Does One Diagnose Atypical Odontalgia?

A suspicion of orodental neuropathic pain should be raised in a patient with pain in a tooth with a vital pulp with no evidence of infection and/or inflammation as a source of the pain. Periapical and panoramic radiographs should be obtained to aid in the diagnostic process of diagnosing a tooth with pulpal pathology. When radiographic findings are negative, sinus infection, myofascial pain, and temporomandibular joint pain should also be considered and eliminated.

There are three phases of diagnostic work-up proposed by Clark that may be followed for diagnosis of suspected AO[1] (**FIGURE 5**). These phases reveal a protocol that begins with eliminating a dental etiology of the pain. It then guides the clinician to consider other etiologies.[1] Atypical odontalgia is diagnosed by excluding these other causes (i.e., pulpal abnormality, occlusal problems, myofascial pain, temporomandibular joint pain, or sinus infection). Following this step-by-step protocol can help the clinician arrive at a diagnosis of atypical odontalgia.

Phase 1 is a baseline work-up which includes, 1) a thorough head and neck examination, 2) a cranial nerve examination with a focus on the trigeminal nerve, 3) a periapical radiograph of the affected area for evidence of apical abnormalities, 4) a panoramic radiograph for evidence of other maxillofacial disease, and 5) cold testing for pulpal vitality.[1]

In patients with no obvious etiology for the reported pain, four additional steps are conducted that comprise phase 2. The first step involves removal of local restorations with subsequent inspection of the tooth for any cracks under magnification (loupes).[37] This is performed in order to rule out any dental causes of the pain. If careful inspection results in negative findings, adjust the tooth in question slightly out of occlusion in order to fabricate an orthotic device for the purpose of examining the tooth loading pattern during sleep. If evaluation of the occlusal splint is negative, discontinue splint use and perform a diagnostic anesthetic test, as well as a cold test on the alveolar mucosa (gingival cold test).[1,2] The anesthetic test involves topical and infiltrative methods. If topical anesthetic reduces pain, the use of a neurosensory stent with topical anesthetic is indicated.[1] Administering 2 percent lidocaine with 1:100,000 epinephrine in the area of pain has been shown to decrease pain in most patients with AO.

A PROPER DIAGNOSIS is the most fundamental measure in effective management of patients with AO.

However, the more somatosensory symptoms present, the less effective the anesthetic appears to be, which indicates a role for central sensitization.[38] The gingival cold test involves spraying a cotton swab with commercial product such as those containing ethyl chloride and applying it to the alveolar mucosa apical to the tooth in question for three seconds. The presence of the intensity of the sensation and pain should be recorded. The presence of pain resulting from this test lasted longer after application in patients with AO (an average of 65.72 seconds in AO patients compared to 25.71 seconds in control patients).[2] If the topical anesthetic test is unsuccessful, systemic medications, usually anticonvulsants, should be initiated (see treatment protocol in No. 9).[1]

If the patient is unresponsive to the diagnostic tests or systemic medications in phase 2, an MRI of the brain should be ordered requesting a report from medical radiologist and a psychological consultation should be sought. Any evidence of pathology noted in these tests requires a referral to the appropriate specialist. If the results are negative, the patient should be reassessed by starting at phase 1 again. If the pain is severe, referral to a medical or dental pain specialist is appropriate.[1]

A proper diagnosis is the most fundamental measure in effective management of patients with AO. The primary objective of this three-phase diagnostic work-up is to successfully identify and evaluate these patients with AO. This powerful clinical tool has the potential to not only increase the frequency and accuracy of AO diagnoses, but it also has the potential to eliminate unnecessary endodontic and surgical treatments, resulting in less pain and trauma to the patient. It is important to note that in the absence of a definitive diagnosis based on identifying the etiology of the problem, endodontic treatment or extraction is not recommended.

Is Atypical Odontalgia Associated With any Comorbidity?

Multiple reports have noted a correlation between atypical odontalgia and psychiatric illnesses including depression, anxiety, and somatoform pain disorder.[25,39-41] This association does

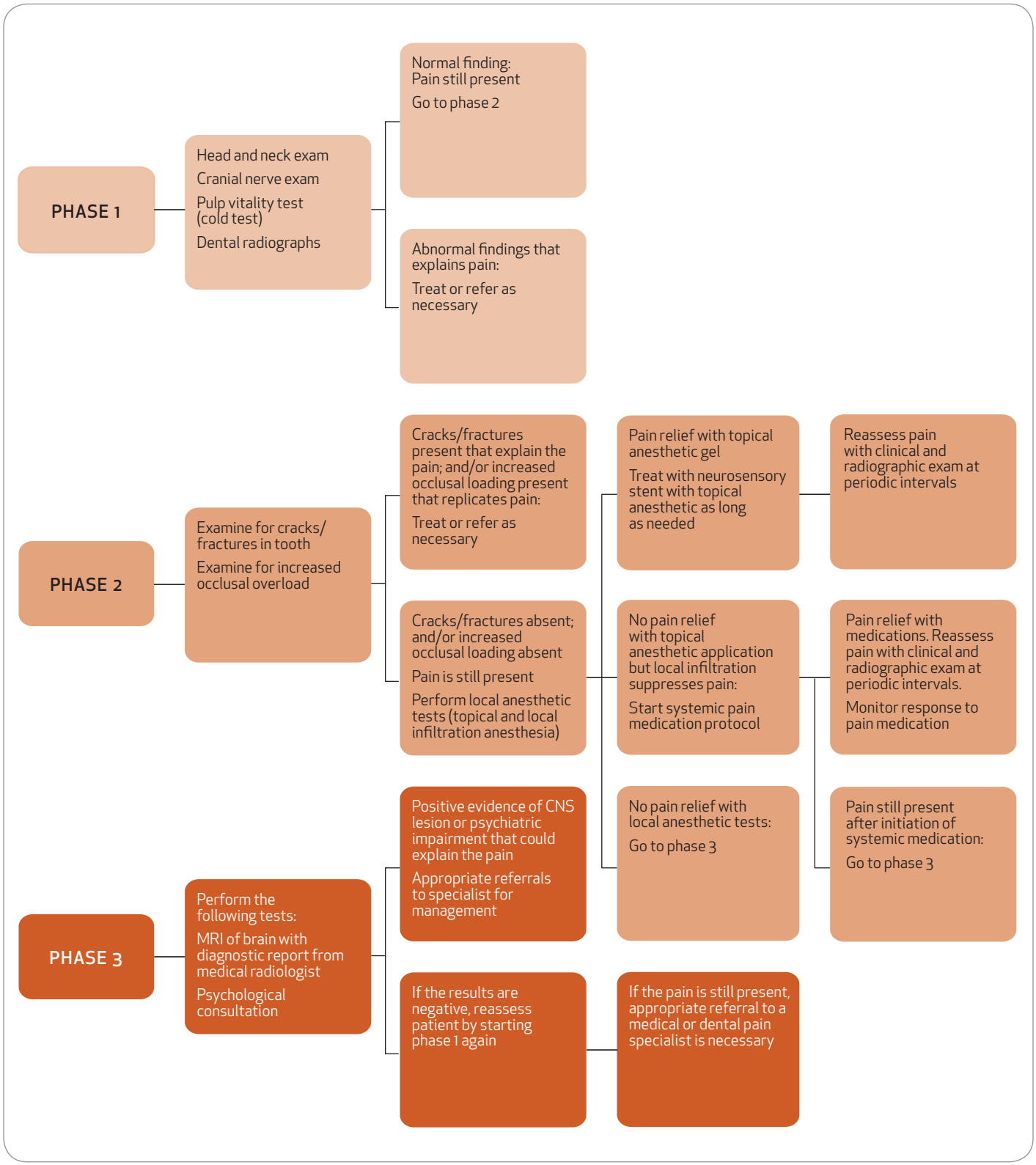


FIGURE 5. Diagnosis of suspected atypical odontalgia. (Modified table from Clark GT, Persistent orodental pain, atypical odontalgia, and phantom tooth pain: when are they neuropathic disorders? *J Calif Dent Assoc* 34(8):599-609, August 2006. Permission for reprint granted.)

not mean that one disorder causes the other, nor does it mean that all patients with depression and anxiety manifest a neuropathic pain disorder. Interestingly, patients suffering from neuropathic pain may subsequently develop psychological impairment as several studies have illustrated personality changes secondary to chronic pain.[1,42] Additional comorbidities in association with neuropathic pain have been described in the medical literature of orthopedics, internal medicine, neurology, and psychiatry.[42] A study by Wirz et al. reported that approximately 29.5 percent of patients (N=521) with chronic orofacial pain exhibited psychological disorders.[41] The authors emphasized that only half of these patients received appropriate referral for treatment of psychological disorders.[41]

What Is the Appropriate Management of Atypical Odontalgia?

When pain is localized to a peripheral origin, a neurosensory stent can be fabricated, and topical anesthetic may be applied to the painful site three to four times per day. When pain is centrally sensitized, systemic medication(s) acting at the level of central nervous system is often indicated.

Due to a lack of sufficient data on the management of AO, treatment is based on evidence related to neuropathic pain in other areas of the body. According to the Mayo Clinic guidelines on the management of neuropathic pain, first-line medications include antidepressants with both serotonin and norepinephrine reuptake inhibition (tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitors), calcium channel blockers/mild anticonvulsants (gabapentin, pregabalin), and topical lidocaine (in the case of peripherally sensitized neuropathic pain).[42]

Second-line medications that are available include tramadol and opioids. Because of the long-term safety concerns, these medications should only be used in patients who do not respond well to first-line medications. In cases of acute neuropathic pain, neuropathic pain caused by cancer, episodic exacerbations of severe neuropathic pain, and in the process of obtaining immediate relief during titration of first-line medications, second-line medications can be used as first-line therapy.[42] When patients do not respond adequately to first- and second-line medications, third-line medications can be used. These include certain antidepressants (bupropion, citalopram, and paroxetine), antiepileptic medications (carbamazepine, lamotrigine, oxcarbazepine, topiramate, and valproic acid), and topical low-concentration capsaicin, dextromorphan, memantine, and mexiletine.[42]

PATIENTS SUFFERING FROM neuropathic pain may subsequently develop psychological impairment as several studies have illustrated personality changes secondary to chronic pain.

Novel agents that lack adequate evidence for efficacy include botulinum toxin, high concentration capsaicin patch, lacosamide, selective serotonin reuptake inhibitors (third-line medications), acupuncture, biofeedback, and dental splints.[42] In 2009, the FDA approved a high concentration (8 percent) capsaicin patch, Qutenza, for neuropathic pain from postherpetic neuralgia in the United States. This patch can be applied in-office, in a single dose for 60 minutes. Phase 1 trial data have shown it to be effective in defunctionalizing nociceptors, and phase 3 trial data have shown efficacy in postherpetic neuralgia, and painful HIV-associated neuropathy. Relief was reported for up to 12 weeks.[43] In another study, the patch has been shown to relieve pain for up to three months in patients.[44] While there is little information regarding capsaicin efficacy for neuropathic pain of the trigeminal nerve, there may be potential benefit for its use intraorally, but additional studies are needed to elucidate a definitive role for this treatment.

