

Journal

CALIFORNIA DENTAL ASSOCIATION



February 2017

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

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PRESIDENT
president@cda.org

Natasha A. Lee, DDS
PRESIDENT-ELECT
presidentelect@cda.org

R. Del Brunner, DDS
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vicepresident@cda.org

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secretary@cda.org

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treasurer@cda.org

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speaker@cda.org

Kenneth G. Wallis, DDS
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pastpresident@cda.org

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EXECUTIVE DIRECTOR

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Alicia Malaby
COMMUNICATIONS
DIRECTOR

Editorial

Kerry K. Carney, DDS, CDE
EDITOR-IN-CHIEF
Kerry.Carney@cda.org

Ruchi K. Sahota, DDS, CDE
ASSOCIATE EDITOR

Brian K. Shue, DDS, CDE
ASSOCIATE EDITOR

Andrea LaMattina, CDE
PUBLICATIONS MANAGER

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SENIOR COMMUNICATIONS
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Production

Val B. Mina
SENIOR GRAPHIC DESIGNER

Randi Taylor
SENIOR GRAPHIC DESIGNER

Upcoming Topics

March/*General Topics*
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Advertising

Doug Brown
ADVERTISING SALES
Doug.Brown@cda.org
916.554.7312

Permission and Reprints

Andrea LaMattina, CDE
PUBLICATIONS MANAGER
Andrea.LaMattina@cda.org
916.554.5950

Manuscript Submissions

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Doing Our Part

Ruchi K. Sahota, DDS, CDE

My grandfather, Nanapapa, takes this stuff very seriously. I remember my first roundtable discussion. I was home for the weekend from college, and we were talking about Measure D. It was not a big deal. No presidential candidate was to be decided that year. The booklet from the League of Women Voters was open in front of us. As the family murmured away in the background, I quickly grabbed Nanapapa's sample ballot and copied the answers into my own absentee ballot. I looked up and my grandfather's eyes were glaring back. Not good. This was not the way "it" was done. We gathered together to discuss the various candidates and ballot measures. We were expected to have a knowledge-based discussion. And then ... fill out the ballots.

Needless to say, honoring the ability to vote, preparing to vote and carrying out the vote is a big deal in our house.

Dentists appear to reflect the general population. Only 64.75 percent of CDA dentists are registered to vote. How can we not have 100 percent voter registration?

Thanks to the National Voter Registration Act of 1993, I was able to register by simply checking a box when I renewed my driver's license. Registering is easy, but registering is only half the battle. Actually voting is the other half. It is not just a right for those who live in our great country, but also a responsibility. Dentists have double the responsibility. The Hippocratic Oath affirms, "I will remember that I remain a member of society, with special obligations to all my fellow human beings, those sound of mind and body as well as the infirm." As leaders of our communities, we must play our role in society and vote.

Are we too busy with patients to visit voting booths on Election Day? Are we



Only 64.75 percent of CDA dentists are registered to vote. How can we not have 100 percent voter registration?

apathetic to the political happenings around us? Do we think that our volunteer engagements are service enough to our communities? If so, are we missing out on the opportunity to have our voices heard?

Several journalists suggested that past elections have been too boring for many to turn out. Who could say that was the case for 2016? No one. No way. No how. To say that we were too bored or too busy to vote is a poor excuse.

The call to vote was all around — almost omnipresent. Friends desperately pleaded on Facebook. Rock stars used their serenading, rump shaking and fist pumping as pleas to draw voters out on Election Day. Endless phone calls and doorknockers asked for support for their candidates. We had debate parties. We watched the political pundits ponder, predict and propose argument after argument until the wee hours on many a night. We were glued to the characters and story lines of the behind-the-scenes drama from the campaign.

Yet, how many of us showed up on Election Day?

The American Dental Association's Political Action Committee (ADPAC) board prioritized a drive to increase voter registration and education during last year's presidential election. Emails, newsletters and other communications were transmitted urging ADA members to register and vote in the primaries and general election.

Which leads to the question: Have the majority of CDA members been helping candidates with an interest in oral health be elected? Are we contributing to the PACs? By donating to the California Dental Political Action Committee (CalDPAC) or ADPAC, we can choose to provide financial backing to a group of people who share similar interests and positions on legislative matters. More than 90 percent of CDA members have contributed to CalDPAC over the past several years.

California only has one state assemblyman who is a dentist, Dr. Jim Wood. Nationally, Arizona, Georgia, Idaho and Texas have each elected a dentist to the U.S. House of Representatives. Because we have initiatives and bills that will go through our state legislature that will impact our profession and the health of the public, these elections affect us. Thus, dentists' participation in the voting process is imperative.

There is a silver lining. Though it seems that not enough of us are voting, there are many who want to serve. The Government Affairs Council and CalDPAC board remain diligent, full of passion and committed to advocating for dentistry in Sacramento. CalDPAC board members interview candidates and evaluate their interests in improving the oral health of Californians. They open their homes to host fundraisers. Leaders spend hours on conference calls and in meetings dissecting bills to

determine intended and unintended consequences for dentistry. CDA is a trusted resource for knowledge-based oral health data for our legislators and works to ensure that our dental voice is heard clearly throughout our Capitol.

When we saw the tobacco tax initiative pass and when antifluoridation efforts in Healdsburg failed, I delightedly said to myself, "And that's what CDA does for us!" These initiatives helped our patients. Whether cavities or oral cancers may have been prevented in a California resident because of these initiatives, by being a CDA member we had a part in this accomplishment. So

while there are many in Sacramento advocating for us, let us all practice our right and responsibility next November and do our part. Let us all vote. ■

Ruchi K. Sahota, DDS, CDE, practices family dentistry in Fremont, Calif., and serves as faculty at the University of the Pacific, Arthur A. Dugoni School of Dentistry. She is also a certified dental editor, a consumer advisor for the American Dental Association, past president of the Southern Alameda County Dental Society and a fellow of the American College of Dentists, International College of Dentists and the Pierre Fauchard Academy.

The Journal welcomes letters

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The Argument From Perfection

David W. Chambers, EdM, MBA, PhD

At the city council meeting last night, the elders listened patiently to a parade of people who were pretty convinced that the whole world is a conspiracy and to half a dozen dentists whom I found more reasonable. Ignoring both groups, our leaders decided to send a letter to the county requesting that the state law on water fluoridation not be applied here.

I had worked out the math on savings in state funding for local schools associated with water fluoridation reducing absences at \$2.5 million per year in the country. But one council member was having none of that. He produced a can of Coke from under the dais and asserted that surely we would be better served if kids would just stop drinking soda. I suppose he is right, but he was not proposing that the council do anything about reducing soda consumption.

What is wrong with this argument? Logically, nothing. Practically, everything. Academic philosophers have a technical term for this kind of reasoning; we call it dumb. Colloquially, it is known as a “red herring.” When riding to the hounds was the thing in England, the most sporting gentlemen gave the fox a chance by sending out their staff to drag strong smelling fish, herrings if they could be found, to confuse the dogs. The basic tactic is to substitute an important but insoluble problem for a solvable one that is being opposed. Result: It kills the practical small gain and accomplishes nothing. And all the while, the politician does not have to go on record as opposing the measure he or she is working to defeat. It is widely believed that there are a lot of red herrings in the Potomac and Sacramento rivers.

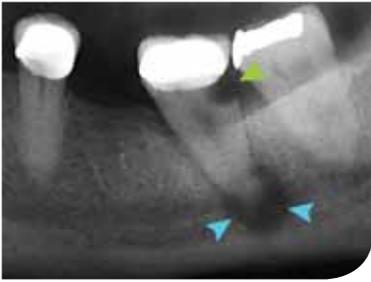
It seems as though a wise person is making a rational choice between two alternatives: fluoride or curtailing sugared beverages. One outcome really is superior to the other. The illusion is, however, that two alternatives are never on the table at the same time. Good logic would have dictated that the councilman make a motion to spend \$2.5 million dollars each year (the projected saving from water fluoridation) to get children to drink less soda.

When dentists buy supplies or patients select treatments, they compare desirable features. But the choice can only be among the various actual available bundles of features on offer. The fact that A costs more than the rest or will fail in 20 years is completely beside the point if *all-things-considered* A beats the other choices. There should be no red herring among the treatment options given to patients. ■

The nub:

1. Making perfection a requirement may mean missing out on the best available.
2. Blocking others from exercising their best option is being a ‘dog in the manger.’
3. The current market for red herrings is much higher than it should be.

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



Delivering stem cells into damaged teeth may someday help restore natural tooth function. An X-ray of deep dental decay (green arrow) and infection (blue arrows).

Stem Cell Delivery Approach Regenerates Dental Pulp-Like Tissue in Rats

Researchers at Tufts University School of Dental Medicine (TUSDM) now show that using a collagen-based biomaterial to deliver stem cells inside damaged teeth can regenerate dental pulp-like tissues in animal model experiments, according to a study published online Dec. 15 in the *Journal of Dental Research*.

“Our findings validate the potential of an alternative approach to endodontic treatment, with the goal of regenerating a damaged tooth so that it remains living and functions like any other normal tooth,” said senior study author Pamela Yelick, PhD, professor at TUSDM and director of its division of craniofacial and molecular genetics.

Yelick and her colleagues, including lead study author Arwa Khayat, former graduate student in dental research at TUSDM, examined the safety and efficacy of gelatin methacrylate (GelMA) as a scaffold to support growth of new dental pulp tissue. Using GelMA, the team encapsulated a mix of human dental pulp stem cells obtained from extracted wisdom teeth and endothelial cells, which accelerate cell growth. This mix was delivered into isolated, previously damaged human tooth roots extracted from patients as part of unrelated clinical treatment and sterilized of remaining living tissue. The roots were then implanted and allowed to grow in a rodent animal model for up to eight weeks.

Common Bacterial Cause of Gum Disease May Drive Rheumatoid Arthritis

Investigators at Johns Hopkins report they have new evidence that a bacterium known to cause chronic inflammatory gum infections also triggers the inflammatory “autoimmune” response characteristic of chronic, joint-destroying rheumatoid arthritis (RA).

In a report published Dec. 14 in *Science Translational Medicine*, the investigators say the common denominator they identified in periodontal disease and in many people with RA is *Aggregatibacter actinomycetemcomitans*. An infection with *A. actinomycetemcomitans* appears to induce the production of citrullinated proteins, which are suspected of activating the immune system and driving the cascade of events leading to RA.

“This is like putting together the last few pieces of a complicated jigsaw puzzle that has been worked on for many years,” said Felipe Andrade, MD, PhD, the senior study investigator and associate professor of medicine at Johns Hopkins University School of Medicine.

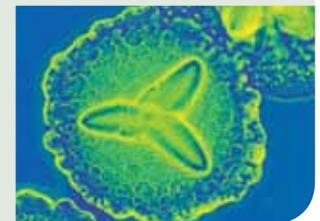
As part of its study, the team developed a test using the bacterium and leukotoxin A (LtxA) to detect antibodies against *A. actinomycetemcomitans* in blood. Using 196 samples from a large study of patients with RA, the researchers found that almost half of the patients – 92 out of 196 – had evidence of infection by *A. actinomycetemcomitans*.

Andrade cautions that his team’s study only looked at patients at a single point in time with established RA. To prove cause and effect of *A.*

actinomycetemcomitans and RA, more research will be needed to track the potential role of the bacteria in the onset and evolution of the disease. “If we know more about the evolution of both combined, perhaps we could prevent rather than just intervene,” Andrade said.

To learn more, go to stm.sciencemag.org.

Colorized image of a colony of *A. actinomycetemcomitans*. (Image: Derren Ready, Wellcome Images)



The researchers observed pulp-like tissue inside the once empty tooth roots after two weeks. Increased cell growth and the formation of blood vessels occurred after four weeks. At eight weeks, pulp-like tissue with highly organized blood vessels populated with red blood cells filled the entire dental pulp space. The team also observed the formation of cellular extensions and strong adhesion into dentin.

The team saw no inflammation at the site of implantation and found no inflammatory cells inside implanted tooth roots, which verified the biocompatibility of GelMA.

“Our work is early stage, but we are excited for the possibility of someday giving patients the option of regenerating their own teeth,” Yelick said.

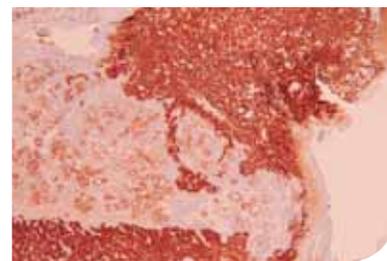
For more information about the study, go to journals.sagepub.com.

Mouth Cancer Rates in UK Soar

A new Cancer Research U.K. analysis reveals that rates of oral cancer have jumped by 68 percent in the United Kingdom over the last 20 years. The figures — released during the U.K.'s Mouth Cancer Action Month in November — reveal the cancer is on

the rise for men and women of all ages climbing from eight to 13 cases per 100,000 people over the last two decades.

For men under age 50, the rate has jumped by 67 percent in the last 20 years — going up from around 340 cases to around 640 cases each



Maintaining Immune Cells in Head and Neck Cancer

Researchers at the Medical University of South Carolina (MUSC) and the Ralph H. Johnson VA Medical Center report that inhibiting prostaglandin production slows the progression of premalignant lesions to head and neck squamous cell carcinoma (HNSCC), according to an article published Sept. 22 in *Frontiers in Immunology*.

Preclinical studies showed that treatment of premalignant lesions with indomethacin, a nonsteroidal anti-inflammatory drug (NSAID) similar to aspirin, increased the presence of immune cells and lessened tumor burden. The current study used a novel mouse model of HNSCC to determine how inhibition of prostaglandin affects tumor progression. Mice with premalignant lesions were given indomethacin, an NSAID that inhibits the production of prostaglandin, the article stated.

Indomethacin treatment increased the presence of immune cells at the lesion site and led to a systemic activation of the immune system. Specifically, there was an increase in both Th1-associated cytokines (IL-2 and IFN- γ) as well as Th2-associated cytokines (IL-10). This activation of the immune system reduced the progression of premalignant lesions to HNSCC.

Immunologist M. Rita Young, PhD, senior author for this study, who holds a dual appointment at MUSC and the Ralph H. Johnson VA Medical Center, said immunotherapy should be considered as a treatment strategy for premalignant lesions before they progress to cancer. “We can detect them. Why not treat them?”

Future studies in this area will focus on maintaining a strong immune presence in premalignant lesions for patients, the *Frontiers* article stated. If studies in humans bear out these preclinical findings, further research using more specific prostaglandin inhibitors in combination with other immunomodulatory compounds could provide a better treatment regimen to prevent the formation of HNSCC.

For more information, visit journal.frontiersin.org.

M. Rita Young, PhD, senior author for the study.
(Photo: Medical University of South Carolina)



year. For men age 50 and older, rates have increased by 59 percent climbing from around 2,100 cases to around 4,400 cases annually.

Oral cancer is more common in men, but women have experienced similar increases. In women younger than 50, oral cancer rates have risen by 71 percent in the last 20 years, with annual cases climbing from around 160 to around 300. Rates for women older than 50 have also gone up by 71 percent, with cases increasing from around 1,100 to around 2,200.

Cancer Research U.K. — working with the British Dental Association — has developed an oral cancer toolkit to help GPs, dentists, nurses and hygienists spot the disease and refer suspected cases sooner.

Andrea Fearon, 47, of the U.K. was diagnosed in 2013 with mouth cancer after a routine checkup by her dentist.

“I had thought that most people with mouth cancer are heavy smokers over the age of 50, so I was completely shocked when I was diagnosed with the disease,” she said. “I’m proof that this type of cancer isn’t limited to a particular age or sex. I thought seeing the dentist was about looking after your teeth — but it can save your life. It’s thanks to my dentist that the mouth cancer was caught early — that’s why I feel so lucky to be alive.”

Editor's Note: The digital image that was originally published with the following article has been removed at the request of its copyright owner.

It's Time to Stop Using Bite Marks in Forensics, Experts Argue

Researchers are increasingly skeptical about the validity of bite-mark identification as trial evidence, according to a paper published in the *Journal of Law and the Biosciences*. The paper describes the legal basis for the rise of bite-mark identification and reviews relevant empirical research on the subject, highlighting the lack of research and support provided by the research that does exist.

Studies of wrongful convictions based on DNA exonerations have found the forensic sciences to be second only to eyewitness errors as a source of false or misleading evidence contributing to erroneous convictions, according to the paper, which also states that error rates by forensic dentists are perhaps the highest of any forensic identification specialty still practiced.

One recent evaluation sought to examine all empirical research aimed at determining whether all human dentition is unique. Following an extensive bibliographic search, 13 studies were found and each was reviewed in detail. None were able to support a conclusion of dental uniqueness, according to the paper.

Moreover, recent reviews of the field's claims, as well as recent empirical findings, have underscored the lack of reliability and validity of the most fundamental claims about the ability of forensic dentists to identify the source of bite marks on human skin.

Vaccine Could Eliminate or Reduce Periodontitis

Australian scientists have developed a world-first vaccine that could eliminate or reduce the need for surgery and antibiotics for severe gum disease, according to research published in early December in the journal *NPJ Vaccines* (part of the Nature series). The findings represent analysis of the vaccine's effectiveness by collaborating groups based in Melbourne, Australia, and Cambridge, Mass.

The vaccine targets enzymes produced by the bacterium *Porphyromonas gingivalis* to trigger an immune response. This response produces antibodies that neutralize the pathogen's destructive toxins. *P. gingivalis* is known as a keystone pathogen, which means it has the potential to distort the balance of microorganisms in dental plaque, causing disease.

