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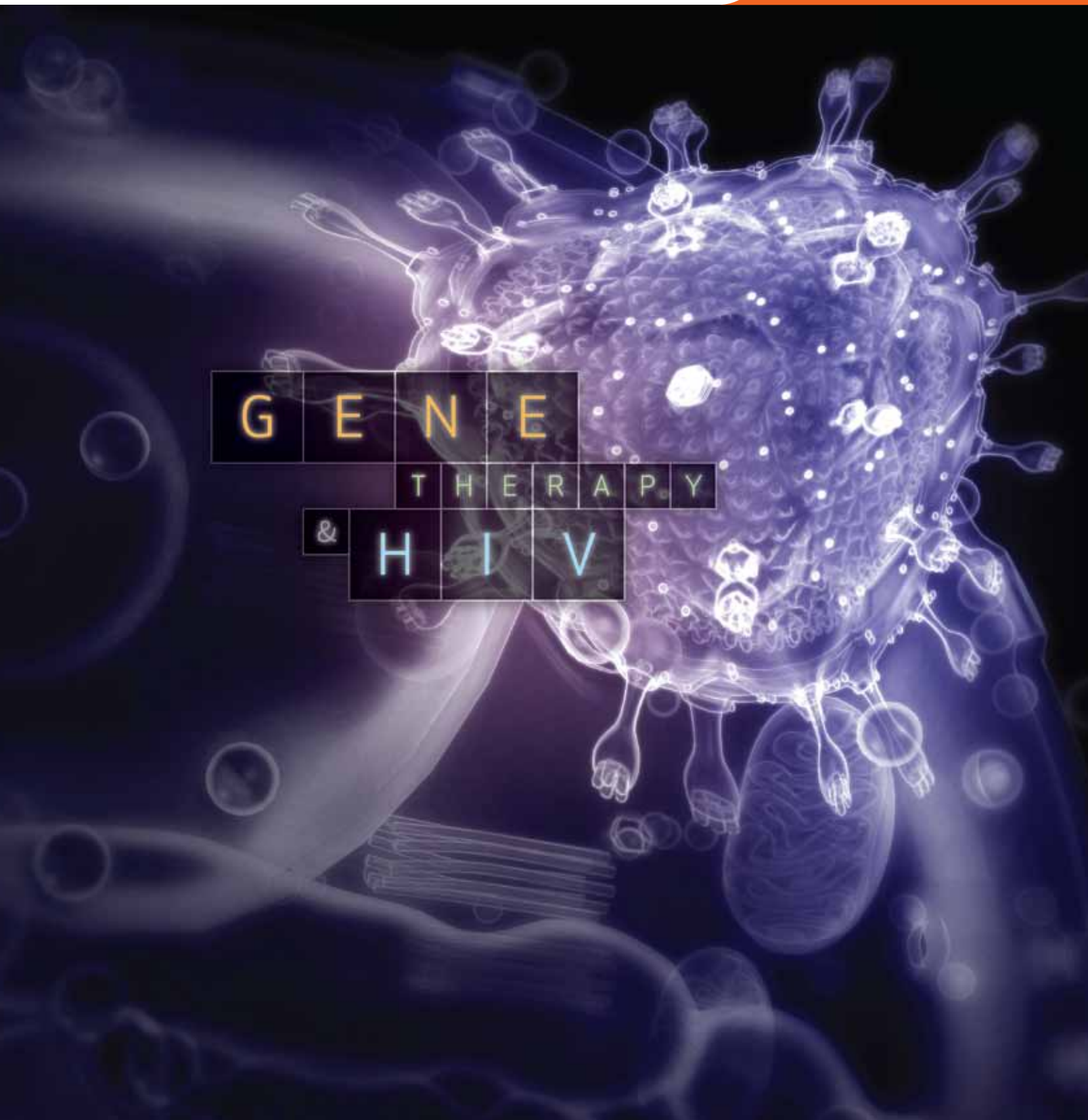
Journal

MAY 2012



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CDA JOURNAL, VOL 40, Nº5

DEPARTMENTS

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FEATURES

OF THE CALIFORNIA DENTAL ASSOCIATION

Journal

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CDA JOURNAL, VOL 40, Nº5

Autonomy and the Maxillary Sinus

BRIAN SHUE, DDS

Editorial autonomy is still important today.

Thirty-three-year-old Dr. Chapin Harris collapsed onto his bed, exhausted after laboriously editing the last article for his upcoming publication. He accomplished this without a PC, Mac or even an iPad—and not just because of a bad WiFi connection. He relaxed and blew out the flame from his nightstand candle. Electric power had not been harnessed yet.

The year was 1839. The world was filled with various dental charlatans and quacks who generally gave dentistry a bad name. And Dr. Harris created the *American Journal of Dental Science,* the first-ever dental journal, which was available as a six-month subscription for $3 or annually for $5 (equivalent to $73 or $121, respectively in today's dollars adjusted for inflation). Best of all, he and his publishing committee were their own bosses.

But not for long. In 1841, Dr. Harris turned his *Journal* operation over to the American Society of Dental Surgeons (ASDS)—the first-ever national dental association—established the year before in order to promote dentistry as a science and a respectable profession. ASDS membership had great benefits, included the opportunity of receiving a doctor of dental surgery degree by paying an extra $10 ($258 in today's dollars).[1] However, talk is cheap, but the printed word isn't—membership did not include a subscription to its *Journal*. Dr. Harris remained editor, but inherited a higher authority over the publication—the ASDS executive committee.

This leadership team included Dr. Horace Henry "Father of American Dental Science" Hayden. With all these great minds in formation to elevate the profession, one would think everyone was on the same page. Not true. Dr. Hayden refused to share a 180-mile-plus journey with Dr. Harris to New York City to go to the first editorial board meeting. Then he crashed the meeting late, demanded that Dr. Harris cease this publishing venture, and said scientific dental knowledge does not belong in a "magazine."[1]

But wait, there's more. This relationship was even more complicated. Not only were the two of them friends and practiced dentistry in the same town, but Drs. Harris and Hayden were the two principals working together at this very same time to establish the first-ever dental school—the Baltimore College of Dental Surgery, which would open the next year—and with Dr. Harris appointed as the first dean and Dr. Hayden the first president.

Which brings us to the third annual ASCS meeting, held in Boston, July 19-21, 1842. Complete with scientific lectures, official meetings, and dental product exhibits, it was a 19th century *CDA Presents*. It even included an officially endorsed product—drill stocks by ASDS Executive Committee member Dr. Edward Maynard (who also invented the barbed broach and a breech-loading U.S. military rifle).

By 1842 standards, things were going pretty well—until one afternoon. Dr. Hayden had just finished an engaging yet lengthy after-lunch lecture titled "Diseases of the Antrum Maxillare." It was 4 p.m. and Dr. Harris was next. He began his address titled "Diseases of the Maxillary Sinus." Uh-oh. Notice the similarity? Dr. Hayden did—after all, he wasn't born yesterday (no, born in 1769 to be exact, before the American Revolution and a time when future presidents John Quincy Adams and Andrew Jackson were still in their colonial diapers).

But after one hour, Dr. Harris stopped his lecture and "begged to be excused from its further reading."[2] Did Dr. Harris have old-fashioned Industrial Revolution food poisoning? Or was it due to the glare from the Father of American Dental Science for "upstaging" him by repeating the same topic? We may never know.

Nevertheless, Dr. Harris was excused. A successful motion was made to publish Dr. Harris' entire presentation in the next issue of the *Journal*, which he did.

It touched a raw nerve in Dr. Hayden. He swung back with a blistering 22,000-word commentary that was so long, it took the next two issues of the *Journal* to contain all of it. He completely tore apart Dr. Harris' article on the maxillary sinus showing multiple examples of errors. Additionally, he made sarcastic personal remarks about "our friend" and "our good doctor" Harris, and, if that wasn't bad enough, he did the unthinkable—he attacked the credibility of the *Journal* all the way back to the first issue.

Why did Dr. Harris publish all of this? Did he have autonomy to reject the publication of Dr. Hayden's 55-page attack? It seems like he didn't. He and his publishing committee had to answer to the ASDS Executive Committee. And Dr. Hayden was ASDS president.

Editorial autonomy is still important today.

In fact, the ADA House of Delegates met Oct. 10-14, 2011, in Las Vegas to address a full set of business, including Resolution 72: "Autonomy of the ADA Editor." It sought to resolve a discovered conflict in the ADA bylaws, which states the ADA Board of Trustees have power to "cause to be published in, or to be omitted from, any official publication of the Association any article in whole or in part (page 40, ADA Bylaws, lines 1836-1838)." In other words, the ADA editor didn't have autonomy in the 21st century.

Widely accepted guidelines already exist on the relationship between the editor and the owner of a scientific publication, which is best described by the World Association of Medical Editors (http://wame.org) as: "editors-in-chief should have full authority over the editorial content of the journal ... including original research, opinion articles and news reports ... and how and when information is published." It also states, "owners should not interfere in the evaluation, selection, or editing of individual articles, either directly or by creating an environment in which editorial decisions are strongly influenced."

Additionally, these guidelines are followed by the American Association of Dental Editors. Note these guidelines focus on written content, not advertisements.

Has this editorial "control" been exercised at the ADA? Not according to an unnamed source. What would happen if the editor decided to publish an article that is contrary to the "will" of the ADA Board? That is why the editor is an appointed position. The responsibility of the editor to publish appropriate material for a publication is balanced by the authority of the owner of such publication to remove the editor when necessary, as well.

The delegates of the ADA's HOD voted overwhelmingly in favor of autonomy and the ADA bylaws will be changed and reviewed at the next meeting. It is appropriate to bring ADA bylaws up to the accepted standard, which in turn, will allow the ADA editor have autonomy to do his job.

Looking back, the relationship between the two founders of modern dentistry was never the same. What caused Dr. Hayden to fume hotter than a steam locomotive's boiler? It was not because the *Journal* didn't publish his material on the maxillary sinus; he declined that request because he planned to publish it in his future book—a fact omitted by a historian. Dr. Hayden said he would continue his critique on Dr. Harris in future issues, but this goal was interrupted when he died in 1844.

Dr. Harris was able to rescue the *American Journal of Dental Science* from the remains of the ASDS, which did not survive the Amalgam War of the 1840s. He once again operated with full autonomy and continued to publish it until his death in 1860—just one year after the start of another national dental organization—the ADA. ■■■■

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Illustrations by Val B. Mina

Utilize 'Surprise Effect' to Deal With Difficult Personality Types

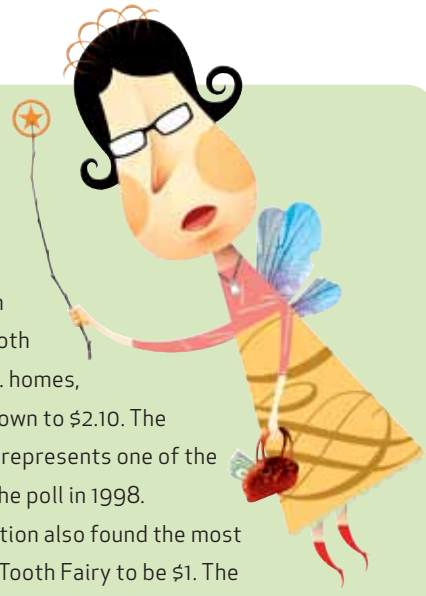
One in three people is a "difficult person." Difficult people are everywhere, according to psychologist-humorist and professional speaker, Bruce Christopher. Difficult personality types can be found in co-workers, neighbors, customers, supervisors – even family members.

There are six basic types of difficult personalities and, according to Christopher, they "can drain us of our energy and bring us from a positive position to a negative state of mind very quickly." He identifies these six personalities as tanks and exploders, snipers, know-it-alls, wet blankets and whiners, super-agreeable charmers, and clams and indecisives.

According to Christopher, tanks and exploders use power to demand that their needs be met; snipers use sarcastic and cutting jokes to distract attention

CONTINUES ON 391

Even Tooth Fairy Found to Be Cutting Back



A recent survey shows the average gift from the Tooth Fairy dropped 42 cents in the last year. According to The Original Tooth Fairy Poll, sponsored by Delta Dental, the Tooth Fairy is still visiting nearly 90 percent of U.S. homes, but the average amount for a baby tooth is down to $2.10. The 17 percent decline from 2010's average $2.52 represents one of the largest declines since Delta Dental started the poll in 1998.

The survey of 1,355 parents across the nation also found the most common amount left under the pillow by the Tooth Fairy to be $1. The poll also revealed that most children can expect to find more money under the pillow for their first lost baby tooth.

Oral Bacterium Linked to Serious Disease

A newly identified bacterium, thought to be a common inhabitant of the oral cavity, could cause serious disease if it enters the bloodstream, according to a study in the *International Journal of Systematic and Evolutionary Microbiology*.

Identifying the oral bacterium will allow scientists to examine how it causes disease and evaluate the risk that it poses, according to a news release.

Researchers at the Institute of Medical Microbiology of the University of Zurich identified the bacterium, which has been named *Streptococcus tigurinus* after the region of Zurich where it was first recognized.

S. tigurinus, which bears a close resemblance to other streptococcus strains that colonize the mouth, was isolated from multiple blood cultures of patients suffering from endocarditis, meningitis, and spondylodiscitis (inflammation of the spine), the study noted. Bleeding gums provide a possible route of entry for oral bacteria into the bloodstream.

The authors stated that comparative gene sequencing studies showed that the organisms were members of the *Streptococcus mitis* group but did not correspond to any recognized species. Based on biochemical and molecular analyses, the novel isolates represent a new species.

The similarity of *S. tigurinus* to other related bacteria has meant that it has existed until now without being identified and its recent identification is clinically important, explained Andrea Zbinden, MD, who led the study.

"Accurate identification of this bacterium is essential to be able to track its spread. Further research must now be done to understand the strategies *S. tigurinus* uses to successfully cause disease," Zbinden said in a news release. "This will allow infected patients to be treated quickly and with the right drug."

For more information: ijs.sgmjournals.org/content/early/2012/01/16/ijs.0.038299-0.

Liver Cells Can Be Produced From Human Dental Pulp

A compound responsible for bad breath, or halitosis, has been shown to help transform stem cells from human dental pulp into liver cells, a study published in IOP Publishing's *Journal of Breath Research* revealed.

A group of Japanese scientists from Nippon Dental University determined that hydrogen sulfide (H2S), an oral malodorous compound, "increased the ability of adult stem cells to differentiate into hepatic (liver) cells, furthering their reputation as a reliable source for future liver cell therapy."

The authors noted that this is the first time liver cells have been formed from human dental pulp, and in high numbers of high purity – meaning fewer "wrong cells" being differentiated to other tissues or remaining as stem cells.

Val B. Mina

"Moreover, these facts suggest that patients undergoing transplantation with the hepatic cells may have almost no possibility of developing teratomas or cancers, as can be the case when using bone marrow stem cells," said lead researcher, Ken Yaegaki, DDS, PhD.

The research team used stem cells from dental pulp obtained from the teeth of dental patients who were undergoing routine tooth extractions. Once prepared, the cells were divided into test and control groups. The test cells were incubated in a hydrogen sulfide chamber, then harvested and analyzed to see if they had converted into liver cells.

Smoking Can Kill Helpful Oral Bacteria

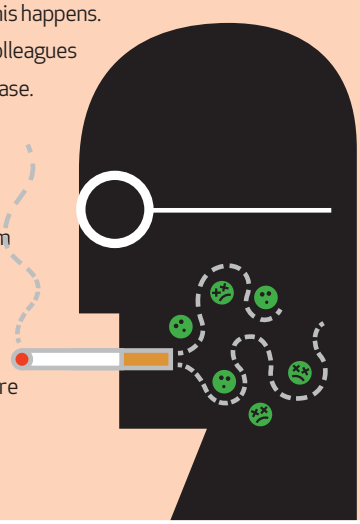
Smoking causes the body to turn against its own helpful bacteria, leaving smokers more vulnerable to disease, according to new research. The mouth of a healthy nonsmoker, despite the regular disturbance of brushing and flossing, contains a stable ecosystem of healthy bacteria while a recent study shows the mouth of a smoker is far more "chaotic" and more susceptible to invasion by harmful bacteria.

While it is known that, as a group, smokers suffer from increased risk of oral disease, including gum disease and oral cancer, a new multistudy investigation by Purnima Kumar, PhD, is exploring how this happens. Kumar, assistant professor of periodontology at Ohio State University, and her colleagues researched the role the body's microbial communities play in preventing oral disease.

"The smoker's mouth kicks out the good bacteria, and the pathogens are called in," said Kumar. "So they're allowed to proliferate much more quickly than they would in a nonsmoking environment."

From 15 healthy nonsmokers and 15 healthy smokers, Kumar and her team took samples of oral biofilms over seven days of plaque development after professional cleaning, and compared the results.

The research team looked for two things when they took samples from the subjects' gums. According to the study, they examined which bacteria were present by analyzing DNA signatures found in dental plaque.



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PERSONALITY TYPES, CONTINUED FROM 389

from their own feelings of insecurity; know-it-alls attempt to use intellectualism to impress others and gain status; wet blankets and whiners are the complainers and chronically pessimistic/negative individuals; super-agreeable charmers are socially seductive and charming, yet tend to be unreliable; clams and indecisives fear failure, they tend to lay back and remain undecided in the hope that someone else will take the risk and decide for them.

Christopher explained in his September 2011 lecture at *CDA Presents* these personality types are actually defense mechanisms – learned behaviors. He believes "what we don't know about people often explains why they do what they do," and compares people to icebergs. "We see only the tip of the iceberg – the behaviors. Below the tip are the 'drivers.'" Drivers of difficult people may include a desire to feel listened to or a need to feel important.

"These personality types are really problem-solving strategies which the individual learned in childhood and carried into his or her adult relationships." For example, those with "exploder" personality types most likely learned as children that a way to handle conflict and get their needs met is by throwing a temper tantrum.

Learning to deal with difficult people means taking control of the situation's outcome, but not controlling the individual. Christopher defines control as "trying to get someone to do what you want them to do," and claims "even if you're right, you are controlling them, and they will resist you." When it comes to persuading someone's behavior, being right isn't a factor. Difficult people do what they do because it works. So how can you stay empowered with difficult people? Interrupt their pattern. Christopher recommends "the surprise effect," which entails doing the exact opposite of what people expect you to do.

For instance, when dealing with exploders, it is important to resist the urge to explode back, mock or taunt, ignore or give in. Instead, try surprising them by acknowledging their feelings. Tell them their feelings are important – grab a notepad and write down how they're feeling in front of them. This will not only surprise the individual, but it will interrupt their pattern of using an exploding technique to get what they want. "How can one explode when you're taking notes on them?" Christopher asked.

Christopher reiterated one last key to handling difficult people by saying, "Difficult people do what they do because it works. So quit trying to change them, instead change yourself."

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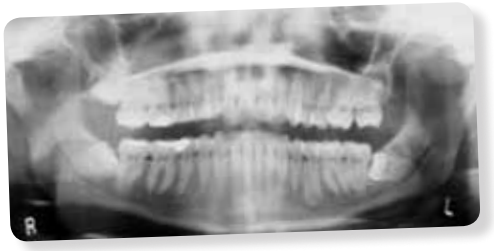

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College Students Challenged to Design Health-Related Apps

The Institute of Medicine and National Academy of Engineering recently challenged college and university students "to work in interdisciplinary teams and transform health data into mobile apps, online tools or games, or other innovative products that solve vexing health problems," according to a news release.