If appropriate medication is unsuccessful, then phase 3 is initiated. An MRI of the brain is indicated along with psychological consultation to identify the possibility of comorbid conditions such as depression and/or anxiety. Not only is a psychological consultation necessary in some cases of AO, but a multidisciplinary approach including neurologists, otolaryngologists, and other medical and dental providers may be beneficial. AO can be complicated by other disorders such as headaches, musculoskeletal disorders, and somatization, and therefore, a comprehensive evaluation and treatment plan is required.[3]

Management of atypical odontalgia can be challenging. Often patients are prescribed a first-line medication, and, with time, medications may be changed or additional medications may be added. Treatment has the potential to be complex and dentists with advanced training in orofacial pain and medical specialists may often be involved in the appropriate management of these patients.

What Is the Prognosis of Atypical Odontalgia?

There is not a sufficient amount of evidence available to determine the success of treatment in patients with AO, but based on the few studies present, approximately 25 percent of patients with AO will have complete pain relief, occurring in five or more years after initiation of therapy.[1,45,46]

Summary

Atypical odontalgia is a commonly underdiagnosed and misdiagnosed condition. Although not a new phenomenon, proper diagnosis and treatment of this disorder remains a challenge to the dental community and its specialties. The consequence of misdiagnosis is often multiple unnecessary dental treatments, such as root canal treatments and/or extractions, which contribute to a worsening of symptoms in patients suffering from AO. ■■■■

REFERENCES

1. Clark GT, Persistent orodental pain, atypical odontalgia, and phantom tooth pain: when are they neuropathic disorders? *J Calif Dent Assoc* 34(8):599-609, 2006.
2. Zagury JG, Eliav E, et al, Prolonged gingival cold allodynia: a novel finding in patients with atypical odontalgia. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 111(3):312-9, 2011.
3. Baad-Hansen L, Atypical odontalgia — pathophysiology and clinical management. *J Oral Rehabil* 35(1):1-11, 2008.
4. List T, Leijon G, Svensson P, Somatosensory abnormalities in atypical odontalgia: a case-control study. *Pain* 15;139(2):333-41, 2009.
5. Ito M, Kimura H, et al, Effectiveness of milnacipran for the treatment of chronic pain in the orofacial region. *Clin Neuropharmacol* 33(2):79-83, 2010.
6. International Headache Society, IHS Classification ICHD-II. ihs-classification.org/en/02_klassifikation/04_teil3/13.18.04_facialpain.html. Accessed Feb. 8, 2011.
7. Nagamatsu C, Nawachi K, et al, Longitudinal follow-up of symptom severity of a patient with continuous neuropathic pain assessed by actual drug consumption record. *Nihon Hotetsu Shika Gakkai Zasshi* 49(5):691-96, 2005.
8. Baad-Hansen L, Juhl GI, et al, Differential effect of intravenous S-ketamine and fentanyl on atypical odontalgia and capsaicin-evoked pain. *Pain* 129:46–54, 2007.
9. Woda A, Pionchon P, A unified concept of idiopathic orofacial pain: pathophysiologic features. *J Orofac Pain* 14(3):196-212, 2000.
10. Ram S, Teruel A, et al, Clinical characteristics and diagnosis of atypical odontalgia. *J Am Dent Assoc* 140(2):223-28, 2009.
11. Greene C, Atypical odontalgia: an oral neuropathic phenomenon. *J Am Dent Assoc* 142(9):1031-32, 2011.
12. Part III: pain terms, a current list with definitions and notes on usage, in Merskey H, Bogduk N, eds., Classification of chronic pain, second ed., IASP Task Force on Taxonomy. Seattle, IASP Press, pages 209-14, 1994.
13. Blasberg B, Greenberg M, Orofacial pain, in Greenberg M , Glick M, eds., Burket's oral medicine: diagnosis and treatment. Hamilton, BC Decker, Inc., pages 1-34, 2003.
14. Campbell RL, Parks KW, Dodds RN, Chronic facial pain associated with endodontic therapy. *Oral Surg Oral Med Oral Pathol* 69(3):287-90, 1990.
15. Marbach JJ, Hulbrock J, et al, Incidence of phantom tooth pain: an atypical facial neuralgia. *Oral Surg Oral Med Oral Pathol* 53(2):190-3, 1982.
16. Berge T, Incidence of chronic neuropathic pain subsequent to surgical removal of impacted third molars. *Acta Odontol Scand* 60(2):108-12, 2002.
17. Nicolodi M, Sicuteri F, Phantom tooth diagnosis and an anamnestic focus on headache. *N Y State Dent J* 59(10):35-7, 2002.
18. Vickers F, Cousins M, Neuropathic orofacial pain part 1-prevalence and pathophysiology. *Australian Endod J* 26(1):19-26, 2001.
19. Polycarpou N, Ng Y, et al, Prevalence of persistent pain after endodontic treatment and factors affecting its occurrence in cases with complete radiographic healing. *Int Endod J* 38:169-78, 2005.
20. Oshima K, Ishii T, et al, Clinical investigation of patients who develop neuropathic tooth pain after endodontic procedures. *J Endod* 35(7):958-61, 2009.
21. Klasser G, Kugelmann M, et al, The prevalence of persistent pain after nonsurgical root canal treatment. *Quintessence Int* 42:259-69, 2011.
22. Nixdorf D, Moana-Filho E, et al, Frequency of persistent tooth pain after root canal therapy: a systematic review and meta-analysis. *J Endod* 36:224-30, 2010.
23. Peñarrocha Ma, Mora E, et al, Idiopathic trigeminal neuropathies: a presentation of 15 cases. *J Oral Maxillofacial Surg* 67:2364-8, 2009.
24. Woolf CJ, Dissecting out mechanisms responsible for peripheral neuropathic pain: implications for diagnosis and therapy. *Life Sci* 74(21):2605-10, 2004.
25. Kuch K, Psychological factors and the development of chronic pain. *Clin J Pain* 17(4 suppl):S33-8, 2001.
26. Zimmermann M, Pathobiology of neuropathic pain. *Eur J Pharmacol* 429(1-3):23-37, 2001.
27. Robinson PP, Boissonade FM et al, Peripheral mechanisms for the initiation of pain following trigeminal nerve injury. *J*

Orofac Pain 18(4):287-92, 2004.
28. Xie W, Strong J et al, Neuropathic pain: Early spontaneous afferent activity is the trigger. *Pain* 116(3):243-56, 2005.
29. Foreman P, Preemptive analgesia: the prevention of neurogenous orofacial pain. *Anesth Prog* 42:36-40, 1995.
30. Dougherty PM, Garrison CJ, Carlton SM, Differential influence of local anesthetic upon two models of experimentally induced peripheral mononeuropathy in the rat. *Brain Res* 570(1-2):109-15, 1992.
31. Melzack R, Coderre T ,et al, Central neuroplasticity and pathological pain. *Ann N Y Acad Sci* 933:157-74, 2001.
32. Costigan M, Woolf CJ, Pain: molecular mechanisms. *J Pain* 1(3 suppl):35-44, 2000.
33. Melis M, Zawawi K, et al, Complex regional pain syndrome in the head and neck: a review of the literature. *J Orofac Pain* 16(2):93-104, 2002.
34. Seltzer Z, Devor M, Ephaptic transmission in chronically damaged peripheral nerves. *Neurology* 29(7):1061-64, 1979.
35. Woolf CJ, Bennett GJ, et al, Toward a mechanism-based classification of pain? *Pain* 77(3):227-9, 1998.
36. Melis M, Lobo SL, et al, Atypical odontalgia: a review of the literature. *Headache* 43(10):1060-74, 2003.
37. Brynjulfsen A, Fristad I, et al, Incompletely fractured teeth associated with diffuse long-standing orofacial pain: diagnosis and treatment outcome. *Int Endod J* 35(5):461-6, 2002.
38. List T, Leijon G, et al, Effect of local anesthesia on atypical odontalgia – a randomized controlled trial. *Pain* 122(3):306-14, 2006.
39. Brooke RI, Atypical odontalgia. A report of 22 cases. *Oral Surg Oral Med Oral Pathol* 49(3):196-9, 1980.
40. Klausner JJ, Epidemiology of chronic facial pain: diagnostic usefulness in patient care. *J Am Dent Assoc* 125(12):1604-11, 1994.
41. Wirz S, Ellerkmann R, et al, Management of chronic orofacial Pain: a survey of general dentists in German university hospitals. *Pain Medicine* 11(3):416-24, 2010.
42. Dworkin R, O'Connor A, et al, Recommendations for the pharmacological management of neuropathic pain: an overview and literature update. *Mayo Clinic Proc* 85(3) (suppl):S3-S14, 2010.
43. Anand P, Bley K, Topical capsaicin for pain management: therapeutic potential and mechanisms of action of the new high concentration capsaicin 8 percent patch. *Br J Anaesthesia* 107(4):490-502, 2011.
44. England J, Wagner T, et al, The capsaicin 8 percent patch for peripheral neuropathic pain. *Br J Nurs* 20(15):926-31, 2011.
45. Allerbring M, Haegerstam G, Chronic idiopathic orofacial pain. A long-term follow-up study. *Acta Odontol Scand* 62(2):66-9, 2004.
46. Wolf E, Nilner M et al, Long-term follow-up by means of a questionnaire of 109 patients with long-lasting orofacial pain. *Swed Dent J* 6(3):125-34, 2002.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT / Satish K.S. Kumar, DDS, MDSc, University of Southern California, Herman Ostrow School of Dentistry, 925 W. 34th St., Room 130, Los Angeles, Calif., 90089.

DENTIST **LAWYER** **BROKER**

SPECIALIZING IN DENTAL PRACTICE SALES, TRANSITIONS & VALUATIONS

A. LEE MADDOX, DDS, ESQ.

MPG
MADDOX
PRACTICE GROUP

KERRI MCCULLOUGH

Now with California offices in La Jolla, Los Angeles, Newport Beach and Walnut Creek

We have been involved with more than **1000 dental practice transactions**.

Here are some of our current listings:

NEW LISTING - $650,000 - General Dentistry Practice in Santa Ana, Orange County, Southern California with four (4) operatories, fully equipped, x-ray room, dark room, reception area. Practice in the same location for 24 years.

NEW LISTING - $709,000 - General Dentistry Practice in Coastal Orange County, Southern California, with four (4) operatories, fully equipped. Great location near shopping center. Modern, beautifully appointed office with high end finishes. Must see! Call our office for more information.

$500,000 - General Dentistry Practice in South Orange County, Southern California with four (4) operatories, fully equipped, sterilization-lab combo, adjustment lab, staff lounge, private office, over 31 years of goodwill, doctor retiring.

SOLD

$80,000 - Dental Leasehold Improvements and Equipment in Lake Forest, Orange County, Southern California with four (4) operatories, sterilization room, reception room, staff lounge, and private office in a retail center with plenty of foot traffic.