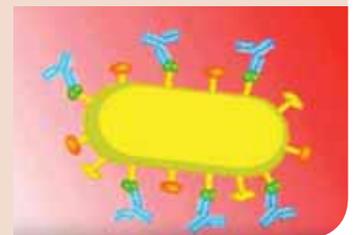
A team of dental scientists at the Oral Health CRC at the University of Melbourne has been working on a vaccine for chronic periodontitis with industry partner CSL, a global specialty biotherapeutics company, for the past 15 years. Clinical trials on periodontitis patients could potentially begin in 2018.

Moderate to severe periodontitis affects one in three adults, according to a news release. A chronic disease that destroys gum tissue and bone supporting teeth, leading to tooth loss, periodontitis is also associated with diabetes, heart disease, rheumatoid arthritis, dementia and certain cancers.

Eric Reynolds, AO, CEO of the Oral Health CRC and Melbourne laureate professor, said periodontitis is currently treated with professional cleaning, sometimes involving surgery, and antibiotic regimes. While these methods are helpful, in many cases the bacterium re-establishes in the dental plaque causing a microbiological imbalance that allows the disease to continue. "Periodontitis is widespread and destructive," Reynolds said. "We hold high hopes for this vaccine to improve quality of life for millions of people."

For more information about the vaccine, visit nature.com.

Antibodies attach themselves to and neutralize gum disease-causing bacteria. (Image: Oral Health CRC)



A number of DNA exonerations have occurred in recent years for people convicted based on erroneous bite-mark identifications. A committee of the National Academy of Sciences recently concluded that bite-mark identification testimony has been "introduced in criminal trials without any meaningful scientific validation, determination of error rates or reliability testing."

Michael Saks, a psychology and law professor at Arizona State University and lead author of the paper, said evidence-based evaluation of forensic techniques has only recently been recognized as essential to establishing scientific claims. "And bite-mark identification has become a central focus of concern," he said.

To learn more about this debate, visit jlb.oxfordjournals.org.

Patients Should Stop e-Cigarette Use Before Plastic Surgery

Cigarette smokers are at increased risk of complications after plastic surgery. Could e-cigarette users face a similar risk?

The answer to this question is “yes,” according to a special topic paper in the December issue of *Plastic and Reconstructive Surgery*, the official medical journal of

the American Society of Plastic Surgeons (ASPS). Evidence and recommendations related to e-cigarette use by plastic surgery patients are discussed in the paper.

“Refraining from [e-cigarette] use four weeks before surgery is a prudent course of action, despite the fact that



Pesticides Can Cause Changes in Oral Microbiome

Research published Nov. 11 in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology, finds that pesticide exposure in farmworkers is associated with changes in the oral microbiome.

In the study, the investigators sampled oral swabs from 65 farmworkers and 52 nonfarmworker adults from the Yakima Valley, Wash., community agricultural cohort during the spring and summer of 2005. Farmworkers can undergo high pesticide exposures during those seasons while working in recently sprayed orchards thinning fruit and pruning. Oral swabs were also sampled in winter of 2006, during a season when exposures are quite low. Concurrently, they measured blood levels of organophosphate pesticides in the study subjects.

Among those farmworkers in whom the organophosphate pesticide azinphos-methyl was detected in the blood, researchers found “significantly reduced abundances of seven common taxa of oral bacteria, including *Streptococcus*, one of the most common normal microbiota in the mouth,” said first author, Ian B. Stanaway, a PhD candidate in environmental toxicology at the University of Washington, Seattle (UW). Changes in populations, species and strains of *Streptococcus*, as well as from the genus *Halomonas*, remained particularly low during the following winter.

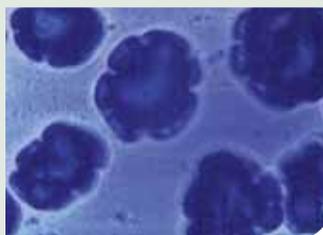
The investigators also saw a pesticide-associated spring-summer general reduction in bacterial diversity in the study subjects, which persisted into the winter, suggesting that “long-lasting effects on the commensal microbiota have occurred,” according to the report.

Predictably, farmworkers had greater blood concentrations of pesticide and greater changes in their oral microbiota than local nonfarmworking adults.

“The challenge becomes, what does this mean? We don’t know,” said principal investigator Elaine M. Faustman, PhD, professor in the UW’s department of environmental and occupational health sciences.

Nonetheless, Stanaway noted that in other studies, changes in species and strains of *Streptococcus* have been associated with changes in oral health.

For more information, visit aem.asm.org.



it has yet to be determined if the effects are similar to traditional cigarettes,” write ASPS member surgeons Peter Taub, MD, of Mount Sinai Medical Center and Alan Matarasso, MD, of Albert Einstein College of Medicine, both in New York City.

Patients who smoke are more likely to have failure of the skin flaps used for many types of plastic and reconstructive surgery procedures, according to a news release. These skin flap complications are thought to be related to nicotine-induced reductions in blood flow (vasoconstriction).

Many “vapers” use e-cigarette solutions that contain nicotine, which might lead to similar adverse effects. The risk isn’t necessarily the same, as cigarette smoke also contains other compounds that might affect blood flow, the news release stated. But there are also questions about other potentially toxic substances in e-cigarette vapor.

In one study of general surgery patients, quitting smoking for three or four weeks before surgery reduced the complication rate from about 40 to 20 percent. Based on this and other high-quality evidence, cigarette smokers are strongly advised to stop smoking at least four weeks before plastic surgery procedures.

A similar guideline should apply to the use of e-cigarettes before plastic surgery, Taub and Matarasso believe. “Based on our current best knowledge, it seems reasonable to advise plastic surgery candidates to cease e-cigarette use in a manner similar to what is advised for [cigarettes],” the doctors said.

For more information, visit eurekaalert.org.



Study Concludes Most Nursing Home Patients Refuse Dental Care

A recent study by University at Buffalo researchers found that nearly 90 percent of patients at long-term care facilities don't take advantage of dental services, even when the services are free.

The research, published in December in *Special Care in Dentistry*, found that the longer a patient stayed at a long-term care facility, such as a nursing home or assisted living facility, the more likely he or she was to use dental services. But even among those who stayed at the facility for years, just 55 percent of patients used the services.

The study examined the dental and medical records of more than 2,500 residents at the Brothers of Mercy Nursing and Rehabilitation Center in Clarence, N.Y., who were discharged between 2008 and 2012. Among the group, only 10 percent received a dental exam at least once during their stay.

The average length of stay at the facility was two years, with nearly half of patients staying less than a month. Usage rates of dental services ranged from 7 percent for patients who stayed less than a month to 30 percent for those who stayed between a month and two years. Usage rates increased to 55 percent among those who stayed beyond two years.

e-Cigarettes Cause Damage to Gum Tissue

A University of Rochester Medical Center study suggests that electronic cigarettes are as equally damaging to gums and teeth as conventional cigarettes. The study, published in *Oncotarget*, was led by Irfan Rahman, PhD, professor of environmental medicine at the University of Richmond School of Medicine and Dentistry, and is the first scientific study to address e-cigarettes and their detrimental effect on oral health on cellular and molecular levels.

Previously, scientists thought that the chemicals found in cigarette smoke were the culprits behind adverse health effects, but a growing body of scientific data, including this study, suggests otherwise. According to the study, when the vapors from an e-cigarette are burned, it causes cells to release inflammatory proteins, which in turn aggravate stress within cells resulting in damage that could lead to various oral diseases.

"How much and how often someone is smoking e-cigarettes will determine the extent of damage to the gums and oral cavity," Rahman said.

The study, which exposed 3-D human, nonsmoker gum tissue to the vapors of e-cigarettes, also found that the flavoring chemicals play a role in damaging cells in the mouth.

"We learned that the flavorings – some more than others – made the damage to the cells even worse," said Fawad Javed, a postdoctoral resident at Eastman Institute for Oral Health, part of the UR Medical Center, who contributed to the study. "It's important to remember that e-cigarettes contain nicotine, which is known to contribute to gum disease."

Rahman said he would like to see manufacturers disclose all the materials and chemicals used in e-cigarettes so consumers can become more educated about potential dangers. "More research, including long-term and comparative studies, are needed to better understand the health effects of e-cigarettes," he added.

For additional information about the study, visit impactjournals.com.



The low usage rate at long-term care facilities echoes a similar issue among the general population. According to 2014 data from the Centers for Disease Control and Prevention, nearly four in 10 American adults don't visit the dentist.

"There is a problem within the population as a whole toward

appreciation for dental care," said Frank A. Scannapieco, DMD, PhD, lead investigator on the study and chair of the department of oral biology in the UB School of Dental Medicine. "The perception is that if you don't have pain, you don't have a problem."

For more information about the study, visit onlinelibrary.wiley.com.

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Crown Lengthening Needs and Outcomes in Adults Attending a Predoctoral Clinic

Ryan McGary, DMD; Josephine Franc, RDH, BS; Sam Chui, DDS; Clara S. Kim, DMD, MS; and Tobias K. Boehm, DDS, PhD

ABSTRACT In this retrospective study of 5,536 patients admitted over four years at a predoctoral dental clinic for comprehensive care, general dentists identified crown lengthening needs in 584 patients and 760 teeth. Only 51 patients and 68 teeth actually received crown lengthening procedures. For the other cases, patients discontinued treatment or chose extraction or restoration without crown lengthening procedures. Teeth that received crown lengthening procedures were most likely restored and functioning for at least one year.

AUTHORS

Ryan McGary, DMD, received his dental degree at Western University of Health Sciences and is currently a practicing general dentist in Fort Carson, Colo.
Conflict of Interest
Disclosure: None reported.

Josephine Franc, RDH, BS, is an instructor and staff registered dental hygienist at Western University of Health Sciences.
Conflict of Interest
Disclosure: None reported.

Sam Chui, DDS, received his dental degree from the University of California at Los Angeles, School of Dentistry, and practices general dentistry in Hacienda Heights, Calif. He is an assistant professor at Western University of Health Sciences.
Conflict of Interest
Disclosure: None reported.

Clara S. Kim, DMD, MS, is a periodontist who received dental training at Harvard University and the University of Southern California. She is an assistant professor at Western University of Health Sciences.
Conflict of Interest
Disclosure: None reported.

Tobias K. Boehm, DDS, PhD, is a periodontist who received dental and research training at the University at Buffalo. He is a full-time assistant professor at Western University of Health Sciences.
Conflict of Interest
Disclosure: None reported.

Crown lengthening procedures are frequently performed by periodontists, but little is known about the typical patient and tooth receiving crown lengthening procedures. While a current literature search in December 2015 on “crown lengthening” produced 624 articles listed in the National Library of Medicine’s PubMed database, most articles on crown lengthening describe unusual cases or review surgical and diagnostic methods. Clinical research studies on crown lengthening do not reveal specific characteristics of patients or teeth that require crown lengthening or are limited to a subset of teeth, such as mandibular molars or maxillary anterior teeth.¹⁻⁶

Given the paucity of descriptive research on this subject, this study aimed to determine the frequency of crown lengthening needs and procedures performed in adults seeking comprehensive

dental care at a predoctoral dental clinic. This study also aimed to determine the characteristics of these patients and teeth requiring crown lengthening procedures for restoration and radiographic characteristics most likely associated with extraction of these teeth. Finally, this study also tested if crown lengthening procedures actually did improve restorative success compared to teeth that were originally thought to require crown lengthening procedures, but were restored without these procedures.

Materials and Methods

Patients

This retrospective study was approved by the Institutional Review Board at Western University of Health Sciences, Pomona, Calif., and performed at the Dental Center of the Western University of Health Sciences. The Dental Center is a comprehensive dental clinic where

TABLE 1

Reasons for Not Performing Crown Lengthening After Crown Lengthening Needs Are Identified

Stage of treatment	Treatment factor	Percent of teeth (number of teeth)
After initial exam	Patient did not return	1.6% (12)
	Dentist decided not to treat	0.8% (6)
	Waiting for consult	4.4% (34)
After treatment plan presentation	Patient did not return for treatment	10% (79)
	Patient chose extraction	11% (84)
	Patient refuses surgical treatment	0.4% (3)
	Dentist deferred treatment	0.4% (3)
Initial therapy in general practice	Patient discontinued treatment prior to referral	9.9% (75)
	Dentist declared tooth nonrestorable and extracted tooth	12% (93)
	Dentist declared tooth restorable without crown lengthening	12% (93)
	Other reasons crown lengthening not performed	0.4% (3)
Periodontist referral	Patient did not return for crown lengthening	9.2% (70)
	Periodontist recommended treatment other than crown lengthening	18% (137)
	Periodontist recommends and performs crown lengthening as planned	8.9% (68)

This table lists reasons why crown lengthening was not performed after initial recognition of crown lengthening need. According to this study, 42 percent of patients who initially were identified to have crown lengthening needs did not get referred to a periodontist because of patient factors.

patients are managed by general dentists who direct junior and senior dental students who perform comprehensive dental care on patients. Most important, treatment and referral decisions for this study were made by general dentists who supervised the students. Specifically, general dentists in this clinic decided when to refer cases to in-house periodontists for evaluation and crown lengthening. Records of all 5,536 adults admitted for comprehensive dental care at the Dental Center between September 2010 and April 2014 were searched for chart entries with various spellings and truncations of the term “crown lengthening.” After eliminating erroneous, duplicate and irrelevant chart entries, we found 760 teeth in 584 patients where crown lengthening needs were identified. We tested the completeness of the search by reviewing a random block of 100 charts and did not find any additional crown lengthening cases. Demographic information, medical history and dental histories were canvassed for relevant information and tabulated in frequency tables. Periodontal diagnoses made by

calibrated dentists following the 1999 International Workshop Definitions⁷ during the patients’ initial exams were collected as well and tabulated. Each case was followed and outcomes were recorded as it passed from the general dentistry clinic to the specialists for crown lengthening procedures and back for restoration and maintenance.

Crown Lengthening Procedures

Although crown lengthening procedures may include orthodontic extrusion, gingivectomy and various crown lengthening surgical techniques, all patients received conventional crown lengthening surgery. Crown lengthening surgery was exclusively performed by three board-certified periodontists under local anesthesia at the Western University of Health Sciences Dental Center. For the vast majority of cases, prior to crown lengthening surgery, teeth were prepared to a final margin and provisionalized with cold-cure acrylic temporary restorations. In a few cases, there was not enough tooth structure to retain a provisional restoration.

For those cases, a vacuform template indicating desired crown exposure was provided to the periodontal surgeon. For crown lengthening, surgeons elevated a mucoperiosteal flap, removed alveolar bone to a level 3 mm apical to the restorative margin using rotating carbide burs and hand chisels, scaled and root planed exposed root surfaces with sharp curettes, thinned palatal tissue as needed and placed flap margins at or apical to the restorative margins after surgery. All patients received analgesics for the first week following surgery and were seen for postoperative evaluations after one week and six weeks. Teeth were usually restored about two to three months after crown lengthening surgery.

Radiographic Analysis

In order to retrospectively determine which radiographic characteristics would be most associated with extraction, one of the periodontists involved in this study evaluated calibrated digital radiographs that were taken when the treating general dentist referred the tooth for crown lengthening. Calibrated

TABLE 2

Patient Characteristics of Cases Where Crown Lengthening Needs Are Identified		
Patient characteristic		Percent of patients (number)
Demographics	Age	45.5 +/- 16.2 years
	Male gender	37.5 % (219)
	Caucasian	32.8 % (192)
	Hispanic	39.4 % (228)
	African-American	7.7 % (45)
Medical conditions	Hypertension	18.3 % (107)
	Current tobacco use	10.5 % (61)
	Type 2 diabetes mellitus	7.53 % (44)
	Asthma	7.36 % (43)
	Gastric esophageal reflux disease	5.48 % (32)
	Former tobacco use	4.97 % (29)
Periodontal disease	Health	0% (0)
	Gingivitis	50.1 % (293)
	Mild chronic periodontitis	40.1 % (234)
	Moderate chronic periodontitis	7.5 % (44)
	Severe chronic periodontitis	1.4 % (8)

This table lists characteristics of patients who were identified by general dentists to need crown lengthening procedures. Average age is given with standard deviation. Patient characteristics do not differ significantly between initial recommendation of crown lengthening procedure by general dentist, referral to periodontist and the crown lengthening appointment as determined by chi-square method with Yates correction ($p > 0.05$).

“conducive to crown lengthening” and possessed at least one of these characteristics, it was categorized as having “poor characteristics.” We then determined for all teeth the eventual outcome (restored, extracted) and used this data for outcome analysis.