Students pursuing degrees toward careers in health, engineering, and computer science were eligible to participate in the second annual "Go Viral to Improve Health" collegiate challenge, which offers $18,000 in prizes for their innovative health-related apps.

The IOM and NAE believe that college students can generate exciting and powerful new products – the next "viral apps" – to improve health for communities and individuals. The "Go Viral to Improve Health" challenge urges students to create interactive apps and other tools that engage and empower people in ways that lead to better health.

A panel of experts will judge submissions on design, usability and how well they integrate public health data. Winning teams and technologies will be honored at the June 5-6 Health Data Initiative Forum in the nation's capital. The first place team will receive a $10,000 prize sponsored by Heritage Provider Network and the opportunity to demonstrate their app during the forum. The second- and third-place teams will receive awards of $5,000 and $3,000 respectively, and both will have the chance to display their winning technologies in the exhibit hall.

For more information: iom.edu/Activities/PublicHealth/HealthData/GoViral.aspx.

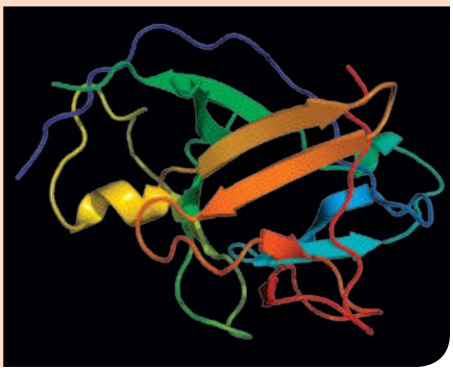
Interleukin-1 Gene Variations Linked to Periodontal Disease Risk

Interleukin-1 (IL-1) gene variations are associated with increased risk of periodontal disease, according to new research by a team from Harvard University.

Published in the *Journal of Periodontology*, the recent study evaluated the potential value of IL-1 genetic variations in the risk for developing severe periodontal disease.

The research team, led by Nadeem Y. Karimbux, DMD, associate professor of Oral Medicine, Infection and Immunity, Harvard School of Dental Medicine, reviewed 27 published studies on IL-1 genetics and periodontal disease from 1997 through June 2011. The studies examined Caucasian adults, 35 years or older with adult periodontal disease, to determine whether there was a significant association between the presence of the IL-1 gene variations and the severity and progression of periodontal disease, according to a news release.

Thirteen studies qualified for the quantitative meta-analysis, which found significant effects for the two individual gene variations: IL1A and IL1B and for a composite genotype that combines minor alleles at each locus.



"This review and meta-analysis show that IL1A and IL1B genetic variations are significant contributors to chronic periodontitis in Caucasians," Karimbux said. "Having this actionable information can assist dentists in establishing more aggressive treatment protocols for patients at increased risk."

For more information: ilgenetics.com/content/news-events/newsDetail.jsp/q/news-id/260.

Successful Implants for Patients Taking Bisphosphonates

Simplifying and reducing treatment time can increase patient acceptance and reduce complication risks.

For dental implants, this means moving away from the traditional two-stage surgical approach toward a one-stage procedure, according to a news release. The success of this concept when combined with another complication — that of patients receiving drug therapy for osteoporosis — was studied to determine the best method of treatment in this situation.

A recent report, published in the *Journal of Oral Implantology*, focuses on the one-stage approach. Fifty-four implants were installed for nine adult osteoporotic patients, 45 to 68 years old, eight of them female. All had been taking oral bisphosphonates for less than three years. They received fixed full-arch dental prostheses supported by six implants. Immediate loading procedures were performed, installing the implants in a one-stage surgery and requiring that motion at the bone-implant interface be kept below a certain threshold during healing, according to a news release.

Osteoporosis weakens bone and increases the risk of fracture, particularly among postmenopausal women. Bisphosphonates, an inhibitor of bone resorption, are widely used as a drug therapy for those with osteoporosis. Prolonged use of bisphosphonates, however, can lead to a painful refractory bone exposure in the jaws, known as bisphosphonate-induced osteonecrosis of the jaw, authors noted in the report.

Kids in Low-Income Families Drink Nearly Twice the Recommended Amount of Juice

A recent study from the University of Michigan C.S. Mott Children's Hospital National Poll on Children's Health showed that many kids in low-income families are getting more than the suggested amount of juice. In children age 1-6, the American Academy of Pediatrics recommends limiting fruit juice to one serving per day in order to minimize the risk of early childhood caries and other health issues.

The poll asked parents of young children of all economic levels about their children's juice consumption. According to a news release, 35 percent of parents reported that their children ages 1-5 have two or more cups of fruit juice on a typical day – twice the suggested amount.

"It is important to limit juice consumption in young children because there is such a strong link between consumption of sugar-sweetened beverages and child health problems like obesity and early tooth decay," Sarah Clark, MPH, associate director of the Child Health Evaluation and Research Unit at the University of Michigan and of the National Poll on Children's Health, said in a news release.

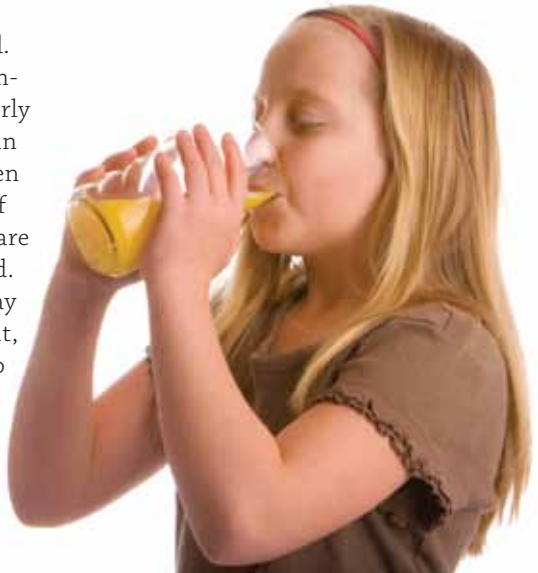
Forty-nine percent of parents with a household income less than $30,000 annually reported that their children drink two or more cups of juice per day, while only 23 percent of parents with household incomes of $100,000 or more report that their children drink two or more cups of juice per day, the report stated.

Clark said these findings are a concern. "Both childhood obesity and early dental problems are more prevalent in lower-income children, so the children we're most worried about in terms of these conditions are also those who are drinking the most juice," Clark stated. "Parents may think juice is an easy way for their child to get a serving of fruit, but it's often difficult to pick out 100 percent fruit juice amid the sugar-sweetened juice drinks," she added.

Thirty-five percent of lower-income parents said that their child's doctor recommends juice, the poll found.

"This is an important message for health care providers as well as parents," Clark said.

The full report is available at mottnpch.org/reports-surveys/too-much-good-thing-kids-low-income-families-drink-more-juice-recommended and the press release is available at uofmhealth.org/news/juice-poll-0222.



FDA Warns Spinbrushes Can Be Choking Hazard

The U.S. Food and Drug Administration issued a warning to parents, caregivers, consumers, and dental care professionals about reports of serious injuries and potential hazards associated with the use of all models of the Spinbrush: specifically the Arm & Hammer or Crest Spinbrush. While turned on, the brush head has either "popped off" or broken off in the user's mouth or near the face, causing cuts to the mouth and gums, chipped or broken teeth, swallowing and choking on the broken pieces, and injuries to the face and eyes, according to the FDA's warning.

The manufacturers of the Spinbrush have added a safety warning to the packaging and taken other steps to lessen the risk since the FDA began investigating complaints about the toothbrushes last year, a news release stated.

The FDA warned about the following models:

- Spinbrush ProClean
- Spinbrush ProClean Recharge
- Spinbrush Pro Whitening
- Spinbrush SONIC
- Spinbrush SONIC Recharge
- Spinbrush Swirl
- Spinbrush Classic Clean
- Spinbrush for Kids
- Spinbrush Replacement Heads

The agency provided the following advice:

- Before using the Spinbrush, inspect it for any damage or loose brush bristles. If you find any, do not use the brush. Report it to Church & Dwight, which can be reached toll-free at (800) 352-3384 or (800) 561-0752.
- Make sure the brush head is connected tightly to the brush handle, and test the brush outside of your mouth before using. If the connection feels loose or the brush head easily detaches from the handle, do not use the brush. Report it to Church & Dwight.
- Use care not to bite down on the brush head while brushing.
- To prevent injuries, always supervise children and adults who may need assistance when using the Spinbrush.
- Follow the instructions and recommended replacement guidelines included with the Spinbrush.
- Report injuries or problems with the Spinbrush to MedWatch—FDA's Safety Information and Adverse Event Reporting Program—either online (fda.gov/MedWatch), by regular mail, fax or by phone. Regular mail: Use postage-paid, preaddressed FDA form 3500 (fda.gov/MedWatch); or to submit via fax, 800-FDA-0178; or via phone, 800-332-1088.

For more information: fda.gov/downloads/ForConsumers/ConsumerUpdates/UCM291863.pdf

UPCOMING MEETINGS

2012	
May 3–5	*CDA Presents the Art and Science of Dentistry,* Anaheim, 800-CDA-SMILE (232-7645), cdapresents.com
June 21–24	Academy of General Dentistry 2012 Annual Meeting and Exhibits, Philadelphia, agd.org/philadelphia.
June 22–24	ADA New Dentist Committee's 26th New Dentist Conference, Washington, D.C., newdentist@ada.org or 312-440-2779.
Sept. 30–Oct. 3	National Primary Oral Health Conference, La Jolla, Calif., nnoha.org/conference/npohc.html
Oct. 18–23	ADA 153rd Annual Session, San Francisco, ada.org
Nov. 4–10	U.S. Dental Tennis Association, Tuscon, Ariz., 800-445-2524 or dentaltennis.org
2013	
April 7–13	U.S. Dental Tennis Association, TOPS'L Resort, Destin, Fla., 800-445-2524 or dentaltennis.org
Nov. 3–9	U.S. Dental Tennis Association, Big Island, Hawaii, 800-445-2524 or dentaltennis.org

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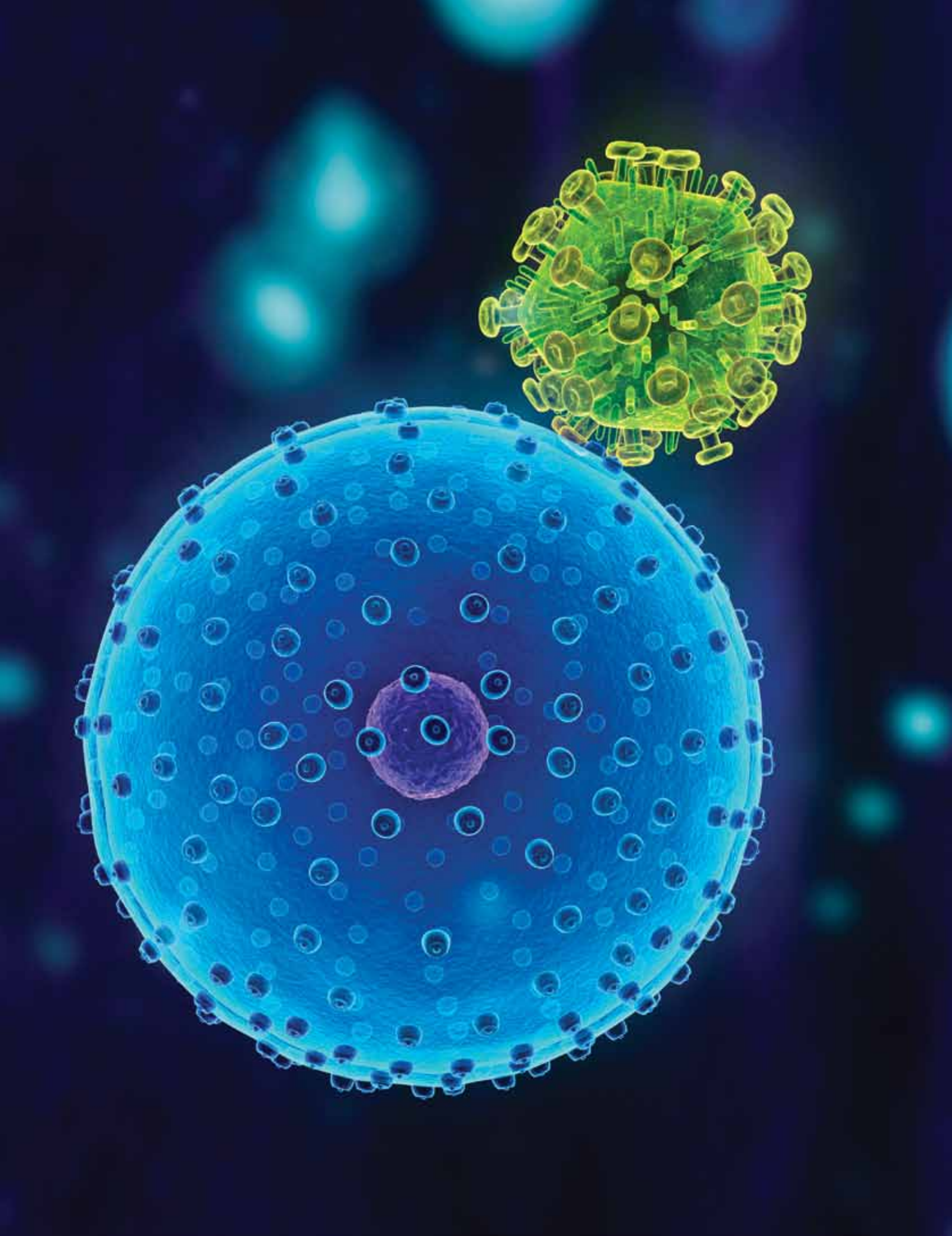

CDA JOURNAL, VOL 40, Nº5

A Gene Therapy Approach to Eliminate HIV-1-Infected Cells

SENAIT GEBREMEDHIN; AMY AU; KRYSTYNA KONOPKA, MD, PHD; MATTHEW MILNES, MS, DDS; AND NEJAT DÜZGÜNEŞ, PHD

ABSTRACT The ideal therapy for HIV infection requires a method to eliminate all HIV-harboring cells in the infected individual. The authors are developing an HIV-specific promoter to drive the expression of suicide genes that would induce cell death specifically in HIV-infected cells. The authors constructed a promoter that is 100-fold more responsive to the HIV transcriptional activator, Tat, than cellular transcription factors, using a plasmid expressing luciferase under the control of the mutated LTR promoter.

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Conflict of Interest Disclosure: None reported.

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Conflict of Interest Disclosure: None reported.

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Conflict of Interest Disclosure: None reported.

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Current antiretroviral drugs for the treatment of human immunodeficiency virus type-1 (HIV-1) infection focus on the inhibition of the viral replication cycle. These include inhibitors of reverse transcriptase, protease, virus-cell fusion, the co-receptor and integrase.[1] Other viral and cellular targets for potential antiretrovirals are being explored.[2] These treatments, however, cannot eliminate the latent, chromosomally integrated proviral genome.[3] The proviral genome and the numerous genes of HIV-1 are shown schematically in **FIGURE 1**.

The long-term aim of this project is to eliminate virally infected cells that are a constant reservoir for the virus. The approach will utilize an HIV-1-specific activator of viral transcription (Tat) (**FIGURE 1**) to induce the expression of a suicide gene specifically in HIV-infected cells, but not in uninfected cells.[4,5] As a first step in this process, the HIV long terminal repeat (LTR) promoter and five progressively truncated or mutated versions of LTR were synthesized (**FIGURE 3**). All of the constructs included the Tat-responsive region, TAR. The wild-type LTR (**FIGURE 2A**), and the mutated LTRs (**FIGURE 2B**) were inserted into a plasmid with the gene for firefly luciferase used as a reporter gene, but without a promoter or an enhancer (pGL3 basic vector). These plasmids were then transfected into HeLa cells that constitutively express Tat (HeLa-*tat*-III), and into control HeLa cells, and luciferase activity was measured after 48 hours.[6] In future studies focusing on therapeutics, the LTR mutant providing the highest HIV-1-specific luciferase expression will be inserted into a plasmid expressing a suicide gene, such as the herpes simplex virus thymidine kinase gene (**FIGURE 2C**).

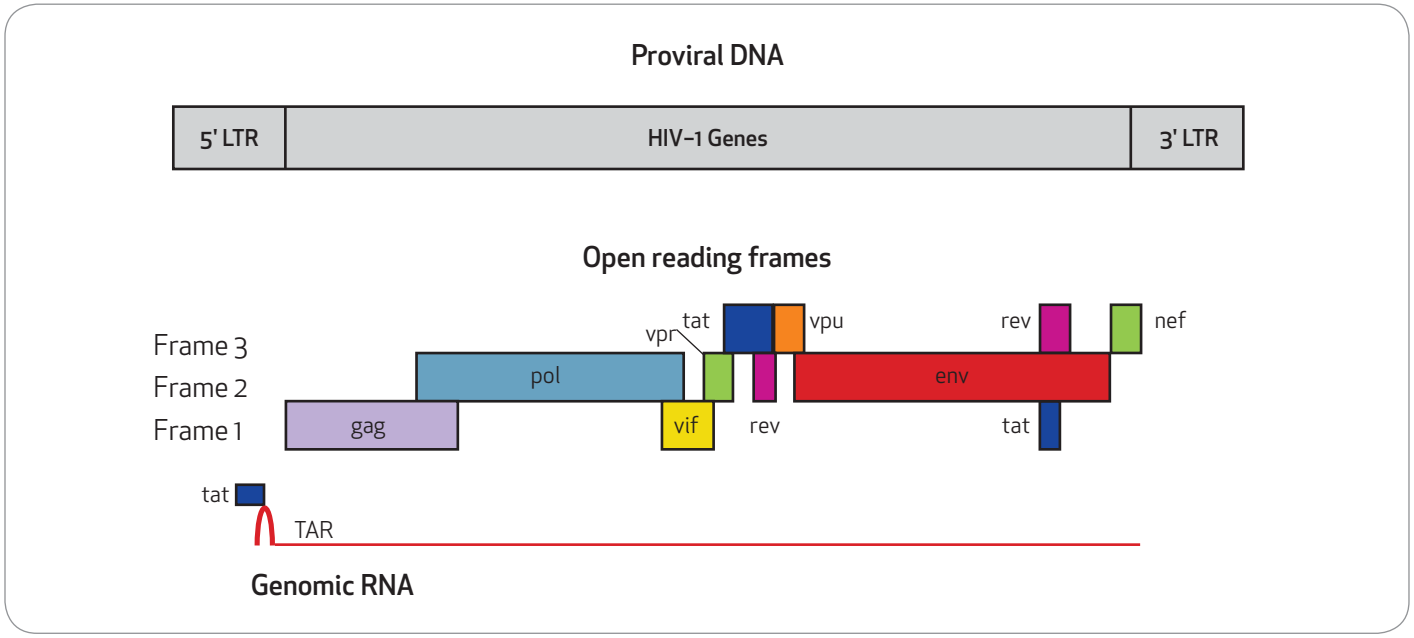

FIGURE 1. The general structure of the HIV-1 proviral genome, the open reading frames showing the HIV-1 genes, and the genomic RNA showing the TAR region to which the transactivator protein Tat binds. Redrawn from Adamson and Freed, and Strauss and Strauss.[2,10]

Materials and Methods

Cells

Tat-expressing human cervical epithelial HeLa cells (HeLa-*tat*-III) were obtained from Drs. William Haseltine, Ernest Terwilliger, and Joseph Sodroski through the NIH AIDS Research and Reference Reagent Program in Germantown, Md. This cell line was generated by transduction of HeLa cells with a Moloney-based retroviral vector containing a segment of the HIV-1 genomic clone pHXBc2 and a neomycin resistance marker. The parent cell line, HeLa, was obtained from the American Type Culture Collection in Manassas, Va., and used as a control for the HeLa-tat-III cells to evaluate nonspecific luciferase expression. The cells were maintained in Dulbecco's Modified Eagle Medium with 10 percent fetal bovine serum, 4 mM L-glutamine, 100 U/ml penicillin and 100 µg/ml streptomycin. They were seeded in 48-well culture plates ($2x10^5$ cells/well) in triplicate for each condition the day before transfection, and used at approximately 85 percent confluence.