$430,000 - Prosthodontic Practice in Walnut Creek, Contra Costa County, Northern California with three (3) operatories, fully equipped, two-desk laboratory, administrative office, and private office near a retirement community. Doctor retiring, 28 years in the same location.

NEW LISTING - $1,100,000 - This office does it all! General Dentistry / Specialty Practice in Sacramento, Sacramento County, Northern California, with two (2) suites, one consists of general dentistry, the other does Specialty work. Nine (9) total operatories, six (6) equipped, three (3) plumbed, not equipped, with sterilization room, adjustment lab, x-ray room, dark room, reception area, staff lounge, private office, and storage room. Digital xrays, paperless office. Member of most PPO/HMO plans, **large monthly CAP CHECKS.**

$300,000 - General Dentistry Practice in Brea, Orange County, Southern California, with four (4) operatories, includes equipment, sterilization room, private office in a shopping center near mall and freeway.

SOLD

NEW LISTING - $450,000 - General Dentistry Practice in N. San Diego County, Southern California with five (5) operatories, sterilization room, adjustment lab, dark room, reception area, staff lounge, and business office. Located in a professional building. Established over 37 years, this practice refers out all specialty work. Room to grow!

PRICE REDUCTION - $4,500,000 - Implant Practice in Orange County, Southern California. This is a large, state-of-the-art practice with an in-house, full-service lab, private office, call center, and much more all located in a beautiful professional building.

$95,000 - Leasehold Improvements in Pasadena, Los Angeles County, Southern California with six (6) Adec Chairs/ Lights in a great part of town. Contact our office for more information.

PRICE REDUCTION - $300,000 - General Dentistry Practice in Los Alamitos, Orange County, Southern California with seven (7) operatories, sterilization room, wet lab, business office, private office, staff lounge. Located on a busy street with plenty of frontage. **IN ESCROW.**

NEW LISTING - $650,000 – General Dentistry practice in Cypress, Orange County, Southern California with six (6) operatories, $13k cap checks/union per month, 20 years in same location. Call our office for more information. **IN ESCROW.**

$545,000 - Amalgam-free General Dentistry Practice in Westwood, Los Angeles County, Southern California with five (5) operatories, includes equipment, wet lab, consultation/ seminar room, sterilization room. Doctor retiring. Great location across from UCLA campus in a professional building.

$450,000 - General Dentistry Practice in La Verne, Los Angeles County, Southern California with four (4) operatories, private office, staff lounge, sterilization/lab combo, adjustment lab, x-ray room, dark room, reception area in a retail center. Over 33 years of Goodwill.

SOLD

$120,000 - General Dentistry Practice in Rancho Cucamonga, San Bernardino County, Southern California, with three (3) operatories, sterilization/lab combo, reception room and much more in a busy retail center. Practice has been in business over 20 years. Call our office for more information.

A. LEE MADDOX, DDS, ESQ. BROKER NUMBER - 01801165

888-685-8100 | INFO@MADDOXPRACTICEGROUP.COM | WWW.MADDOXPRACTICEGROUP.COM

LAW OFFICES OF
A. LEE MADDOX, DDS

COMPREHENSIVE & PROFESSIONAL LEGAL SERVICES EXCLUSIVLY FOR DENTISTS

- Lease Reviews
- Partnership Agreements
- Practice Purchase Agreements
- Corporation Formation / Dissolutions
- Space Sharing Group / Solo Agreements
- Associate / Independent Contractor Agreements
- MSO /BSO Agents
- LLC Formation and Agreements

EMAIL: LMADDOX@CADENTALLAW.COM | WWW.CADENTALLAW.COM

EXPERIENCE **PROFESSIONALISM** **INTEGRITY** **EXPERTISE**

CDA JOURNAL, VOL 40, Nº9

Peripheral Ossifying Fibroma: A Clinical Report

BIANCA NAZARETH, MDS; HARSHWARDHAN ARYA, MDS; AND RINKEE MOHANTY, MDS

ABSTRACT Most localized growths on the gingiva are considered to be reactive rather than neoplastic in nature. The authors describe a 20-year-old male patient with a peripheral ossifying fibroma in the maxilla exhibiting significant size with the disease duration of one year. The signs of recurrence in spite of thorough excision and debridement exposed the need for further study of the causes of recurrence. Clinical, radiographical, and histological characteristics are discussed.

AUTHORS

Bianca Nazareth, MDS, is a senior lecturer, Department of Periodontics and Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra State, India. *Conflict of Interest Disclosure: None reported.*

Harshwardhan Arya, MDS, is an associate professor, Department of Prosthodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra State, India. *Conflict of Interest Disclosure: None reported.*

Rinkee Mohanty, MDS, is a professor, Department of Periodontics and Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra State, India. *Conflict of Interest Disclosure: None reported.*

Localized gingival enlargements are fairly common and typically represent reactive proliferative lesions, rather than true neoplasms.[1-3] Reactive or inflammatory lesions represent more than 90 percent of histopathologically analyzed gingival biopsies and most commonly include diagnoses of pyogenic granuloma, fibrous hyperplasia, peripheral ossifying fibroma, and peripheral giant cell granuloma.[1,2]

Peripheral ossifying fibroma (POF) has been cited in the literature under various names such as cemento-ossifying fibroma, peripheral fibroma with osteogenesis, peripheral odontogenic fibroma, calcifying fibroblastic granuloma etc.[1,4]

POF is defined as a well-demarcated and occasionally encapsulated lesion consisting of fibrous tissue containing variable amounts of mineralized material resembling bone (ossifying fibroma).[5] It is considered to be the soft-tissue counterpart to central ossifying fibroma. A case of POF in the maxillary gingiva of a 20-year-old male patient is described in this report.

Case Report

A 20-year-old apparently healthy male patient reported to the department of periodontics with the chief complaint of soft-tissue overgrowth in the palate. The patient first noticed it one year ago but did not seek treatment until it reached the current proportions. Extraoral examination showed bilateral facial symmetry and overlying skin showed no signs of inflammation. The regional lymph nodes were nonpalpable. A thorough intraoral examination

FIGURE 1. Preoperative condition of the gingiva and buccal view of the lesion.

FIGURE 2. Growth extending from midline to tooth No. 14.

FIGURE 3. Occlusal radiograph.

revealed a firm, reddish, sessile mass on the palatal aspect of the maxillary left permanent central incisor–premolar region (teeth Nos. 9-14). Severely carious and malpositioned first and second premolars (teeth Nos. 12 and 13) were also associated with the lesion. The lateral incisor and canine appeared to have been displaced buccally. The lesion was large; approximately 3 cm mesiodistally and 2 cm buccopalatally. The mucosa overlying the lesion was intact and pinkish-red in color. The lesion was painless unless traumatized by enthusiastic toothbrushing or chewing certain hard foodstuff.

Prescribed radiographs included a periapical radiograph (IOPA) and an occlusal radiograph. The occlusal radiograph revealed a soft-tissue shadow extending from tooth No. 10 to tooth No. 12 on the buccal aspect. Tooth No. 11 appeared displaced buccally on the occlusal radiograph along with diffuse radiopacities, which overlap on the normal trabecular pattern of bone. The lesion demonstrated diffuse radiopacities in a flocculent (fluffy or wooly appearance) pattern between teeth Nos. 10 and 11 extending interdentally as well as crestal bone resorption between teeth Nos. 9 and 10. The lamina dura of teeth Nos. 10 and 11 appear to have been partially lost.

A provisional diagnosis of peripheral ossifying fibroma was reached. After ensuring that the hemogram of the patient was within normal limits, an excisional biopsy of the lesion was performed under local anesthesia. Tooth No. 12 and tooth No. 13 were extracted.

Histological examination of the specimen revealed a peripheral covering of parakeratinized stratified squamous epithelium with moderate to marked proliferation. The basement membrane was intact uniformly. The connective tissue showed variable degree of maturation: more cellular in the juxta-epithelial region while being more mature in the deeper region where a typical whorled pattern was observed. In addition, there was evidence of calcifications in the hypercellular fibroblastic stroma in the form of numerous bony trabeculae scattered in the connective tissue confirming the diagnosis of POF.

The initial follow-up of the case showed uneventful healing. However approximately three months after the procedure there appeared to be signs suggestive of recurrence in the same region. A slight swelling, when compared to the contralateral side, was noted. Also, the patient's oral hygiene was found to be lacking, resulting in continued gingivitis in the rest of the mouth.

A second, more thorough surgical procedure was planned for the same patient; however, the patient did not return for subsequent follow-up visits.

Discussion

A POF may occur at any age but exhibits a peak incidence between the second and third decades. Almost 60 percent of the lesions occur in the maxilla and mostly occur anterior to the molars in the second decade of life, which is consistent with the presented case. The lesion affects females more often than males (5:1 respectively).[6]

FIGURE 4. Radiograph showing soft-tissue shadow and radiopacities between tooth No. 10 and No. 11.

Clinically, POF is sessile or pedunculated, usually ulcerated and erythematous, or exhibits a color similar to that of surrounding gingiva. It does not blanch on palpation.[4,7]

The case presented with significant amounts of plaque, calculus, and a significantly carious tooth that encouraged further food lodgement – all of which are considered to be irritants triggering the lesion.[8]

The lesions of POF are usually less than 1.5-2 cm in diameter, but have been known to grow to larger sizes.[9] The growth in the above case was significantly larger in size than the average lesion. POF can cause resorption of the alveolar crest and separation of adjacent teeth with pathologic migration, both of which were seen in the present case.[9]

FIGURE 5. Excised growth.

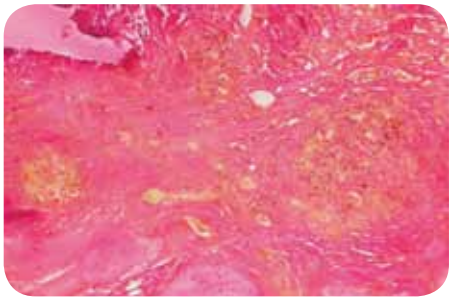


FIGURE 6. Histological picture of the lesion (H&E staining at 10x).

FIGURE 7. Postop after three months showing signs of recurrence.

Histologically, a typical ulcerated POF can exhibit three zones:

- **Zone I:** The superficial ulcerated zone covered with fibrinous exudates and enmeshed with polymorphonuclear neutrophils and debris.
- **Zone II:** The zone below the surface epithelium composed almost exclusively of proliferating fibroblasts with diffuse infiltration of chronic inflammatory cells mostly lymphocytes and plasma cells.
- **Zone III:** More collagenized connective tissue with less vascularity and high cellularity; osteogenesis consisting of osteoid and bone formation is a prominent feature, which can even reach the ulcerated surface in some cases.

The nonulcerated POF lesions are similar to an ulcerated type except for the presence of surface epithelium.[10] The presented case demonstrated the features of a nonulcerated POF.

Treatment requires proper surgical intervention that ensures thorough excision of the lesion including the involved periosteum and the periodontal ligament. Thorough full-mouth scaling and root planing should be accomplished.