Data Analysis

Frequency tables were created for demographic, patient history and tooth-related factors for all patients at the initial determination of crown lengthening needs by a general dentist, at the presurgical evaluation visit by a periodontist, at the surgical appointment with the periodontist and after restoration by a general dentist. We correlated extraction and restoration of teeth with meeting radiographic criteria at the conclusion of each case using contingency tables. Records were kept for all teeth recording if teeth survived and were successfully restored for at least one year after restoration. Restoration was considered successful if, after at least one year of restoration placement, no records indicated patient dissatisfaction with the restoration or recurrent caries, open margin, open contact, other restorative defects noted, absence of bleeding on probing and probing depths less than 5 mm. One-year success rates of teeth restored after crown lengthening were compared with those of teeth where crown lengthening was considered, but not performed before restoration using the chi-square method with Yates correction. For comparison of patient and tooth characteristics between time points and the general clinic patient populations, comparisons were also made with the chi square with Yates correction and Fisher exact test methods, depending on the number of teeth or patients in each comparison group. All statistical calculations were performed using R: A Language and Environment for Statistical Computing (Vienna).

digital radiographs were evaluated using drawing and measurement tools provided in MiPACS Dental Enterprise Viewer (Medicor Imaging, Charlotte, N.C.). The periodontist evaluating the radiographs began by outlining the planned restoration on the radiograph using the provisional restoration and margin as a guide, checking if there was at least 1.5 mm occlusal reduction and a preparation length of at least 3.5 mm.⁸ If root canal treatment was planned for the tooth in question, a ferrule of at least 1 mm⁹ needed to be present as additional criterion. If the tooth preparation did not meet any of these criteria, it was categorized as “restorative criteria not met.” From the predicted restorative margin, the predicted new bone level was drawn 3 mm apical to the restorative margin¹⁰⁻¹² using a calibrated digital ruler and ramped to the existing bone level two teeth mesial and distal to the tooth with crown lengthening

needs. If this predicted bone level was located apical to radiographic furcations in the area of the tooth in question and the two adjacent teeth mesial and distal to it, the tooth was categorized as “furcation exposure likely.”¹³ The predicted bone level was measured from the nearest cusp tip of the tooth mesial or distal to the tooth receiving crown lengthening and transferred to the periapical radiograph. If this predicted bone level resulted in poor crown-to-root ratios (length of tooth outside of bone greater than length of tooth still embedded in predicted bone level after surgery), the tooth was categorized as “poor crown-to-root ratio likely.”¹⁴ Furthermore, if this predicted bone level would require more than 5 mm bone removal as measured on the bitewing radiograph, it was categorized as “excessive bone removal needed.” If a tooth lacked all those radiographic characteristics, was categorized as

TABLE 3A

Characteristics of Teeth With Crown Lengthening Needs

Tooth/Location	Percent of teeth (number)
Maxillary molars	25.0% (191)
Maxillary premolars	21.0% (157)
Maxillary canines	5.9% (45)
Maxillary incisors	6.2% (47)
Mandibular molars	31% (238)
Mandibular premolars	9.0% (68)
Mandibular canines	1.2% (9)
Mandibular incisors	0.3% (2)

This table lists crown lengthening needs by tooth type, as originally identified by a general dentist. For three teeth, crown lengthening needs were recorded for a general area. Comparing these frequencies to other time points in treatment, molars and premolars were the most commonly affected teeth at all time points. When comparing crown lengthening needs of different tooth groups, a significantly higher need for crown lengthening for posterior teeth ($p = 0.03$, chi-square method with Yates correction) was noticed. No statistically significant differences were seen between left and right side or maxilla versus mandible.

Results

How Common Are Crown Lengthening Needs in Adult Patients?

In our clinic, about 1–10 percent of patients appear to have crown lengthening needs, as crown lengthening needs were recorded for 584 patients out of 5,536 adult patients. A fraction of these patients received crown lengthening procedures as the result of patient dropout, patient choices and dental treatment decisions. These 584 patients had 760 teeth that were recognized by general dentists to need crown lengthening. However, only about one-tenth of these cases actually received crown lengthening. As seen in TABLE 1, most teeth with crown lengthening needs did not receive crown lengthening procedures because more than 30 percent of patients discontinued treatment prior to the procedure. There was a consistent rate of patient dropout as these cases progressed, with 12 percent of patients not returning after the initial dental exam. Another 10 percent of patients did not start treatment after

TABLE 3B

Reasons Crown Lengthening Needs Were Identified

Reason	Percent of teeth (number)	
Caries	Enamel only	0.9% (7)
	D1	4.1% (31)
	D2	6.3% (48)
	D3	15.6% (118)
	Clearly into pulp	46% (348)
External resorption	0.2% (2)	
Other restorative need	Miscellaneous needs	1.7% (13)
	Lengthen short crown	1.2% (9)
	Correct overhanging restoration	1.5% (11)
	Improve esthetics	2.8% (21)
	Replacement missing restoration	2.9% (22)
	Reestablish biologic width	3.4% (26)
	Restore fractured tooth	4.5% (34)
Treat open margins	8.9% (67)	

At various time points during treatment, tooth characteristics and reasons for crown lengthening stayed similar throughout treatment. For three teeth, crown lengthening needs were recorded for a general area and no rationale was given. The most common reason crown lengthening was needed was for restoration of deep caries involving the pulp.

treatment plan presentation and 10 percent discontinued dental treatment during initial dental treatment.

The second most common reason for nonreferral was that teeth were extracted, either as decided by patients (11 percent) or restorative dentists (12 percent) who declared the teeth nonrestorable. In another 12 percent of teeth, restorative dentists planned restoration of these teeth without periodontal consults. Among the remaining 34 percent of teeth that were referred for evaluation and treatment, only half of these teeth were deemed possible candidates for crown lengthening by periodontists and only a quarter of those teeth actually received crown lengthening. We observed that for 86 percent of the teeth, referral was initiated by a general dentist. In the remaining cases, the referral decision for crown lengthening was made after consultation with a prosthodontist or endodontist.

Considering patients instead of teeth, crown lengthening needs were identified in 10 percent of all patients by restorative practitioners, 4 percent of all

patients were referred for evaluation for crown lengthening and only 1 percent of all patients actually received crown lengthening. When tracking the source of patients, we observed that about 90 percent of crown lengthening patients originally had self-referred to the dental clinic for general care and only 5 percent of crown lengthening patients were originally seen for acute needs such as a toothache. The remaining patients were originally referred from outside dental providers, such as community clinics and hygiene school clinics.

What Is the Typical Patient and Tooth That Needs Crown Lengthening Procedures?

The average age for a patient identified to need crown lengthening procedures is 45.5 years \pm 16.2 years, with a slight but statistically significant bias toward female patients and Hispanic ethnicity ($p < 0.001$, chi square with Yates correction)(TABLE 2). The most common conditions were hypertension, history of tobacco use, asthma or type 2

TABLE 4

Radiographic Characteristics of Teeth			
Of all 275 teeth that were referred to periodontist for crown lengthening procedures		Percentage (number)	
Teeth that lack poor radiographic characteristics		61%	(168)
Teeth with poor radiographic characteristics	Restorative criteria not met	0.4%	(1)
	Furcation exposure likely	23%	(63)
	Poor crown-to-root ratio likely	26%	(70)
	Excessive bone removal needed	5.8%	(16)

This table lists radiographic characteristics of teeth referred for crown lengthening. Poor characteristics are those that were considered not conducive for crown lengthening. Percentages do not add to 100 percent as many teeth had more than just one characteristic that made them poor candidates for crown lengthening.

TABLE 5

Radiographic Characteristics and Outcome of Teeth With Crown Lengthening Needs		
Teeth	Radiographic characteristic(s) conducive to crown lengthening	Poor radiographic characteristic(s)
Restored	64	8
Extracted	14	57
If a tooth has radiographic characteristics conducive to crown lengthening, the likelihood of tooth being restored was ...		88.9%
If a tooth had at least one poor radiographic characteristic, the likelihood of extraction was ...		80.3%

Retrospectively, radiographic characteristics were determined for all 143 teeth that originally were identified to need crown lengthening by a general dentist, and where treatment was completed as either restoration or extraction. As seen here, radiographic characteristics correlate well with treatment outcome.

diabetes mellitus. In all cases, these were controlled enough to have little effect on dental treatment. The majority of cases needed treatment or maintenance procedures for plaque-associated gingivitis and mild generalized chronic periodontitis along with crown lengthening and restorative procedures. The characteristics of patients were slightly different from the average dental clinic patient, with a notably higher prevalence of hypertension. Case characteristics did not change at each stage of treatment, indicating no case selection bias between general dentists and periodontists.

As seen in TABLES 3A and 3B, the most common tooth receiving crown lengthening procedures in our clinic was a posterior tooth with deep caries. The tooth surface needing crown lengthening was an interproximal tooth surface in nearly all cases, and in the majority of cases, recurrent caries on existing restorations

triggered the need for crown lengthening. No significant differences were observed between right and left sides or maxillary and mandibular teeth in the number of teeth receiving crown lengthening. The proportion of tooth types for teeth with crown lengthening needs did not change significantly during the treatment process and neither did the restorative reason for crown lengthening between initial identification of crown lengthening needs, evaluation by a periodontist and actual surgery. Interestingly, mandibular canines and incisors were never considered for crown lengthening procedures (TABLE 3A). The need for crown lengthening was triggered by many restorative reasons, as listed in TABLE 3B, but at the time of crown lengthening, reasons other than caries were limited to concerns about biologic width invasion, short crowns, tooth fractures, missing restoration and open margins.

What Radiographic Characteristics Are Most Associated With Extraction of Teeth That Have Crown Lengthening Needs?

As shown in TABLE 4, for teeth that were referred to a periodontist for crown lengthening, the most common radiographic characteristic associated with tooth extraction was poor crown-to-root ratio and proximity of the furcation to the proposed restoration. As shown in TABLE 5, in patients who completed dental treatment, 89 percent of teeth that had radiographic characteristics conducive to crown lengthening were restored. In contrast, 80 percent of teeth that had at least one poor radiographic characteristic were extracted.

Does Crown Lengthening Improve Restorative Success?

In our setting, one-year success rates were nearly twice as high (44 percent) if a tooth with crown lengthening needs was managed by a general dentist and periodontist, compared to teeth with crown lengthening needs managed by general dentists alone (24 percent) (TABLE 6). Restorative success was defined if the tooth in question was in function, the restoration still in place with no new caries or replacement planned, probing depths equal or less than 4 mm and no bleeding on probing. Teeth with crown lengthening needs that received crown lengthening procedures also had higher rates of restoration regardless of follow-up time. Importantly, differences in extractions, teeth with periodontal problems after restoration and dropout rates were not significantly different between teeth with crown lengthening needs that were managed by restorative dentists or those jointly managed by restorative dentists and periodontists. We also followed teeth where crown lengthening was recommended but not performed and found that the majority of

TABLE 6

Outcomes for Different Scenarios for Teeth Where Crown Lengthening Needs Were Originally Identified by a General Dentist

Treatment	Outcome	Percent of teeth (number)	
General dentist only	Success > one year	24%	(22)
	Restored, other outcome	47%	(43)
	Extracted	3%	(3)
	Other outcome	26%	(24)
General dentist and periodontist, crown lengthening performed	Success > one year	44%	(30) *
	Restored, other outcome	38%	(26)
	Extracted	3%	(2) ^{ns}
	Other outcome	15%	(10)
General dentist and periodontist, crown lengthening recommended by periodontist, but not performed	Success > one year	0%	(0)
	Restored, other outcome	11%	(6)
	Extracted	4%	(2)
	Other outcome	85%	(48)
General dentist after periodontist did not recommend crown lengthening as treatment	Success > one year	1%	(3)
	Restored, other outcome	6%	(7)
	Extracted	51%	(70)
	Other outcome	42%	(57)

* $p = 0.01$ chi-square test with Yates correction; statistically significant difference between number of cases successfully restored for at least one year.

^{ns} $p > 0.05$ Fisher's exact test; no significant differences between number of teeth extracted or teeth with periodontal problems after restoration.

Outcomes were analyzed for different scenarios that unfolded after a general dentist initially recognized the need for crown lengthening in a case. As seen here, successful restoration was most likely if a crown lengthening case was co-managed by a general dentist and periodontist.

these teeth were lost because of patient dropout. As expected, if crown lengthening was not recommended by periodontists, the majority of those teeth were extracted and only a few teeth were restored successfully.

Discussion

In this large, general practice dental school clinic, crown lengthening most likely is needed and performed for posterior teeth with deep recurrent caries against a backdrop of mild systemic disease and periodontal disease. It is possible that these findings may be unique to our setting if our patient population is not representative of the typical patient attending a private general practice. However, the characteristics of our patient population closely match demographic characteristics of the surrounding communities in the San Gabriel Valley

and Inland Empire region of Southern California. Moreover, prevalence of medical conditions is similar to published data for California and prevalence of periodontal disease and caries is similar to published national and state epidemiologic data.¹⁵ Our results are also comparable to Iranian data on crown lengthening referrals, where the average age of patients receiving crown lengthening was 38 + 14 years, caries was the most common reason for crown lengthening, and molars and premolars were also the most common teeth receiving crown lengthening.¹⁶ Given that our patient population seems to be representative of the surrounding community and findings are comparable to findings from a distant patient population, findings from this study should apply well to many other areas in California with similar demographics. We attempted

other approaches to verify this idea, such as obtaining statewide dental insurance data. However, we could not obtain suitable data, and it is likely that this type of data contains significant sample bias and may be biased toward extractions if crown lengthening procedures are not covered by a given plan.

Another major concern raised by this study was the fact that even though a significant number of teeth was determined to have crown lengthening needs, few were referred for crown lengthening procedures. Barriers to referrals from general practitioners to periodontists have been studied before,¹⁷⁻²⁰ but these studies only evaluated if a referral was made from a private general dental office to a private periodontal office. In these studies, the main factor that prevented referrals was access to a periodontal specialist and awareness of periodontal needs. However, this did not apply to our study's setting, as periodontists were available in the same clinic and restorative dentists received regular training on periodontal referrals. Several British researchers found the quality of periodontal referrals to be poor,²¹⁻²³ but criticized mostly the lack of detail provided in referral letters. This was not an issue in this study because specialists and generalists shared the same clinical record system and a standardized referral form is part of the record for each patient. We are not aware of any study that evaluated referrals for the likelihood of specialist treatment after the referral is made, and we propose that the low rate of referrals seen in this study is mostly related to patient factors, as evidenced by the large dropout rate and to a lesser degree on an absence of clear diagnostic guidelines for crown lengthening.

Apart from practitioners referring teeth for crown lengthening where crown lengthening was not indicated,

the main reason why crown lengthening procedures were not performed was patient dropout. In our study, 48 percent of patients dropped out prior to surgical treatment and continued dropout after the crown lengthening procedure was the main reason for the low case completion rates observed. Although discouraging, a similar dropout rate of 50 percent during presurgical phase periodontal treatment has been reported in another university clinic setting.²⁴ Similar poor compliance with periodontal treatment has been reported in multiple private practice settings prior to and after surgery.²⁵⁻²⁷ We therefore suggest that restorative dentists and periodontists should strive to educate their patients about the value of treatment and motivate them to follow through with treatment.

To our knowledge, this is the first study that characterizes patients and teeth receiving crown lengthening procedures during the course of treatment by general dentists and periodontists. We did not see any significant differences in crown lengthening case characteristics at any point of care. It seems therefore likely that restorative dentist and periodontist case selection criteria do not differ when it comes to demographics, medical history, restorative needs and periodontal status. We noticed, however, that crown lengthening patients form a distinct group among the general clinic patient population. While our general patient population resembles the surrounding community in demographics except for the older age, we observed that patients with crown lengthening needs had a small but significantly higher proportion of females and Hispanic patients. Similarly, while our overall patient population has statistically similar prevalences in medical conditions such as type 2 diabetes mellitus, asthma, obesity, hypertension (8 percent) and tobacco use to surrounding communities,

patients with crown lengthening needs report nearly twice as much hypertension (17 to 18 percent, $p < 0.05$) as part of their medical history. We suspect that antihypertensive medications contribute to xerostomia²⁸ and an increased risk of deep recurrent caries precipitating crown lengthening procedures. While our overall patient population has slightly higher than average levels of periodontal disease (moderate to severe chronic periodontitis: 26 percent) likely due to the older median age compared to the national average,¹⁵ crown lengthening

We suspect that anti-hypertensive medications contribute to xerostomia and an increased risk of deep recurrent caries precipitating crown lengthening procedures.

patients in this study experienced a significantly lower level of periodontal disease (moderate to severe chronic periodontitis: 6 percent, $p < 0.05$). Most likely, this difference can be explained by the poor crown-to-root ratio observed for teeth with advanced bone loss caused by moderate to severe periodontitis, which then renders these teeth poor candidates for complex restorative procedures including crown lengthening.

Furcation involvement and poor crown-to-root ratio are not absolute contraindications for crown lengthening and restoration and therefore have no maximum predictive values for restoration or extraction. Although furcation involvement is not desired for maintenance of teeth, it is entirely possible to treat furcations exposed during crown

lengthening with a variety of methods, such as tunneling, root amputation or odontoplasty and an appropriately contoured restoration.^{29,30} Similarly, it may be possible in selected cases to add support to teeth with poor crown-to-root ratio by various splinting methods. In addition, relying on radiographic measures alone may be misleading, as projecting a new bone level by 3 mm apical to the final restorative margin may not apply to all patients. Wagenberg et al. suggested that some patients need up to 5 mm of bone removal to avoid long-term biologic width complications,³¹ and restorative needs, such as increased need for occlusal clearance, might dictate an even greater need for crown lengthening.

This study attempted to determine how the periodontists involved decided if crown lengthening should be recommended by reviewing their chart notes. Chart notes revealed little in how periodontists arrived at their diagnosis, and there likely was not a uniform approach to diagnosis because we did not calibrate diagnostic methods prior to this study. Judging from informal case discussions that take place weekly during periodontal faculty meetings, surgical techniques for crown lengthening are the same as described above, but use somewhat different approaches for diagnosing the need and likelihood of success for crown lengthening cases. Because the periodontists involved in this study combine varying amounts of clinical and radiographic evidence for their recommendations on crown lengthening, we were interested in which combination of radiographic criteria most closely predicted the recommendation and eventual treatment outcome. As the periodontists often did not specify in their chart notes what clinical evidence determined their recommended treatment, and radiographs were the

most common documentation for those cases, we evaluated radiographs and noted correlation between outcome and radiographic parameters after each case was completed. All radiographic measurements were performed by one of the periodontists on cases where the case was completed as either extraction or restored and where diagnostic preoperative radiographs were available.