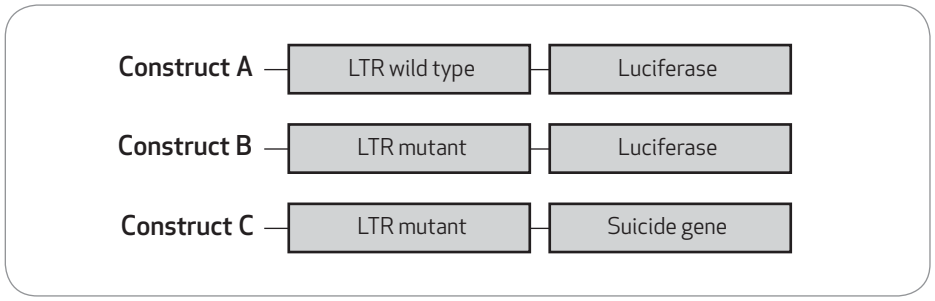

FIGURE 2. Gene constructs, with wild-type or mutant LTRs driving the expression of the reporter gene, luciferase, or a suicide gene. Constructs A and B were used in this study. Construct C represents a future design that would activate a suicide gene specifically in HIV-1-infected cells.

Plasmids

The LTR promoter region (LTR1) was synthesized by PCR amplification from the HIV-1 proviral clone pHXBΔbgl by Bionexus (Oakland). The mutant constructs (LT2-LTR6) were amplified from LTR1 by PCR using appropriate primers containing KpnI and SmaI restriction enzyme recognition sequences (**FIGURE 3**). These fragments were ligated into the pGL3 Basic Vector (Promega, Madison, Wis.) at the KpnI/SmaI site in the multiple cloning site of the vector, using standard methods. The vector includes the gene for firefly luciferase, but lacks a promoter and enhancer region of its own. All the constructs included the TAR region (blue bars in **FIGURE 3**). LTR5 was further modified prior to ligation using PCR to incorporate a specific mutation, designated by the red bar in **FIGURE 3**. The resulting plasmids were designated as pLTR1-tar-*luc* through pLTR6-tar-*luc*.

Transfection

Metafectene, a polycationic liposomal transfection reagent, containing a polyamino-lipid and dioleoylphos-

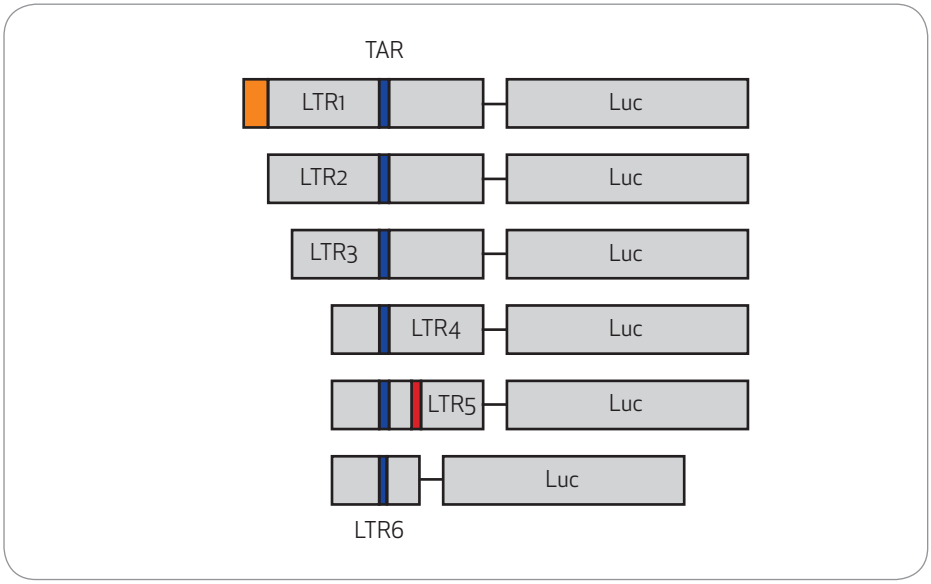

FIGURE 3. The promoter constructs LTR1–LTR6. The orange bar indicates the modulatory region, the blue bar the TAR sequence, and the red bar the AP1 binding site knockout mutation.

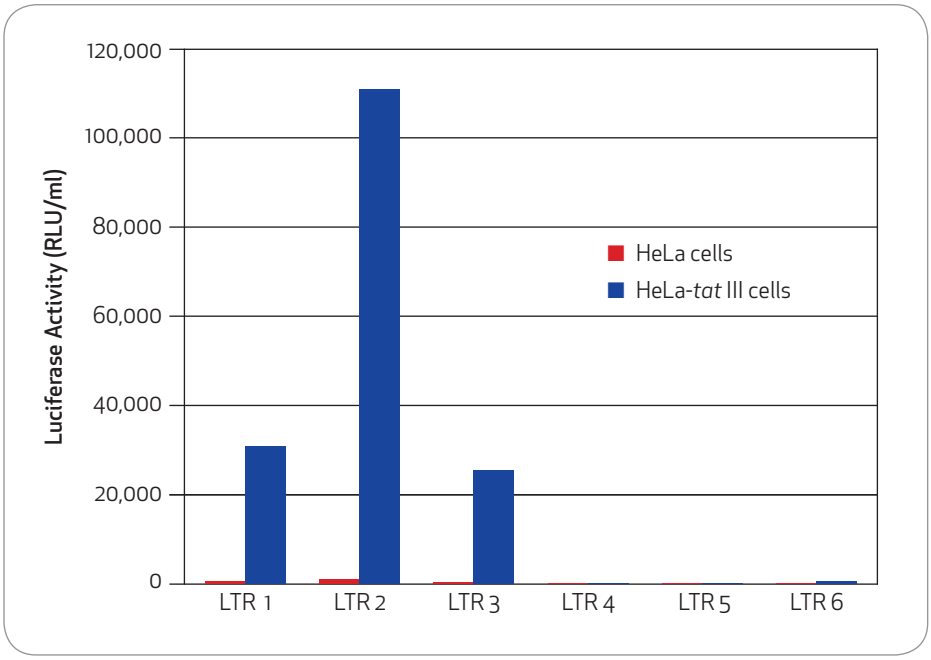

FIGURE 4. Luciferase expression in HeLa and HeLa-*tat*-III cells, following the transfection of pLTR1-tar-*luc* through pLTR6-tar-*luc* using Metafectene as the nonviral vector.

phatidylethanolamine (DOPE) was purchased from Biontex Laboratories, GmbH (Munich, Germany). HeLa and HeLa-*tat*-III cells were transfected with 1 µg of various pLTR-tar-*luc* plasmids.[7] Forty-eight hours after transfection, the cells were washed, solubilized with Passive Lysis Buffer (Promega) and centrifuged 15 s in an Eppendorf centrifuge to precipitate cellular debris. Luciferase activity in the supernatant was assayed using the Luciferase Assay System (Promega) and a Turner Designs (Sunnyvale, Calif.) TD-20/20 luminometer. The activity was expressed as relative light units (RLU) per ml cell lysate.

Results

Transfection of the pLTR1-tar-*luc* through pLTR6-tar-*luc* plasmids into HeLa-*tat*-III cells resulted in higher luciferase expression compared to the transfection of parent HeLa cells (**FIGURE 4**). The pLTR2-tar-*luc* plasmid containing the LTR2 promoter mediated the highest Tat-specific transcription, resulting in an average luciferase activity of 108,187 RLU/ml. This was a 102-fold enhancement in luciferase activity over that in control cells. The LTR1 and LTR3 promoters resulted in a 51-fold enhancement of luciferase activity in HeLa-*tat*-III cells compared to that in HeLa cells. It is of interest to note that luciferase activity induced by LTR2 was about 3.6 times higher than that induced by wild-type LTR 1 in HeLa-*tat*-III cells.

By contrast, the LTR4, LTR5 and LTR 6 constructs induced a 5-, 8-, and 8-fold increase in gene expression in HeLa-*tat*-III cells, respectively, compared to control cells. However, the levels of luciferase expression with these promoters were much lower than that obtained with LTR1–LTR3. For

example, whereas the LTR2 promoter resulted in an average luciferase activity of 108,187 RLU/ml, LTR4, LTR5, and LTR 6 induced an activity of 168, 32, and 674 RLU/ml, respectively.

Discussion

Of all the plasmids generated in this study, pLTR2-tar-*luc* was the most specific and effective Tat-responsive plasmid in our cellular system. The truncation of the LTR modulatory region (orange box in LTR1, **FIGURE 3**) in the LTR2 construct and the presence of the NF-κB enhancer region may be contributing factors to the Tat-specific enhancement. In LTR3, the NF-κB enhancer region was truncated, resulting in a lower level of luciferase expression compared to LTR2. The transcription factor SP1-binding sites were truncated in LTR4, and this resulted in much lower levels of Luciferase activity. In LTR5, the transcription factor AP1 binding site was mutated (red bar); this construct led to the lowest levels of gene expression in both HeLa-*tat*-III and HeLa cells, among all the plasmids tested. The TATA box and the TAR region were maintained in the much shorter LTR6 construct, but the AP1 binding site was eliminated. Despite these truncations, LTR 6 facilitated the highest level of gene expression among LTR4, LTR5, and LTR6.

The LTR2 can be used potentially to turn on a suicide gene (**FIGURE 2**), e.g., HSV thymidine kinase, in a Tat-specific manner in HIV-infected cells.[7,8] If this therapeutic gene can be inserted into every virus-infected cell, treatment with ganciclovir is likely to lead to apoptosis and cell death.

In future studies, LTR2 will be cloned into a lentiviral vector that can transduce both virus-producing cells and latently infected cells. Latently infected cells, primarily resting memory T-cells, do not produce virions and hence do not produce Tat. These cells can be activated by various agents to generate HIV-1, in the presence of a combination of antiretroviral agents to prevent new infections.[9] This will, in turn, lead to the production of Tat and the activation of the LTR2-HSV-tk construct, potentially resulting in cell death in an HIV-1-specific manner. ■■■■

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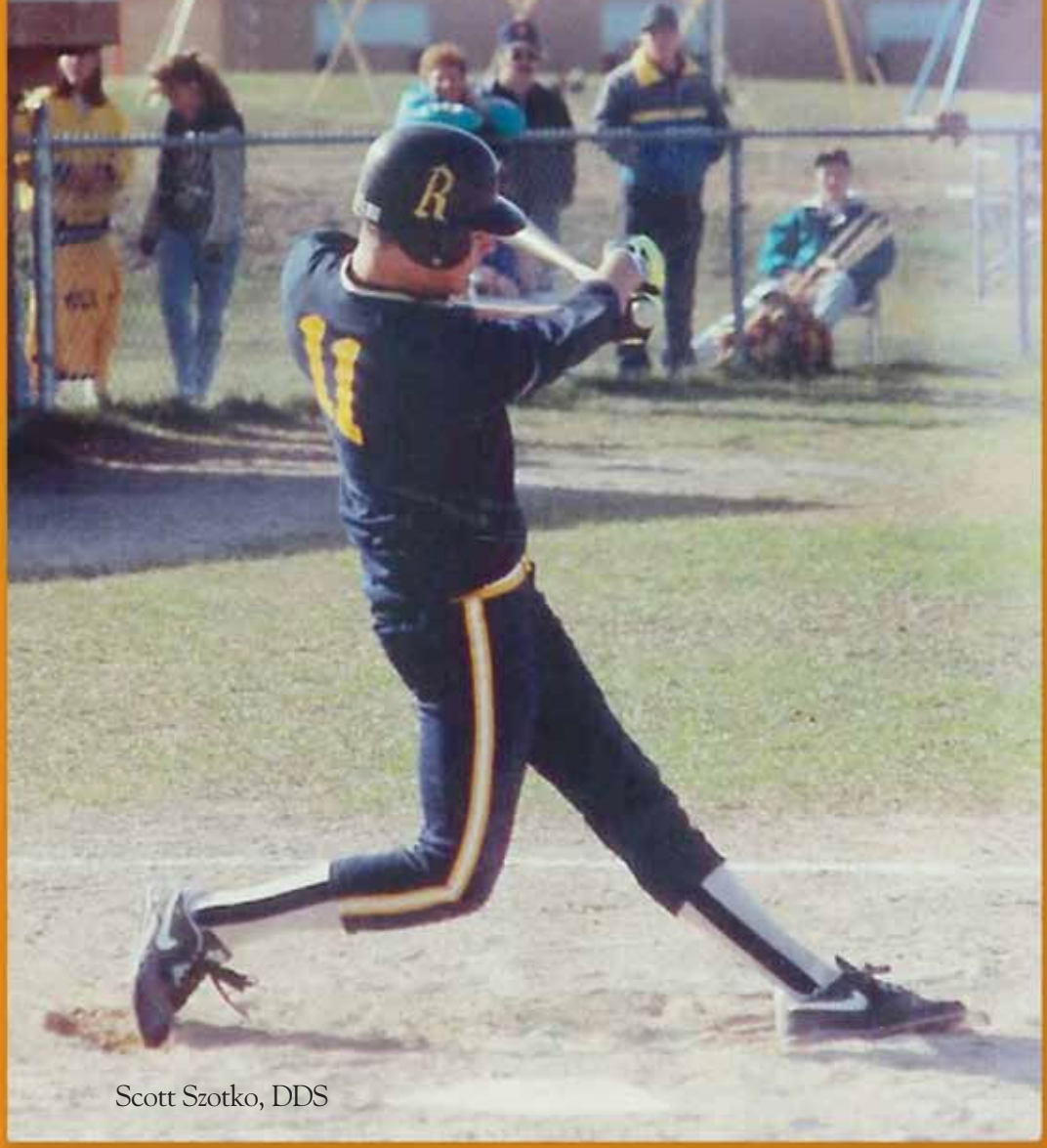

Scott Szotko, DDS

Hand-eye coordination in sports, helped him hit a home run in dentistry. Scott Szotko had two passions growing up, sports and science. And while originally he thought he'd go into medicine, he began to think about dentistry in high school when his own dentist piqued his interest in the profession. Everything coalesced in college when he realized that with dentistry, he could use the hand-eye coordination from sports and his love of science to help people. A home run in his book.

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Novel Strategies to Enhance Survival and Growth of Pulp Cells After Dental Restorations

DIPAK CHAUDHARI, BDS, MS; ERIC C. SUNG, DDS; AVINA PARANJPE, BDS, MS, PHD, MSD; AND ANAHID JEWETT, PHD, MPH

ABSTRACT Using ex vivo human tooth, the authors demonstrated that dental pulp stromal cells that survive after placement of composite, mineral trioxide aggregate, and glass ionomer are weaker since they undergo synergistic cell death when exposed to 2-hydroxyethylmethacrylate. DPSCs extracted from teeth that were restored with the combination of composite or MTA or GI with N-acetyl cysteine were protected from cell death. Therefore, application of NAC may protect the DPSCs from adverse effects after tooth restoration.

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Conflict of Interest Disclosure: None reported.

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Conflict of Interest Disclosure: None reported.

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Conflict of Interest Disclosure: None reported.

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Conflict of Interest Disclosure: None reported.

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Resin-based and resin-containing materials are now used widely in dental restorations and are found in direct filling materials (both composite resin and glass ionomer), in pit and fissure sealing agents, and in bonding resins or resin cements for metal, porcelain and resin inlays, veneers, crowns, and bridges. They are part of "bonded" amalgam restorations, "bonded" posts, and "bonded" orthodontic brackets.

Mineral trioxide aggregate (MTA) is another dental pulp material used in pulp capping, apexifications, and perforation repairs.[1-3] The action of MTA is postulated to be due to the upregulation of osteocalcin (OCN), alkaline phosphatase (ALP), and dentin sialoprotein (DSP) that induce differentiation of dental pulp stromal cells (DPSCs) into odotoblast-like cells and formation of the dentin bridge.[4]

Glass ionomer (GI) is extensively used as liners, cements, core build-up, and restorations. Unique properties of this cement-like binding to hard structure of teeth and fluoride release makes this material commonplace in restorative dentistry. Although there are different types of GI, basic mechanism of action is the same. GI forms chemical bond to dental hard tissue through acid-base reaction between polyacrylic acid and fluroaluminosilicate base. It also has an anticariogenic effect through fluoride release over an extended period of time.[2] In addition, the thermal coefficient for GI is the same as tooth structure. The disadvantages include longer setting time, brittleness, low and poor wear resistance, and sensitivity to moisture or dehydration during early stages of setting.

Attempts to overcome some of these disadvantages include the introduction of resin-modified glass ionomer (RMGI)

cement. RMGI is a modification of GI, which is primarily set by an acid-base reaction and polymerization of methacrylate by utilizing a photoinitiator. The addition of resin gives added mechanical properties, such as increased strength and stiffness along with ease of manipulation and setting. Unpolymerized HEMA, which is a component of RMGI, can cause pulp tissue toxicity through the production of ROS.[5,6]

While use of the above-mentioned materials is beneficial to the dental function and appearance of patients, they carry the risk of local and systemic adverse effects. The potential risks are direct damage to the cells and immune-mediated responses (allergy).[7-9] For either type of response to occur, biologically active components must be released from the material and then move to an area where responsive cells exist. The authors have previously shown that 2-hydroxyethylmethacrylateylate (HEMA) and TEGDMA are released in vitro from many resin-based tooth restorative materials used in dentistry in microgram to milligram amounts in the first days after placement of clinically used amounts of the source materials.[10-15]

Cytotoxicity studies related to resin-based materials have focused on the possible effects on the dental pulp. Clinical studies in humans and monkeys have shown that pulp cell damage and acute pulpal inflammation occur in the absence of bacterial microleakage with the application of resins to smear layer-free dentin.[16,17]

Dental pulp contains a diverse population of the cells including odontoblasts, fibroblasts, immune cells, nerve cells, and vascular cells.[18,19] Differentiation of the pulp stem cells into odontoblasts is essential as these cells are capable of laying secondary/reparative dentin, which, in turn, is able to protect the pulp from further damage induced by a number of mechanisms including those induced by resin materials.[3,20] The authors have shown previously that HEMA induces apoptosis in different cell types and also in DPSCs and in odontoblast-like cells.[21] HEMA-induced apoptosis has been linked to the decrease in intracellular glutathione (GSH) levels and the production of reactive oxygen species (ROS) in the cells.[22-25]

N-acetyl cysteine (NAC) is a membrane permeable aminothiol compound with diverse functions. NAC is shown to be the precursor of glutathiones with a significant antioxidant effect.[26,27] Although previously published reports on the function of NAC have largely concentrated on its antioxidant effect, other reports have underscored the significance of this compound in inhibition of proliferation and induction of differentiation.[28,29] The authors have reported previously that undifferentiated DPSCs have exquisite sensitivity to HEMA-induced cell death, and their differentiation with NAC provides the basis for their increased protection from HEMA-mediated functional loss and cell death.[30]

UNPOLYMERIZED HEMA, which is a component of RMGI, can cause pulp tissue toxicity through the production of ROS.[5]

Moreover, increased differentiation triggered by NAC in DPSCs is paralleled with an increased induction of NFκB activity since this transcription factor is responsible for survival of the cells. In this study, the authors demonstrated in an ex vivo human tooth model system, the evidence that the use of NAC prior to the application of different restorative materials protects pulp DPSCs from synergistic induction of cell death when treated with HEMA.[1,4]

Materials and Methods

Cells and Reagents

DMEM (Cellgro, Va.) supplemented with 10 percent FBS, 1 percent nonessential amino acids, 1 percent sodium pyruvate, 1 percent streptomycin and 1 percent L-glutamine (Invitrogen, Carlsbad, Calif.) were used for cultures of DPSCs. ß-glycerophosphate, ascorbic acid, NAC, HEMA, sodium hydroxide, HEPES and the ALP staining kit were all purchased from Sigma (St. Louis, Mo.). Fluorescein iothiocyanate conjugated annexin V/ propidium iodide kit was purchased from Coulter Immunotech (Miami).