The recurrence rate of the POF is said to be 7-20 percent.[4,6-8] Recurrence probably occurs due to incomplete removal of lesion, repeated injury or persistence of local irritants.[7] The apparent progress toward recurrence, seen in the case presented, may be the result of one or both of two possibilities. One being the continued plaque accumulation during follow-up, which means one of the possible etiological factors has not been eliminated leading to a recurrence. The other possibility is an inadequate removal of the lesion at the time of the surgical excision that has led to the lesion regrowing at the same site.

Conclusion

In conclusion, it is difficult clinically to differentiate between the various gingival lesions. For positive identification, the lesion must be examined thoroughly both radiographically and histologically. Also, regardless of the surgical technique employed, its complete removal as well as complete elimination of the etiological factors must be achieved to prevent recurrence. ■■■■

REFERENCES

1. Bhaskar SN, Levin MP, Histopathology of the human gingiva (study based on 1,269 biopsies). *J Periodontol* 44:3-17, 1973
2. Stablein MJ, Silverglade LB, Comparative analysis of biopsy specimens from gingiva and alveolar mucosa. *J Periodontol* 56:671-6, 1985.
3. Van der Waal I, Nonplaque-related periodontal lesions. An overview of some common and uncommon lesions. *J Clin Periodontol* 18:436-40, 1991.
4. Walters JD, Will JK, et al, Excision and repair of the peripheral ossifying fibroma : A report of three cases. *J Periodontol* 72:939-44, 2001.
5. Waldrom CA, Fibro-osseus lesions of the jaws. *J Oral Maxillofac Surg* 51:828–35, 1993.
6. Buchner A, Hansen LS, The histomorphological spectrum of peripheral ossifying fibroma. *Oral Surg Oral Med Oral Pathol* 63:452-61, 1987.
7. Kenney JN, Kaugars GE, Abbey LM, Comparison between the peripheral ossifying fibroma and peripheral odontogenic fibroma. *J Oral Maxillofac Surg* 47:378-82, 1989.
8. Gardner DG, The peripheral odontogenic fibroma: an attempt at clarification. *Oral Surg* 47:378-82, 1982.
9. Poon CK, Kwan PC, Chao SY, Giant peripheral ossifying fibroma of the maxilla: report of a case. *J Oral Maxillofac Surg* 53:695-8, 1995.
10. Bhaskar NS, Jacoway JR, Peripheral fibroma and Peripheral fibroma with calcification : report of 376 cases. *J Am Dent Assoc* 73:1312-20, 1966.

TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Bianca Nazareth, MDS, at dr.bianca.naz@gmail.com.

Specializing in the Selling and Appraising of Dental Practices

CALIFORNIA PRACTICE SALES INC.

Serving California Since 1974

"Your local Southern California Broker"

Phone: (714) 639-2775
(800) 697-5656
Fax: (714) 771-1346
Email: jknipf@aol.com
rpalumbo@calpracticesales.com
WWW.CALPRACTICESALES.COM

John Knipf & Robert Palumbo

LOS ANGELES COUNTY

CERRITOS (GP) Turn-Key practice w/ over 40 yrs of gdwll in a strip mall w/ no vacancies. 3 eqops/4 plumbed to expand. ID # 4205.
DOWNEY(GP) - Turn-Key office w/ 50 yrs of gdwll in medical bldg w/ 3 eq ops/1 plmd no eq. Low sales price for immediate sale. #4203.
LOS ANGELES - General Practice w/ 18 yrs gdwll in free standing bldg with 5 spacious ops. Monthly revenues of $30K/mo. ID# 4113.
LOS ANGELES (GP) - State-of-the art off w/ 34 yrs gdwll on one of the busiest blvds. Has 4 eq. ops w/. Dentrix software. ID#4147
N. HOLLYWOOD (GP)- New build out, store front Turn-Key office w/ excellent signage. Office has 7 spacious office. ID #4211.
MONROVIA - Dental space for rent in a busy shopping center on a major street w/ great visibility. 1 eq. op / 7 plumbed not eq. ID #4207.
SAN GABRIEL (Spec./GP) - 2 practices bundled here that can be sold together or separately. Corner location w/ great signage. ID#4139.
SANTA CLARITA - GP nestled up against the mountains with a beautiful view. Consists of 4 eq. ops & 2 plmbd in 1 story bldg. ID#4133.
TARZANA - Located in 3 story Med bldg. 5 eq ops. Seller works 2.5 days/wk. Grossed $447,681 in 2011. NET OF $163K ID #4157.
SOUTH GATE - Equip & Charts! Fee for service office on busy shopping center w/ 2 eq ops & 2 ops to expand.ID # 4199.
W. HOLLYWOOD - Located in Prestigious bldg w/ mountain views. 3 ops. 48 yrs of gdwll. Grossed approx.$1,031,093 in 2011. ID#4153.
WESTLAKE VILLAGE - Equip & Charts! Beautiful office set up for Paperless / Digital. Located on 2nd floor of Med bldg. ID #3211.
WESTWOOD (GP) - With over 30 years of goodwill this modern designed office is in a 12 story med/dent bldg. 2 eq ops. ID # 4181.

ORANGE COUNTY

HUNTINGTON BEACH (GP) - State-of-the-Art office located in a 2 story prof. bldg. w/ 5 eq. ops. / 2 plmbd to expand. ID # 4027.
IRVINE - Located in busy shopping cntr w/ lots of foot traffic. Modern designed w/ 4 eq. ops. Over 10 years of goodwill. ID #4053.
IRVINE - Great opportunity for GP or Specialist!! Leasehold & Equip Only! 5 eq. ops. located in busy large shopping center. ID #3401.
LAGUNA HILLS - General practice located in 2 story busy shopping center. 19 yrs gdwll. 4 eq. ops. NET OF $230K . ID # 4155.
LAGUNA NIGUEL - Turn key office located in busy shopping center w/ 3 eq ops in 1,119 sq. ft. suite. Digital office. ID#4163
ORANGE - Fee for service practice open 4 days/wk located in a single story med center w/ 4 eq. ops., on a 1,040 sq. ft. suite.ID #3531.
SAN JUAN CAPISTRANO - Equip & Charts! Modern designed practice w/ 3 fully eq. ops. in a 1,113 sq. ft. suite. ID #3071
SANTA ANA (GP) - Turn-Key Location. Absentee owner. Long established practice w/ 4 eq ops. Seller owns Bldg. ID #4071.

RIVERSIDE / SAN BERNARDINO COUNTIES

CATHEDRAL CITY - Leasehold & Equip Only! Bank owned location. Consists of 7 spacious eq. ops. Corner location. ID # 4173.
CHINO HILLS - Equip & Charts! Excellent starter opportunity. Has 4 ops in a busy shopping center. Off freeway. ID # 4135.
LA QUINTA - Price Reduced. Leasehold & Equip Only! Located in strip shopping center W/ 3 eq. ops, 1,000 sq. ft. ste.ID#4063
LAKE ELSINORE (GP) -This modern design office established in 2007. Has great visibility and signage. Some Cap. ID #4189.
RANCHO CUCAMONGA - Leasehold & Equip Only! Consists of 4 eq. ops in a 1,275 sq. ft. suite in busy shopping center. ID # 4161.
TEMECULA - Leasehold & Equip Only! Bank owned office with 2 eq. ops, 2 plumbed not eq. in a 3 story prestigious building. ID #4159.

SAN DIEGO COUNTY

OCEANSIDE(GP) - TurnKey office w/ 3 ops in professional bldg with ocean view. 52 years of goodwill. Fee for service. ID # 4191.

VENTURA & KERN COUNTY

CENTRAL COAST - Located in a Historic Colony District on a 1 story bldg . Fee for Service. 3 eq.. ops. Proj. $1M for 2012. ID # 4201.
BAKERSFIELD (GP) - Located in free standing bldg owned by Seller. 3 eq ops. Ins/Cash/Medi-cal/Some Cap. NET OF $354K. ID #4165
PORT HUENEME (GP) - Absentee Owner Practice. Established in 1980. Consists of 3 eq. ops, in a 920 sq. ft. suite. ID #4167.
VENTURA -Turn Key office w/ 3 eq. ops. 24 years of goodwill. Located in single strip mall on one of the busiest intersections. ID #4193.

Need CE Credits View Upcoming Continuing Education Opportunities
http://www.calpracticesales.com/blog

Call us about Debt Consolidation & Retirement Planning
VISIT OUR WEBSITE WWW.CALPRACTICESALES.COM
CA DRE#00491323

John Knipf
President

Also serving you: Robert Palumbo, Executive V. P. /Partner, Alice C. King, V.P., Greg Beamer, V.P., Tina Ochoa, V.P., & Maria Silva, V.P.

How to Place a Classified Ad

The *Journal* has changed its classified advertising policy for CDA members to place free classified ads online and publish in the *Journal*. Only CDA members can place classified ads. Non-CDA members can place display ads.

All classified ads must be submitted through cda.org/classifieds. Fill out the blank fields provided, including whether the ad is to appear online only or online and in the *Journal*. Click "post" to submit your ad in its final form. The ad will be posted immediately on cda.org and will remain for 60 days.

Classified ads for publication in the *Journal* must be submitted by the fifth of every month, prior to the month of publication. Example: Jan. 5 at 5 p.m. is the deadline for the February issue of the *Journal*. If the fifth falls on a weekend or holiday, then the deadline will be 5 p.m. the following workday. After the deadline closes, classified ads for the *Journal* will not be accepted, altered or canceled. Deadlines are firm.

Classified advertisements available are: Equipment for Sale, Offices for Sale, Offices for Rent or Lease, Opportunities Available, Opportunities Wanted, and Practices for Sale.

For information on display advertising, please contact Corey Gerhard at 916-554-5304 or corey.gerhard@cda.org.

CDA reserves the right to edit copy and does not assume liability for contents of classified advertising.

OFFICES FOR RENT OR LEASE

OFFICE FOR RENT OR LEASE — Newly constructed and built-out dental office with 3 fully equipped operatories. Contact Dmengdds@gmail.com.

OFFICE FOR RENT OR LEASE — Fully equipped dental office for lease in prime area in Newark, Calif. 4 ops, ster room, recp room, 2 bathrms, dk room, stor room, lab, priv off, and bus off. Central air, vacuum & amalgam separator are provided. Offices are fully equipped in a move-in condition with 4 X-rays, pano X-ray, 2 intraoral cameras, N2O2 in all ops and full complement of dental instruments. Great opportunity for recent grads. Call 510-792-1456 for more info and appt for inspection.

OFFICE FOR RENT OR LEASE — We're offering a great opportunity to sublease 2 ops in our 5-op office with a great location just off the 5 frwy in Irvine. The office suite is a 3-story medical building. The ops are plumbed and ready to add your chairs, units and X-ray heads. There is room for your supplies and a front desk area for your use. Great for someone looking to cut overhead. E-mail us at russellcannondds@earthlink.net; check out the website at www.DrRussellCannon.com; or call 949-552-7874.