Although scientific literature contains diagnostic reasoning for crown lengthening and descriptions of crown lengthening procedures starting from the 1970s,¹⁰ little research has been done to examine crown lengthening outcomes including tooth survival. To our knowledge, only one study examined tooth survival after crown lengthening surgery. The study reports a tooth survival rate in the 83 to 98 percent range over three to 10 years, which is comparable to survival of dental implants and root canal-treated teeth.³² This study also confirms some of our findings, as it also identifies posterior teeth as the teeth most commonly needing crown lengthening. It also shows poor crown-to-root ratio as a good predictor for tooth loss in teeth that may need crown lengthening.

Conclusion

In this retrospective study of crown lengthening cases at the Dental Center of Western University of Health Sciences, crown lengthening needs were identified in about 1–10 percent of the adult patient population. In most cases where crown lengthening needs were identified by a general dentist, patients discontinued treatment prior to referral or teeth were extracted. Crown lengthening procedures were most commonly needed for molars and premolars with interproximal, recurrent caries close to the pulp in middle-aged patients with common, mild systemic conditions and

mild periodontal disease. Following these cases for at least one year, teeth crown lengthening needs were most likely successfully restored and retained if they received crown lengthening and were managed by a periodontist and general dentist. For teeth evaluated for crown lengthening, poor expected crown-to-root ratio and furcation invasion were the most useful determinants for eventual extraction versus successful restoration. ■

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THE CORRESPONDING AUTHOR, Tobias K. Boehm, DDS, PhD, can be reached at tboehm@westernu.edu.



Giant Cell Tumor of Mandibular Condyle: A Rarity

Jaishankar HP, MDS; Karthikeya Patil, MDS; Mahima VG, MDS; and Deepika Keshari, MDS

ABSTRACT Giant cell tumor (GCT) of bone accounts for 2 percent of craniofacial tumors. It is benign in nature and an aggressive tumor that tends to recur if inadequately excised. Giant cell tumors are frequently encountered in the long bones; however, occurrence in the maxillofacial region is rare, commonly affecting the mandible, maxilla, temporal bone and calvarium. Lesions affecting mandibular condyle are extremely rare. We report a rare case of giant cell tumor involving the mandibular condyle in a young male patient.

AUTHORS

Jaishankar HP, MDS, is a reader in the department of oral medicine and radiology at JSS Dental College and Hospital and JSS University in Mysuru, Karnataka, India.

Conflict of Interest

Disclosure: None reported.

Karthikeya Patil, MDS, is a professor and head of the department of oral medicine and radiology at JSS Dental College and Hospital and JSS University in Mysuru, Karnataka, India.

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Disclosure: None reported.

Mahima VG, MDS, is a professor in the department of oral medicine and radiology at JSS Dental College and Hospital and JSS University in Mysuru, Karnataka, India.

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Disclosure: None reported.

Deepika Keshari, MDS, is a postgraduate student in the department of oral medicine and radiology at JSS Dental College and Hospital and JSS University in Mysuru, Karnataka, India.

Conflict of Interest

Disclosure: None reported.

Giant cell tumor (GCT) of bone was first described by Cooper and Travers in 1818.¹ GCTs are rare, aggressive benign tumors that originate from the undifferentiated mesenchymal cells of the bone marrow.^{2,3} They generally occur in adults between the ages of 20 and 40. GCTs occur in approximately one person per million per year.² They constitute 5 percent of all primary bone tumors. The frequency of occurrence is 25 percent in the epiphyses of long bones and 2 percent in the craniofacial bones.⁴ In the craniofacial region, they are frequently found in the mandible, maxilla, temporal bone and calvarium. However, involvement of other craniofacial bones, such as zygomatic bone, external auditory meatus, frontal bone, petrosal pyramid, occipital bone, sphenoid bone, ethmoid bone, sphenoidal sinus, mandibular condyle and jugular foramen, are extremely rare.⁵

An extensive literature review revealed an exceptionally low number of cases affecting the mandibular condyle, as reported by Berges et al.,⁶ Bortot et al.⁷ and Paume et al.⁸ We report a rare case of a giant cell tumor affecting the right mandibular condyle in a young male patient.

Case Report

A 26-year-old male patient presented to the department of oral medicine and radiology with a chief complaint of swelling and pain in the right preauricular region that had been occurring for three months. Swelling had gradually increased to the current size (**FIGURE 1**). The patient also reported associated pain that was mild and intermittent in nature and aggravated on jaw movement. Examination of the right preauricular region revealed a diffuse swelling measuring roughly 3.5 cm by 3 cm that was mildly tender and firm to hard in consistency on palpation.



FIGURE 1. Extraoral swelling is seen on the right side of the face (arrow).



FIGURE 2. Orthopantomograph showing well-defined, multilocular lesion involving right mandibular condyle and ramus.



FIGURE 3. Reverse Towne's projection showing expansile lesion. Note the mediolateral extent of the lesion.

Temporomandibular joint (TMJ) examination showed slight deviation of the mandible toward the left with a restricted maximum unassisted mouth opening of 25 mm. Maximum assisted mouth opening was approximately 30 mm but was painful. Right and left lateral movements of the mandible were restricted. Condylar movement on the right side was not appreciable.

Parotid gland examination revealed no abnormalities and the Stensen's duct was patent with copious salivary flow. Neurological examination of the face, tonicity of muscles of mastication and motor coordination of the muscles of facial expression were performed to rule out any pathology affecting or involving the facial nerve. Intraoral examination did not reveal any tooth-related abnormalities.

Correlating with the history and clinical findings, a working diagnosis of a benign lesion of nonodontogenic origin affecting the right mandibular condyle was made. In this regard, the following lesions were considered in the list of differential diagnosis: aneurysmal bone cyst, osteochondroma, chondroblastoma, synovial chondromatosis, giant cell tumor and preauricular cyst.

Routine radiological investigations were performed. The panoramic radiograph revealed a solitary, well-defined, well-corticated, multilocular radiolucent lesion involving the head and neck of the right mandibular condyle and part of the ascending ramus, measuring approximately 3.5 cm by 3 cm. The septae were variably placed and had a soap-bubble-to honeycomb-like appearance. The condylar architecture was lost, giving an impression of a benign multilocular lesion of nonodontogenic origin (**FIGURE 2**).

A Reverse Towne's view showed an osteolytic, mediolaterally expansile lesion causing destruction of the mandibular condyle. The medial wall was thin and the lateral wall was discontinuous (**FIGURE 3**).

Three-dimensional CT with reconstruction was performed and showed a large expansile hypodense lytic lesion with lobulated margins measuring 2.7 by 2.9 by 2.6 cm involving the articular surface of the right condyle with multiple thin bony septae within it. The coronal section showed mediolateral expansion and the axial section showed destruction of the medial wall. The TMJ space appeared normal on the side. There was no evidence of intralesional calcification (**FIGURES 4** and **5**). The 3-D reconstruction image showed the true extent of the lesion (**FIGURE 6**). There was no evidence of any soft tissue infiltration.

Following clinical and radiographic examination, aneurysmal bone cyst, osteochondroma, chondroblastoma and GCT were considered in the differential diagnosis.

An excisional biopsy was planned. A preauricular incision was made through the skin and superficial fascia, lower to the temporal fascia. The temporal fascia was separated into superficial and deep fascia and a flap was raised. The upper border of the facial nerve

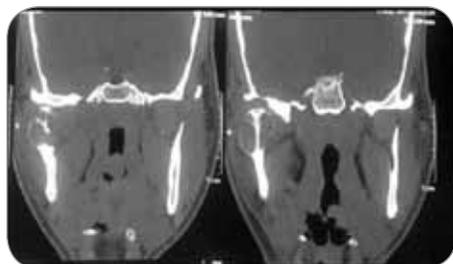


FIGURE 4. Coronal section of CT showing mediolateral expansion of condyle.

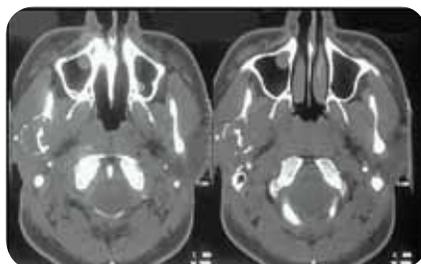


FIGURE 5. Axial section of CT showing destruction of medial condylar wall.



FIGURES 6A-B. Three-dimensional CT with reconstruction.

remained safely within the flap with an intact temporal vessel. Proceeding downward from the zygomatic arch and TMJ socket, the tissues were exposed superficial to the joint capsule and retracted until the condylar neck was exposed. The lesion was excised with adequate surgical margins followed by reconstruction with an iliac crest graft. The excised specimen was sent for histopathological analysis, which showed multiple foci of mononuclear spindle and round cells with interspersed multinuclear giant cells that showed greater than 20 nuclei. The foci were separated by a dense collagenous stroma. Areas of cartilaginous metaplasia and hemorrhage were seen. Final diagnosis of a GCT was made (**FIGURE 7**). After three months, the follow-up panoramic radiograph showed satisfactory healing and bony attachment (**FIGURE 8**). The functional status of the TMJ was restored to normal (**FIGURE 9**).

Discussion

Giant cell tumor of bone is primarily an intramedullary tumor that is apparently benign but can be locally aggressive and even metastasize. The tumor is named after the characteristic giant cells that are found within the stroma.⁹

Various theories of etiopathogenesis have been proposed, such as inflammatory, angiogenic and osteoclastic, however, none of these has been demonstrated clearly. The role played by the suppressor p53 gene in its genesis has recently been confirmed.¹⁰

GCTs exhibit an overall predominance for the female sex, with the female to male ratio of 1.3 to 1.5:1.^{9,11} However, males and females are equally affected in the cephalic segments.⁵

There are no clinical symptoms specific to GCTs.¹² Patients with GCT involving the head and neck region may present with varied symptoms depending on the location of primary

lesion. Symptoms include pain, swelling, epistaxis, neurological deficits, proptosis, visual abnormalities, tinnitus and hearing loss.¹³ The patient in this case presented with swelling, a mild amount of pain and restricted jaw movements. GCTs have an infiltrative nature and erratic biological behavior with high tendency for recurrences.¹¹

Radiologically, GCTs usually appear as well-circumscribed lytic lesions with a nonsclerotic or mildly sclerotic border. The tumors may occasionally breach the cortex and invade the soft tissue or the adjoining articular space.¹³ A multilocular radiolucent soap-bubble-like appearance that mimics ameloblastomas may be seen.¹⁰

A detailed assessment of GCT can be obtained by a CT scan, demarcating the amount of bony destruction, soft tissue mass of the lesion, cortical perforation and extension into important adjacent anatomical structures, such as the cranial base. The advantage of 3-D CT with reconstruction is that it provides accurate delineation of the pathology and will aid the surgeon in adequate excision and reconstruction, thereby preventing recurrence of the lesion.

MRI has improved contrast resolution and is thus superior to CT in defining the extent of a soft tissue tumor. Increased radionuclide uptake is noted in bone scintigraphy scans in the majority of cases.¹⁰

GCTs clinically and radiologically resemble other bony jaw lesions, such as giant cell granuloma, aneurysmal bone cyst, fibro-osseous lesions, cherubism, vascular lesions of the bone, osteoblastoma, chondroblastoma, hyperparathyroidism and malignant neoplasm of the jawbone, such as Langerhans cell histiocytosis and sarcoma.^{4,10,11}

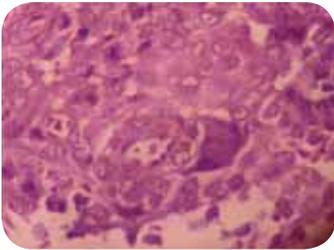


FIGURE 7. Hematoxylin and eosin stain section showing numerous multinucleated giant cells in dense collagenous stroma.



FIGURE 8. Follow-up orthopantomograph after three months.



FIGURE 9. Follow-up after three months showed no evidence of swelling on the right side of the face.

Histologically, the characteristic cell is a giant cell that is multinucleated. It is presumed to be a neoplastic osteoclast. It is seen on a stroma of spindle-shaped mesenchymal cells that are fusiform and highly vascular containing capillary veins with fine walls and small areas of hemorrhage. Areas of ossification and small trabeculae of residual lamellar bone along with hemosiderin deposits are found.¹⁰ This histopathological appearance is consistent with that of GCTs of long bones.

The treatment of choice is wide resection of the tumor mass. Other treatment modalities include cryotherapy, chemotherapy and curettage with adjuvant agents like bone cement or bone graft.⁴ GCTs of bone occasionally respond well to chemotherapy, but these cases are anecdotal and their incidence is not overwhelming. Currently, there are no accepted effective chemotherapeutic agents available for the management of these tumors. GCTs treated by radiation therapy may undergo secondary sarcomatous transformation.

Although surgery remains the treatment of choice, radiotherapy is recommended when complete excision or curettage is impractical for medical or functional reasons.¹⁴

The documented recurrence in the literature after resection of the tumor mass is 7 percent. Our patient is being reviewed regularly and is normal. The documented malignant transformation rate is 1 to 5 percent.⁴ We followed up our case for six months. Postoperative panoramic radiograph showed no evidence of recurrence and the patient is still being followed up for any recurrence.

Conclusion

Giant cell tumors in the maxillofacial region are rare and clinically present with mild or no symptoms. GCTs arising from the mandibular condyle are a rare entity. Imaging alone or a preoperative fine-needle aspiration biopsy is usually insufficient to provide a confirmatory diagnosis. Therefore, although rare, GCTs should be included in the list of differential diagnoses of craniofacial bone lesions until a confirmatory diagnosis is obtained following a histopathologic examination. Considering the high recurrence rates, wide complete excision is required. Delayed diagnosis may lead to serious complications such as extension into the cranial base. Therefore, it is essential that clinicians and radiologists accurately identify the clinical and radiographic features, the extent of the lesion and its biological nature. ■

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THE CORRESPONDING AUTHOR, Karthikeya Patil, MDS, can be reached at patilkarthik@gmail.com.



California Dentists' Opinions of the Interface Between Oral and Overall Health

Paul Gavaza, MS, MSc, PhD; Thomas Rogers, DDS, MPH; and Rashid Mosavin, PhD, RPh

ABSTRACT This cross-sectional study investigated California dentists' knowledge and opinion of the interface between oral and overall health. A questionnaire and cover letter explaining the purpose of the study were mailed to 1,100 randomly selected California licensed general dentists. The survey measured dentists' knowledge and opinions of the interface between oral and overall health as well as their recommendations for strengthening this interface. Dentists believed that there was minimal interface between oral and overall health care.

AUTHORS

Paul Gavaza, MS, MSc, PhD, is an associate professor at the Loma Linda University School of Pharmacy. He works on social and behavioral aspects of pharmacy practice.
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Disclosure: None reported.

Thomas Rogers, DDS, MPH, is an associate professor at the Loma Linda University School of Dentistry.
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Rashid Mosavin, PhD, RPh, is an executive associate dean and associate professor at the Loma Linda University School of Pharmacy.
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Dental disease is considered a “silent epidemic.”¹ Oral conditions, including untreated caries, severe periodontitis and severe tooth loss, collectively affected 3.9 billion people worldwide in 2010.² That year, 35 percent of the worldwide population had untreated caries in permanent teeth.² “Approximately 91 percent of U.S. adults aged 20 to 64 had dental caries in permanent teeth in 2011–2012.”³ National Health Interview Survey data show that 7 percent of adults aged 18 to 64 had poor oral health in 2008.⁴

Oral diseases and conditions have significant health, economic and social impacts on the population. Dental care has been identified as the most common unmet health need among American children.¹ “Every year, children lose approximately 52 million school hours

and adults lose 164 million work hours because of dental disease.”¹ Patients with dental problems account for millions of emergency room visits annually.

Many systemic diseases and conditions, including cardiovascular disease,^{6,7} osteoporosis,⁷ HIV/AIDS,⁸ diabetes mellitus^{9,10} and cancer, among others,^{11,12} have been linked to oral diseases. There is a close association between oral health and general health. Dental caries and periodontal diseases are sources of systemic infection. Furthermore, many medications that treat systemic diseases can have detrimental effects on oral health,¹ such as xerostomia (listed as a side effect for more than 400 medications), dysgeusia and stomatitis.^{13,14} Xerostomia is associated with an increased incidence of fungal infections¹² and dental caries.¹⁵

Oral health care is an important component of overall health care.¹ The

treatment and prevention of dental problems by dental professionals help in the prevention of many systemic conditions and their complications.¹⁶⁻²⁰ Life-threatening infections can occur if oral infection is not treated before immunosuppressive therapy.²¹ For example, according to the American College of Rheumatology, “It is vital for patients to receive appropriate dental evaluation and prompt treatment so they can continue their immune suppressant medications.”²²

The undeniable close relationship between oral and overall health necessitates that all primary care providers, including dentists, physicians, pharmacists and nurses, collaborate in caring for patients and in managing the oral health-general health interface.¹ Dentists can positively impact the early detection, prevention and treatment of many systemic diseases and conditions in collaboration with other health care professionals. However, many primary care providers and the general public often do not perceive the link between oral health and overall health. For example, dentists may fail to consider the medical ramifications of the oral health care they provide.

Little is known about dentists’ opinions of the interface between oral and overall health in the U.S. The aim of this study is to investigate California dentists’ opinions of the oral and overall health interface. The specific objectives of the study are to:

- Determine dentists’ perception of the interface between oral and overall health.
- Determine dentists’ knowledge of issues surrounding oral and general health interface.
- Determine dentists’ recommendations for strengthening the oral and overall health interface.