Restoration of Human Teeth With Composite and NAC in an Ex Vivo System

Freshly extracted human third molars were obtained from a consenting donor and were immediately placed in media after extraction and delivered to the laboratory for restorations, which were completed within one hour of extraction. The teeth were prepared with class V preparations at the level of the CEJ. It was prepared with a No. 8 round bur (2.3 mm in diameter) in a high-speed dental handpiece (Brasseler, Savannah, Ga.). The preparation was approximately 1 mm deep (half the depth of the bur) not violating the pulp space, ~2.3 mm in depth (width of the bur), and ~4.6 mm in diameter (two times the width of the bur). The cavity was then restored in the following manner.

Restorations With Composite

For composite restorations four freshly extracted human molars were restored as follows: 1) control, cavity was prepared but no material was applied; 2) the cavity was

prepared and only NAC was applied; 3) the cavity was prepared and the tooth was restored with composite restoration alone; and 4) the cavity was prepared and NAC was applied before restoration with composite. Cavity preparation was etched with 37 percent phosphoric acid for 10 seconds, after which it was irrigated with tap water from the air-water syringe for five seconds. Excess fluid was gently removed with an air syringe, and the dental bonding agent was then applied per the manufacturer's directions (Clearfil SE Bond, Kuraray America, Inc., New York.). It was light-cured for 15 seconds with an LED-curing unit, Ultralume 5 (Ultradent, South Jordan, Utah). Composite restoration (Matrix shade A2, Discus Dental, Culver City, Calif.) was then applied to the normal contour of the dentition, cured with an LED light-curing unit for 40 seconds, and polished.

Restoration of the teeth in the presence of NAC was followed exactly the same way with the exception that NAC solution (20 mM) was applied with a microbrush for five seconds before application of the bonding agent. Excess NAC solution was removed gently with the air syringe and a dental bonding agent was applied as per manufacturer's directions. After six hours, the tooth was cracked and the pulp was extracted and grown for evaluation.

Restorations With MTA

Similarly for teeth restored with MTA, four freshly extracted human molars were restored as follows: 1) control, the cavity was prepared but no material was applied; 2) the cavity was prepared and only NAC was applied; 3) the cavity was prepared and the tooth was restored with MTA alone; and 4) the cavity was prepared and NAC was applied before restoration with MTA.

Gray MTA (ProRoot MTA; DENTSPLY Tulsa Dental, Okla.) was mixed according to the manufacturer's instruction and restored in cavities. Restoration of the teeth in the presence of NAC was followed exactly the same way with the exception that NAC solution (20 mM) was applied with a microbrush for five seconds before placement of the MTA material in the cavity preparation. Excess NAC solution was removed gently with the air syringe. Upon completion, the teeth were then placed in media for six hours. Removal of this excess NAC also helped us to avoid any change in the water-powder ratio of MTA.

NAC IS SHOWN
to be the precursor of glutathiones with a significant antioxidant effect.

Restorations With Glass Ionomer

For GI restorations, four freshly extracted human molars were also restored as follows: 1) control, the cavity was prepared but no material was applied; 2) the cavity was prepared and only NAC was applied; 3) the cavity was prepared and tooth was restored with GI restoration alone; and 4) the cavity was prepared and NAC was applied before restoration with GI. For GI restorations, GC cavity conditioner was applied for 10 seconds and the cavity was thoroughly irrigated with tap water from the air-water syringe for five seconds. Excess fluid was gently removed to avoid desiccation. A resin-modified glass ionomer was prepared according to manufacturer's instruction (Fuji II LC, America, Alsip, Ill.). All procedures were performed at room temperature. The restoration was then light-cured for 20 seconds with an LED-curing unit, Ultralume 5. Restoration of the teeth in the presence of NAC was followed exactly the same way with the exception that NAC solution (20 mM) was applied with a microbrush for five seconds before placement of the GI restorative material in the cavity. Excess NAC solution was removed gently with the air syringe. Upon completion, the teeth were then placed in media for six hours.

DPSC Cultures

After six hours of tooth restoration, each tooth was opened, the pulp was treated using 0.1 percent collagenase (Sigma Aldrich, Mo.) and 0.25 percent trypsin EDTA (1 mM) (Invitrogen, Calif.) at 37 degrees Celsius for 60 minutes to obtain single-cell suspension of the pulp cells. Cells were then washed twice and resuspended in complete medium (DMEM supplemented with 10 percent FBS, 1 percent antibiotic-antimycotic, 1 percent nonessential amino acids, 1 percent Na pyruvate). DPSCs were cultured with ascorbic acid (50µg/ml) and Na-ß-glycerophosphate (10 mM) (Sigma Aldrich) to induce differentiation as indicated in the result section. The cells were cultured at 37 degrees Celsius in 5 percent CO_2 and they were passaged and used in the experiments at 80 percent confluency.

Apoptosis Assay

To determine the levels of apoptosis propidium iodide (PI) staining was performed. After three weeks of growth, DPSCs from each set of restorations were either left untreated or treated with HEMA at 0.001 mM

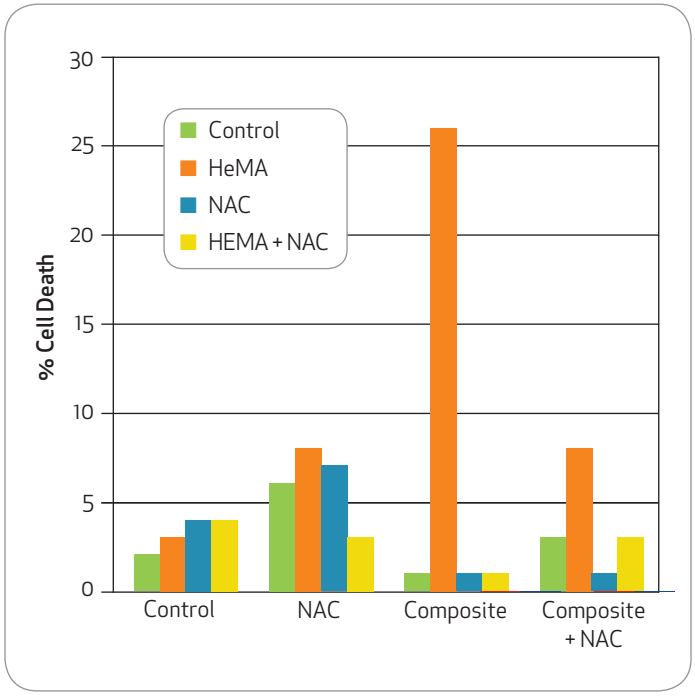

FIGURE 1. Four freshly extracted human molars from the same individuals were collected, cleaned, and randomly selected for each restoration as follows: 1) control, the cavity was prepared but no material was applied; 2) the cavity was prepared and only NAC was applied; 3) the cavity was prepared and the tooth was restored with composite restoration alone; and 4) the cavity was prepared and NAC was applied before restoration with composite. After six hours of incubation, each tooth was cracked, the pulp was extracted, and a single-cell suspension of DPSCs was prepared and grown as described in the "Materials and Methods" section. After three weeks of growth , DPSCs from each set of restorations were either left untreated or treated with NAC (20 mM) alone, or HEMA at 0.001 mM alone, or the combination of NAC (20 mM) and HEMA (0.001M) and the levels of cell death were determined by flow cytometric analysis of PI-stained DPSCs after an overnight incubation. One of five representative experiments is shown in this figure.

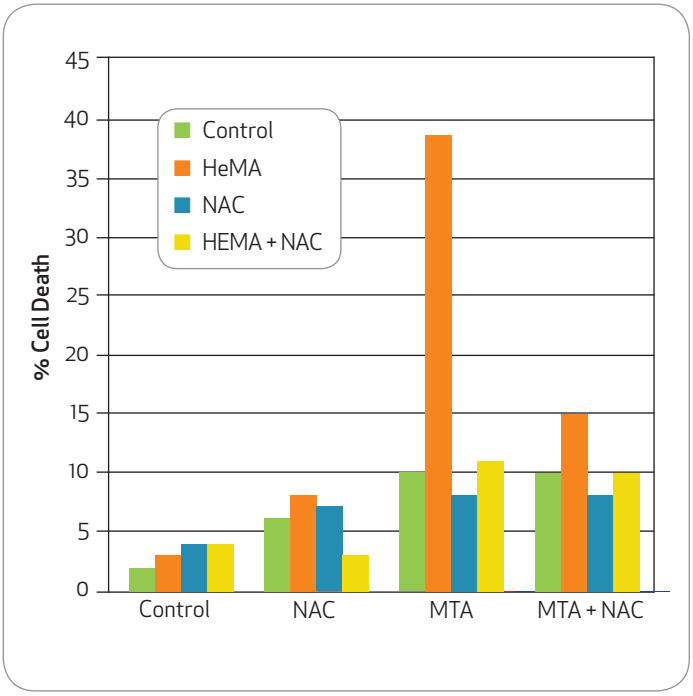

FIGURE 2. Four freshly extracted human molars from two individulas were collected, cleaned, and restored as follows: 1) control, the cavity was prepared but no material was applied; 2) the cavity was prepared and only NAC was applied; 3) cavity was prepared and the tooth was restored with MTA alone; and 4) the cavity was prepared and NAC was applied before restoration with MTA. The control teeth and those restored with NAC alone were obtained from the same donor whereas the other two teeth were obtained from a different donor and were randomized to either MTA or MTA+NAC restoration. After six hours of incubation, each tooth was cracked, the pulp was extracted, and single-cell suspension of DPSCs was prepared and grown as described in the "Materials and Methods" section. After three weeks of growth, DPSCs from each set of restorations were either left untreated or treated with NAC (20 mM) alone or HEMA at 0.001 mM alone or the combination of NAC (20 mM) and HEMA (0.001M), and the levels of cell death were determined by flow cytometric analysis of PI-stained DPSCs after an overnight incubation. One of two representative experiments is shown in this figure.

and/or NAC (20 mM), and the levels of cell death were determined after an overnight incubation using PI staining. Treated DPSCs were washed twice and resuspended in PBS. Propidium iodide at a final concentration of 10 µg/ml was added to each sample. After 10 minutes of incubation on ice, PI stained cells were analyzed by flow cytometry. Flow cytometric analysis was performed using EPICs-ELITE flow cytometer (Coulter). Dead cell fragments and debris were gated out by forward and side scatter gating.

Results

NAC Protects the Human Pulp Cells From Synergistic Induction of Cell Death When Treated With HEMA After Restorations With Composite, MTA, and GI

As shown in the **FIGURE 1**, cells that were restored with composite in the absence of NAC were significantly more sensitive to HEMA-mediated cell death as compared to either control pulpal cells or those that were restored only with NAC. In addition, when DPSCs from composite-restored teeth were treated with both HEMA and NAC, significantly lower levels of cell death could be observed when compared to DPSCs obtained from composite alone restored teeth treated with HEMA alone. DPSCs that were extracted from teeth restored with composite and NAC were resistant to HEMA-mediated effect and treatment with HEMA and NAC further decreased cell death when compared to HEMA-alone-treated cells (**FIGURE 1**).

Similar to composite restoration, DPSCs that were restored with MTA in the absence of NAC were significantly more sensitive to HEMA-mediated cell death

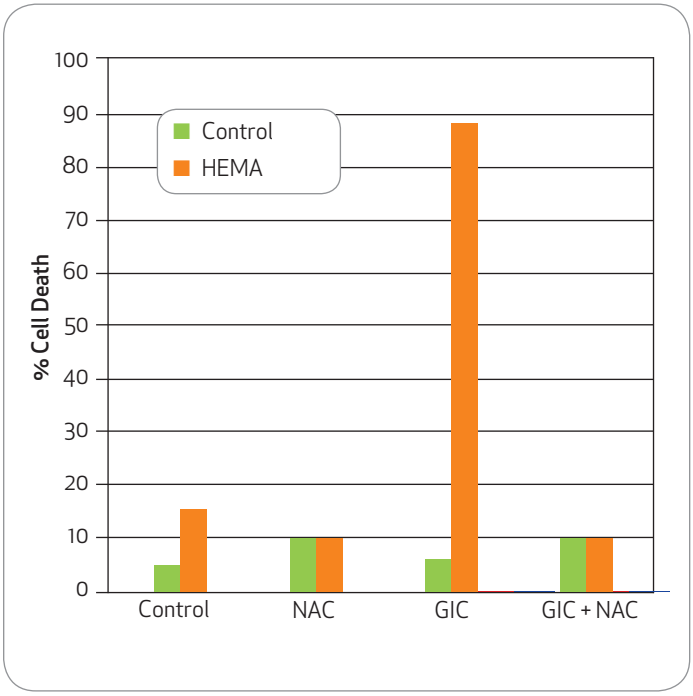

FIGURE 3. Four freshly extracted human molars from two individulas were collected, cleaned, and restored as follows: 1) control, the cavity was prepared but no material was applied; 2) the cavity was prepared and only NAC was applied; 3) the cavity was prepared and the tooth was restored with GIC restoration alone; and 4) the cavity was prepared and NAC was applied before restoration with GI. The control teeth and those restored with NAC alone were obtained from the same donor whereas the other two teeth were obtained from a different donor and were randomized to either GI or GI+NAC restoration. After six hours of incubation, each tooth was cracked, the pulp was extracted, and single-cell suspension of DPSCs was prepared and grown as described in the "Materials and Methods" section. After three weeks of growth, DPSCs from each set of restorations were either left untreated or treated with NAC (20 mM) alone, or HEMA at 0.001 mM alone, or the combination of NAC (20 mM) and HEMA (0.001M), and the levels of cell death were determined by flow cytometric analysis of PI-stained DPSCs after an overnight incubation. One of two representative experiments is shown in this figure.

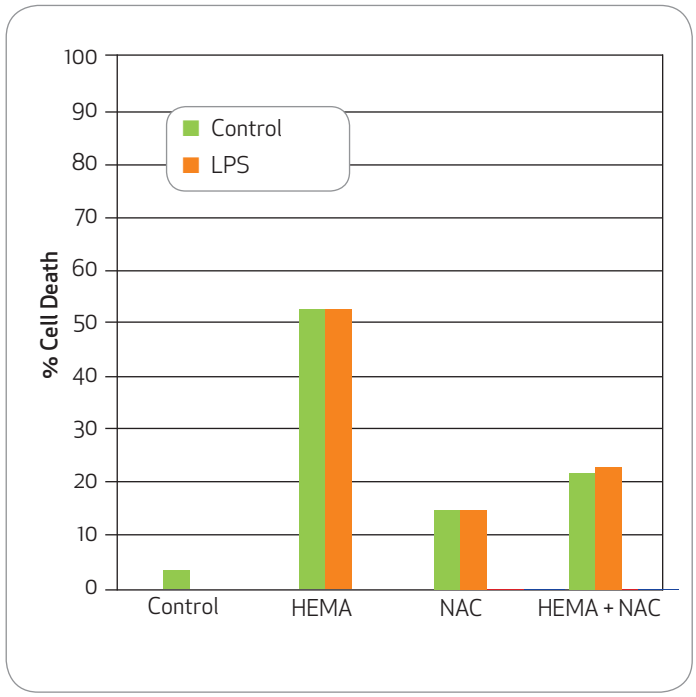

FIGURE 4. DPSCs grown from one tooth were either left untreated or treated with HEMA (0.001M) alone, or NAC (20 mM) alone, or the combination of HEMA (0.001M) and LPS (10 µg/ml) in the presence and absence of NAC (20 mM). After an overnight incubation, the levels of cell death in each sample were determined by flow cytometric analysis of PI-stained DPSCs. One of three representative experiments is shown in this figure.

as compared to either control pulp DPSCs or those that were only treated with NAC (**FIGURE 2**). In addition, when DPSCs from MTA-restored teeth were treated with both HEMA and NAC, significantly lower levels of cell death could be observed when compared to DPSCs obtained from MTA-alone-restored teeth treated with HEMA-alone (**FIGURE 2**). DPSCs that were extracted from teeth restored with MTA and NAC were resistant to HEMA-mediated effect and treatment with HEMA and NAC further decreased cell death when compared to HEMA-alone-treated cells (**FIGURE 2**).

As shown in the **FIGURE 3**, DPSCs that were restored with GI were significantly more sensitive to HEMA-mediated cell death as compared to either control pulp DPSCs or those that were restored only with NAC. DPSCs that were extracted from teeth restored with GI and NAC were resistant to the HEMA-mediated effect. Therefore, NAC can exert its protective effect at not only at the initial insult by composite, MTA or GI, but also can prevent further damage induced by repeated insults long after the initial toxicity.

NAC Blocks HEMA-Mediated Cell Death in the Presence and Absence of LPS Treatment

Bacterial contamination of dental restorations may cause eventual failure of restorations. To demonstrate the protective effect of NAC will not be modified in the presence of bacterial LPS, the authors treated DPSCs with and without HEMA in the presence and absence of NAC, and cell death was determined after an overnight incubation. As shown in **FIGURE 4**, the treatment of DPSCs with LPS did not modify either HEMA-mediated cell death or the inhibi-

tion of HEMA-mediated cell death by NAC. Therefore, it is likely that NAC can still inhibit DPSC cell death after restorations even in the presence of bacterial contamination.