CONTINUES ON 754

CLASSIFIEDS, CONTINUED FROM 753

OFFICE FOR RENT OR LEASE — Beautiful new dental building. Prime Albany/Solano Ave. Approx. 1,500 sqft. 2nd flr. Elevator. High ceiling and glass wall. Wonderful natural lighting. Great visibility and easy access (close to El Cerrito BART Station). Great neighborhood demographics. Incl. vacuum & compressor. Orthodontist landlord on ground flr. Plentiful parking. Contact isongortho@aol.com.

OFFICES FOR RENT OR SALE

OFFICE FOR SALE — Orthodontic office available in Encino. Orthodontist retiring after 32 years in same location. Recently remodeled. Four chairs in open bay and one private operatory. All leaseholds included in sale. Great opportunity for recent graduate to build a practice or for established orthodontist to relocate. Please e-mail your response to drewstaxi@aol.com.

OFFICE FOR SALE — Luxurious 3-op suite in an upscale retail/office center. In affluent neighborhood located in beautiful Northern California foothills. Approx 1,500 sf with adjacent suite for potential expansion. Ready to move in! Contact hansen.brenda@sbcglobal.net.

OPPORTUNITIES AVAILABLE

OPPORTUNITIES AVAILABLE — UC Irvine offers excellent benefits for dental assistant, including good work/life balance, health and dental insurance, minimum 3 weeks vacation per year and 2 weeks sick leave. To review the full job requirements for this opportunity, to be considered for and to apply for this position, please go to jobs.uci.edu. Click on Job Listings and Find Job. No. 2012-0372.

OPPORTUNITIES AVAILABLE — CSVS is a system of nine Federally Qualified, Joint Commission Accredited, Health Care Centers that provide general dentistry, medical, optometry, and mental health services to families in Monterey County. We have an opening for a general dentist who shares our vision of providing excellent quality dental care to men, women, and children in our community. In addition to a $25,000 sign-on bonus, we offer a competitive salary, excellent benefits including: 403b, bonus system, employee recognition program, paid time off (128-208 hours annual accrual), life, medical, vision, dental insurance, and reimbursements for license fees and continuing education. Please send resume and contact information to alvinjobs@csvs.org.

CONTINUES ON 758

WESTERN PRACTICE SALES

John M. Cahill Associates

Visit Us at the ADA Convention - Booth # 2141

Moscone Center, San Francisco October 18th - 21st

BAY AREA

AG-053 SAN FRANCISCO - Incredible visibility, signage, unique city views! 9ops +1 add'l **$750K**

AC-085 SAN FRANCISCO- Long established. 2nd floor. 1,433 sf overlooking Park Presidio. 4 large ops. Skylights/large windows **$189k**

AC-093 SAN FRANCISCO- Location & excellent reputation! Full spectrum of dental care. 1,100 sf w/ 4 ops. Plumbed for 1 add'l **Seller Extremely Motivated! $450k**

B-9851 SAN RAMON Facility—This opportunity will not wait! Office ~ 1,700sf w/ 3+ ops **$219k**

BC-082 OAKLAND-On top of the Oakland Hills, in vibrant Montclair District. 900 sf w/3 ops and room for 4th **$475k**

BN-068 ORINDA - Attractive 2-story Professional building. Office is ~800sf w/3 ops. **$850k**

BN-051 HAYWARD— Well-established, family-oriented practice has ~1,000sf w/3 ops **$150k**

BN-052 PLEASANTON *Facility Only*— Spectacular 8-op office. Med Prof Bldg, 1950sf. **$195k**

CC-056 Marin County- With beautiful garden setting, this well maintained office is centrally located near popular shopping center. Easy access to Hwy 101. 1200sf w/ 3 ops. Room for 2 add'l ops **$350k**

CC-077 BENICIA- Highly visible. Within walking distance of downtown. 820 sf w/2 ops **$125k**

D-9091 ATHERTON -Turnkey operation 969 sf & 3 ops ***Call for Details!***

D-960 *Facility only* SAN JOSE -Opportunity to purchase condo suite also! 1,158sf w/3 ops **REDUCED! NOW ONLY $48k**

DN-055 Facility MILPITAS - Located in bustling heart of town. Spacious, fully networked 4-op office (2 fully equipped ops). 1450 sf! **$125k**

DN-062 LOS ALTOS— ~1222 sf w/3 ops. **$250k**

DN-063 SAN JOSE - Long-established, Popular Retail Shopping Center. 780 sf w/ 2 ops **$70k**

DG-060 WATSONVILLE- Practice & Real Estate Available! Spectacular 2,245 sf w/ 4 ops. Call for Details!! **Practice: $250k / Real Estate: TBD**

DN-083 REDWOOD CITY- Modern, attractive, state-of-the-art practice! 2,315sf, 7ops **$395k**

DG-097 GILROY – Medical Issues force immediate sale! Spacious, modern, fully equipped office with **state-of-the-art equipment,** i-Mac computers, beautiful Kavo chairs/Delivery systems & Digital X-ray units in popular retail shopping center. 2,000 sf w/2 fully equipped ops. Plumbed for 1 add'l **$250k**

BAY AREA CONTINUED

DN-084 PALO ALTO - Location, location, location! Drawing from an educated, upper middle class community, this facility is "move-in" ready! 700 sf w/3 fully equipped ops **$125k**

NORTHERN CALIFORNIA

E-8641 SACRAMENTO-FACILITY - 2,100+ sf w/ 3 ops & plumbed for 1 add'l **$50k**

EN-026 ROSEVILLE—Warm Caring Environment, ~1000sf, w/ 3 ops . **$380k**

EC-045 SACRAMENTO - FFS, Established 20+ yrs. 1500 sf w/4 ops. Plumbed for 1 add'l op! **$320k**

EG-065 SACRAMENTO-Practice AND Property only $145k. Collections $350k+ '07. Huge growth potential!! 1,200 sf w/4 ops.

EN-090 CARMICHAEL - It just doesn't get any better than this! ~2000sf w/6ops. **$895k**

F-1013 FORTUNA-Well respected FFS GP. Loyal stable patient base. 1,000 sf w/ 3 ops **$195k**

FN-087 LAKE COUNTY—Quality practice w/ friendly staff! ~2400sf w/3+ops. **$775k**

G-883 CHICO VICINITY – Quality FFS GP. Attractive Prof Plaza. 1,990 sf w/ 5 ops **$495k**

G-998 CHICO/PARADISE—Breathtaking natural beauty! ~898sf, 3 ops. **Now $240k**

H-856 SOUTH LAKE TAHOE Over 50 new patients/mo Respected & Growing! 1568 sf & 4 ops **$325k**

HC-054 SIERRA FOOTHILLS- Seller Retiring. 1,800 sf w/ 5 ops **$600k**

G-1019 WILLOWS AREA—Small Community practice! ~1,600sf w/ 2 ops. **$152k**

GN-034 PARADISE—Central Local and great views! ~1168sf w/ 3ops. **$210k**

GN-058 YUBA CITY— Emphasis on quality dental care / patient comfort, 1,704sf w/ 4 ops **$450K**

GN-075 YUBA CITY—Well established practice w/ loyal patient base! ~3000 sf w/ 8 ops**. $350K**

HN-059 LASSEN CO-Quality, well-established, family-oriented practice. 1600sf w/3 ops **$120k**

FN-088 SISKIYOU CO— Family Friendly Location! ~1300sf w/ 2 ops. **$85k /Real Estate: TBD**

SOUTHERN CALIFORNIA

KF-070 BREA-Affluent, loyal, stable, well-educated patient base. Highly-esteemed practice. 2,400 sf w/2 ops. Plumbed for 3 add'l **$350k**

CENTRAL VALLEY

I-9721 STOCKTON –Prof. complex 1,450 sf w/3 ops & plumbed for 1 add'l op. **$75k.**

I-1005 SAN JOAQUIN VLY- Long-established High-End . 2,500+ sf w/ 6 ops **$650k**

IN-024 MERCED - This immaculate practice is an absolute jewel! ~1250sf, 3 ops + 1 add'l **$240k**

IC-066 TRACY - Modern, paperless, FFS practice. Excellent visibility! 1,600 sf w/ 4 spacious, fully-equipped ops; plumbed for 2more **$525k**

IG-067 STOCKTON- Fully computerized, paperless, digitalized. 5,000 sf w/10ops **$475k**

IN-071 MODESTO– FFS/Large/stable patient base. Recently remodeled/digitalized. 2,600 sf w/7ops ***$900k***

J-1000 TULARE– Highly visible location! ~1650sf w/ 4ops **Practice: $465k /Real Estate: $249k**

J-1001 LINDSEY— All American City! Conveniently located ~3,380sf w/5ops. **$264k**

J-1009 VISALIA- Buy 50% or 100%! Prof Bldg. Desirable area. 4 ops. **$250k /$500k**

IN-072 STOCKTON-Fully computerized/digitalized/paperless. 3,290 sf w/10 ops. **$700k**

JN-074 CENTRAL VALLEY - This Seller is Extremely motivated! ~2,600 sf w/ + 1 add'l **$85k**

JG-079 FRESNO-Large, Stable Patient Base. Spacious 5,000 sf w/9 fully equipped ops. Plumbed for add'l ops **$250k**

JN-086 FRESNO FACILITY—Low Rent & Overhead! <1yr old, ~1200sf, 3 ops + poss. 4th! $**160K**

SPECIALTY PRACTICES

I-7861 CTRL VLY ORTHO- 2,000sf, open bay w/8 chairs. FFS. 60-70 patients/day. Prof Plaza. **$370k**

I-9461 CENTRAL VALLEY/ORTHO - .~ 1,650 sf w/5 chairs/bays + (2) add'l plumbed. **$140k**

G-975 CHICO ORTHO—Denti-Cal patient base. ~ 900 sf w/ 2 + ops . **$90k**

BC-033 ALAMEDA CO ORTHO – ~ 50 pats/day. Highly visible. 1,250 sf w/4 Chairs/Bays **$450k**

GN-050 NORTHERN CA PERIO - once in a lifetime opportunity! Remodeled office is ~3,500 sf w/ 5 ops. **$1m**

EN-089 ORTHO- ROCKLIN AREA - Contracted as a Preferred Provider w/one of the largest Medical Systems in area. Large, stable referral base. 1,500 sf w/3 chairs/bays. Plumbed for **$425k**

800.641.4179

westernpracticesales.com

HENRY SCHEIN®
PROFESSIONAL PRACTICE TRANSITIONS

"DENTAL PRACTICE BROKERAGE"

Making your transition a reality.

ADA BOOTH # 1042

More information is available on our website regarding practices listed in other states, articles, upcoming seminars and more.

For more information regarding the listings below:

VISIT OUR WEBSITE AT:
WWW.PPTSALES.COM
(Practice Opportunities)

Practice Sales • Mergers
Partnerships • Appraisals
Patient Record Sales

- **ANAHEIM:** *For Sale*-General Dentistry Practice. This 3 op had $253,000 in collections in 2011. There are 3 ops in this 864 sq. ft. office with 3.5 days of hygiene. Owner works 3 days per week. No welfare or HMO's. Laser, Dentrix Software and Intra-Oral Camera. SOLD

- **BISHOP:** *For Sale*-General Dentistry Practice and Building. After 29 years in the same location this retiring dentist is selling both his practice and building. Collections were $1,000,243 in 2011 with $387,000 Adjusted net income. There are 6 days of hygiene in this 5 op 1,800 sq. ft. building. 100% financing is available for both building and practice.