TABLE 1

Demographic and Practice Characteristics of Dentists		
Items	Frequency	Percentage (%)
Type of practice setting at primary place of employment (n = 113)		
Private practice	89	78.8
Corporate dental setting	7	6.2
Community clinic	5	4.4
Hospital	—	—
Academic institution	3	2.6
Other (e.g., federal, military, VA)	9	8.0
Current job title (n = 114)		
Practice owner/Partner	66	57.9
Dentist/Staff dentist	44	38.6
Other (e.g., resident, managing orthodontist, etc.)	4	3.5
Area/Setting of your primary place of employment (n = 117)		
Urban	39	34.2
Suburban	65	57.0
Rural	10	8.8
Gender (n = 113)		
Male	80	70.8
Female	33	29.2
Race/Ethnicity (n = 112)		
African American/non-Hispanic black	—	—
American Indian or Alaska Native	—	—
Asian American/Pacific Islander	25	22.3
Caucasian/non-Hispanic white	72	64.3
Mexican American/Hispanic	10	8.9
Other	5	4.5
	Mean (SD)	
Age (n = 111)	53 (13.94)	
Number of years practicing dentistry (n = 109)	24.71 (13.15)	
Hours of work per week at primary place of employment (n = 112)	32.85 (8.66)	

Methods

The research protocol for this cross-sectional study was approved by the Loma Linda University Health Institutional Review Board (IRB). The study targeted all general licensed dentists practicing in California. The large number of dentists practicing in California as well as their diversity made it an ideal setting for this exploratory study.

Data Collection and Survey Instrument

Fifteen Likert-type questions were used to measure dentists’ opinions of various issues surrounding the interface between oral and overall health. Additionally, seven Likert-type questions were used to measure dentists’ recommendations for improving the oral-overall health interface. Each item was rated using a bipolar semantic

TABLE 2

Dentists' Opinions of Oral and Overall Health Interface

Item (n = 116)	Mean (SD)	Strongly Disagree/ Disagree N (%)	Neutral N (%)	Strongly Agree/ Agree N (%)
a. Physicians prescribing immunosuppressive and cytotoxic pharmaceuticals infrequently inquire about a patient's dental status (n = 115).	4.09 (1.0)	7 (6.1)	17 (14.8)	91 (79.2)
b. Physicians prescribing immunosuppressive and cytotoxic pharmaceuticals rarely advise patients about the importance of maintaining dental health while taking the medications (n = 115).	3.81 (1.0)	12 (10.5)	25 (21.7)	78 (67.8)
c. Many primary care providers are aware of the relationship between oral health and the treatment/management of many systemic diseases (n = 115).	2.82 (1.1)	47 (40.9)	34 (29.6)	34 (29.8)
d. Many primary care providers often regard oral health as less important than other health needs of patients.	3.97 (0.8)	9 (7.7)	18 (15.5)	93 (80.2)
e. The dental discipline remains relatively segregated from other health care disciplines.	4.05 (0.8)	7 (6.1)	10 (8.6)	99 (85.3)
f. Little time is devoted to oral health topics in the education of nondental health professionals.	4.18 (0.7)	1 (0.9)	14 (12.1)	101 (87.1)
g. The separation of dental and other primary health care disciplines has grown over time.	3.28 (1.0)	26 (22.5)	42 (36.2)	48 (41.3)
h. Dental caries and periodontal diseases are generally thought of as infections by primary health care professionals.	2.91 (1.0)	44 (38.0)	36 (31)	36 (31.1)
i. As a dentist, I often consider the medical ramifications of the oral health care I provide (n = 117).	4.53 (0.7)	2 (1.8)	5 (4.3)	110 (94.0)
j. I generally regard oral health as an important component of overall medical (n = 117).	4.8 (0.5)	1 (0.9)	–	116 (99.1)
k. Many medications are prescribed by physicians without consideration of their oral health ramifications (n = 117).	4.08 (0.9)	7 (6.0)	17 (14.5)	93 (79.5)
l. The labels of most medications that can have xerostomic effects (dry mouth) do not contain information on the potential impacts on oral health (n = 117).	4.11 (0.8)	3 (2.6)	19 (16.2)	95 (81.2)
m. The inadvertent prescribing of medications that can have xerostomic effects without considering their oral health implications is a major problem (n = 117).	4.15 (0.8)	5 (4.3)	19 (16.2)	95 (81.2)
n. Patients taking medications that can have xerostomic effects are adequately informed about the importance of maintaining dental health while taking the medications (n = 117).	2.56 (1.2)	72 (61.5)	16 (13.7)	29 (24.8)
o. Pharmacists are a great resource to my patients for advice on drugs with oral health untoward effects.	3.66 (1.1)	20 (17.2)	24 (20.7)	72 (62.1)

differential scale anchored by strongly disagree (1) and strongly agree (5).

Dentists were asked to rate their knowledge of issues surrounding the oral and overall health interface (seven true or false items). The study also collected the following demographic and practice characteristics data (potential confounders): type of practice settings at primary place of employment, current

job title, setting of primary place of employment, years practicing dentistry, gender, year of birth, racial-ethnic background and hours worked per week.

Data were collected using a self-administered, postage-paid anonymous paper survey that was mailed to the 1,256 randomly selected dentists' addresses in winter 2015. These dentists' addresses were obtained from

a register provided by the California Department of Consumer Affairs. The simple random sampling was conducted using Microsoft Excel 2010. The survey booklet included the survey and a cover letter inviting the dentists to complete the survey. Upon completion of the survey, dentists were instructed to fold it with the business reply on the outside, secure it with tape and mail it back

TABLE 3

Dentists' Opinions on Strategies to Improve Oral Health

Item (n = 117)	Mean (SD)	Strongly Disagree/ Disagree N (%)	Neutral N (%)	Strongly Agree/ Agree N (%)
a. Oral health should be more closely regarded as an important component of overall medical care.	4.59 (0.6)	1 (0.9)	1 (0.9)	115 (98.3)
b. Dentistry should be identified as a medical subspecialty.	3.84 (1.1)	14 (11.9)	27 (23.1)	76 (65.0)
c. Drug labelling materials need to clarify that the most common dental diseases are infections.	3.91 (0.9)	4 (3.5)	33 (28.2)	80 (68.4)
d. Medicare should cover medically essential dental care/services.	4.16 (1.0)	7 (6.0)	17 (14.5)	93 (79.5)
e. Drug labeling should be modified as necessary to improve patients' understanding of the relationship between oral disease and risk of medical complications.	4.39 (0.6)	–	8 (6.8)	109 (93.2)
f. There is a need for more interprofessional care by primary care providers in managing oral health and overall health concerns of patients.	4.5 (0.5)	–	2 (1.7)	115 (98.3)
g. There is a need for improved integration of dentistry with other primary health care services.	4.41 (0.6)	1 (0.9)	6 (5.1)	110 (94.1)

to the researchers. No follow-ups or reminders were mailed to the dentists.

The survey took approximately 10 minutes to complete. Completing the survey indicated the dentists' consent. As an incentive, participating dentists were entered into a drawing to win an iPad 2 or one of 10 Amazon gift cards worth \$25 each.

Data Analysis

Data were inputted into Microsoft Excel 2010 and then uploaded to PASW Statistics 22 (SPSS Inc., Chicago) for analysis. Descriptive statistics, such as means, standard deviations and frequencies, were computed for all study variables. Responses to all the 22 Likert-type items were collapsed into three categories: strongly agree/agree, neither agree nor disagree and strongly disagree/disagree. One-way analysis of variance (ANOVA) was computed to compare the mean attitude scores of dentists by practice location (urban, suburban and rural) and race/ethnicity; post hoc analysis was performed using Scheffe's method for all statistically significant differences ($p < 0.05$). Differences in

scores by gender were analyzed using the independent t-test. Pearson correlation was run to explore the association between age and dentist scores on the 22 items. An a priori power estimation was conducted using G*Power version 3 software in order to determine the adequate sample size relative to the goals of the study.

Results

From the 1,256 survey packets that were mailed out, 256 were returned or not delivered for various reasons. Thus, 1,100 surveys were considered delivered. A total of 117 responses were received from these 1,100 surveys for a 10.6 percent response rate. Most dentists worked in private practice ($n = 89$; 76.1 percent), were male ($n = 80$; 70.8 percent) and were practice owners-partners ($n = 66$; 57.9 percent) (TABLE 1). The mean age of the dentists was 53 (SD = 13.9) years (range = 26 to 82 years; TABLE 1).

Most dentists indicated that they had encountered a situation in their practices whereby a patient's oral health was compromised because of prescription medications ($n = 94$; 84.7 percent).

Most dentists strongly agreed/agreed that physicians prescribing immunosuppressive and cytotoxic pharmaceuticals infrequently inquire about a patient's dental status ($n = 91$; 79.2 percent): "Many primary care providers often regard oral health as less important than other health needs of patients" ($n = 93$; 80.2 percent) and "Little time is devoted to oral health topics in the education of non-dental health professionals" ($n = 101$, 87.1 percent) (TABLE 2).

Most dentists strongly agreed/agreed with the statements: "The labels of most medications that can have xerostomic effects (dry mouth) do not contain information on the potential impacts on oral health" ($n = 95$; 81.2 percent), "Many medications are prescribed by physicians without consideration of their oral health ramifications" ($n = 93$; 79.5 percent) and "The inadvertent prescribing of medications that can have xerostomic effects without considering their oral health implications is a major problem" ($n = 95$; 81.2 percent) (TABLE 2).

Most dentists strongly agreed/agreed that drug labeling should be modified

TABLE 4

Dentists' Knowledge of Oral and Overall Health Issues

Item (n = 117)	True N (%)	False N (%)	Don't Know N (%)
a. The use of many pharmaceuticals among individuals with oral infections poses an increased risk of medical complications (n = 115).	86 (74.8)	14 (12.2)	15 (13.0)
b. Many Americans do not receive even basic dental care that they need.	106 (90.6)	2 (1.7)	9 (7.7)
c. The risk of medical complications from bacterial dental infections increases among individuals who are immunocompromised by diseases or medications.	116 (99.1)	1 (0.9)	–
d. Dental cavities, periodontal diseases are infections (n = 116).	109 (94.0)	7 (6.0)	–
e. The oral cavity and its functions can be adversely affected by many medications used in treating systemic conditions.	113 (96.6)	–	4 (3.4)
f. Poor dental health can compromise the ability of patients to achieve good medical outcomes.	113 (96.6)	–	7 (3.4)
g. I have adequate knowledge of the interaction between oral health and the treatment/management of many systemic diseases.	84 (71.8)	15 (12.8)	18 (15.4)

as necessary to improve patients' understanding of the relationship between oral disease and the risk of medical complications (n = 109; 93.2 percent) and that there is a need for more interprofessional care by primary care providers in managing oral health and overall health concerns of patients (n = 115; 98.3 percent) (TABLE 3).

Most dentists were knowledgeable of the oral health issues investigated. Most dentists agreed with the statement, "I have adequate knowledge of the interaction between oral health and the treatment/management of many systemic diseases" (n = 84; 71.8 percent) and only 33 did not agree with the statement (28.2 percent) (TABLE 4).

Dentists' Opinions by Gender, Age, Practice Location and Race/Ethnicity

There was no significant difference in dentists' opinions by gender on 20 of the 22 items investigated (p > 0.05). However, female dentists had stronger opinions than male dentists on the remaining two items as follows: "Medicare should cover medically essential dental care/services" (4.52 versus 4.10; p = 0.033) and "Drug

labeling should be modified as necessary to improve patients' understanding of the relationship between oral disease and the risk of medical complications" (4.64 versus 4.33; p = 0.011).

There was no significant difference in mean dentists' attitude scores by practice on 17 of the 22 items investigated (p > 0.05). On four items, those dentists practicing in urban areas had higher mean scores than those practicing in suburban areas (p < 0.05). The dentists practicing in urban areas had significant higher mean scores than those practicing in rural areas on the remaining item: "Drug labelling materials need to clarify that the most common dental diseases are infections" (p = 0.019).

The study results showed no significant mean differences by the race/ethnicity of the dentist on 19 of the 22 items (p > 0.05). Furthermore, age was not correlated with dentists' beliefs on 21 of the 22 items. However, younger dentists were more likely to agree with the statement "Medicare should cover medically essential dental care/services" than older dentists (r = -0.237).

Discussion

The study findings show that many dentists regard oral health as an important component of overall medical care and that they consider the medical ramifications of the oral health care they provide. As reported elsewhere,²³ this suggests that dentists understand the connection between periodontal diseases and systemic diseases and conditions. Similarly, a previous study of 7,400 U.S. general dentists found that most had a positive attitude toward medical screening in a dental setting.²⁴ Furthermore, most general dentists in California, West Virginia and Pennsylvania believed "that intervening with patients with diabetes was an important or very important part of their role as a dentist."²⁵ This heightened appreciation can be explained by several high-profile reports that highlighted the issue, including *Oral Health in America: A Report of the Surgeon General in 2000*.¹ Similarly, in 1995 the Institute of Medicine also recommended the close integration of dentistry with medicine.²⁶

However, most dentists believed that the dental discipline remains

relatively segregated from other health care disciplines and that the separation has grown over time. This suggests that there is minimal collaboration between medical and dental providers in practice. Similarly, a previous study found that few general dentists discussed the association between systemic diseases and conditions and oral health.²⁷ Furthermore, general dentists were reported to be not confident to manage patients with dry mouth.²⁸ Kunzel and colleagues²⁹ found that most general dentists believed that the management of patients with diabetes was peripheral to their role. The separation of dental and other health disciplines has serious consequences on patient care especially in light of this study's findings, some of which are described below:

- Physicians prescribing immunosuppressive and cytotoxic pharmaceuticals infrequently inquire about a patient's dental status.
- Physicians prescribing immunosuppressive and cytotoxic pharmaceuticals rarely advise patients about the importance of maintaining dental health while taking the medications.
- Dental caries and periodontal diseases are not generally thought of as infections by primary health care professionals, including some dentists (TABLE 4).
- Medications that can have xerostomic effects are inadvertently prescribed without considering their oral health implications.
- Many medications are prescribed by physicians without consideration of their oral health ramifications.
- Patients taking medications that can have xerostomic effects are inadequately informed about the importance of maintaining dental health while taking the medications.

Collectively, these findings suggest that the evidence and scientific knowledge on the connection between general and oral health are not being readily translated into clinical practice by all the dentists. This can be explained by the existence of several barriers such as limited formal training, lack of knowledge, lack of reimbursement for some services, lack of time, lack of confidence and negative beliefs and attitudes.^{25,30}

Much can and should be done to bridge oral and overall health care. First, as noted in a previous study, there is need

The evidence and scientific knowledge on the connection between general and oral health are not being readily translated into clinical practice by all the dentists.

for more education and awareness on the oral-systemic link among dentists and other health care providers.²³ Furthermore, dental schools should increase their integration of total health into their curriculum. Enhanced awareness and education about the importance of oral considerations in general health care diagnosis and treatment planning by dentists are essential for optimal care. Continuing dental education in this area is available for practicing dentists.

Second, the dentists in this study noted that there is need for more interprofessional collaboration by all primary care providers. They also believed that "there is a need for improved integration of dentistry with other primary health care services" and that dentistry should be identified as a medical

subspecialty. This suggests that these dentists appreciate the need to holistically and systematically address patient care and the importance of working closely with other primary care providers to further the oral and overall health care needs of their patients. Previous studies reported that dentists agreed to physicians conducting routine dental assessment and counseling patients on the prevention of dental problems.³¹ Interestingly, dentists believed that, "Pharmacists are a great resource to my patients for advice on drugs with untoward oral health effects." This is encouraging and augurs well for interprofessional collaboration between these two professions. All primary care providers should work collaboratively in managing the oral and general health concerns of their patients.^{1,32} Dentists can refer patients with potential health issues identified during regular dental checkups to physicians for follow up. More interdisciplinary care will result in improved dental diagnosis and treatment planning as part of a holistic care plan.

The study results showed that the dentists' beliefs about the interface between oral and overall health were not generally significant related with the dentists' age, race-ethnicity, practice location and gender. However, there were significant differences in dentists' beliefs on the item, "Medicare should cover medically essential dental care/services" by gender (female = higher), location (urban higher than suburban) and age (negative correlation). More research needs to be conducted to further explore reasons for this finding.

The study is limited by the small sample size and the low response rate of 10.6 percent, which limit the generalizability of the findings. It is possible that those who responded to this study had opinions different from those who did not, making nonresponse bias

a concern. The low response rate can be explained by the fact that we did not send a second mailing or reminders to the dentists. However, a previous study involving dentists reported a similarly low response rate (12 percent).²⁵ Furthermore, the study sample's gender distribution and mean age closely resembled those of the California Dental Association (CDA) members. For example, in 2015, 70.5 percent (n = 16,363) of CDA members were male (compare with sample = 70.8 percent) and had a mean age of 53 years (exactly the same mean for this sample) (K. Ross-Patchin, director of membership, personal communication, March 31, 2016). This suggests that our study sample is somewhat representative of the population of CDA members. Consequently, this study provides useful insight into the dentists' opinions and knowledge of the oral-systemic health link. Further research into dentists' opinions and knowledge pertaining to the oral-systemic health link utilizing larger samples are needed.

Conclusion

Despite many dentists having a positive attitude toward the role of oral health in overall health care, they believed that there was minimal interface between oral and overall health care in practice. More interdisciplinary and collaborative care by all health care providers is necessary to appropriately manage their patients' oral and overall health care needs. ■

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THE CORRESPONDING AUTHOR, Paul Gavaza, MS, MSc, PhD, can be reached at pgavaza@llu.edu.



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Final Notice: Sending an Account to Collections

TDIC Risk Management Staff

Most dentists enter the profession with one focus in mind: patient care. In theory, the concept of providing care is pretty simple: Dentists perform a service and patients pay for that service. But what happens when patients fail to hold up their end of the bargain?