Discussion

Tooth sensitivity, pain, and immune hypersensitivity reactions to dental materials in patients are adverse events that may increase in the future since the use of such materials have become increasingly common in dental practice. In order to find novel strategies to minimize or significantly prevent future risks of adverse effects of dental materials, studies should be designed to find compounds that decrease or eliminate material toxicities while preserving their beneficial effects. This study presented one such agent that could not only decrease death induced by cytotoxic dental materials but also it could preserve DPSCs function and proliferation as shown in previous studies.[21,31-34]

The authors have previously shown that NAC inhibits cell death in part by augmenting the levels of NFκB and increasing differentiation of the cells.[21,31-34] In addition, previous reports have also attributed an antioxidant effect to NAC.[26,27]

The authors have reported previously that the addition of NAC significantly increased NFκB expression in epithelial cells, and restored NFκB activity in HEMA-treated cells, with concomitant rescue of cell viability and function.[21,31,34] Therefore, NAC may provide the protective mechanisms by increasing the anti-apoptotic proteins regulated by NFκB. The authors have also demonstrated that the protective effect of NAC is due to its ability to modulate important differentiation and activation genes in DPSCs.[31] NAC is capable of inducing a stepwise increase in osteopontin, osteocalcin, and dentin sialoprotein depending on the stage of differentiation of the cells, and correlated with significant inhibition of cell death at all stages of differentiation in DPSCs.[31]

Inhibition of cell death by NAC may also indicate the significance of oxidative stress in HEMA-mediated apoptotic cell death since NAC has been shown to have antioxidant effect. NAC is shown to act directly as a reducing agent and indirectly by stimulating the synthesis of other antioxidants such as glutathiones.[35] At the intracellular level, NAC is shown to be the precursor of GSH synthesis since it can easily penetrate the cells where it will be deacetylated to form L-cysteine thus supporting the biosynthesis of GSH.[26,27] Therefore, it is suggested that NAC may function through an antioxidant mechanism to counteract HEMA-mediated effects.[36,37]

NAC MAY PROVIDE the protective mechanisms by increasing the anti-apoptotic proteins regulated by NFκB.

The authors have shown in this paper that DPSCs that survived and grew out after the placing of the restorative materials were significantly more sensitive to an exposure to HEMA. This data indicated that DPSCs were considerably weakened after exposure to chemicals released from the dental restorative materials used, and, any additional stress may predispose them to further damage and inhibit their survival and function. Therefore, it is possible DPSCs that have been exposed to chemicals released from restorative materials may be less able to survive exposures to other oral environmental factors and toxins, or be more susceptible to adverse inflammatory immune effectors or factors leading to DPSCs decreased function and survival.

This may eventually influence adversely the process of tissue repair and regeneration, and disturb potential clearance of oral bacteria that might have gained access to or remained in the dental pulp complex after restoration, leading to bacterial growth and expansion and subsequent, additional pulp damage or pulp death. Blocking cell death by NAC may provide protection not only for DPSCs, but, it should, in theory, also decrease the levels of inflammation, allowing for optimal tissue repair and pulp regeneration since NAC is also known to decrease inflammation. This may not only decrease tooth sensitivity and pain, but it may also prevent eventual immune sensitization and hypersensitivity seen in certain susceptible patients.

Although repeated application of NAC is more protective as shown by the authors' data, only one application of NAC also provided significant inhibition of synergistic cell death by HEMA in DPSCs from composite-, MTA- and GI-restored teeth. Interestingly, MTA is found to be more biocompatible than composite in the initial restoration since it caused less cell death in DPSCs (data not shown). However, after tooth restoration and extraction and expansion of DPSCs, MTA-exposed DPSCs were as susceptible as composite exposed DPSCs to HEMA-mediated synergistic cell death and NAC blocked significantly the synergistic death induced by HEMA in MTA-restored teeth. Therefore, even one application of NAC can be very effective in reducing adverse effects of dental materials and provide long-lasting protection for DPSCs from other environmental adverse effects.

Although the blood flow rate maybe crucial for eventual clearance of toxic and inflammatory materials from pulp, the initial exposure of the cells to the restorative materials in the presence of decreased blood flow rate and clearance induced by

anesthetics and vasoconstrictors may be sufficient to initiate significant cell death and loss of cellular function. Thus, the models presented in this paper may be relevant to initial or acute phases of pulp exposure during and immediately after tooth restoration in the presence of decreased blood flow rate and clearance. However, it is important to emphasize that further studies, in particular those using live pulp models in animals and humans, will be required, and which is ongoing in the authors' laboratory, to determine how chemical clearance through the vasculature may influence local concentration dynamics and effect on pulp cells.

NAC prevented HEMA-mediated cell death equally well in the presence and absence of the treatment with bacterial LPS. Interestingly, treatment of DPSCs with LPS did not change either the levels of cell death in control untreated DPSCs or those treated with HEMA or NAC. These results suggested that NAC is likely to prevent death induced by dental materials in the presence and absence of bacterial contaminations.

Overall, the results of the present study indicated that DPSCs grown from teeth restored with composite resins, MTA and GI were considerably weaker and were induced to undergo synergistic cell death when exposed to HEMA. Inclusion of NAC in the process of restoration, however, decreased cell death not only in the initial phases of restoration as shown previously, but it also prevented synergistic cell death when DPSCs grown from the restored teeth were treated with the additional insults such as HEMA.[38] Therefore, the use of NAC prior to or along with the restorative materials may be beneficial for the health and safety of the dental patients.[39] In addition, NAC may also prevent the generation of well-established hypersensitivity and immune sensitization resulting in the prevention of systemic effects induced by dental materials. ■■■■

Timothy G. Giroux DDS/Broker

ASK THE BROKER

Question:

I recently bought a practice where the selling doctor cut the "co-payment" for many of the patients. What are my issues as the buyer in this situation?

Every dentist that accepts insurance with a fee schedule has, at some point, waived a portion of their fee for a friend, family member or a patient who came into some financial hardship after the procedure has been completed. Chances are that they did not inform the insurance company that they extended that discount. Cutting co-pay technically puts the doctor in violation of the contract they signed with the insurance provider if they do not extend the discount along to the insurance company.

During the due diligence process, the buyer should be able to ascertain whether the practice "waives co-pay" on a large scale by simply looking at the basic financials. Since the UCR fee will usually be entered into the computer for the production, the production/collection percentage will be drastically lower compared to practices that don't waive co-pay. The normal lab and dental supply categories would appear higher if the practice waives co-pay. ***In any event, the financials provided to the buyer reflect the valid operating expenses of the practice.***

The only problem moving forward is that those patients who are not accustomed to paying their co-pay may become upset if they are now asked to pay when the new doctor takes over. My sage advice is that the buying doctor should not change normal operating procedures in the practice as it may adversely affect the goodwill or revenue streams for the practice. Eventually the practice will adapt to the management philosophies of the new buyer.

There are certain neighborhoods where the patient base in that area expects the dentists to simply "accept what the insurance pays". One should always consult their attorney on the contractual ramifications of "cutting co-pay", and then decide how best to deal with the issue in their particular circumstance. There are some practices that do NOT enter into the PPO contracts, but then advertise that they will accept what the insurance pays. This is perfectly legal, but normally the insurance company then pays the patient directly and not the dentist. Normally, waiving co-pay on a large scale occurs with lower income patients that may not otherwise be able to afford dental care.

In my humble opinion, we should work together to renegotiate the language in these contracts that places the dentist in violation. The insurance companies already maintain their cost containment by reducing their fee schedule, usually paying less than 80% of the standard UCR in the area. (For this reason, I eventually dropped all PPO's from my practice.) Dentists should be free to accept and negotiate whatever financial arrangement they can with the patient.

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

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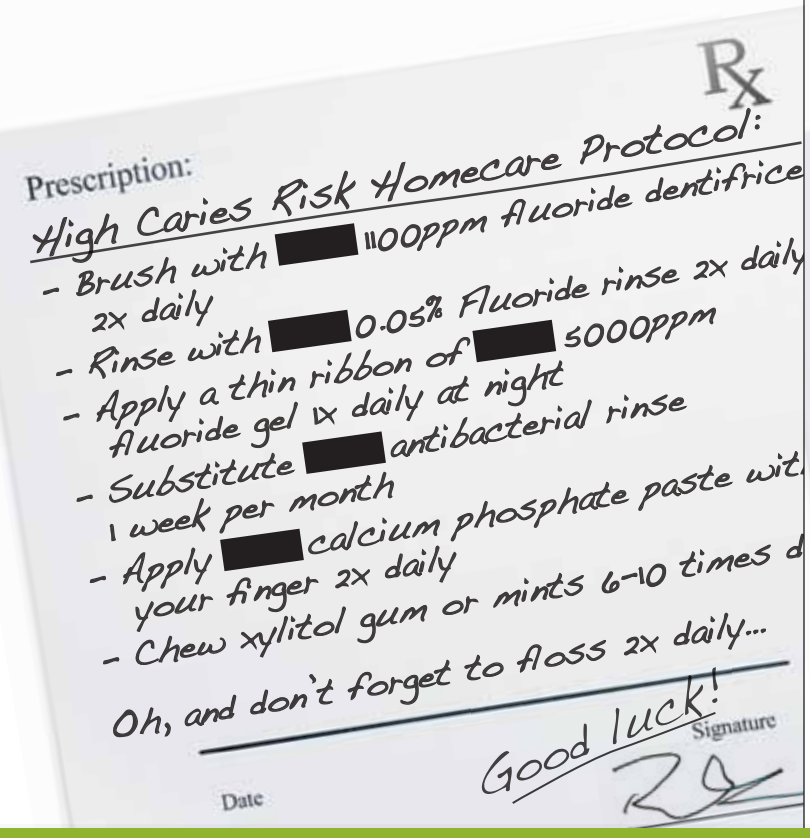

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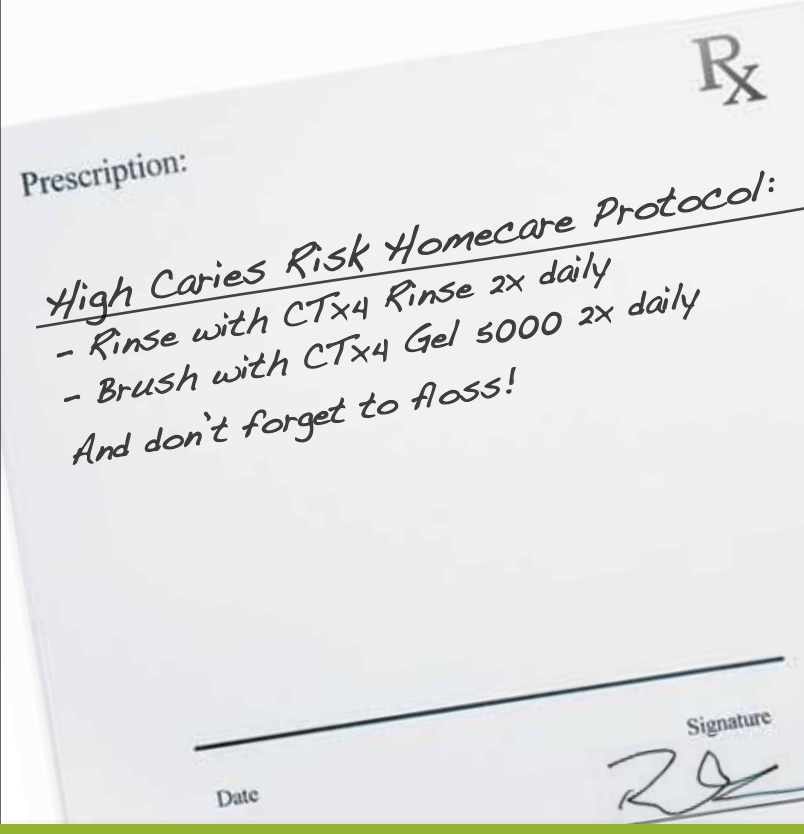

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Sterilization Analysis of Contaminated Healing Abutments and Impression Copings

VANESSA BROWNE; MICHAEL FLEWELLING; MARK WIERENGA; ALISA WILSON, RDA; RAY APRECIO, OD; PAUL RICHARDSON, DDS, MSD; NIKOLA ANGELOV, DDS, MS, PHD; AND NEAL JOHNSON, DDS, PHD

ABSTRACT This study investigated sterilization of used implant impression copings and healing abutments. Components were analyzed after contamination with *Enterococcus faecalis*, followed by multiple rounds of sterilization by both steam autoclave and Chemiclave protocols. The authors' results demonstrated that used components showed sterility equal to new components without any visible distortion. These data suggest that component resterilization and reuse may be justified or at least considered in clinical practice. Also, implications for cost savings in the placement of implants are advanced.

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Infection control is a very important issue in dentistry. The recent rise in information on transmission of the Hepatitis B virus (HBV) and the human immunodeficiency virus (HIV) have led to even tighter precautions to prevent cross-contamination in the dental practice. The Centers for Disease Control (CDC), in 1987, coined the phrase "universal precaution," to denote the procedures that must be taken in health care settings to protect both the health professionals and patients from transmitting disease.[1] Later, in 1996, the CDC expanded this definition to "standard precautions," which now applies to any instrument in contact with blood; all body fluids, secretions, and excretions (except sweat), regardless of whether they contain blood; nonintact skin; and mucous membranes.[2] These precautions include personal protective equipment, barriers, disinfectants, and sterilization of reusable instruments.

FIGURE 1. Standard impression coping.

FIGURE 2. Standard healing abutment.

FIGURE 3. Plated samples plated and incubated to determine growth.

Sterilization is the process by which spores are eliminated to rid instruments of microbes. It has been concluded that if spores are eliminated, one can be certain that the instruments are void of microbial life and are safe to use on a new patient. Within the health care setting, an autoclave, which utilizes steam sterilization, is the most dependable form of sterilization. Critical instruments are subject to steam at 121 degrees Celsius for 20 minutes under 15 psi pressure.[3] Mechanical, chemical, and biological indicators are used in this process to ensure proper sterilization is achieved. In addition, chemical vapor sterilization, or Chemiclave, is another form of sterilization that uses a combination of formaldehyde, alcohols, acetone, ketones, and steam at 138 kPa to sterilize instruments.[4] As with many other dental procedures, an aseptic environment is necessary when placing implants. As such, implant manufacturers recommend the use of new implant healing abutments and impression copings for each patient.

Healing abutments are collars placed on an implant after the bone has healed and an incision in the gingival tissue has been made to expose the implant. The healing abutment is placed on the implant for an extended period of time to allow the gingival tissue to heal in the configuration necessary for a crown to be placed. After the healing period, the healing abutment is removed and an impression coping is attached to the implant for the purpose of taking an impression to fabricate the crown. The impression coping is retained in the oral cavity for several minutes.

Implant manufacturers recommend the use of new (sterile) or single-use implant healing abutments and impression copings for each patient. However, this recommendation has recently been challenged, albeit privately, by dental practitioners involved in the routine placement of implants. Venkatasubramanian et al. compared the effectiveness of sterilization of endodontic files and demonstrated that the autoclave was effective at sterilizing used files.[5] This study and the anecdotal evidence of other dental practitioners who currently sterilize these components and burs further adds to the skepticism that new implant components need to be purchased for every implant case.

The ability to reuse impression copings and healing abutments could save a substantial amount of money, which can vary depending on the manufacturer's price, as well as the number of times components will be used or reused per implant placed. This could lead to significant cost savings for both the clinician and patient. In an evidence-based profession where the practice of sterilizing and reusing these implant components is becoming common in clinical practice, research to verify the safety and validity of this practice is necessary. In this study, the authors examined the ability to safely and effectively sterilize implant healing abutments and impression copings using Loma Linda University School of Dentistry (LLUSD) steam and Chemiclave sterilization protocols.

To the authors' knowledge, this is the first publication examining the feasibility of sterilizing implant healing abutments and impression copings.

Materials and Methods

Eight groups of 10 components each were prepared for sterilization analysis. Groups were divided into the following categories: new and used components, (healing abutments and impression copings (**FIGURES 1 AND 2**)), and the utilization of either steam or chemical sterilization protocols. All components were separated using sterile techniques, placed in 2 ml of sterile nutrient broth (Gibco, Invitrogen, Carlsbad, Calif.) in glass vials and incubated for 24 hours at 37 degrees Celsius. Positive controls did not undergo sterilization. Vials were evaluated for turbidity. Broth from each of the turbid vials was spread onto nutrient agar plates (Gibco, Invitrogen) and incubated for 24 hours at 37 degrees Celsius (**FIGURE 3**). Contaminated components from the turbid vials were autoclaved with their either respective sterilization protocols, steam (121 degrees Celsius, 15 psi for 15 minutes) or chemical sterilization (132 degrees Celsius, 20 psi, 20 minutes). All components were incubated in broth inoculated with a vital clinical strain of *E. faecalis* for 24 hours at 37 degrees Celsius. Components were removed from the contaminated broth with sterile forceps and submitted to their respective sterilization protocols. Components were then returned from sterilization, placed in 2 ml of sterile broth with sterile forceps and incubated at 37 degrees Celsius. Samples were analyzed at 24, 48, and 72 hours (**FIGURE 4**). Turbidity was evaluated and recorded. In addition, a gram stain was used to confirm the identity of the *E. faecalis* strain.

FIGURE 4. Impression copings incubated in broth culture to evaluate bacterial growth.

FIGURE 5. Positive and negative controls (impression copings) after incubation at 37 degrees Celsius.

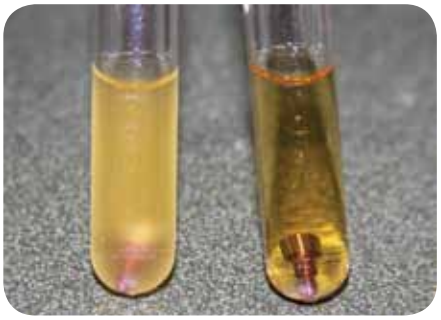

FIGURE 6. Positive and negative controls (healing abutments) after incubation at 37 degrees Celsius.

Results

Each of the components in all eight of the authors' research groups showed no turbidity after undergoing their respective steam or Chemiclave sterilization protocol (**FIGURE 4**). In all groups, the positive controls remained turbid, verifying that the *E. faecalis* utilized in the study was viable (**FIGURES 5 AND 6**). A gram stain added further support to the identity of the bacteria (data not shown). In each of the eight groups, the negative control vials lacked turbidity, which verified there were no contaminants introduced during the sterilization process (**FIGURES 5 AND 6**).

Conclusion

Manufacturers sell implant components as sterile to clinicians but recommend against re-sterilization. These components in question are not made of deformable materials that would preclude sterilization. As a consequence, some practitioners have sterilized these components for years to cut cost to them and their patients. Sterilization of what are termed single-use items has been evaluated previously. Dunn has discussed the ethical issues associated with sterilizing single-use items as well as specific procedures for sterilization of the same.[6] Moreover, in dentistry, there are no published studies that suggest that sterilization of implant copings or healing abutments is detrimental to the integrity of the implant placement or success. In this study, the authors demonstrated that utilizing a standardized sterilization protocol for either steam or Chemiclave could return used implant components to a level of absolute sterility, as tested.