- **CHICO:** *For Sale*-General Dentistry Practice. The collections in 2011 were $1,209,207. There are 7 days of hygiene in this 5 op., 2,400 sq. ft. office. Equipment includes Laser, Intra-Oral Camera, new Cone Beam X-ray and Dentrix software. This excellent practice has 1,824 active patients with 12 new patients a month. Owner will consider an Associate to Buy-In position leading to the purchase of this practice. #14392

- **CHULA VISTA:** *For Sale*-General Dentistry Practice and Building. **DECEASED DENTIST** as of March 25th, 2012. This beautiful 11 op. office located in a highly visible prime area in Chula Vista, had collections of $1,684,000 in 2011 and $1,730,000 in 2010. There are 5 days of hygiene with approx. 30 new patients per month. Lasers, Intra-Oral Camera, Pan-Ceph, etc. Practice has been in this location since 1998. 100% financing available for practice and building. Staff will stay. #14394 SOLD

- **EAST BAY:** For Sale-ENDODONTIC PRACTICE. The adjusted net income was $186,000 in 2011 in this 3 operatory, 1000 sq. ft. office. Includes Microscope, X-ray Scanner and PBS software. Transfer of referral base should be excellent. Ideal office for new endodontist or as a satellite practice for established practitioner. Dr. is retiring.

- **FRESNO:** *For Sale*-General Dentistry Practice: $935K in collections in 2011, w/adjusted net income of $337K, 15% of practice is HMO. Office is 2,300 sq. ft. and is located in north Fresno in a highly visible professional office complex on a main thoroughfare. There are 6 equipped operatories, owner reports average age of equipment is 4 years. Practice has been operating in present location for over 20 years. Eaglesoft software, owner is retiring. #CA502

- **FRESNO:** *For Sale*-General Dentistry Facility. One of the best opportunities this year! This 3 op dental office comes equipped. It is in a great location and has about 200 active patients. Owner is in the process of completing his Orthodontic training and only works in the office 5 days a month. Complete pictures of the office and an inventory list of included furniture and fixtures are available. Everything included for only $85,000 You can't afford to pass this up. #14383 SOLD

- **GLENDALE:** *FACILITY SALE*-General Dentistry Office Space & Leasehold Improvements Sale- Office located in a medical plaza, 1760 sq. ft. 7 operatories, computerized equipment approximately 5 years old. Two 5-year options available. #14373

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. 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. SOLD

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. GR 545K 3 days/wk (4 avail). 3 hygiene days/week. 5 Ops (6 Avail) 1,950 sq ft. Refers out most/all Ortho, Perio, Endo, Surgery. Office has Laser, Intraoral Camera, Pano, & Dentrix Software. Owner retiring. #14372.

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. Owner retiring. Well-designed 1,550 sq. ft. office with 4 ops plumbed, 3 ops furnished. Gross Receipts for 2011 were $309K on easy 3 days/wk with low (47+%) overhead. Practice refers out Endo, Perio, Surgery & Ortho. Pano, PBS software. May be able to merge with another existing practice that will also be for sale in the near future, This merger would result in $800,000 gross annually. #CA503

- **GREATER CHICO/YUBA CITY:** *For Sale*-General Dentistry Practice. 2011 GR $592,520 on 4 days. 1,200 sq. ft. office with 4 equipped ops. Intra-Oral Camera, Pano, 1,100+ patients. Owner retiring after 33+ years in this picturesque and prosperous community with abundant recreation, close to the mountains and near one of the largest lakes in N. CA. #14359

- **GREATER SACRAMENTO:** *For Sale*-Periodontal Practice: Retiring owner is the only Periodontist in a comunity of 50+K with a draw area of 100K. Implant experience a must. Great opportunity to work closley with a Prosthodontist and an Endodontist. Nicely appointed 1,500 sq. ft. office with 5 operatories, Digital X-rays and Dentrix software. 2011 gross receipts of $719K. #CA500.

- **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. #20101

- **HAYWARD:** *For Sale*-General Dentistry Practice. This practice consists of 1,600 sq ft with 4 treatment rooms in an excellent location. 2010 collections was $501,000 with a $228K adjusted net income. Dental Vision software, Average age of equipment is 8 yrs. Approximately 1,200 active patients. SOLD

- **LANCASTER:** *For Sale*-General Dentistry Practice. This 4 operatory office is located in 2,360 Sq Ft on the second floor of an attractive Medical Dental office building. Gross receipts were $676,000 with a $174K adjusted net income. Dentist is retiring after 39 years. 4 days of hygiene. Additional operatories could be added to existing space. Great location.#14376.

- **LEMOORE/HANFORD AREA:** *For Sale*-General Dentistry Practice & Building. Owner has worked in this location since 1971. Gross Receipts were $378K with $139K adj. net income. There are 3 equipped operatories and 3 days of hygiene. Purchase of the building is optional to the Buyer. 100% financing is available for both building and practice. Excellent opportunity for new grad or satellite practice. #14375.

- **MILLBRAE:** *For Sale*-General Dentistry Practice. This beautiful, well-established office is located on the main thoroughfare of the North Penninsula, offering great exposure that generates 25-30 new patients per month. 5 treatment rooms (6th plumbed) in approx. 1,500 sq. ft. equipped with Digital Pan, Digital Imaging and Intra-Oral Camera. 2011 gross receipts of $651,000 with $230,000 adjusted net income. Owner is retiring. Don't delay, this won't last long! #14395

- **MODESTO:** *For Sale* - General Dentistry Practice. Collections have been approximately $700K per year with a 62% overhead on 3 days per week schedule. Six days of hygiene in this 4 op. office. Eaglesoft software and Panoramic X-ray. Approximately 2,000 active patients. Perio and Endo referred out. Excellent location. #CA505

- **MODESTO-TRACY- AREA:** *For Sale*-Pediatric Practice. $677,000 in collections in 2010 with a $357,000 net income. This 3-chair office is located in approximately 1,250 sq. ft & has recently been remodeled. Patient Base software. Office equipped for NO2 & IV sedation. Practice has operated in its present location for 20 years.

CALIFORNIA / NEVADA REGIONAL OFFICE

HENRY SCHEIN PPT INC.
California Regional Coporate Office
DR. DENNIS HOOVER, Broker
Office:(800) 519-3458 Office (209) 545-2491
Fax (209) 545-0824 Email: dennis.hoover@henryschein.com
5831 Stoddard Road, Ste. 804 Modesto, CA 95356

Henry Schein PPT Inc., Real Estate Agents
and Transitions Consultants
Dr. Tom Wagner (916) 812-3255 N. Calif.
Jim Engel (925) 330-2207 S.F./Bay Area
Mario Molina (323) 974-4592 S. Calif.
Thinh Tran (949) 533-8308 S. Calif.

HENRY SCHEIN®
PROFESSIONAL PRACTICE TRANSITIONS

Dr. Dennis Hoover
Western Regional Manager
& Corporate Broker
CA R.E. Lic. #01233804
NV R.E. Lic. #0053890 • NV B.O. Lic. #0000301

Dr. Thomas Wagner
Transitions Consultant
CA R.E. Lic. #01418359

Jim Engel
Transitions Consultant
CA R.E. Lic. #01898522

Thinh Tran
Transitions Consultant
CA R.E. Lic. #01863784

Mario Molina
Transitions Consultant
CA R.E. Lic. #01423762

- **MOUNTAIN VIEW:** *For Sale*-General Dentistry Practice: This 2 day per week satellite office is located the heart of Silicon Valley, surrounded by most of Mountain View's largest employers. 2 fully equipped treatment rooms (expandable to 4), Pano, Digital Processor and Dentrix Software in approx.. 1500 sq. ft. With household names as your neighbors, few opportunities are this good! #14398

- **MORGAN HILL:** *For Sale*-General Dentistry Practice & Building. DECEASED DENTIST AS OF JUNE 6TH, 2012. The office and equipment are only 5 years old. The office is beautifully decorated and efficiently laid out with 5 operatories. The condominium space is located in highly visible, upscale, professional office building. 2011 gross receipts were $846,000. Intra-oral Camera, Panoramic X-Ray and Digital X-Ray. Staff and hygiene are working daily with out-of-the-area doctor covering. Approximately 1,700 active patients. #14399

- **NEWPORT BEACH:** *For Sale*-General Dentistry Practice. This 4 operatory practice is located in beautiful Newport Beach and is part of a larger office complex. Gross receipts were $490K in 2011, with an average of 20 new patients per month. The office is 920 sq. ft. with Dentrix software, Dental laser, and up-to-date equipment. #14397

- **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 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. #14251

- **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 5–chair office. 2009 Gross Receipts $713K with 48% overhead. Owner retiring. Call for Details.

- **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.

- **NORTH OF SAN FRANCISCO:** *For Sale*-PERIODONTAL PRACTICE. Owner retiring: Great opportunity for a Periodontist with experience in dental implant placement. This well-appointed practice is located in a 1,300 sq. ft. office with 4 operatories along the busy 101 corridor north of San Francisco. 2011 gross receipts of $558,000. DSN software. Buyer will be the only full-time periodontist in an area with the population of approximately 60,000. #14396

- **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

- **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

- **ROSEVILLE:** *For Sale*-General Dentistry Practice. Great Location. 2009 GR $900K with adjusted net income of $300K. 1,970 sq. ft. with 4 ops, 8 days hygiene/wk. Digital, Intra-Oral Camera, Dentrix, Trojan, fiber optics, P & C chairs - all less than 5 years old. Owner is retiring. #14327

- **SACRAMENTO:** For Sale-General Dentistry Practice. Gross Receipts $546K with adjusted net income of $159K. Office is 2,400 sq ft with 7 operatories. Practice has been operating in the same location for the past 50 years. Pano, Softdent software. Owner to retire. #14374

- **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. 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

- **SAN FRANCISCO:** *For Sale*-General Dentistry Practice. This 1000 sq. ft. office is located in the heart of the financial district. It is a corner office with each of the 4 operatories looking out at the incredible views on Golden Gate side of the bay. The 2011 collections were $1,200,000 with a low overhead. The practice averages approximately 15 new patients a month.