Collections is one of the most crucial, yet also the most challenging, aspects of practice management. Using a collections protocol is a basic first step in addressing unpaid balances, but if phone calls and letters go unanswered, a dentist is faced with the dilemma of whether to turn the account over to a collection agency. The Dentists Insurance Company advises dentists to carefully consider the pros and cons of such an action. Depending on the dollar amount of the outstanding balance, the length of time that has passed and the patient's payment history, the negatives may outweigh the positives. Angry patients can and have attempted to retaliate against dentists for sending their bills to collections.

In one case reported to TDIC, a patient presented for an exam requesting veneers on her upper front teeth. The dentist wanted to address the patient's periodontal issues and improve her oral hygiene prior to placing the veneers. The patient underwent scaling and root planing on four quadrants and a few months later, the dentist began preparations for veneers. The patient returned for an occlusal adjustment and the dentist delivered her permanent veneers two weeks later.

The patient returned several times for occlusal adjustments over the next few months. At the last visit, the dentist noted that one tooth

Depending on the dollar amount of the outstanding balance, the length of time that has passed and the patient's payment history, the negatives may outweigh the positives.

was tender and another had slight mobility. The dentist recommended a nightguard and took impressions for its fabrication. But the patient did not return for the delivery of the nightguard, leaving a \$3,800 balance. The dentist hired a collection agency in an attempt to recover the unpaid balance, but the patient filed a lawsuit alleging negligent treatment, demanding \$15,000 to correct the treatment in addition to compensation for pain and suffering.

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“All too often, as soon as a dentist starts pursuing an unpaid balance, a patient claims that the treatment was unsatisfactory,” said Taiba Solaiman, a risk management analyst at TDIC. “Unfortunately, this triggers them to pursue actions against the dentist to avoid paying the bill.”

Professional liability claims aren’t the only retaliatory threats dentists face. Patients have filed complaints with their respective dental boards, insurance companies and the Better Business Bureau. They have also resorted to posting negative reviews on social media and other user-generated review sites.

In another case reported to TDIC, a patient presented to a prosthodontist

to get replacement crowns on his upper front teeth. The original crowns were made by a general dentist several months prior and were of marginal quality and esthetic integrity.

The prosthodontist completed treatment, but it took the patient two years to pay \$1,500 of his \$9,000 balance, so the doctor decided to turn the account over to collections. In response, the patient posted a negative review online, stating it was the worst experience of his life and advising others not to waste their time or money on the doctor’s services. In the review, the patient also stated that he attempted to contact the dentist on multiple occasions and left several voicemails, but the dentist failed

to return his calls. However, the dentist’s records did not reflect this assertion.

TDIC reports several issues with this case. First, the dentist did not have the documentation to prove patient acceptance of treatment at the delivery of the restorations. Second, there was no record of follow-up in terms of postoperative checks. Third, the practice did not hear from the patient for two years and assumed he wasn’t coming back, but failed to send a dismissal letter. TDIC advised the dentist to reach out to the patient directly to resolve the matter or not to pursue it.

“While dentists certainly have a right and an obligation to pursue money that is owed them, it is important to consider the pros and cons of doing so. Sometimes, the long-term costs can outweigh the short-term benefits,” Solaiman explained.

To mitigate any potential risk, TDIC recommends implementing a sound, clear financial policy. The policy should explain the patient’s financial obligations and clearly state that delinquent accounts (for example, those that are 120 days overdue) are turned over to collection agencies. It should also detail any fees, if applicable. All patients should sign the financial agreement and consent form, as well as authorization to release patient information to a third party should a collection agency be used. If so, it is also important to have a business associate agreement on file and to limit the information shared to avoid potential HIPAA violations.

It should also be noted that, in the end, dentists usually only see a small fraction of the amount owed once a collection agency is involved. Most agencies charge a percentage of the money collected, as much as 50 percent, depending on the amount and age of debt. But the amount collected is not

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CONTINUES ON 96

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4103 SAN FRANCISCO GP

Vibrant downtown location in historic high-rise bldg. Retiring doctor offering 30+ years of goodwill. 4.5 days of hygiene, 1,500+ active patients, 20-25 new patients/mo. Gorgeous, spacious facility in approx. 2,500 sq. ft. 2015 GR \$796K. 2014 GR \$768K. Average adjusted net income \$274K+ Asking \$599K.

4133 NAPA GP

Napa County GP in newly furnished, fully equipped 2 op facility with digital x-ray. 4 doctor day/week with 3 hygiene days. Monthly average revenue of \$36K. Seller willing to help for a smooth transition. Asking \$331K.

4139 MILPITAS GP

4 fully equipped ops in 1,300 sq. ft. Attractive office with newer equipment, new flooring, etc. Great location with easy freeway access off 680. Average gross receipts \$616K. Asking \$450K.

4135 CAMPBELL OPPORTUNITY

Join a well-run solo group practice in a highly desirable location near Westfield Valley Fair Mall. Each doctor has a separate practice in a spacious and modern facility with 14 ops. and 6 additional hygiene ops. plus in house dental lab. Seller offering interest plus one fifth group assets. Asking \$154K.

4131 PETALUMA FAMILY PRACTICE

Well established family practice located in charming downtown Petaluma. More than 1,300 sq. ft main floor facility with 4 spacious fully equipped operatories in professional building, reserved staff parking, friendly team, many years of patient goodwill, low overhead. Asking \$375K.

4129 PETALUMA GP

GP located in stunning 1,856 sq. ft. seller owned facility. State-of-the-art office includes 6 ops, staff lounge, reception area, private office, business office, lab area, sterilization area, consult room, separate storage area, bathroom plus private bathroom. Asking \$525K.

4108 HUMBOLDT COUNTY GP

Well-established, high performing general practice boasts 6 fully equipped ops. in 2,900 sq. ft. free standing office w/ Digital X-ray, 2 platinum Dexis sensors, & Cerec Omnicam & MCXL units. Loyal & stable pt. base in charming community, w/ a small town feel. Perfect for a dentist who wants to escape the grind and live along the coastline. Avg. GR \$1.4M+, 2016 on schedule for \$1.5M+. Seller willing to help for smooth transition. Asking \$1,041,000.

4151 MARIN COUNTY GP

Quality general practice overlooking a beautiful park like setting adjacent to a peaceful creek. Owner/Doctor is relocating out of area. Office contains 5 ops in ~1,300 sq. ft. Gross receipts average \$1.2M annually with less than 4 doctor days/week. Asking \$865K.

4134 MENLO PARK GP

Open bay style practice on second floor of professional office building in the heart of downtown Menlo Park. Established in 1982, well-trained, seasoned and loyal staff. Average Gross Receipts \$726K. Asking \$338K.

4138 SOUTH SAN FRANCISCO GP

1,100 sq. ft. beautifully appointed, state-of-art 4 op office located near Tanforan in modern professional building. 2016 annualized gross receipts \$415K with adj net income of \$166K. Doctor works 4 day work week. 3 hygiene days. Approx 1,000 active patients. Asking \$327K.

4091 SOUTH VALLEY - HOLLISTER GP & PEDIATRIC

Country living at its best ~ small town community feel with affordable housing. Fully-equipped 1,600 sq. ft. office with 2 enclosed adult ops and 3 open pedo ops. Great opportunity with trained staff and approximately 550 active patients. 2014 GR \$228K. Seller is willing to help for a smooth transition. Asking price only \$125K.

4093 SAN JOAQUIN ORTHO

Established over 35 years with a solid reputation, near several referral sources in seller owned building. 2,500 sq. ft. office with 7 chair open bay in professional center on a well-travelled street with many retailers. Avg. Gross Receipts \$763K. Seller retiring and willing to help for smooth transition. Asking \$561K. The building is available to purchase as well for \$608K.

4096 UKIAH GP

Seller offering well est. 48 year practice. Located in outdoorsman's paradise. Just 2 hours North of SF surrounded by redwood forest, vineyards and mountains. 950 sq. ft. office in single level building w/ 4 fully equipped ops. 2014 GR \$565. Asking \$300K.



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CONTINUED FROM 94

necessarily the amount owed; agencies usually negotiate a smaller settlement. For example, if a patient owes a dentist \$500 and the collection agency negotiates to \$300 and charges 30 percent, the dentist will only receive \$210.

In addition, collection agencies are required by law to cease collection efforts should the amount in question be in dispute. Consumers have 30 days to notify collection agencies that the debt is disputed, and agencies must then obtain verification of the debt or a copy of a judgment in order to pursue it. Dentists are, however, allowed to pursue disputed debt on their own.

Not all circumstances necessitate the involvement of a collection agency. In some cases, dentists would have more luck talking to patients directly to determine why they are unable to fulfill their financial obligations. Offering options such as a payment plan to a patient who has become unemployed or is going through a divorce may be a much more appropriate avenue.

Generally speaking, patients whose accounts have been sent to collections should be dismissed from the practice. It is crucial to follow the proper dismissal protocol, ensuring the patient is not midtreatment.

Even the most well-managed practices occasionally find themselves with patients who, for whatever reason, fail to meet their financial obligations. Choosing to send an unpaid balance to a collection agency is a personal decision each practice owner should make on a case-by-case basis. By being aware of both the benefits and drawbacks of such actions, dentists can make informed decisions. ■

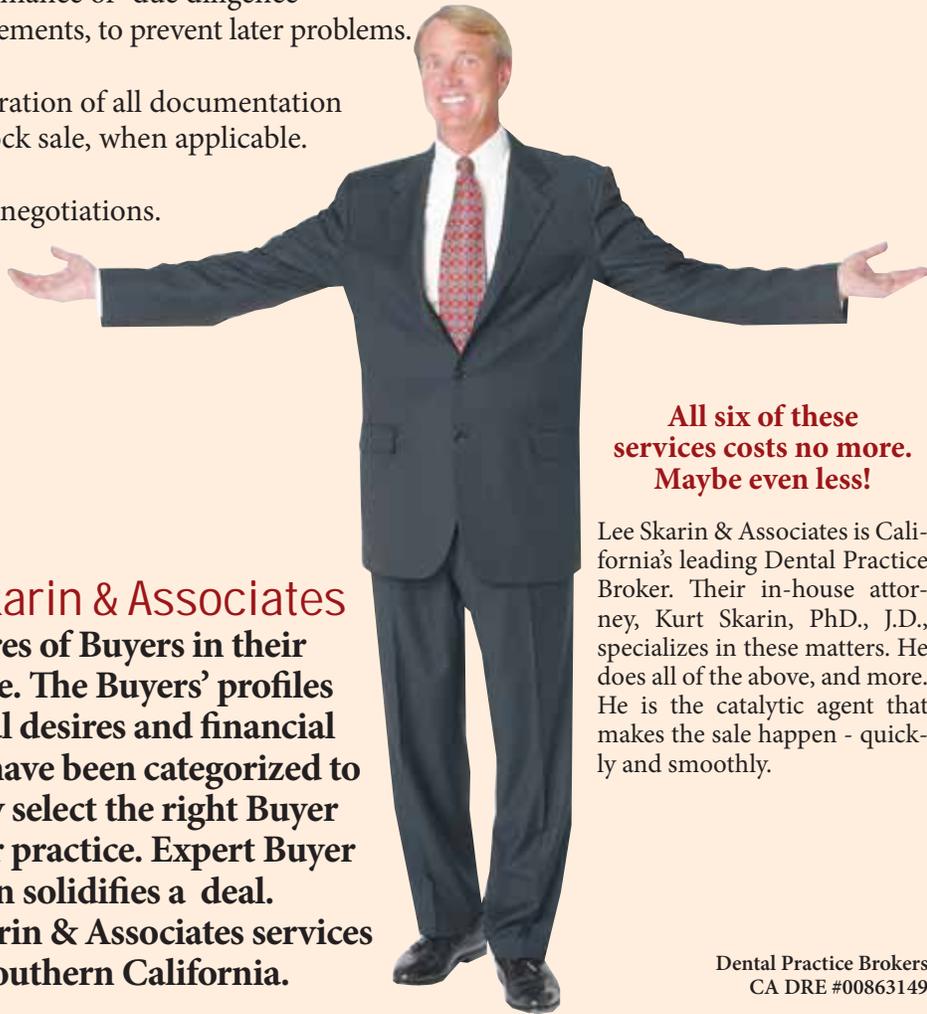
TDIC's Risk Management Advice Line at 800.733.0633 is staffed with trained analysts who can answer collections and other questions related to a dental practice.

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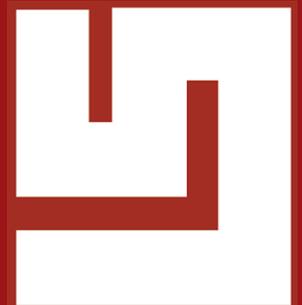
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NORTHERN CALIFORNIA

ALAMEDA: Office w/2 equip. Ops, 3rd plumbed in approx. 3000 sq. ft., below market rent. 52% adjusted net on \$416,000 GR. Owner retiring. #CA378

BERKELEY: *New Listing!* 1700 sq. ft., 4 Ops, Dentrrix Software, Digital X-Ray, Laser. 2015 GR \$1,288,000, adjusted net \$494,000. 100% fee for service. #CA379

BRENTWOOD: *New Listing!* 1,600 sq. ft., 4 Ops, Dentrrix, Digital X-ray, Pano, Intra-Oral Camera. Endo, Oral Surgery & implants referred out. 2015 GR \$600K #CA391

CASTRO VALLEY: 1700 sq. ft. office w/4 Ops. 2015 GR \$500K. EagleSoft PMS, Digital X-Ray, Fiber Optics & Laser. Owner retiring. #CA368

CONTRA COSTA COUNTY: 4 Op Endo office w/Digital X-ray, Microscopes, and PBS Endo in approx. 1,200 sq. ft. 2014 GR \$672K. #CA284

EL DORADO COUNTY: 960 sq. ft. w/4 Ops, intraoral camera, digital x-ray, Practice Works software. 2015 GR \$466K. #CA339

EL DORADO COUNTY: *New Listing!* 1,200 sq. ft., 3 Ops, with Pano, EZ 2000 software. 2015 GR \$342K on 3 day week. #CA390

GREATER EL DORADO HILLS: 1,700 sq. ft. office w/3 Ops, Digital Pan, Digital Sensors, EagleSoft software. 2015 GR \$737K. #CA343

GREATER ROSEVILLE/ROCKLIN: 1,300 sq. ft., 4 Ops, Intra-Oral Camera, digital Pano, X-ray, Scanner, Dentrrix software. 2015 GR \$697K. #CA350

GREATER SACRAMENTO: 7 Ops, 3,079 Sq. Ft. Clean and DDS - Separate Practices), 2015 GR \$974K. #CA140

GREATER SACRAMENTO: 2,099 sq. ft. Prosthodontic office 5 Ops Fiber Optic, EagleSoft software. 2015 GR \$926K on 4 day week. #CA377

GREATER SACRAMENTO: *New Listing!* 1,000 sq. ft., 3 Ops, Intra-Oral, Digital X-Ray, Easy Dental software. Practice established 20+ years. 2015 \$433K. #CA397

MARIN COUNTY: 1,100 sq. ft. 3 operatories. 4 Op. 2014 GR \$370K, on pace for sale in 2015. #CA302

MTN. VIEW: 1150 sq. ft., 4 Ops, 3 equipped, Dentrrix Software, Dexis Digital X-Ray, Laser, Intra-Oral Camera. 2015 GR \$514,000, 4 days/week. #CA385

OAKLAND: 12 ops in 5000 sq. ft. modern office. GR of \$1,500,000 with PPO, HMO and FFS patients. #CA360

OAKLAND: *New Listing!* 2015 GR \$355K on 4 day work week. Approx. 1000 sq. ft., 3 Ops, Dexis Digital X-Ray, Carestream PMS. Owner retiring. #CA396

PASO ROBLES AREA: \$2.25M GR, 52% overhead. Buyer to be skilled in restorative, surgical procedures, implant placement. #CA355

SACRAMENTO: 1,000 sq. ft. office w/2 Equip. Ops, 2 add'l Plumbed. DentalMate software. 2015 GR \$110,427 #CA332

SACRAMENTO: *New Listing!* 1,020 sq. ft., 3 Ops, intra-oral, digital x-ray, Open Dental software. HMO practice, 2015 GR \$420K, low overhead. #CA384

SAN FRANCISCO: Financial District office, 5 Ops, room for 6th, 1760 sq. ft. 2015 GR \$1.2 mil, Adj. Net. \$480,000. #CA357

SAN FRANCISCO: Periodontal Practice & Condo Unit, 1,160 sq. ft. w/4 Op, 2014 GR \$714K w/\$363K Adj. Net. #CA274

SAN JOSE: *CAN'T RENEW LEASE!* 2015 GR \$568K on 2 1/2 day work. 4 Equipped ops, 2 add'l Plumb. 1,100 sq. Ft. EZ Dental, Dexis, film-based Panoramic. #CA330
Some equipment also for sale!