The authors subjected new and used implant healing abutments and impression copings to contamination by a known microorganism with subsequent sterilization. *E. faecalis*' role as an oral pathogen is well-documented.[7] It is considered to be the "gold standard" bacterium when testing for elimination of pathogens due to its high virulence and resistance to antimicrobials. *E. faecalis* is commonly used when testing for effectiveness of methods for implant disinfection. In a recent article, *E. faecalis* was used to test the efficacy of lasers in implant disinfection.[8] In addition, some studies have identified *E. faecalis* as one of the etiological agents identified in peri-implant disease.[9,10] At the conclusion of the study, there was no visual damage to new or used implant components. While one cannot rule out the effect repeated sterilization could have on the metallurgic integrity of impression copings and healing abutments, from a microbial basis, it may be considered possible to sterilize and reuse these components. Further, it is important to note that functional integrity as dictated by surface wear after repeated rounds of sterilization, was not evaluated in this study nor was the use of a multiorganism biofilm and saliva components. However, experiments to evaluate the impact of these factors are currently under investigation. Knowledge of the functional lifespan of each of these implant components simulated in an oral environment, could provide significant information in order to definitively assert that reuse of impression coping and healing abutments after sterilization is a safe practice. These data can translate to savings to both clinician and patient in future implant treatments. ■■■■

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Parental Functional Health Literacy Relates to Skip Pattern Questionnaire Error and to Child Oral Health

GAIL M. GARRETT, DDS; ALICIA M. CITI, BS; AND STUART A. GANSKY, DRPH

ABSTRACT The study's purpose was to determine if parental dental functional health literacy related to child oral health. A secondary aim was to assess if errors in completing the questionnaire related to FHL and child oral health. Parents of pediatric clinic children (N=101) completed questionnaires and dental caries indices were recorded. Higher FHL was negatively correlated with worse child caries (r=-0.23), but not subjective oral health. Mean FHL seemed to differ by skip pattern (p=0.087), indicating it may be a potential FHL proxy.

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According to the 2003 National Assessment of Adult Literacy, 53 percent of adults have intermediate health literacy while 22 percent have basic, and 14 percent have below basic health literacy levels. Thus, 36 percent of the U.S. adult population possesses only enough skills to perform the most simple, concrete everyday literacy activities (e.g., searching text and decoding and recognizing basic words).[1] As reported by the surgeon general's first report on oral health in 2000, families who lack basic health literacy skills have an increased prevalence of dental caries, most of which is untreated.[2] Oral health research in health literacy has increased in recent years, often following the lead of medicine.[3] In dentistry, verbal directions regarding maintenance of oral health and

written educational brochures are often provided. Low functional health literacy (FHL) levels mean that patients are less likely to understand verbal directions or not even read the brochures, resulting in lower oral health knowledge and health status.[4] In addition, those groups with less education or lower incomes lack the literacy skills to seek out information about preventive health services or treatment options.[5] Decreased FHL has been shown to be associated with a wide variety of poor health outcomes, including disproportionately high rates of disease and mortality.[1] In a recent preliminary report, FHL has been shown to relate to self-rated oral health (e.g., five-point ordinal scale from poor to excellent) and dental utilization (i.e., annual dental visit).[2]

The National Institute of Dental and Craniofacial Research Working Group on Functional Health Literacy defined dental FHL as "the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions."[6] However, many dental instructions and brochures are presented at a reading level beyond the 12th grade, containing dental terminology that is unfamiliar and difficult for patients to understand.[5,7] The short form Test of Functional Health Literacy in Adults (S-TOFHLA) significantly related to children's caries index.[2] The 30-item REALD-30 is a validated and reliable instrument that is significantly related to perceived dental health status and to oral health-related quality of life, an abbreviated version of the REALD-99.[6,8]

Using the 1993-4 California Oral Health Needs Assessment of Children (COHNAC), Gansky and Wilson determined that children of parents who did not correctly follow the self-administered questionnaire skip patterns (i.e., instructions for completing later questionnaire items conditional on the responses to earlier items) had significantly worse oral health.[5] Errors in the self-administered parent questionnaire of the 2004-5 COHNAC (California Smile Survey), which differed from the one in 1993-4, also were associated with worse oral health status. For example, incorrectly following the skip pattern (more specific details are given in the "Methods" section below) was associated with lack of dental sealants.[9] These questionnaire inconsistencies (errors) might empirically identify parents with low FHL who may have other problems such as completing insurance forms or understanding health care provider instructions for themselves or their children. However, since a validated reliable measure of FHL was not part of the COHNACs, questionnaire inconsistencies have not been proven to be a FHL proxy; a proxy must relate to both the standard predictor (here a measure of FHL) as well as an accepted measure of oral health.[10]

THOSE GROUPS WITH less education or lower incomes lack the literacy skills to seek out information about preventive health services or treatment options.

Hypotheses

1) Decreased parental FHL would relate to decreased child's oral health status (decreased Michigan Oral Health-Related Quality of Life (MOHRQOL) and increased caries index); 2) parents with skip pattern inconsistency (error) would have decreased REALD-30 FHL score; 3) mean scores would differ between the modified color-coded MOHRQOL instrument with a sample item and the original reliable, validated version instrument; and 4) parental FHL would moderate the difference in scores between versions of MOHRQOL.

Methods

Methods/Design

At the suggestion of the director of the pediatric dentistry clinic, the lead investigator (Garrett) provided an information session to faculty, staff, residents, and students of the pediatric clinic. This facilitated participant recruitment and enrollment. The pediatric dentistry clinic sees approximately 40 patients per day. This planned study sample size of 100 over a period of 2.5 months was logistically feasible.

Parents of patients in the UCSF Pediatric Dental clinic were told about the study and invited to participate. Inclusion criteria consisted of the ability to read and write English, and the ability to give consent for one's self and child. Exclusion criteria included having participated already with another child, having hearing, visual, or cognitive impairment, and parents/guardians younger than the age of 18. Thus, this was a convenience sample of consenting parents and their children in the UCSF Pediatric Dental clinic August-September, 2007.

After the study was explained and participants consented, parents completed a 20-item questionnaire including their perception of their child's oral health status, the MOHRQOL scale in regard to their child's health, and the California Smile Survey. Parents then were asked to read the REALD-30 to the investigator.[7]

Each parent received a small incentive ($5 coffee retailer gift card) for participa-

tion. Clinical data were abstracted by 10 attending pediatric dentistry residents onto a study dental chart form that had the participants' study identification number as the only unique identifier. This allowed determining the number of decayed, missing, and filled primary and permanent teeth (dmft+DMFT) and tooth surfaces (dmfs+DMFS) indices.

Instruments

MOHRQOL scale: This is a 10-item validated reliable measure of parent report of child's oral health.[7] Half of the parent participants were randomly selected to receive the standard black and white MOHRQOL, while the other half were randomly selected to receive a revised MOHRQOL in a red and green shaded color format with an example question at the top of the page. The random ordering was determined using randomizer.org and questionnaire packets were compiled in advance with three-digit study ID numbers on the outside of packets. The one MOHRQOL item phrased in the negative was reverse scored and all 10 items were summed to determine the score, ranging from 10 to 50 with larger scores indicating worse QOL. Measuring MOHRQOL allowed comparing the inter-relationships among FHL, MOHRQOL and clinically determined dmft+DMFT and dmfs+DMFS.

Parent-reported child oral health status: The valid and reliable single ordinal-scaled item of parent-reported child oral health status ("How would you describe the condition of your child's teeth?" with responses of excellent, very good, good, fair, or poor) was assessed.

California Smile Survey: The six-item survey items about child dental care, containing a skip pattern associated with poor dental care postulated as a low FHL indicator, was administered.

Skip Pattern Inconsistency (Error): In the one-page, six-question, self-administered written California Smile Survey given to parents/guardians, question 3 was "During the past year, was there a time when you wanted dental care for your child but could not get it?" with response options "Yes (go to question 4)," "No (go to question 5)," and "Don't know (go to question 5)." Respondents who answered "No" or "Don't know" for question 3, but answered question 4 instead of skipping to question 5 were classified as having "answered anyway," while those who answered "Yes" to question 3, did not answer question 4 but did answer question 5 were classified as having "omitted" the next question to be answered. Both situations were classified as a skip pattern inconsistency (error).

INCLUSION CRITERIA consisted of the ability to read and write English, and the ability to give consent for one's self and child.

READ-30: This contains 30 commonly used dental words arranged in order of increasing difficulty and tests the patient's ability to correctly pronounce each word.[4] It is short and easy to administer, taking less than five minutes. The interviewer (Garrett) consulted the *American Heritage Stedman's Medical Dictionary* to establish the correct pronunciation of each dental term in the READ-30. The READ-30 is scored on a scale of 0-30, tabulating the number of correctly pronounced terms.

Confidentiality and data security were preserved in accordance with UCSF Investigational Review Board, the Committee for Human Research, procedures.

Sample Size

The investigators planned the study to have a sample size of 100, which was calculated using an alpha=0.05, two-sided Fisher's z test of the null hypothesis that the Pearson correlation coefficient is rho=0.09 and 90 percent power to detect an observed rho of 0.40. If the sample size dropped to 75, the power was estimated at 80 percent. Adequate power was estimated for other relevant projected values of rho.

Data Analysis

Summary statistics (mean, median, standard deviation, standard error) were compiled for READ-30, MOHRQOL, dmft+DMFT and dmfs+DMFS index. Counts and frequencies were tabulated for dichotomous skip pattern inconsistency and for ordinal categories of parent report of child health. Pearson correlation coefficients (r) with 95 percent Fisher confidence intervals were estimated to assess the relationships of READ-30 with MOHRQOL and caries indices (dmft+DMFT and dmfs+DMFS). Spearman nonparametric correlation coefficients (r_s) with 95 percent Fisher confidence intervals were estimated to assess the relationships among skip pattern inconsistency, READ-30 and parent-rated ordinal child oral health, as well as skip pattern inconsistency with MOHRQOL and caries indices (dmft+DMFT and dmfs+DMFS).

Since variables might not have been normally distributed, appropriate normalizing transformations were utilized (natural logarithm of one plus the dmf+DMF index and the Box-Cox

TABLE 1

Relationship of Parental Functional Health Literary With Child Oral Health Measures; N=99, August-September 2007, UCSF Pediatric Dentistry Clinic; Pearson Product Correlation, [Fisher 95% Confidence Interval], P-value

	Children's Tooth Surfaces log (dmfs+DMFS+1)	Children's Teeth log (dmft+DMFT+1)	Parent-Reported Children's QOL log (MOHRQOL)	Parent-Reported Children's Oral Health (Ordinal Ranking)
Parental functional health literacy (REALD-30)[2]	-0.23 [-0.41, -0.04] P=0.020	-0.24 [-0.41, -0.04] P=0.018	-0.04 [-0.23, 0.16] P=0.727	-0.11 [-0.30,-0.09] P=0.278

READ-30 = Rapid examination of adult literacy in dentistry
dmfs+DMFS = number of primary and adult decayed, missing, or filled tooth surfaces
dmft+DMFT = number of primary and adult decayed, missing, or filled teeth
MOHRQOL = Michigan Oral Health-related Quality of Life scale
Ordinal ranking = Excellent, very good, good, fair, poor

transformation for REALD-30). To assess the validity of the skip pattern inconsistency as a proxy for FHL, a two sample (unpaired) t-test was used to compare the validated, reliable REALD-30 score between those parents with a questionnaire skip pattern inconsistency (error) and those with a consistent questionnaire.

Results

The study consisted of 101 children, mostly white, black or multiracial including one of those races (76 percent); 17 percent were Hispanic. The children were a mean age of 6.6 years (standard deviation of 3.5 and median of 5.5) with slightly more males (53 percent) than females (47 percent). Of these children, 75 percent were on MediCal (California's Medicaid) or Healthy Families alone or with another program; 62 percent were in the free or reduced-cost lunch program, and 84 percent reportedly visited the dentist in the prior year, but 10 percent had never been to a dentist.

The overall REALD-30 score of the 100 parents who were tested had a mean of 21.8 with a standard deviation (SD) of 5.0 and a range of 3 to 30. Eighteen (18 percent) of the 100 parents improperly (inconsistently) followed the questionnaire skip pattern. The overall mean MOHRQOL score was 19.7 with a SD of 7.7. For the caries indices, pediatric dentist residents did not transfer clinical chart data for two children, so the sample size with exam data was 99. The overall mean dmft+DMFT index was 6.3 with a SD of 4.6 and a range of 0 to 18. The overall mean dmfs+DMFS index was 14.3 with a SD of 14.2 and a range of 0 to 68.

Results testing hypothesis 1 that decreased parental FHL would relate to decreased child's oral health status (decreased Michigan Oral Health-Related Quality of Life (MOHRQOL) and increased caries index) are shown in **TABLES 1 AND 2**. Results indicated that the better the parent's dental health literacy, the lower the child's clinically determined (objective) dental disease. **TABLE 1** shows that parental dental functional health literacy (REALD-30) significantly but modestly related inversely to dental examination determined caries experience, but did not relate to subjective oral health measures. **TABLE 2** shows there were no differences in children's oral health status between parents who correctly followed the skip pattern and those who did not. Additionally, both groups of parents reported the median (and mode) ordinal oral health level of "good" for their children (1 df chi-square test, P=0.874).

Results from hypothesis 2, that parents with skip pattern inconsistency (error) would have decreased REALD-30 FHL score, have been shown in **TABLE 3**. Mean REALD-30 was suggestive of differing by questionnaire skip pattern as those 18 parents with an inconsistency (error) had a mean REALD-30 score of 19.9 compared to those 82 with a consistent questionnaire who had a mean REALD-30 score of 22.2 (unpaired t-test of REALD-30[2], P=0.087).

Hypothesis 3 was that mean scores would differ between the modified color-coded MOHRQOL instrument with a sample item and the original reliable, validated version instrument. Mean MOHRQOL scores did not differ between the two versions (19.3 and SE=1.2 vs 19.9 and SE=1.0; unpaired t-test of log(MOHRQOL) P=0.490). Thus, the revised form did not appear to provide any changes in scores.

Hypothesis 4 was that FHL would moderate the difference between MOHRQOL versions — this means, one would see if the difference in MOHRQOL scores between versions only occurred in those with low FHL (because only people with low FHL would have benefited from the new color-coded version with an example). Since there was no difference, the next

TABLE 2

Difference Between Skip Pattern Inconsistency (Error) and Consistency in Child Oral Health Measures; N=100, August-September 2007, UCSF Pediatric Dentistry Clinic; Mean ± Standard Error, P-value

Skip pattern	Children's Tooth Surfaces dmfs+DMFS	Children's Teeth dmft+DMFT	Parent-Reported Children's Quality of Life MOHRQOL
Inconsistent (error) (n=18)	14.2 +/- 3.9	6.3 +/- 1.2	20.8 +/- 2.2
Consistent (no error) (n=82)†	14.4 +/- 1.5	6.3 +/- 0.5	19.4 +/- 0.8
Unpaired t-test P-value*	0.887	0.947	0.682

dmfs+DMFS = number of primary and adult decayed, missing, or filled tooth surfaces
dmft+DMFT = number of primary and adult decayed, missing, or filled teeth
MOHRQOL = Michigan Oral Health-Related Quality of Life scale
† n=80 for dental examinations
* unpaired t-tests used log(dmfs+DMFS+1), log(dmft+DMFT+1), and log(MOHRQOL)

steps in an effect modification (moderation) analysis were not performed. If there had been a significant difference, a statistical interaction effect to determine moderation in the linear regression model would have been used.

In addition, subjective oral health measures were significantly correlated with objective ones: parent ordinal rating with dental examiner caries indices (log(dmfs+DMFS+1), r_s=0.46, P<0.001; log(dmft+DMFT+1), r_s =0.43, P<0.001) and log(MOHRQOL) with caries indices (log(dmfs+DMFS+1), r=0.31, P=0.002; log(dmft+DMFT+1), r=0.29, P=0.004).

Participating in the free/reduced-cost lunch program was not significantly related to dental caries indices (dmfs+DMFTS or dmft+DMFT). Children having government insurance (e.g., MediCal) had significantly higher dental disease (dmfs+DMFS and dmft+DMFT) than those without government insurance, but REALD-30 was still significantly negatively related to dental disease (r=-0.22, P<0.032) even after adjusting for government insurance status.

Transformations (squaring REALD-30 and logging dmfs+DMFS, dmft+DMFT and MOHRQOL) were needed to make the distributions more Normal (bell-shaped). Squaring REALD-30 was found to be appropriate by the Box-Cox transformation determination method. Logarithmic transformations of dmf+DMF indices (plus an offset of one) were also found to be appropriate in other studies.

Discussion

Several implications have resulted from this study, including a new approach for evaluating FHL in other studies. The results of the California Smile Survey questionnaire items were consistent with the hypothesis that persons with skip pattern inconsistencies have a lower FHL. The child's parent/guardian assessed the child's oral health and included questions with specific instructions to skip to another question, depending on the answer chosen. In analyses of the association between parent skip pattern inconsistency and preschooler dental health in the 1993-4 COHNAC, the questionnaire differed with multiple skip patterns. For example, question 5 asked, "Does this child take prescription vitamins with fluoride or another kind of fluoride drops or tablets, at school or at home?" with the options of "Yes, No" or "Don't Know" and "(If 'No,' Skip to question 7)." Question 6 began with "If 'Yes' and asked how often the child used fluoride. Parents who responded "No" to question 5, should have skipped to question 7. Those who answered "No" to question 5 but answered question 6 were classified as incorrectly following the skip pattern since they answered anyway when they should have skipped. Those who answered "Yes" to question 5 and skipped question 6 to question 7 were classified as incorrectly following the skip pattern since they improperly skipped or omitted. Based on comparison to the REALD-30 assessments, improper questionnaire skip pattern is a potential tool in identifying low FHL.

As with all studies, this study has several limitations; first and foremost, non-English speakers and readers were excluded. The REALD-30 has only been tested and shown to be reliable and valid in English-speaking populations and could not simply be translated into another language. Additionally, the REALD-30 only tests word recognition and pronunciation, not actual comprehension. Another instrument developed by the same group that developed the REALD-30, called the Test of Functional Health Literacy in Dentistry (TOFHLiD), assesses reading and numeracy abilities, but takes longer to administer. It would be possible to develop a reliable, valid version of the TOFHLiD for Spanish-speaking populations. To reduce burden on participants, only the REALD-30 was used. Additionally, the REALD-99 has been shown to correlate highly with the TOFHLiD (r=0.82).[8,11] However, in that report, and

TABLE 3

Difference Between Skip Pattern Inconsistency (Error) and Consistency in Parent Functional Health Literacy; N=100, August-September 2007, UCSF Pediatric Dentistry Clinic; Mean ± Standard Error, P-value

Skip Pattern	Parent Functional Health Literacy (REALD-30)
Inconsistent (error) (n=18)	19.9 +/- 1.4
Consistent (no error) (n=82)	22.3 +/- 0.5
Unpaired t-test P-value*	0.087

REALD-30 = Rapid examination of adult literacy in dentistry
* unpaired t-tests used (REALD)[2]

in a subsequent systematic review, TOFHLiD was not related to a parent or child's oral health status, while this current study showed REALD-30 was significantly related to objectively determined oral health.[12]

This study used a cross-sectional study design assessing parental dental health literacy and child oral health status at the same time. A longitudinal design would be needed to determine if parental health literacy relates to their child's future dental health. Due to the design of the study, reverse causation was possible: some participants may have recognized certain dental words because of prior treatment for their child in the study; only a longitudinal study can give insight on the temporal relationship. Nevertheless, there is a moderate correlation of the skip pattern inconsistencies to parents with low FHL, who were more likely to have children with poor oral health status.

Children in his study had a wide age range (3-18 years), a narrow socioeconomic status range, and access to care. However, not all children had caries (16 percent were caries-free, i.e., dmf+DMF=0). As a sensitivity analysis, the authors analyzed the subset of data from the 57 children aged 3-6, finding very similar results. With the total sample size of 101 and about 18 percent of parents improperly following the skip pattern, power was limited. Still, this illustrates the potential of an empirical FHL measure such as questionnaire error. Thus, the strengths of the study outweigh its limitations to contribute new important information.