- **SAN JOSE:** *For Sale* - FACILITY SALE ONLY - NO PATIENTS: Exclusive Willow Glen district offering 4 fully equipped treatments rooms, 2 additional plumed, in approximately 1,900 sq. ft.. Digital Scanner, Intra-Oral Camera in a very elegant setting. This facility only sale offers favorable lease terms as well. #CA504

- **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 BARBARA:** *For Sale*-General Dentistry Practice. Wonderful opportunity to live and work in one of California's most desirable areas. 2010 Gross Receipts were $974,000 with a $370,00 adjusted net income. Six days of hygiene. Dentrix software, Intra-Oral Camera and Panoramic X-Ray. Owner is retiring. #14382

- **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. 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. #14320

- **VICTORVILLE:** *For Sale* - General Dentistry Practice. This practice is worked just on a three day a week schedule. There are 3 operatories with 10 off-street parking spaces. Practice has high visibility. The practice was acquired from previous owner in 2002. #14393

SALE PENDING
SOLD
SOLD
SOLD
SOLD
SOLD
SOLD
SOLD
SOLD
SOLD
SOLD

CALIFORNIA / NEVADA REGIONAL OFFICE

THE SNYDER GROUP
A DIVISION OF HENRY SCHEIN®

HENRY SCHEIN®
PROFESSIONAL PRACTICE TRANSITIONS

CLASSIFIEDS, CONTINUED FROM 754

OPPORTUNITIES AVAILABLE — Big Sur Health Center has a community-based dental clinic with need of a dentist 2-3 days per week. Please fax cv to 415-898-9003 or email MLewFAGD@comcast.net.

OPPORTUNITIES AVAILABLE — Associate position with potential for buy-in. High-end patient-centered adult cosmetic and restorative fee for service practice. Energetic younger dentist preferred, great people skills a must. Contact drjphansen@yahoo.com.

OPPORTUNITIES AVAILABLE — Looking for an associate dentist for a solo GP practice in Roseville. Start ASAP, 3-4 days per week. Hoping to find a dentist who likes to do it all and help build the practice. Need someone who has great communication skills and is ethical. This practice is starting from scratch so initially there will be time for the person hired to help with marketing. Please send your CV to ciindy@comcast.net.

OPPORTUNITIES AVAILABLE — Seeking enthusiastic, hard-working front office individual to join the team. Must know Eaglesoft. Task includes entering payments, checking overdue accounts, filing, scanning checking eligibility, calling patient. Contact Docgladen@yahoo.com.

OPPORTUNITIES AVAILABLE — Periodontist/Oral Surgeon/Endodontist needed for busy private dental office in West Covina, Calif. Please email resume to kkdental2@gmail.com.

ORANGE COUNTY — Associate position leading to partnership for a general dentist with excellent clinical and verbal skills who has the ability to work within a group practice. This is a fantastic opportunity in a rapidly growing private practice (no HMO). Please fax your CV to (714) 242-1866.

CONTINUES ON 760

CARROLL & COMPANY

"MATCHING THE RIGHT DENTIST TO THE RIGHT PRACTICE"

Complete Evaluation of Dental Practices & All Aspects of Buying and Selling Transactions

Serving you: Mike Carroll & Pamela Gardiner

3073 SAN MATEO GP
San Mateo GP now available. Located in highly visible single story professional building in a desirable residential professional mix neighborhood blocks from downtown. 1,100 sq. ft. office w/4 fully-equipped ops setup for right handed delivery. Recently upgraded, networked computer system using Dentrix practice software & Dentrix Digital X-ray. 3 year avg. GR $179K+. w/3 doctor days. Doctor retiring. Asking $108K.

3073 LOS GATOS FACILITY
Great location with Beautiful State-of-the-Art Dental Office with 6 fully-equipped ops in approximately 2,000 sq. ft. of a magnificent designed setting. There is one additional private op plumed and ready to go. Equipment includes the 4 chairs, 4 stools, new Vacuum & Compressor, Ultra Sonic, Trash Compactor, large TV in reception area, Spectacular Water Fall in Hall Way and 2 swing through X-Rays. Owner willing to provide long term lease and or options to renew. Asking $195K.

3072 SOUTH BAY GP
Owner retiring from well est. 4 op GP in desirable commercial/residential mix neighborhood. Highly visible location near well travelled intersection. ~1,300 sq. ft. facility with dedicated parking lot, across from shopping plaza. Experienced & well trained, long term staff. 1,400 active patients (all fee-for-service) and 7 full days of hygiene. Ave. GR $840K+. Owner willing to help Buyer for a smooth transition. Asking only $503K.

SOLD

3062 SAN JOSE OMFS
Established and well-respected OMFS available. Located in desirable professional & residential mix neighborhood 2 blocks from large mall. 1,080 sq. ft. office w/3 fully-equipped ops. Seller preparing to retire. 2010 GR $377K+. Asking $240K.

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). Asking $195K.

3075 DOWNTOWN SF GP
Owner retiring from exceptionally successful GP in downtown, SF. Gorgeous state-of-the-art office. 87 stunning views of San Francisco and the Bay. 4 year avg. GR $831,819. Approx. 1,200 active pts. Dedicated long term staff. Asking $660K.

SOLD

3059 SANTA CRUZ COUNTY GP & BDG
Charming practice tucked among soaring redwoods in Santa Cruz County. 2011 GR $626K+ 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.

3074 SOUTH-PENINSULA GP
Successful neighborhood practice in single level medical and dental building on a highly visible corner of a well travelled intersection. ~1,500 sq. ft. office w/4 fully-equipped ops and space for 5. 2011 GR $720K+. Asking $523K.

SOLD

3067 MID-PENINSULA GP
Gorgeous modern, highly visible GP in 3,000 sq. ft. office w/7 fully equipped ops. 5 years avg. GR $991K+. Asking $808K.

SOLD

3071 MID-PENINSULA GP
Well-established 3 op GP in desirable neighborhood. 1,400 sq. ft. facility. Ownership in building available.

SOLD

UPCOMING:
San Jose GP
Santa Rosa GP
Hollister GP
Santa Clara GP

Contact Us:
Carroll & Company
2055 Woodside Road, Ste 160
Redwood City, CA 94061

Phone:
650.403.1010

Email:
dental@carrollandco.info

Website:
www.carrollandco.info

CA DRE #00777682

CLASSIFIEDS, CONTINUED FROM 758

OPPORTUNITIES WANTED

OPPORTUNITIES WANTED — Young dentist seeking either a full- or part-time opportunity within a practice where I can continue to learn and develop as a clinician. I graduated with a DMD degree in May 2011. I have been working in a private practice where I have gained experience in all phases of general dentistry. I have a resume and cover letter available upon request. Thank you for your consideration and hope to hear from you soon. Contact draakd@yahoo.com.

OPPORTUNITIES WANTED — Seeking enthusiastic, professional, team player individual for front office. Must know Eaglesoft, and know mostly front task, entering payments, checking overdue accounts, filing, scanning, collecting copays, checking eligibility, calling patients, etc. Kingslydentistry@yahoo.com.

OPPORTUNITIES WANTED — I am a positive enthusiastic dentist looking to grow with a well-established dental practice. I hope to bring my experience of restorative/cosmetic dentistry to the practice. Education: University of California, San Francisco, Doctor of Dental Surgery, 2008 California State University, Fullerton, bachelor of science, 2003 cum laude. Professional strengths: I have four years of strong dental training including surgical extractions with bone grafting with or without membranes, scaling/root-planning using Sirona laser, rotary endodontics including molars in 45 min, bonding, implant restorations and crown/bridge work. I place dental implants restoring using crowns, bridges or all on four dentures. I am personable and work well with patients and staff. Certificates: Lumineer certified. I am certified to used the Sirona laser. I am an advanced CERAC doctor making over 500 CERAC crowns. Contact 714-390-8449.

DENTAL EQUIPMENT FOR SALE

DENTAL EQUIPMENT FOR SALE — Enough dental equipment to start a small office. Major and minor equipment left over after combining 2 offices. Almost enough to start a new office or satellite office. Buy it all or just one item. Pictures available upon request Air Techniques 2 head Airstar 3 air compressor Dental Ez 2 head vacuum Adec Priority 1005 dental chair (2) Adec Cascade wall mounted

CONTINUES ON 762

Professional Practice Sales

Specialists in the Sale and Appraisal of Dental Practices

Serving California Dentists since 1966

How much is your practice worth??

Selling or Buying, Call PPS today!

Practices Wanted

NORTHERN CALIFORNIA
(415) 899-8580 – (800) 422-2818
Raymond and Edna Irving
Ray@PPSsellsDDS.com
www.PPSsellsDDS.com
California DRE License 1422122

6008 MENDOCINO COAST - FORT BRAGG Cultural haven offers attractive lifestyle. 2011 collected $725,000 on Owner 3-day week. 4-days of Hygiene. Digital radiography. Computers in ops.

6020 PEDO PRACTICE - ATTRACTIVE FAMILY COMMUNITY 2012 trending $550,000+ in collections with Available Profits of $280,000+. Remarkable office with investment here topping $345,000. Computerized charting with digital Pano and Ceph. Full price $240,000.

6024 PERIO PRACTICE – SAN FRANCISCO'S SOUTH BAY On part time schedule of 19-hour week with 7-weeks off, collected $600,000 in 2011. 2012 trending Profits of $270,000. Attractive office, nice location. Full price $150,000.

6025 CENTRAL MARIN COUNTY - SAN ANSELMO Well established practice collected $490,000 in 2011 on 3-day week. 2+ days of Hygiene.

6026 SACRAMENTO 2011 collected $825,000 on 3-day week. Practice coupled with facility and location can do much more. Bring in specialists. Strong foundation can be developed into busier practice.

6027 PLEASANTON Collected $500,000 with Profits of $260,000 in 2011. Office remodeled 3-years ago at cost of $60,000. Nice "Town & Country" feel. Adec delivery systems.

6028 BERKELEY'S ALTA BATES MEDICAL VILLAGE 2011 collected $525,000. Collections for first 6-months of 2012 have practice tracking $600,000. Busy Hygiene schedule.

6029 NORTHEAST CALIFORNIA - ALTURAS Trade in smog and congestion for soaring mountains and close-knit communities. 2012 tracking $600,000 on 3-day week. 3+ days of Hygiene. Strong Recall. Great staff. Beautiful office. 3-ops with Adec delivery systems. Be busy, be happy and take vacations. No worries here. Full price $185,000.

6030 "COMING UP - SANTA ROSA AREA Last 3-years have each topped $800,000 in collections. Strong foundation, beautiful office, digital radiography. This is special!

Detailed Prospectuses on NorCal Practices can be viewed at www.PPSsellsDDS.com

SELL YOUR ORANGE COUNTY OR LA PRACTICE GROSSING $500K AND ASK PPS FOR A PRACTICE NETTING $500K OR MORE.

FOUNDERS OF PRACTICE SALES

115+ years of combined expertise and experience!

3,000+ Sales - - 10,000+ Appraisals

CONFIDENTIAL

PPS Representatives do not give our business name when returning your calls.

BUYERS AND SELLERS SAY

"We have dealt with other firms - we like YOUR professional expertise. We will recommend YOU to all our colleagues. Thank you."

SOUTHERN CALIFORNIA
(714) 832-0230 – (800) 695-2732
Thomas Fitterer and Dean George
PPSincnet@aol.com
www.PPSDental.com
California DRE License 324962

3193 PALM DESERT Grossing $400,000+. Great Location.

3237 ANAHEIM HILLS Solo group member wanted-Hi-identity-HiTech share beautiful space.

3250 ANAHEIM NW Disneyland. Part time Seller. 2 days wk. Hi identity corner. Grossing $370K in '09. 1,800 sq. ft. 5 Ops equipped. Low rent.