SAN RAMON-FACILITY: 4 Op facility w/high-end Pelton & Crane Equipment, Digital X-Ray, Digital Pan, I.O. Cameras, 1654 sq. ft. corner suite. #CA370

SANTA ROSA: General Dentistry & Building. 3 Ops. 2013 GR \$542K w/Adj. Net \$182K. #CA200

STOCKTON: 7 Ops, 2052 sq. ft., great lease and options to renew. GR \$750,000 with PPO, HMO and FFS patients. #CA361

VACAVILLE: *New Listing!* 1,342 sq. ft., 4 Ops, intra-oral camera, Gendex digital x-ray, Pano, Laser, Dentrrix software. 2015 GR \$911,000, 4 day/week. #CA389

CENTRAL CALIFORNIA

FRESNO: Great start-up or satellite office. 4 Ops, 1480 sq. ft., great lease. 2015 GR \$237,000 and priced to sell. #CA349

HANFORD: 4 days Hygiene, 1,345 Active Patients. 2015 GR \$509K. Digital x-rays, Intra-oral cameras, and Imaging System. #CA336

MODESTO: *New Listing!* 2015 GR \$918,000, adj. net \$441,000, 2,800 sq. ft., 8 Ops, digital x-rays, Pano, Dentrrix Software. Owner retiring. #CA380

MODESTO: *New Listing!* 1630 sq. ft., 4 ops, Schick Digital X-rays, Cerec, Panorographic X-Ray, EagleSoft. 2015 GR \$450K. Owner retiring. #CA388

MODESTO: Dental Air Space Condominium. 1,511 sq. ft. dental office. Sale price \$286,000. #CA353

SOUTHERN CALIFORNIA

ALISO VIEJO: *New Listing!* Turnkey Leaseholds Sale-5 Ops, 3 Equipped, Retail Plaza. Great Signage, move-in ready. Includes computers, x-rays & instruments. #CA365

BAKERSFIELD: *New Listing!* 5 Ops, Est. 20+ years. Dentrrix, Digital X-rays Avg. Equip. Age is ~5 years old. 2015 GR \$675K. Seller retiring. #CA386

BELL: 3 Ops, Dentrrix Digital in a free-standing building in Fullerton. 2015 GR \$453K with \$259K Adj. Net. #CA317

BEVERLY HILLS: 5 Ops, EagleSoft, Digital, CEREC. Long-term staff, newer equipment. 2015 GR 1.2M+, #CA210

BURBANK: General/Prosth/Implant practice. 15 years of goodwill, retail center. 5 Ops, 3 equipped, EasyDental, Digital. 2015 GR \$291K, \$118K Adj. Net. #CA348

CARSON: 3 Ops Paperless, EagleSoft, Digital, Pano. All Equip. <3 yrs. old. 2014 GR \$143K. #CA280

CENTRAL ORANGE COUNTY: 3 Ops, Paperless, digital, busy retail center. 2015 GR of 381K with 156K Adj. Net. #CA328

ENCINO: 4 Ops, Est. 10+ years, EagleSoft, Digital, intra-oral camera. 2015 GR of \$450K and \$182K Adjusted Net. #CA372

FULLERTON: 6 Ops, 4 Equipped, 13 years of Goodwill, Dentrrix, Digital, Paperless. Great location. 2015 GR of \$410K. #CA352

GREATER LOS ANGELES: Perio Practice. 5 Ops, 34 Yrs. of Goodwill. Dentrrix, Digital, Laser, Great Referral Base, 2015 GR \$728K, Adj. Net \$307K. #CA173

HUNTINGTON BEACH: 3 Ops, 4 days of hygiene/wk. Dentrrix Digital x-rays and an intra-oral camera. 2015 GR of \$432K. #CA382

INLAND EMPIRE: *New Listing!* 5 Ops, PracticeWorks, Digital x-rays, 4 days of hygiene/wk. 2015 GR of \$950K and low overhead. #CA393

INLAND EMPIRE: 5 Ops, Dentrrix, Digital, Pano, 30 yrs. of Goodwill. 4 1/2 days of Hygiene. #CA283

LAKEWOOD: 4 Ops, 3 Equipped, retail center location on busy corner. 38 years of Goodwill, Dentrrix, Digital. 2015 GR \$264K. #CA341

LONG BEACH: *New Listing!* 5 Ops, 4 Equipped, Est. for 50+ years, 1,850 sq. ft., digital. 2015 GR \$359K. #CA363

LOS ANGELES: 3 Ops, 50+ years of Goodwill. Pano, Digital, Laser. 2015 GR \$241K and Adj. Net of \$121K on 2 days/wk. #CA345

NEWPORT BEACH: 5 Ops, 3 Equipped, EagleSoft, Digital, Paperless, Pano, Intra-Oral Camera. 2015 GR \$550K+. #CA366

NEWPORT BEACH: *New Listing!* 4 Ops, 3 Equipped, Dentrrix, Digital, and all high-end equipment that is less than 10 years old. Est. 21+ years. #CA375

NORTHEAST ORANGE COUNTY: *New Listing!* 6 Ops, affluent area. Est. over 50 years 4 days of hygiene/wk. 2015 GR of 771K with \$271K Adj. Net. #CA392

ORANGE COUNTY: Endo practice with 6 Ops, Digital and Paperless, 5 year old equipment. Strong referral base for 25+ years. #CA327

ORANGE COUNTY: 6 chair Ortho practice +2 Ops, 1 room. Paperless, Digital Pano, 2015 GR of \$945K and \$300K Adj. Net. #CA371

OXNARD: *New Listing!* 4 Ops, Paperless, Dentrrix, Dexis Digital x-rays, 6 days of Hygiene per week. Seller retiring. Favorable lease. 2015 GR of \$795K #CA387

PALM SPRINGS: *New Listing!* 4 Ops, 30 years of goodwill. Good location, Doctor wants to remain and work part time if possible. 2015 GR \$549K. #CA351

PASADENA AREA: Practice & Building - 3 Ops, Dentrrix, Digital, CEREC #CA282

SAN BERNARDINO: *New Listing!* Facility Only. No Patients - includes equipment - Beautiful 5 Op office, nicely decorated, same location 30+ years. Selling as is. #CA395

SANTA BARBARA: 4 Ops, est. for 40+ years. 8 days Hygiene/week, long-term staff. FFS. GR of \$827K. #CA291

UPLAND: *New Listing!* Leasehold Improvements. 4 Ops, custom tile throughout suite, modern design. Beautiful Spanish style building. #CA394

VICTORVILLE: *Price Reduced!* 3 Ops, 3 Plumbed, 2,150 Sq. Ft. Est. 34 yrs., SoftDent. 2015 GR \$277K. #CA149

WESTERN SAN FERNANDO VALLEY: *New Listing!* Pedito Practice in upscale location, 4 Ops, EagleSoft, Intra-Oral Camera, Pano. 9 years Goodwill. #CA399

SAN DIEGO

LA JOLLA: 3 Ops, Delta Premier. 2015 GR of \$500K. Owner retiring. #CA278

NORTH COUNTY, SAN DIEGO: 5 Ops, 26 years Goodwill, PPO some HMO. 2015 GR of \$453K low overhead. #CA354

NORTH COUNTY, INLAND: 3 Ops, Digital X-Rays, EagleSoft, Excellent Location, Bright and Modern Facility. 2015 GR of \$397K. #CA376

SAN DIEGO: *New Listing!* High-grossing practice, 44 years of Goodwill. Shopping center location. #CA381

SAN DIEGO: Modern Restorative/Implant Practice. State of the art Digital, i-CAT, Lab, 5 Ops, 2 Special Rooms, High-grossing. #CA334

OUT OF CALIFORNIA

CENTRAL OAHU, HAWAII: 3 Ops in Central Oahu. Dentrrix, Dexis, Pano. 2015 GR \$353K #HI102

HONOLULU, HAWAII: 6 Ops, 5 Equipped, Dentrrix, Digital CEREC Blue Cam, Est. 37 years. 2015 GR \$797K #HI103

HONOLULU, HAWAII: *New Listing!* 6 Ops Plumbed, 4 Equipped, PPO/FFS, Dentrrix, Excellent Location and Visibility, Established for 30 years #HI105

MAUI, HAWAII: 7 Ops, 5 Equipped, Modern Design, CEREC. 2015 GR \$1.3MM+. #HI101

Don't Get Caught by Phishing

CDA Practice Support Staff

According to a major industry report, the Verizon Data Breaches Report, human error likely caused most health care data security incidents in 2015 in the form of stolen or lost electronic devices or media, insider misuse and other errors, such as improper device disposal or mishandling protected health information (PHI). In 2016, health care experienced a large increase in ransomware and other malware, many of which were launched by employees caught by phishing schemes. The U.S. Department of Health and Human Services, which enforces HIPAA, reported that, on average, there were 4,000 daily ransomware attacks on all entities in the first part of 2016 (a 300 percent increase over the 1,000 daily ransomware attacks reported in 2015). HHS in 2016 issued guidance stating that the result of a ransomware attack can be considered a breach under HIPAA unless the covered entity or business associate can demonstrate that there is a low probability that the PHI has been compromised. When PHI is encrypted by ransomware, HHS asserts that unauthorized individuals have taken possession or control of the information and thus the unauthorized encryption is a disclosure not permitted by HIPAA.

An essential ransomware prevention method is to train staff to recognize and appropriately respond to phishing attempts. Phishing cannot be stopped, but training and reminding your staff about phishing can limit damage done to your practice. This article can be used for such training.

What is phishing?

Phishing uses “social engineering” to get an individual to believe he or she is responding to a legitimate email or website by providing information. Phishing attempts are widespread. Variations of phishing include “spear phishing,” which targets specific groups or individuals, and “whale phishing,” which targets company executives or others believed to hold key information.

Successful phishing relies on certain human tendencies. A phishing email:

- Will appear to be from a well-known company, or if you work in a dental clinic that is part of a larger organization, the email can look like it comes from another department in your organization, such as human resources.
- Will ask you to update or validate personal, financial or confidential information.
- Will create a sense of urgency by including a veiled threat of lost money or stolen identity or promise a reward for submitting information immediately.
- May direct you to a website that looks real.

Examples of possible phishing attempts are:

- An email from a potential patient who has attached an image that he or she would like the dentist to view.
- An email from your bank warns of potential fraud and requests you use a link included in the email to log in to your online account and check it.
- An email from an office supply company includes an attachment that the company states is an unpaid invoice.

- A government agency, such as the IRS, sends an email that warns of identity fraud and requests you use a link included in the email to verify your personal information.

Both HHS and the IRS have issued alerts about phishing. Last November, an email appearing to be from HHS prompted recipients to click a link regarding possible inclusion in the HIPAA audit program. The link then directed recipients to a website marketing a firm’s cybersecurity services. The IRS issued three taxpayer alerts in 2016. The agency saw an approximate 400 percent surge in phishing and malware incidents during the 2016 tax season and is again issuing alerts in 2017.

What to do if you get a phishing email

If you know the email is fake, delete the email without opening and notify the practice’s HIPAA Security Officer of the incident.

Do not click on anything if you do not know whether the email is legitimate. Look up the telephone number or website of the company to confirm information is the same. Do not use the link or telephone number provided in the email.

- Take a close look at the sender’s email address.
- If there is a web link in the email, place your mouse over the link (*don’t click*) to see the web address on the screen.
- Find the first forward slash (/) in a web address and inspect the text in between the first two periods to the left of the slash. This is the

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domain name. Verify that it is a legitimate domain name. Can you spot the fake web address below?

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- http://www.dbc.ca.gov/verification/instructions.shtml
- http://www.@silverway.345.com/cdph.ca.gov/programs/RadiologicHealthBranch.aspx

- Fake sites will have numbers or the @ symbol in an unusual sequence.
- Trained staff is key to preventing malware from infecting your information

systems. Security software does not catch everything because malware can be rewritten to get around it. If you would like to supplement this article with additional training material, you can find it by doing an internet and YouTube search on “phishing training.” ■

Regulatory Compliance appears monthly and features resources about laws that impact dental practices. Visit cda.org/practicesupport for more than 600 practice support resources, including practice management, employment practices, dental benefits plans and regulatory compliance.



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6118 SAN FRANCISCO'S EAST BAY Unique opportunity. Large equity stake and 4-day work week being offered in an extremely well positioned and branded practice. 2016 produced \$2.64 Million and collected \$2.53 Million, reflecting a 10% improvement over 2015. Full complement of specialties offered. 300+ new patients in 2016. Delta Premier status shall continue.

6117 PATTERSON AREA 2016 collected \$657,000 with \$365,000 in Profits. PPO practice. Full Price \$275,000.

6115 SAN FRANCISCO'S RUSSIAN HILL – CHINESE PRACTICE 2016 shall collect \$300,000 with Profits of \$145,000. Has been a \$400,000 year performer. Full Price \$120,000.

6114 AUBURN – ROSEVILLE AREA 2016 realized another \$1.1+ Million year. Profits totaling \$425,000+. Beautiful and extensive facility leases for \$1.60 sq.ft. Not a Premier Practice.

6113 FRESNO Consistently collecting \$600,000+ per year. Shopping center location with fixed rent. Profits topped \$365,000 in 2015.

6112 HEALDSBURG Ideal as part-time practice in desirable locale or foundation to grow. 100% out-of-network. 2016 topped \$210,000 in collections. Full Price \$30,000.

6111 SANTA ROSA Perfectly positioned for next Owner. Best equipment, networked and digital including Pano. 3-days of Hygiene. 2016 trending \$520,000+ with profits exceeding \$250,000. Conservative Owner. Best location.

6110 CONCORD Well cared for practice. 2016 collected \$260,000. 3-ops. 580 patients. Great curb appeal. Little done in marketing. Great merger opportunity for nearby practice. Full price \$135,000.

6107 EUREKA 100% out-of-network with insurance industry. 2016 produced and collected \$1 Million on Doctor's 20-hour week. Doctor's schedule booked 3-months out. 7+ days of Hygiene. Highly respected. Full Price \$250,000.

6106 SACRAMENTO'S EL DORADO HILLS 2015 collected \$640,000. UCR Fees. Beautiful office. Very solid opportunity.

6105 MODESTO Collected \$436,000+ on 3-day week. 3-days of Hygiene. 5-ops. Central location. Successor should open 4th day.

6103 SAN FRANCISCO'S UNION SQUARE Opportunity to acquire highly regarded practice with condo. Beautiful 5-ops, digital and paperless. 6th op available. 2015 collected \$658,000.

6098 WEST PETALUMA THE business center of the North Bay! Business parks are growing and young families are drawn to this great family community per the unique amenities of this historic river city. Collected \$468,000 with Profits of \$212,500. 4-days of Hygiene.

6089 MOUNT SHASTA Small town living renowned for outdoor lifestyle. 3-day week collected \$950,000. Very strong bottom line. Digital including Pano. Full Price \$350,000.

ANTELOPE VALLEY Has grossed \$1.8 Million. Fantastic location. 60,000 autos pass by per day. 8 ops. Partnership for \$250,000 or buy all.

ARCADIA Facility only. 3-ops equipped. \$65,000 or \$95,000 with Ortho.

BAKERSFIELD AREA 5-ops, next to McDonalds. 1,800 sq.ft. includes building. Grosses \$40,000/month. Full Price with building \$350,000.

BAKERSFIELD Established 55 years. 5-ops in 3,000 sq. ft. Will do \$1 Million. Full Price \$300,000. Building available for \$350,000.

BELLFLOWER Established 60-years. Grossing \$350,000. Full Price \$240,000.

EAST LOS ANGELES One million Latinos in service area. PPS sold to Seller in 1985. Will do \$1 Million in 18 months. Full Price \$300,000.

EAST SAN FERNANDO VALLEY Absentee Owner. \$8,000/month Cap Check. 4-ops. Do a Million within a year.

INDIO 4,000 sq.ft. dental building. Full Price \$650,000.

LADERA RANCH Grossing \$650,000. Shopping center location.

LAGUNA NIGUEL Location, location, location! 4-ops with Panorex. Full Price \$185,000.

LA JOLLA Established 20-years. 3-ops. Grossed \$150,000. Super opportunity with immediate growth. Full Price \$150,000.

LAWDALE Hi identity. 2 ops. Full price \$125,000.

LOS ANGELES HMO Grossing \$1.2 Million. 5-ops. Full Price \$1.2 Million.

LOS ANGELES HMO Does \$4 Million. Full Price \$1.2 Million.

NORCO – CORONA Will do \$1.5 Million. 8-ops. Exquisite. Full Price \$1.2 Million.

NORWALK Fantastic high identity location. 5 ops. Full Price \$250,000.

ORAL SURGERY PRACTICE – LOS ANGELES Established 40 years.

ORANGE Beautiful 10 operatory office ready for merger.

PASADENA Established 60 years. 7-ops. Always \$1+ Million. Full Price \$600,000.

REDLANDS Shopping center. Grosses \$350,000. Full Price \$250,000.

RIVERSIDE Facility only. 4 ops. Full Price \$50,000.

SOUTH ORANGE COUNTY BEACH CITY Grosses \$650,000. 4 ops. Beautiful!

PERIO PRACTICE - PRESTIGIOUS BEACH CITY Established 40 years.

TORRANCE Established 12 years. 5 star building. 3-ops. Grossing \$250,000. Full Price \$195,000.

TUSTIN Dental building. Full Price \$1.5 Million.

VENTURA - OXNARD 5-ops. Grossing \$850,000. High identity. Full Price \$685,000.

YUCCA VALLEY 8/10th of an acre. Great highway visibility. Full Price \$250,000.

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Better
Fit

Better
Price

BAY AREA

AC-566 SAN FRANCISCO: Spectacular views of Washington Square. 3ops +2 add'l, 1400 sf \$225k

AC-578 SAN FRANCISCO Patient Charts: near Union Sq., 7 Doctor pts/day and 8 Hygiene pts/day \$190k

AC-624 SAN FRANCISCO: Wonderful Patients, solid income in great stand-alone bldg. \$475k

AC-640 SAN FRANCISCO: On 23rd Floor of Prestigious SF Bldg, 2ops in 700sf. Seasoned Staff, Seller Retiring \$175k

AC-649 SAN FRANCISCO Facility Only: Richmond District, 3 ops+1 add'l, Equipment less than 5yrs old \$155k

AG-564 SAN FRANCISCO: 25 + yrs goodwill. Large 5600+ sf w/ 9 ops near Land's End \$2.225M

AG-645 SAN FRANCISCO: Low Overhead, compact practice ready for expansion or relocation. Retail/Commercial area. 2nd Floor \$125k

AG-648 SAN FRANCISCO: Newly Built Dental Space now Available for Rent! Call for Details!