As some parents with low FHL may experience a degree of shame in conjunction with being tested for low FHL, it is important for the clinic staff to ensure that the respondent feels as comfortable as possible when administering these assessments. In similar studies, participants whose FHL was assessed were later surveyed on their comfort during the assessment. Protecting patients from feeling shame or embarrassment involves key factors including the minimal use of words such as "help" or "how often" that may imply they had regular difficultly with literacy. The participants in this study were all English speakers, which may reduce generalizability because potential participants may have been too embarrassed to participate in the assessment.[13] Causing the participant to feel uncomfortable during a dental visit may stimulate fear and the patient feeling stigmatized once the assessment is complete.[14] A skip pattern like the one in the California Smile Survey offers benefits in the assessment of low FHL since it virtually eliminates patient discomfort of FHL-focused tests, making it possible for clinicians to identify patients who need more targeted communication.

Because this survey is limited to English-speaking populations, generalizability is impacted. The surgeon general reported that Mexican-American children living below the poverty level have the highest incidence of untreated, decayed teeth. Many studies in dental FHL have been plagued by this language barrier. The REALD-30 is limited to English speakers and this tool cannot assess persons whose native language is not English. For example, pronunciation rules in Spanish are firm and any person fluent in the language could pronounce the word without knowing its actual meaning; thus, the results would not be accurate. The TOFHLiD assessment tool translated to other languages could be used to increase generalizability.[15]

Due to low FHL, some parents may not fully understand the instructions for preventive care nor know the extent of their child's oral health. Once the patient has been identified as having potentially low FHL, additional teaching methods can be used so the parent fully understands clinician instructions. Until an assessment for all patients is established clinicians can utilize the model of universal precautions in regard to FHL. A universal precaution is the notion to treat all patients with the same caution.[16] Each patient then would be given information in the same clear manner, regardless of their FHL. Techniques include having patients demonstrate and repeat instructions back to the clinician to ensure understanding.

Studies that incorporate using techniques like the "teach-back" method could give further insight on appropriate responses to low FHL.[1] As concluded in the current study, parents with low FHL are more likely to have children with a higher prevalence of dental caries. It is therefore important to present information to patients in a well-designed manner that can appeal to patients of all backgrounds. Similar studies used methods that tested the readability of customary dental educational materials and found that most were rated at or

above a ninth-grade reading level. The more common and widespread reading materials, such as newspapers, are written at a sixth-grade reading level.[17]

There is a link between parental FHL with the overall oral health of the child. The noteworthy method of using complex instructions to evaluate patient FHL is a potential breakthrough in gathering more data regarding FHL from patients in which their primary language is not English. From further investigation into this new assessment, it may also be possible to reduce the shame associated with these assessments and to employ universal precautions with every patient regarding their FHL.

Conclusions

Results indicated that children of parents with lower functional dental health literacy had significantly lower objective oral health status, albeit to a modest extent. Dental functional health literacy was not correlated with subjective measures of oral health; however, subjective oral health measures were correlated with objective ones, indicating that parents have an accurate grasp of their child's oral health status. Additionally, FHL, although not statistically significant, as evidenced by the two sample t-test, was suggestive of being lower in those with incorrect skip pattern behavior. Finally, the mean MOHRQOL scores did not differ between the original version and the modified color-coded version.

Parental FHL appears moderately negatively related to children's oral health status. Moreover, skip pattern inconsistency appears as a potential proxy or substitute for longer reliable, validated FHL scales (e.g., READ-30), but further assessment is needed. Skip pattern inconsistency (error) could be particularly useful in self-administered surveys conducted before FHL scales were developed and widely utilized. If further studies demonstrate a relation-

ship of parent skip pattern inconsistency (error) with child oral health, that would help establish skip pattern inconsistency as a proxy, which practitioners and researchers could use as a screen to identify patients with whom to spend additional time reviewing health care instructions.

A health practitioner can have the best training, manual dexterity, and equipment but it is nearly futile if patients do not understand health care instructions for themselves or their children. In the future, a form in a new patient packet could assess dental health literacy or current new patient forms could be scanned for inconsistencies. Patient's oral health status is dependent upon his or her ability to understand and follow directions, so providers should be more careful to explain directions to those with obvious errors in their forms. Furthermore, medical brochures are presented at a third-grade reading level. In the future, dental brochures should be rewritten and this study could be repeated to see if the same results occur. Future longitudinal studies of approaches to overcome low functional dental health literacy should be considered. ■■■■

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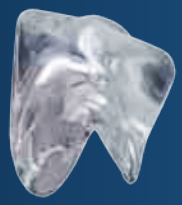

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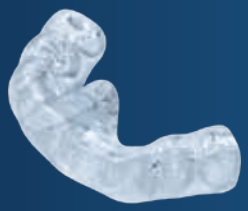

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CDA JOURNAL, VOL 40, Nº5

A Collaborative Approach to Advance Student Research at the University of Southern California

HEATHER STEPHENS, BS; BRIDGER JENSEN, BS; WESTON CARPIAUX, BS; PARISH SEDGHIZADEH, DDS, MS; AND YANG CHAI, DDS, PHD

ABSTRACT The continued advancement of oral health and science relies upon the cultivation of a student's interest in research. The Student Research Group at the Ostrow School of Dentistry of the University of Southern California is working to increase student involvement in research and develop future academic leaders. This study aims to, through student surveys, quantitatively evaluate students' involvement in research, students' interest in participating in research and to identify specific barriers students feel challenge their ability to participate in research.

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Research is the foundation upon which any scientific field is built. Research allows for new ideas to be developed, tested, and analyzed thereby advancing the field of study. Introducing students to research is important not only to encourage their future participation in scholarship, but also to ensure that as future dental practitioners they will be able to objectively evaluate research, therapeutics, and products they are presented with while in practice. The students, educational institutions, and patients receiving care all benefit from dental student participation in research.

Rosenstiel et al. found that when compared to the dental student class as a whole, student researchers were more than three times more likely to complete specialty training, nearly five times more likely to become full-time faculty members, and 31 percent more likely to be financial donors to their school.[1] Bertolami has advocated the importance of dental students understanding research as "persons of science" able to acquire and assimilate new knowledge and adapt to the changes in practice and the profession that the future requires to prevent dentistry from slipping into vocationalism, becoming a trade rather than a learned profession.[2]

A significant source of student research encouragement, advisement, and support is the Student Research Group (SRG). This student-led organization has national and local chapters that work to increase dental student research awareness, involvement, and to promote future academic leadership. To identify

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and cultivate the scientific interest of students seeking research training, for whom dental school research experience might develop into future scholarship and leadership.

Methods

A cross-sectional study was performed based on data collected via a schoolwide survey (**FIGURE 1**) administered to the DDS and ASPID (advanced standing program for international dentists) students at the USC School of Dentistry. Out of the school's 640 enrolled students, in 2009, 476 student survey responses were obtained, while in 2010, 432 students completed the survey. This represents a response rate of 74.4 percent in 2009 and 67.5 percent in 2010 (**TABLES 1 AND 2**). Survey distribution was approved by the school administration. Surveys were voluntarily completed, anonymously without penalty, influence, or coercion.

Results

An average of 10.5 percent of 476 student respondents in 2009 and 12.2 percent of 432 in 2010 reported they had participated in research while at USC. This ranged from a low in the 2010 first-year class of 7 percent, to a high of 16.5 percent in the 2010 second-year class (**FIGURE 2**).

An average of 56.7 percent of students in 2009 and 54.8 percent of students in 2010 indicated that they would be interested in participating in research at USC. The highest interest level was recorded in both first-year classes (71.0 percent and 77.0 percent, respectively) while the lowest levels were both the fourth-year classes (27.2 percent in 2009 and 30.1 percent in 2010) (**FIGURE 3**).

In regard to how interested students are in finding research projects, 16 percent of underclassmen reported they are actively looking for research projects, while only 7.8 percent of upperclassmen reported the same. A larger proportion of students (ranging from 10 to 35 percent) reported they would be interested in starting a research project if one was presented to them, but were not actively seeking a project. Similar numbers of students (ranging from 23 to 47 percent) indicated they would be interested in starting a project in the future, but not at the time they completed the survey (**FIGURE 4**).

Reported awareness of the SRG increased a total of 6 percent between the two years surveyed. Knowledge of the student organization was fairly constant across all classes, ranging from 51.9 to 77.1 percent (**FIGURE 5**).

Students reported that the biggest challenge facing USC dental school students interested in research was time. Time was the category choice with the most responses in every class in both years surveyed. Responses of time as the biggest challenge ranged from 51.9 to 61.2 percent. The next most reported category for both years was "other." Students who marked multiple answer selections on their survey were reported in this category along with those who wrote in responses not offered. Self-reported

USC Student Research Group (SRG) Research Metrics Survey

1. What year are you? ☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior
2. Have you participated in research here at USC?
   ☐ Yes ☐ No (if no skip to question 3)
   Who was your research adviser?
   What was the title/subject/area of your research?
   How many hours per week do/did you spend doing research?
   Over what length of time (how many months/years)?
   Have you presented your research anywhere or published?
   Have you received any awards related to your research?
3. Would you be interested in participating in research while at USC SD?
   ☐ Yes ☐ No
4. How interested are you in participating in research?
   ☐ I am actively looking for a project right now
   ☐ I would be interested in starting a project right now if one was presented to me but I am not actively looking
   ☐ I would be interested in participating in research, but not right now
   ☐ I am not interested in participating in research
5. Have you heard of the student research group (SRG)? ☐ Yes ☐ No
6. What do you think is the biggest challenge facing USC students interested in research?
   ☐ Finding a project ☐ Time commitment
   ☐ Contacting research faculty ☐ Other _____
7. Did you participate in any research prior to attending USC?
   ☐ Yes ☐ No
   If so, please summarize your research.

FIGURE 1. USC Student Research Group Research Metrics Survey questions.

TABLE 1

Research Metrics Survey Results From the Ostrow School of Dentistry of USC for 2009

2009		First-Year Students		Second-Year Students		Third-Year Students		Fourth-Year Students	
Research at USC Dental School?	Yes	13	11.6%	15	12.2%	12	8.8%	10	9.5%
	No	99	88.4%	108	87.8	124	91.2%	95	90.5%
	Total	112		123		136		105	
Interested in Research?	Yes	76	71.0%	72	61.5%	86	67.2%	28	27.8%
	No	31	28.9%	45	38.5%	42	32.8%	75	72.8%
	Total	107		117		128		103	
How Interested?	Actively looking	16	15.1%	18	16.2%	20	15.7%	7	6.9%
	If presented	35	33.0%	32	28.8%	44	34.6%	10	9.9%
	Not now	35	33.0%	33	29.7%	29	22.8%	31	30.7%
	No interest	20	18.8%	25	22.5%	33	26%	53	52.5%
	Total	106		111		127		101	
Aware of SRG?	Yes	84	77.1%	66	55%	78	59.5%	55	51.9%
	No	25	22.9%	54	45%	53	40.5%	51	48.1%
	Total	109		120		131		106	
Biggest Challenge?	Finding	10	9.4%	16	14.4%	34	27.4%	16	16.8%
	Contacting	10	9.4%	7	6.3%	7	5.6%	3	3.2%
	Time	64	60.4%	62	55.9%	70	56.5%	63	66.3%
	Other	22	20.7%	26	23.4%	13	10.5%	13	13.7%
	Total	106		111		124		95	
Research Prior to USC?	Yes	60	56.6%	74	61.2%	70	54.3%	54	51.9%
	No	46	43.4%	47	38.8%	59	45.7%	50	48.1%
	Total	106		121		129		104	

challenges facing students interested in research included finding projects that matched student interests, knowing what projects are available, motivation, competition for research opportunities, funding, lack of academic credit for participation, and travel distance to research facilities. (Some of USC's dental research laboratories are located at the Center for Craniofacial Molecular Biology, a 10-15 minute drive from the main dental school building.) Finding a project was reported as the third-largest challenge in both 2009 and 2010, while contacting faculty was reported as the least-reported challenge facing students interested in participating in research in both years surveyed (FIGURE 6).

Slightly more than half of respondents indicated they had participated in research prior to attending USC, 56 percent in 2009 and 64.3 percent in 2010.

Discussion

There are two different aspects to consider when discussing dental student involvement in research; the first is the need to sufficiently educate all students about the fundamental principles, critical evaluation, application to clinical practice, and overall importance of research. The second is to identify and cultivate those students who are interested in not only understanding and applying research, but also creating it; those who will become academic leaders in the future. De Paola et al. stated that "the outcome of dental education is to educate an individual who not only possesses the technical skills required for the provision of patient care, but, also and equally important, can think critically, understand the scientific method, and apply this to the practice of the profession."[3] It is a dental school's duty not only to develop students' technical skills, but also to advance their ability to think critically and objectively about clinical materials and techniques used in their practice.

The cultivation of students interested in becoming future academic leaders needs to be encouraged and increased at USC

TABLE 2

Research Metrics Survey Results From the Ostrow School of Dentistry of USC for 2010

2010		First-Year Students		Second-Year Students		Third-Year Students		Fourth-Year Students	
Research at USC Dental School?	Yes	8	7%	17	16.5%	17	12.5%	10	12.7%
	No	106	93%	86	83.5%	119	87.5%	69	87.3%
	Total	114		103		136		79	
Interested in Research?	Yes	87	77.0%	61	64.2%	65	47.8%	22	30.1%
	No	26	23.0%	34	35.8%	71	52.2%	51	69.9%
	Total	113		95		136		73	
How Interested?	Actively looking	18	17%	14	15.7%	9	7.3%	1	1.2%
	If presented	36	34%	23	25.8%	34	27.4%	9	11.0%
	Not now	32	30.1%	28	31.5%	29	23.4	39	47.6%
	No interest	19	17.9%	23	25.8%	52	41.9%	33	40.2%
	Total	106		89		124		82	
Aware of SRG?	Yes	62	55.8%	75	74.3%	96	70.6%	54	69.2%
	No	49	44.1%	26	25.7%	40	29.4%	24	30.8%
	Total	111		101		136		78	
Biggest Challenge?	Finding	16	14.8%	6	6.1%	21	17.1%	14	19.2%
	Contacting	4	3.7%	5	5.1%	3	2.4%	4	5.4%
	Time	56	51.9%	60	61.2%	69	56.1%	42	57.5%
	Other	32	29.6	27	27.6	30	24.4%	13	17.8%
	Total	108		98		123		73	
Research Prior to USC?	Yes	62	55.8%	61	60.4%	79	58.5%	38	50%
	No	49	44.1%	40	39.6%	56	41.5%	38	50%
	Total	111		101		135		76	

and other dental schools. Warner et al. cautioned, "dentistry is a profession based on a strong foundation in science. For dentistry to remain viable and contemporary, the creation of new knowledge, not simply the consumption of existing knowledge, must be an integral component of dental education and continued clinical practice."[4] Research represents the fundamental means by which dental medicine progresses. The authors' study shows that many students, especially in their first and second years of school, have an interest in becoming involved in research. While not directly measured in this study, the authors believe one factor that contributes to first- and second-year dental students being more interested in participating in research is that they have a wider scope of dental career opportunities than upperclassmen.

Underclassmen are still exploring what path to follow once they complete their DDS/DMD degree. Specialty fields, academic positions, industry work, as well as research careers, are still all viable options for most students starting their predoctoral education while upperclassmen often have begun to narrow their path to either include or preclude academic research or specialty program positions. If enabled and encouraged to participate, some of the students who indicate an interest in research will hopefully, with mentoring, develop into the academic leaders of the future. Student research exposure and involvement has been shown by Rosenstiel et al. to increase a student's likelihood of becoming a full-time faculty member nearly five times.[1] With the current and predicted shortage of dental school faculty, this is another excellent reason to promote dental student participation in research. It is our goal, as leaders of the USC Student Research Group, to help these students with an interest in research to find the projects, mentors and resources they need in order to become involved in dental research while in school and to develop research skills that they will be able to utilize throughout their professional career.

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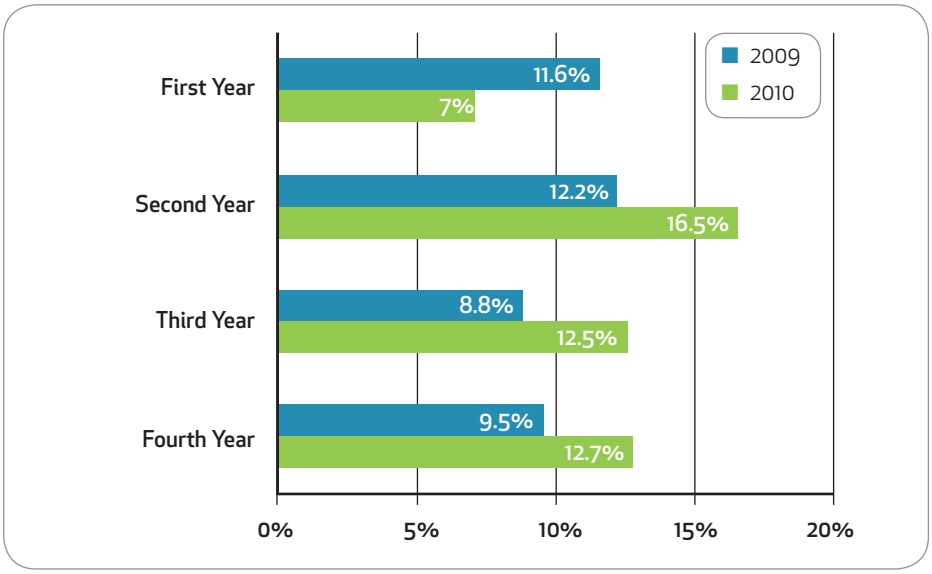

FIGURE 2. Survey results show that between 7 percent and 17 percent of students per class have participated in research while in dental school.

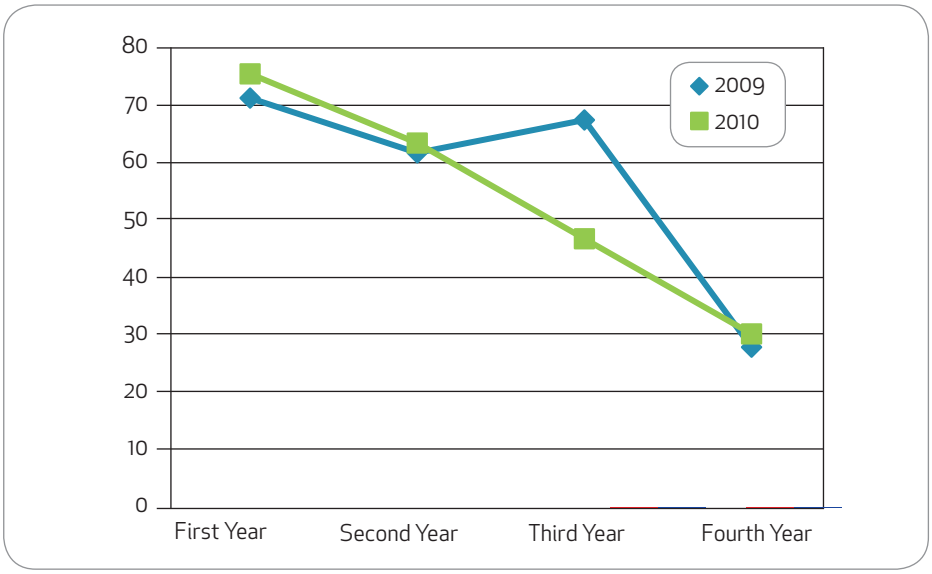

FIGURE 3. Interest in research participation dramatically declines after the first year of dental school. This result emphasizes how the first year is a vital time to encourage and engage students in research.