SMALL TOWN Minutes from Bakersfield. Modern RE. Practice Grosses $20-to-$40K per month. Bargain.

APPLE VALLEY/HESPERIA Gross $700,000 to $800,000. Free standing building as optional purchase. Absentee owner.

3290 SANTA PAULA, NEAR FILLMORE Hi identity location. Gross $400,000+. Established 2006. 5-ops, 3 equipped. Beautiful office. Steady growth.

TEMECULA/HEMET HMO. Gr. $700,000 part time. 8 ops fantastic location Million Dollar corner. Full price $565,000.

HEMET/TEMECULA HMO. Absentee owner. Grosses $700K. PPS says Buyer will do $1.5 Million within 18 months. Special Situation.

VICTORVILLE-APPLE VALLEY-HESPERIA AREA Established 20 years. Gross $700,000+. Net approx $300,000. More volume available. 8 ops. Hi identity shopping center. Full price $650,000. Serious Seller. Can do $1 Million.

SANTA ANA Super Hi identity intersection. 50,000 to 75,000 auto/day. 5 ops. Grossing $40-to-$60K/mth. Net $200,000 to $300,000. Great opportunity to build Million Dollar office here.

LANCASTER Estb 50 years - Hi identity central location, low overhead. Gross $480,000 by part time owner. Seller can work back per new owner. Five operatories.

ORANGE COUNTY Beautiful office. Right buyer will gross $2 million first year. Financing in place. Need Entrepreneur who has team of specialists in place or Dentist with multiple talents. HMO/PPO/Ins/Cash. Includes 9 days hygiene. 10,000 charts. As stated, right team will do $2 million first year.

APPLE VALLEY CLASSIC $600,000+. Low overhead.

LAVERNE Grossing $1.2 Million. Fulltime DDS can do more.

MONTCLAIRE High identity location. Hi tech, 2,260 sq.ft. 6-op office. If you don't gross $80K/month, don't buy. Take 6-months to try before buying.

CARLSBAD Free standing building, great visibility. Grossing $700,000 with owner not here. FP $585,000.

GARDEN GROVE $450,000 Gross. Korean patients. Asking $330,000.

RESEDA High visibility corner location. Collected $414,000 first 6-months of 2012.

PARAMOUNT Shopping center. Grossing $360K. More hours, more Gross.

CLASSIFIEDS, CONTINUED FROM 760

dental units with articulating arms Duo assistant/Dr (2) Adec doctor carts (4-5) dr/assistant chairs Porter nitrous oxide system including: (4) wall outlet stations (4) MXR telescoping wall mounts (2) Porter MXR Flow meters (1) Porter Vanguard Manifold (1) Porter Vanguard alarm panel (4) Star in-wall mount X-ray viewers (2) DMD intraoral cameras & (4) white Quasar TV (2) Hon vertical file cabinets with locking doors (1) Star red X-ray safelight (1) X-ray duplicator (1-2) curing lights wired (5) wood frame/cloth reception chairs (green print). Contact 559-438-0121.

DENTAL EQUIPMENT FOR SALE — Plan Meca Pro One Panorex, new in 2010. $15K, paid $30K two years ago. Has external BW option. Perfect condition. I am stepping up to cone beam. Free shipping and install in So Cal by Patterson. Contact 714-668-9811.

DENTAL PRACTICES FOR SALE

DENTAL PRACTICE FOR SALE — 5-yr.-old equipment, newly remodeled, 4OPS, Pano, Noble Biocare Implant system, much more. 3d/wk hygiene. Collections 764K in 2010 on 5d/wk, 527K in 2011 on 3d/wk. Great Christian staff, reasonable rent. Asking 175K. Contact ddspractice4sale@yahoo.com.

DENTAL PRACTICE FOR SALE — Downtown Union Square in San Francisco fee-for-service practice. The doctor currently refers all endo, perio, surgery, and implant procedures. 30 years of goodwill with a terrific, loyal patient base on which to build your future. Attractive price. Looking for a transition date of Jan. 1, 2013. Please call Gloria at 415-433-7810 to arrange a visit. We're waiting to meet you.

QUESTIONS MOST OFTEN ASKED BY SELLERS:

1. Can I get all cash for the sale of my practice?
2. If I decide to assist the Buyer with financing, how can I be guaranteed payment of the balance of the sales price?
3. Can I sell my practice and continue to work on a part time basis?
4. How can I most successfully transfer my patients to the new dentist?
5. What if I have some reservation about a prospective Buyer of my practice?
6. How can I be certain my Broker will demonstrate absolute discretion in handling the transaction in all aspects, including dealing with personnel and patients?
7. What are the tax and legal ramifications when a dental practice is sold?

QUESTIONS MOST OFTEN ASKED BY BUYERS:

1. Can I afford to buy a dental practice?
2. Can I afford not to buy a dental practice?
3. What are ALL of the benefits of owning a practice?
4. What kinds of assets will help me qualify for financing the purchase of a practice?
5. Is it possible to purchase a practice without a personal cash investment?
6. What kinds of things should a Buyer consider when evaluating a practice?
7. What are the tax consequences for the Buyer when purchasing a practice?

Lee Skarin & Associates have been successfully assisting Sellers and Buyers of Dental Practices for nearly 30 years in providing the answers to these and other questions that have been of concern to Dentists.

Call at anytime for a no obligation response to any or all of your questions
Visit our website for current listings: www.LeeSkarinandAssociates.com

LEE SKARIN & ASSOCIATES INC.

Offices:
805.777.7707
818.991.6552
800.752.7461
CA DRE #00863149

ADVERTISER INDEX

DR. BOB, CONTINUED FROM 766

Prisoner: Thirty-eight packages ought to do it. Unwaxed if you don't mind. The waxed stuff tends to slip through my hands. Also, the knots won't hold well.

Clerk: You must have a lot of poor interproximal contacts, man.

Prisoner: That's right, bubba, and the stringy chicken and tough beef they serve in this joint are raising hob with my interdental papilla.

Clerk: Here you are, sir. We are always happy to see our inmates diligently and conscientiously engaged in a properly applied program of dental hygiene.

The *Times* article also mentions that Shepard was being disciplined for scraping the mortar in his cell with an instrument (possibly a cleoid or a double-ended spoon excavator) and was not permitted in the exercise yard until late at night, at which time he tossed his braided floss rope over the wall and was once again on the lam.

Several interesting developments have evolved from this episode. Dental floss manufacturers are rethinking some of their marketing strategies. For years, they are saying, we've advocated whacking off 18 inches of our product to clean between teeth and it takes a felon with a little imagination to show us what can be really accomplished. Boy, this changes everything!

A source close to one of the leading floss purveyors has leaked that the company is thinking of increasing the tensile strength of its floss and marketing it as mooring lines for larger boats up to and including the QE II.

Tightrope walkers with Ringling Brothers Circus are now using floss in its original form right from the container and several suspension bridges are now being refitted with floss, replacing the standard steel cables because it does not rust.

On the other hand, state and federal prisons are considering banning sales of floss except in 18-inch increments, limit three lengths per month. A requisition cosigned by both the warden and the prison dentist will be required. This will come as a major disappointment to many cons, who, fired up by Shepard's daring escape, had already begun stockpiling floss and trying to braid appropriate lengths of getaway floss after lights out.

> At the risk of aggrieving tree-hugging environmentalists, we are thinking of introducing artificially flavored twigs in hazelnut, French vanilla and apple cinnamon.

Prison grapevine has it that Shepard has promised that as soon as the heat is off, he will send back a contingency plan he had formulated as a backup in case the floss thing let him down. This is rumored to consist of an intricate scaffolding made up of toothbrushes wired together with noodles from the soup served on Thursdays at the prisoners' mess.

Prison officials are naturally chagrined at having been fooled with the Great Floss Escape, particularly the guards, who believed Shepard when he told them the floss was for his macrame class. They are now taking the added precaution of allowing only edentulous prisoners to have access to the exercise yards and those with dentition requiring toothbrushes and floss will be detained indefinitely in maximum security sections of the prison.

Although, according to West Virginia law, dentists are in the clear on this, morally we must accept some of the blame for this latest perversion of our instructions. After all, who has been campaigning forever to get folks to use floss on a daily basis? And now that floss acceptance seems to be on the upswing, who is doing the using — some small-time post office crook who probably claims his dentist told him it was the way to go.

From now on, when I prescribe the use of dental floss, the patient is going to have to sign an affidavit stating he will not use it for busting out of the slammer or any other illegal purposes. He's also going to sign a waiver holding me personally blameless for having suggested its use. I have no idea what we'll do about the toothbrushes. ■■■■

CDA JOURNAL, VOL 40, Nº9

Felonious Flosser Flees to Freedom

Several interesting developments have evolved from this episode. Dental floss manufacturers are rethinking some of their marketing strategies.

Robert E. Horseman, DDS

ILLUSTRATION BY VAL B. MINA

Honest, I'm not making this up. The *Los Angeles Times* ran an article recently from *Associated Press* datelined Charleston, W.Va. It seems that the South Central Regional jail in South Charleston was host to one Robert Shepard who apparently did not take kindly to incarceration. He had been awaiting trial for robbing a post office, a charge he vigorously denied, claiming he was only going in after midnight when he wouldn't get in the way, to speed up the delivery of the mail, particularly those pieces containing cash or negotiable securities. Tiring of waiting for the wheels of justice to laboriously get around to his problem and exercising more of the same ingenuity that got him in jail in the first place, he braided *dental floss* into a rope as thick as a telephone cord and used it successfully to scale an 18-foot-wall to freedom.

I've been trying to think of how this guy accomplished such a remarkable feat. The typical floss package contains 55 yards (165 feet), so one package could have made about nine strands of floss rope for the 18-foot climb. Shepard is said to have weighed 155 pounds, so there's no argument about whether a floss rope as big as a telephone cord could support his weight in the wall climb; it's a fait accompli. Jail Administrator Larry Parsons said officials were checking records to see how much floss Shepard may have bought at the commissary.

Clerk: You want *how many* packages of floss?

CONTINUES ON 765

Dental Practice Sales & Transitions

Bette Robin, DDS, JD

DENTIST • ATTORNEY • BROKER

Loma Linda Dental 83 Southwestern Law 95

Select Practice Services, Inc.
Dental Practice Sales and Transitions
877.377.6246 • www.BetteRobin.com
17482 Irvine Blvd., Ste. E • Tustin, CA 92780

Opalescence®
tooth whitening systems

believe your smile

Our full line of whitening products provides professional whitening options to fit every patient and their unique needs.

Call for a **Free Sample**
800.552.5512
Promo Code **12J01**

Our products. Your expertise. Their smiles.

WHITEN

ULTRADENT PRODUCTS, INC.
Improving Oral Health Globally

800.552.5512 | ultradent.com