AN-514 SAN FRANCISCO Facility: Located in the bustling financial district! 1007 sf w/4 ops Only \$95k

AN-565 SAN FRANCISCO: Remarkable opportunity 2067 sf w/ 6 ops \$1.05M

AN-592 SAN FRANCISCO: Easy accessibility, visibility & free parking! 1000sf w/ 2 ops + 1 add'l \$100k

AN-513 REDWOOD CITY: The practice of your dreams! 900 sf w/ 4 ops + 2 add'l \$375k

BC-432 PITTSBURG: Family-oriented Practice! 1640 sf w/ 6 ops. Seller retiring. \$350k

BC-520 HAYWARD Facility: Located in Downtown, 1500 sf, 4 equipped ops, X-Rays in 3 ops. \$65k

BC-614 SAN LEANDRO Patient Charts: Increase your Production & continue TX to this stable patient base \$150k

BC-646 ORINDA: Well-established, family-oriented Practice, Word-of-Mouth Refs, 4ops in 1080sf. \$825k

BAY AREA CONTINUED

BN-504 RICHMOND: Practice & Real Estate! 1450 sf w/ 2 ops + 2 add'l \$100k /RE \$700k

CC-567 ST. HELENA: Beautiful Wine Country, 5 ops 1842 sf single-story bldg \$790k

CC-599 SANTA ROSA: Stable pts base, Well-respected Practice, 3 ops in 1040 sf \$250k

CC-611 S. MARIN CO: Desirable, well-established neighborhood, 20npts/mo 3ops, 1100 sf \$650k

CC-632 SAN RAFAEL: Small town life, vibrant-growing city, 6-8 pts/day, 3ops in 800sf office in beautiful bldg \$165k

CG-616 NAPA: State of the Art Practice - Seller moving out of state! Call for Details!

DC-480 SILICON VALLEY: Multi-Specialty Practice, 14+ops in 7500 sf, Owner Financing available Terms \$1.075M

DC-604 LIVERMORE Facility: Turn Key Facility, fast growing city, 3ops +3 add'l plumbed in 2380 sf modern office \$110k

DC-623 MENLO PARK: LOTS of room for GROWTH w/ close proximity to Facebook, Stanford, Google & Telsa \$380k

DN-497 PLEASANTON Facility: Great Location! 870 sf w/ 3 ops + 1 add'l. Owner Financing w/10% Down! \$95k

DN-631 CAMPBELL: Rare Opportunity! 1100 sf w/ 3 ops, busy retail center \$249k

DG-519 SANTA CLARA Facility: Move In Ready! 2240 sf w 6 fully equipped ops \$225k

DG-530 SAN JOSE: Dentrax JUST Installed! Highly respected quality practice! 2015 collections \$1M+ \$795k

DG-635 CASTRO VALLEY: Excellent Location & Stellar Reputation! Solo Group Practice \$690k

DG-643 SAN JOSE: Seller Motivated! 3,300 sf w/ 4 ops + 2 add'l available! Call for Details! \$65k

DG-581 SAN JOSE: Must See to Appreciate! Gorgeous Practice, stable patient base & loyal staff \$496k

DG-619 SAN JOSE: One of the most unique practices you will ever see! 1450 sf w/ 5 ops \$1.1M

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Timothy Giroux, DDS



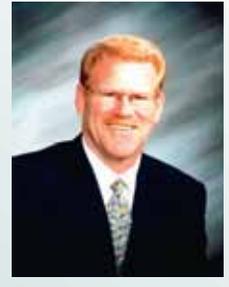
Jon B. Noble, MBA



Mona Chang, DDS



John M. Cahill, MBA



Edmond P. Cahill, JD

NORTHERN CALIFORNIA

EC-525 SACRAMENTO: Great Location! Excellent Visibility! 1500 sf w/ 3ops, 10-15 new pts/mo. Motivated Seller **\$195k**

EC-531 GREATER SACRAMENTO: Practice & Real Estate 1750 sf w/ 4ops + 1 add'l, 8npts/mo **\$800k**

EN-464 ROCKLIN Facility: Don't miss out on this remarkable opportunity! 2150 sf w/ 4 ops **\$100k**

EG-638 CITRUS HEIGHTS: Focus on Crown & Bridge. 1,680 sf w/ 2 ops. Plumbed for 1 add'l & Room to expand. (Real Estate also Available) **CALL for DETAILS!**

EG-639 CITRUS HEIGHTS: Real Estate for Sale – Call for Details!

EN-625 SACRAMENTO: Looking for a HMO practice in a great Location? 2,500 sf w/5 ops **\$450k**

EN-621 ELK GROVE: This opportunity comes loaded with goodwill galore! 1400 sf w/ 3op + 2 add'l **\$195k**

EN-626 CARMICHAEL: Lifestyle you just can't be beat! HMO 1,250 sf w/ 3 ops **\$350k**

EN-628 ORANGEVALE: Great place to work, play & live. HMO 1,310 sf w/ 4 ops + 1 add'l **\$375k**

EN-621 CARMICHAEL: Remarkable HMO opp. awaits your talent & skill! 1,200 sf w/3 ops + 1 add'l **\$268k**

EN-634 ROSEVILLE: Beautifully designed, well-appointed and fully digital! 2352 sf w/4 ops + 2 add'l **\$235k**

FC-489 CLEARLAKE: Great lifestyle. 2015 Gross \$915k on 3 day week, 4ops. Real Estate 3600 sf shared, interest **"Pride Institute"** designed office **\$470k**

FN-527 TRINITY COUNTY: Be the only dentist in town! **"Pride Institute"** designed! 2350sf w/ 5 ops +1 add'l. **\$250k**

GC-472 ORLAND: Live & Practice in charming small town community. 1000 sf w/ 2ops, Seller Retiring. **\$160k**

GG-453 CHICO: 5000 sf w/ 7 ops Perfect for 1 or more dentists! **\$325k**

GG-454 PARADISE: 2550 sf w/ 9 ops, 40 yrs goodwill! Amazing Opportunity! **\$525k**

GG-617 YUBA CITY: Rare Opportunity to purchase Dental Facility with REAL ESTATE! **\$275k**

GN-244 OROVILLE: Must See! Gorgeous, Spacious 2500 sf w/5 ops! **\$315k**

GN-399 REDDING: Loyal patient base & relaxed workweek schedule, 1440 sf w/3 ops **\$150k**

GN-546 CHICO AREA: Catering to fearful patients, offering quality sedation dentistry, 2600 sf w/ 4 ops **\$350K**

GN-606 BUTTE COUNTY: Hesitate & you'll miss out on this one-of-a-kind opportunity! 1700 sf w/ 4 ops **Reduced \$125k**

NORTHERN CALIFORNIA CONTINUED

GN-641 YUBA CITY: Fantastic signage & visibility. **Building available for purchase!** 2,400 sf w/ 5 ops **\$475k**

HN-213 ALTURAS: Well managed, consistent revenues! 2200 sf w/ 3 ops + 1 add'l. **\$115k**

HN-280 NO EAST CA: Only Practice in Town 900 sf w/ 2 ops **REDUCED! ONLY \$60k**

HN-618 SIERRA FOOTHILLS: Seller Retiring! Much room for growth by increasing office hours! 750 sf w/ 2 ops **\$95k**

HN-633 AUBURN VICINITY: Loaded w/ warmth, charm & goodwill galore! 1,430 sf w/ 4 ops **\$525k**

CENTRAL VALLEY

IC-468 SAN JOAQUIN VALLEY: High-End Restore Practice! 6 ops in 2500+ sf office. Call for Details! **\$425k**

IN-569 MADERA: Stellar reputation and load with goodwill! 2,900 sf w/ 7 ops **\$634k**

JC-541 FRESNO Facility: 1210 sf & consists of 2 fully equipped ops & plumbed for add'l op **Call for Details!**

JN-551 COALINGA AREA: Serving community of working families! Paperless Practice. 1200 sf w/ 3 ops **\$395k**

SPECIALTY PRACTICES

BC-600 CONCORD Ortho/Pedo Charts Only: Continue treatment to these Ortho/Pedo patients Call for Details! **\$400k**

BC-612 CONTRA COSTA COUNTY Ortho: Just of the I-80 commuter corridor! Call for Details! **Only \$40k**

CG-424 NAPA Prosthodontics: Digital X-ray & NEW 3D Imaging Unit! On track to collect just under \$1m **\$690k**

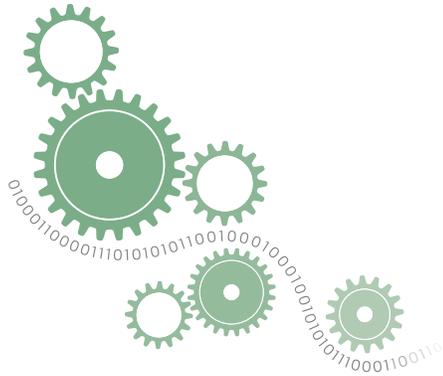
EG-637 CITRUS HEIGHTS (Prosthodontics): 1,680 sf w/ 2 ops. Plumbed for 1 add'l & Room to expand. **\$390k (Real Estate Also Available)**

FN-536 LAKE COUNTY Pedodontics: Focusing on Prevent dental problems **before** they begin! 1750 sf w/ 3ops **\$225k**

IC-543 CENTRAL VALLEY Orthodontics: 1650 sf w/ 5 chair bays & plumbed for 2 add'l, Strong Refs & Satisfied Pts Base **\$125k**

JC-540 FRESNO Sleep Apnea: Motivated Seller retiring! Step right in & make it yours! **Call for Details!**

"ASK THE BROKER" CAN NOW BE FOUND AT WWW.WESTERNPRACTICESALES.COM



A look into the latest dental and general technology on the market

Technology Helping Elderly Boost Mental Health

The benefits of technology are far reaching, and a new study has proven that those who are considered elderly are benefitting from it greatly. Researchers at the Stanford Center on Longevity found that adults who are over the age of 80 and use technology to connect with loved ones have a higher rate of mental well-being. In addition to this, they reported that gaining new information through technology helped them become more physically fit. To come to this conclusion, researchers sampled 445 people who ranged between 80 and 93 years old. The participants were asked what motivated them to use the devices (cellphones, computers, streaming and apps) and how many they used. The researchers found that most of them utilized one device. More information on this study can be found at news.stanford.edu.

— Blake Ellington, *Tech Trends* editor

Online Black Friday Sales Hit Record

There was a substantial increase in the amount of money spent online on Black Friday in 2016. A recent study by Adobe shows that \$5 billion was spent in the U.S. online by the end of Black Friday, which included Thanksgiving Day. This is a 17.7 percent increase from 2015. The study was based on aggregated and anonymous data from 22.6 billion visits to retail websites.

Tamara Gaffney is the principal analyst and director at Adobe Digital Insights.

“Shoppers hit the buy button at unprecedented levels as conversion rates were up nearly a full percent across all devices in the evening hours on Black Friday,” Gaffney said. “With the full day total coming in at \$3.34 billion, Black Friday may have just dethroned Cyber Monday’s position as the largest online shopping day of the year. Shoppers are still buying at higher than expected levels in the early morning hours of Small Business Saturday.”

More information on this study can be found at news.adobe.com.

— Blake Ellington, *Tech Trends* editor

Sense (\$299, Sense)

Every electrical device in a home has a signature, a unique identity that distinguishes it from the others. Discovering each device along with its specific patterns and duration of use can bring insight into the energy consumption of homeowners who are looking for ways to save. Sense is a monitor that taps into a home electrical panel and tracks the energy use and consumption of things that people turn on every day. Sense must be installed by an electrician or qualified professional able to safely handle high-voltage wiring in a home electrical panel. Once installed, homeowners download and launch the companion app on their iOS or Android mobile devices near the monitor to complete setup. Sense uses a home Wi-Fi connection to transmit its data. After setup is complete, homeowners simply allow the monitor to learn the various devices, from kitchen appliances to refrigerators and lights, as they are being used. Sense learns to distinguish each item, when it is being used and how many watts it is consuming. This information is displayed in real time as energy bubbles on the app. The larger the bubble, the more energy the device is consuming. Bubbles disappear when devices are turned off. History of every detectable device as well as overall home energy consumption can be easily accessed with the app. Homeowners can set up custom notifications to be alerted when any recognized device is used. For those with solar panels, an add-on option is available to detect its energy production. Understanding how much energy is used in a home is the first step toward making decisions on how to conserve it. Sense can reveal information about power-hungry devices that can help a homeowner determine whether to replace them with energy-efficient ones or simply decrease their overall use. The knowledge gained from using Sense can help any homeowner make smart choices to save energy.

— Hubert Chan, *DDS*

Would you like to write about technology?

Dentists interested in contributing to this section should contact Andrea LaMattina, CDE, at andrea.lamattina@cda.org.

Worm's Eye View



Even into the late Renaissance period, this belief in odontically endowed worms as the causative agent of dental caries was firmly held.

Robert E.
Horseman,
DDS

ILLUSTRATION
BY VAL B. MINA

Once upon a time according to the late Dr. Malvin Ring, dentistry's authoritative link to the past, an ordinary, elongated, usually naked, soft-bodied animal, the worm, got a lot of attention from the dental profession.

Reflect for a moment on the oral health of a 1600s citizen. "Hollow teeth" were endemic, i.e., teeth that had deteriorated to the point of resembling the Coliseum in structure. Packed with food debris, it became a socially irritating necessity to continually suck on these carious teeth. A gathering of hollow-toothed people would sound like a gaggle of today's teenagers in a snack shop all inhaling their smoothies

through straws. Toothache, of course, was common and was ascribed to the gnawing action of worms. Even into the late Renaissance period, this belief in odontically endowed worms as the causative agent of dental caries was firmly held. Many reputable and prominent authorities of the day supported the theory in spite of the worms' vigorous denial that they had anything to do with it.

Universally held in contempt as being more useless than a Braille TV remote, your average nematode has long felt a massive inferiority complex heightened by his cousin the snake. Denied fangs, poison sacs and the ability to slither or hiss, the worm came off a pathetic

second best in every department. Lurking in apples, popping up unexpectedly in salads or lying about dehydrating in random patterns on sidewalks after a rain, the worm's only friendly recognition came from predator early birds.

Fifteenth century scientific investigators bestowed a certain species of worms with the classy Latin name of *C. elegans* because of the dignified way it emerged from its soil home every February to predict another six weeks of winter if it spied its shadow. The first name *Caenorhabditis* was shrewdly abbreviated to "C." because researchers learned long ago that no matter what they were researching, it was sure to attract activists and protesters both pro and con based on religion, culture, racism, feminism or people who just enjoyed a good stake burning or a day of interrupting traffic at intersections.

As far as activists were concerned, the C. could then be *Charlie* or *Celeste*, thus making life easier for banner makers and slogan chanters.

Years went by without much happening except for the proliferation of politicians, wars and locust invasions. The ramifications of discovering some Big Trouble is still commonly referred to as "opening a can of worms," but the nematode's centuries of notoriety came to an end in December 1859 (Chinese and Mayans dispute this, but agree it was on a Tuesday) when Louis Pasteur proved that worms causing toothache was the dumbest idea since the Flat Earth Theory. Other dumb ideas since then have been embraced, rap "music" being a top contender.

Except for bait shops along the Eastern Seaboard and serving fishing aficionados along the Gulf State shores, we didn't hear much about worms after viruses were discovered. Viruses are currently giving way to stress and other hazards of being alive.

Fifteenth century scientific investigators bestowed a certain species of worms with the classy Latin name of *C. elegans* because of the dignified way it emerged from its soil home every February to predict another six weeks of winter if it spied its shadow.

A batch of scientific investigators from such elegant institutions as The John Hopkins School of Medicine, the National Institute of Aging, MIT and the National Heart, Lung and Blood Institute made headlines a dozen years ago with the discovery of a marvelous anti-aging enzyme of the *sirtuin* (pronounced sir-TOO-in) class called *resveratrol*. And who or what provided a basis for the research? Our friend, *C. elegans*, the nonhazardous, non-infectious, nonparasitic, nonpathogenic one-millimeter-long worm.

"3' UTRs Are the Primary Regulators of Gene Expression in the *C. elegans* Germline"

This headline was obviously directed to the readers of molecular biology and genetics research and may not send *your* pulses reeling, even if you may have known all along that genes have primary regulators for their expression. The fact that this particular worm with its 3' UTRs (UTR = untranslated regions – 3' can't mean 3 feet in a 1 mm worm?) plays any part in the business of cell dynamics, is something that never came up in dental school biology when I was there sometime in the last century.

Not worth a darn as bait, *C. elegans* seems to have an ideal compromise between complexity and tractability. Its genome has an entire 100,000,000 base of DNA, of which 959 somatic cells of its transparent body are visible with a microscope if you want to take a look. With such a load, *C. elegans* has an average life span of only two to three weeks, which makes it a more durable subject than the Mayfly nymph (Ephemeroptera) that checks out in only 24 hours except on holiday weekends (11 a.m.).

Biologists at the Howard Hughes Medical Institute Center for Cell Dynamics enthusiastically note that *C. elegans*' gonad is "*an excellent tissue to study gene regulation during development*" with the potential of slowing or stopping cell development beyond the mature stage in human beings. In other words, discovery of a sort of DNA switch might halt cells from going downhill beyond maturing to their natural death. Chronologically you might reach a lonesome 120 and spend your time pouring over dating services.

That would be nice unless you consider that if research ever comes to actual practice, it might involve your own gonads. Everybody who could afford the DNA switch but hadn't enlightened themselves Googling *gonad* could stop maturing beyond at ... say, age 40 to 50, but there is a difference between aging and maturing. We already have a lot of aged old people who show no sign of maturing, and even worse, a lot of 20-year-old individuals who think they are mature right now.

Talk about a can of worms! ■



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