In line with the vision of the National Student Research Group, the local chapter of USC's SRG has been working on 1) better identifying students interested in participating in research; 2) increasing the number, scope, and variety of research opportunities available to students; and 3) supporting students interested in pursuing academic career paths. One way the authors hope to accomplish increasing student involvement in research is to understand, through this study, the challenges facing students interested in becoming involved in research, as well as how a student's perspective of these challenges changes throughout their dental school experience.

One avenue of remedying the issue of insufficient time, which a majority of students reported as the biggest challenge associated with participating in research, is to work toward altering student schedules to allow more time for research activities. Another more immediately feasible approach is to better support and encourage those students who choose to use their limited free time to pursue research activities. The USC SRG organization took dramatic strides through the 2009-2010 school year to develop programs and activities that recruit students with an interest in research and foster those who have already chosen to participate in research. As an organic mobilization of students, with the support of faculty, the authors have aimed to increase the recognition of benefits and encourage student participation in research.

A series of new and modified activities were developed:

- Annual student organized and written award-winning journal, *The Explorer*;
- SRG promotion of student involvement in Research Day;
- Summer research fellowship program;
- Freshmen research orientation lecture;
- Emails about conferences, internships and postgraduation research opportunities;
- Abstracts/poster development workshop;
- Monthly journal club meetings featuring literature discussion by professors and presentations of current USC research projects;
- Quarterly faculty/student networking events; and
- Yearly cross-sectional research surveys and student-led scholarship with the data.

Conclusions

This data shows that more than half of the DDS and ASPID students in the dental predoctoral program at USC are interested in participating in research activities, but that only about 10 percent actually participate. While currently working on narrowing this margin, the authors' survey results also showed that more than 60 percent of students who reported being involved in

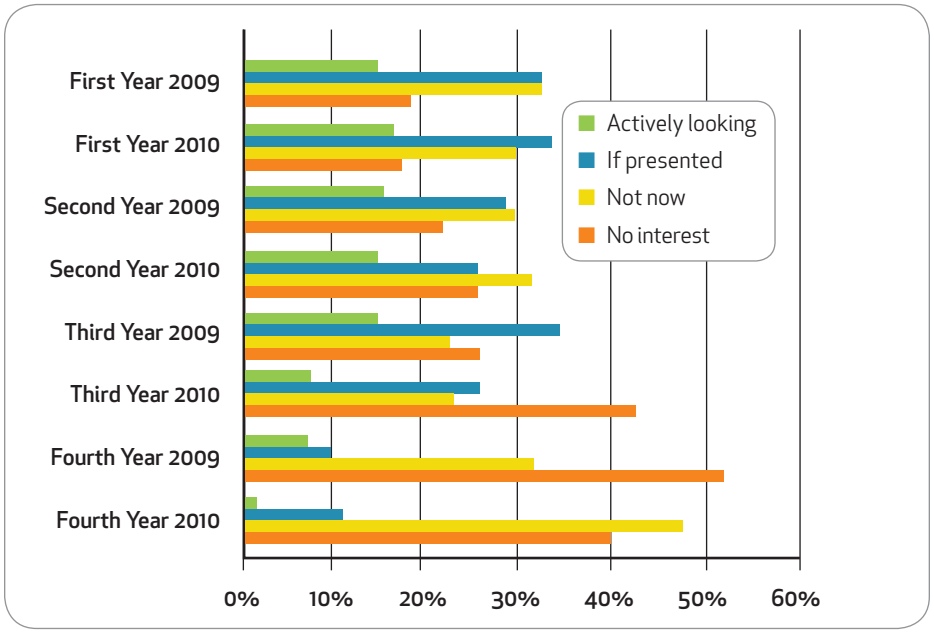

FIGURE 4. A comparison of student's level of interest in starting a research project. Survey answer choices were 1) actively looking for a project; 2) interested in starting a project if one was presented; 3) interested in starting a project but not right now; and 4) no interest in participating in research.

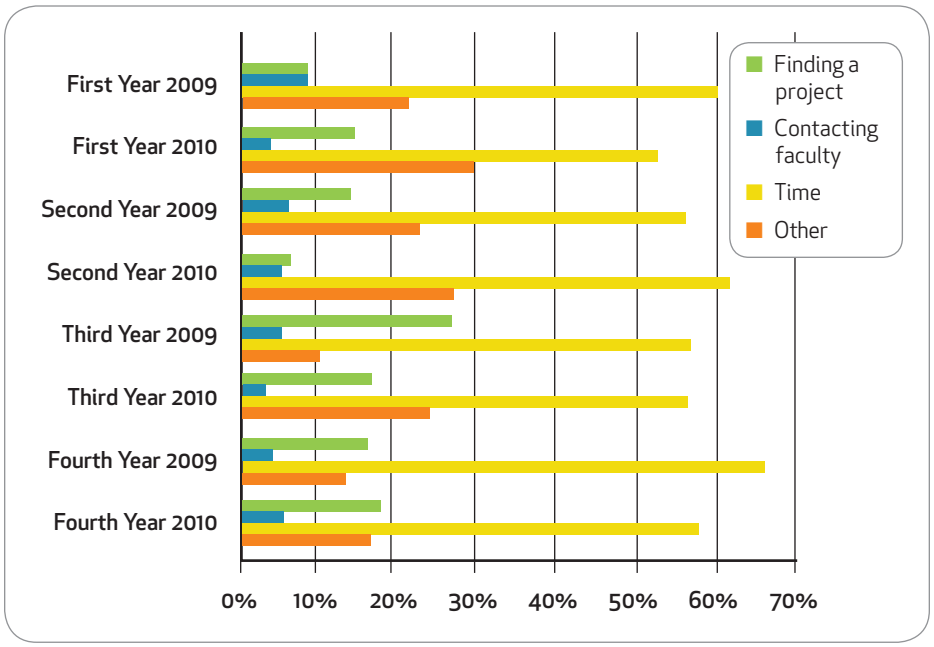

FIGURE 6. Time was cited as the biggest challenge facing USC students interested in research by every class, for both years that data was collected.

research had or were planning to present or publish their work. The programs and activities implemented in 2009 have already shown a small but positive effect on student involvement in research and awareness of SRG activities. Further studies are necessary to determine the sustainability and effectiveness of SRG efforts. While this study covers a narrow range of time (2009-2010) the authors hope the data collected will act

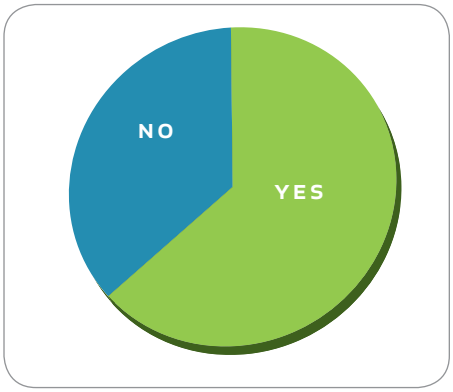

FIGURE 5. A total of 570 out of 892 student survey responses in 2009 and 2010 (63.9 percent) indicated they were aware of the student research group.

as a foundation for future student research group members to continue to examine and evaluate the topic of dental student's awareness, interest and participation in research activities, an area of significant interest to the dental community, through more extensive comparisons across additional years.

It is the authors' hope that a core group of motivated students, with the support of research faculty, directing the actions of the USC's SRG can increase the quantity and quality of student dental research at USC, and that the SRG activities can serve as an exemplar for other institutions to universally increase dental student research awareness and involvement. ■■■■

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G-1019 CHICO AREA—Small Community practice! ~1,600sf w/ 2 ops. **$185k**

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

GN-039 CHICO - Family-oriented, FFS Practice, tucked in vibrant community! 1,040 sf w/3 ops **$95k**

GN-048 CHICO—Long established, well respected, spacious practice, 1,39sf w/5ops. **$437.5k**

SOUTHERN CALIFORNIA

K-986 NEWPORT BEACH -Attractive, multi-story Medical/Dental bldg. 1,000 sf w/2 ops **$195k**

KG-023 IMPERIAL VALLEY- Free-standing, Medical Prof Bldg. 1,050 sf w/3 ops **$195k**

CENTRAL VALLEY

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

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

I-1012 MANTECA- Location, Growth, High Profit. Well-equipped 780 sf w/2 ops **$479k**

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

IN-032 GREATER MERCED AREA - Prime Location! Modern equip ~1,100 sf w/ 4 ops **$335k**

J-1000 TULARE— *Real Estate Available too!* Great highly visible location! ~ 1650sf w/ 4op. **$465k and R.E. $249k**

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

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

SPECIALTY PRACTICES

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

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

J-983 CENTRAL VALLEY ORTHO - Attractive, single-story ~1,773sf w/ 6 chairs/bays. **$325k**

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

DN-022 ENDO TRI-VALLEY-~ 30 new pats/mo. 975 sf w/ 2 fully equipped ops **$275k**

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

EN-038 ENDO/PERIO SACRAMENTO - Stunning, sleek, spectacular office in attractive, like-new, 2-story Prof Bldg. 3 ops w/ plumbing for 2 add'l ops **$680k**

GN-050 NORTHERN CA PERIO - An opportunity like this comes only once in a lifetime! This recently remodeled office is ~3,500 sf w/ 5 ops. **$1mil**

Timothy G. Giroux, DDS

Jon B. Noble, MBA

Mona Chang, DDS

John M. Cahill, MBA

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- **ANAHEIM:** *For Sale*-General Dentistry Practice. This 3 op had $253,000 in collections in 2011. There are 3 ops in this 864 sq. ft. office with 1.5 days of hygiene. Owner works 3 days per week. No welfare or HMO's. Laser, Dentrix Software and Intra-Oral Camera.

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

- **CHICO:** *For Sale*-General Dental Practice. The collections in 2011 were $1,209,207. There are 7 days of hygiene in this 5 operatory, 2,400 sq. ft. office. Equipment includes Laser, Intra-Oral camera, new Cone Beam X-ray and Dentrix software. This excellent practice has 1,824 active patients with 12 new patients a month.

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

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

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

- **FOUNTAIN VALLEY:** *For Sale*-General Dentistry Practice. Gross Receipts $284,000 with only a 47% overhead. Practice has been in its present location for the past 37 years. There are two equipped operatories in this 5 op office. E2 2000 software. Doctor is retiring. SOLD

- **FREMONT:** *For Sale*-(General Dentistry Practice Facility and Equipment Sale) Beautiful Central Fremont office in upscale professional building. This is a facility sale with 4 fully equipped treatment rooms, panoramic x-ray, intra-oral camera and nitrous oxide plumbed throughout. Very modern design and efficient layout in approximately 1,400 sq. ft. Seller is relocation to a larger facility. Patients and goodwill are not included.

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

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

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

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

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

- **GRASS VALLEY:** *For Sale*-General Dentistry Practice. Gross Receipts $491K with an adjusted net income of $130K. Overhead 73%. Office leased 1,555 sq ft. 4 equipped operatories 5 available. Laser, Intra-Oral Camera, Cerac, & Eaglesoft software. Owner would like to retire. #37108.

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

- **HAWAII (MAUI):** *For Sale*-General dentistry practice. Gross Receipts of $636K. Office has four equipped operatories in 1198 sq.ft. Pano, Laser, I.O. Camera, Fiber Optics, 2 ½ days of hygiene. Owner retiring: Don't miss this opportunity to live and work in paradise. #20101

- **HAYWARD:** *For Sale*-General Dentistry Practice. This practice consists of 1,600 sq ft with 4 treatment rooms in an excellent location. 2011 Gross was $501,000 with a $228K adjusted net income. Dental Vision software, Average age of equipment is 8 yrs. Approximately 1,200 active patients. SOLD

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

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

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

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

- **LINDSAY:** *For Sale*-General Dentistry Practice & building. Gross Receipts $330K with adjusted net income of $219K. Office space 1,489 sq. ft., 4 equipped operatories, Intra-Oral Camera, Soft-Dent software, 3-hygiene days a week. Owner retiring. #14363

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

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

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

- **NORTHERN CALIFORNIA:** *For Sale*-Endodontic Practice. This Endodontic practice is located in an upscale professional office complex. The owners condominium occupies 1,770 sq ft, There are 4 equipped treatment rooms with an additional 5th room available. Gross Receipts were $638K with $239K adjusted net income. Owner will stay for transition to introduce buyer. Owner is retiring. #14251

- **NORTHERN CALIFORNIA:** *For Sale*-Pediatric practice. Owner has operated in same location for 32 years. Approx 1,760 active pts, 1,160 sq ft, panoramic X-Ray, Dexis Digital and Dentrix software in this 5–chair office. 2009 Gross Receipts $713K with 48% overhead. Owner retiring. Call for Details. SOLD

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

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

- **ROSEVILLE:** *For Sale*-General Dentistry Practice. Great Location. 2009 GR $900K with adjusted net income of $300K. 1,975 sq. ft. with 4 ops, 8 day hygiene/wk. Digital, Intra-Oral Camera, Dentrix, Trojan, Fiber optics, P & C chairs - all less than 5 years old. Owner is retiring. #14327 SOLD

- **SACRAMENTO:** Must be sold immediately. Well-established General Dentistry practice is desirable N. Sacramento location. Office is 1950 sq. ft. with 4 ops, 3 fully functional dental lab. (porcelain oven, casting, spatnts) which can be converted into 2 additional ops., Digital x-rays and digital Pan, Practice Works software, 2010 Net receipts $1,967,047. Don't assume anything about the purchase price. Inquire immediately. Purchase price is totally negotiable. SOLD

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

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

- **SAN BERNARDINO:** *For Sale*-General Dentistry Practice. GR $972K. Practice has been in its present location for the past 35 years. Leased 4,500 sq ft of office space- 12 equipped operatories. Dentrix software, Pano and Cerac. Accepts HMO. Multi-specialty practice. Owner to relocate. #14377

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

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

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

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

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

- **SANTA CLARA:** *For Sale* - BUILDING ONLY: This building is located just west of Westfield Mall and Santana Row. The building has two units. One side is designed and plumbed for dentistry and the other was a law office. There is 3,776 sq. ft. of office space. The dental office is approximately 1,800 sq. ft. with 6 operatories. The building has been recently re-roofed. Excellent opportunity for a startup practice or for the dentist that needs more space. Financing available through various dental lenders. #14368

- **SANTA CRUZ:** *For Sale*-General Dentistry practice. Gross Receipts $300K with a 57% overhead. Office is 1,140 sq. ft. 3 equipped operatories. Intra-Oral Camera, Pano, Digital X-Rays, and Dentrix software. Practice has been in its present location since 1980. Owner retiring. #14358. SOLD

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

- **TORRANCE:** *For Sale*-General Dentistry practice. This excellent practice is centrally located in a professional complex. Office is approx. 1,885 sq. ft. 4 operatories with room for one additional. There are approx. 2000 active patients with 6 days of hygiene per week. Practice Pano, Intra-Oral Camera and Easy Dental software. Owner is retiring. Reasonable lease available. #14320 SOLD

- **TORRANCE:** *For Sale* - General Dentistry Practice. Gross Receipts $413K with an adjusted net income of $203K. 50% overhead. Practice has been in its present location for the past 25 years. The office has been tastefully remodeled. Office is 800+ sq. ft. with 3 equipped operatories. 4 -hygiene days per week. Doctor is to retire. #14369

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

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OPPORTUNITY AVAILABLE — Established practice for over 20 years looking for endodontist to join our practice. We have in house surgeon, periodontist and Orthodontist. Excellent caring and supporting staff. Please email resume to gilbertlim@msn.com or call 916-838-1090.

OPPORTUNITY AVAILABLE — Established practice looking for a general dentist to join our practice. Must have excellent communication skills and proficient with treatment planning. Most RCT's are refered out. Excellent caring and supporting staff . Plese email resume to gilbertlim@msn.com

OPPORTUNITY AVAILABLE — We are a multi-specialty dental office with multiple locations. We are looking for an Endodontist to join us. Please email your resume to bayareadentist2009@gmail.com.

OPPORTUNITY AVAILABLE — We are looking for a General Dentist for a growing multi-specialty office for our office in Sunnyvale. If you have at least 3 years of hands-on experience and have the following qualifications we would love to hear from you: Experience in all phases of general dentistry - Experience in performing root canals and extractions. Complex root canals and extractions can be referred out to in-house Endodontist. - Implant experience preferred but not required - Invisalign experience desired - Mindset to meet and exceed production goals without compromising quality dentistry. Please email your resume to bayareadentist2009@gmail.com or fax it to 408-493-4585.

OPPORTUNITY AVAILABLE — We have a thriving general practice, with long term committed patients and a nice, long term friendly team. The Foothills offer an ideal location, excellent schools, and great place to live. Looking for an experienced, friendly, competent, family minded professional that

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

PENDING

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

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

PENDING

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

3049 SAN JOSE GP
Well-located, across from O'Connor Hospital, general practice in 2,118 sq. ft.state-of-the-art facility w/ 3 fully-equipped ops. 2 pvt. offices (1 can be plumbed for 4th op). Asking $195K.

3069 NAPA VALLEY ENDO
Endodontic practice now available in Napa Valley. Gorgeous state-of-the-art 1,450 sq. ft. facility w/4 fully-equipped ops & microscope in every op. Excellent referral sources and upside opportunity.

SOLD

3059 SANTA CRUZ COUNTY GP & BDG
Charming practice tucked among soaring redwoods in Santa Cruz County. 2010 GR $595K+ w/3 doctor days. All fee-for-service. Owner retiring and willing to help for a smooth transition. This is a great turn key practice and opportunity to own a hidden gem. Practice asking price $373K, building is also available.

PENDING

3064 SAN JOSE GP
Now available. Great turnkey opportunity. Beautiful 1,500 sq. ft. facility with 4 fully equipped ops. State-of-the-art fully networked office, Dentrix software, digital x-ray & recently purchased dental & office equipment. Avg. GR $328K+ with 4 doctor-days. Owner willing to help in transition. Asking $220K.

3061 SAN JOSE DENTAL FACILITY
Dental facility ideal for Pediatric or easily converted to GP. Gross lease with utilities included expires July 2013 with 5 year option to renew. Modern, tastefully designed, approximately 1,321 square feet. Asking $95K.

SOLD

3067 MID-PENINSULA GP
Gorgeous modern, highly visible GP in 3,000 sq. ft. office w/7 fully equipped ops. Approx. 1,600 active pts. & avg. 16 new pts./month. 4 doctor-days/week. 5 years avg. GR $991K+. Asking $808K.

SOLD

UPCOMING LISTING:

3068 MONTEREY COUNTY GP
2,000 sq. ft. state-of-the-art office w/6 modern, fully-equipped ops. & w/digital x-ray. Long term & loyal staff. Approx. 1,500 active patients all fee-for-service. 3 year avg. GR $1.7M, 2011 GR on schedule for $1.8M.

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OPPORTUNITY AVAILABLE — Opportunity for Prosthodontist in new upscale office located in Westlake Village. Five operatories with lab. Only prosthodontists need apply. Visit smilesbyaps.com and contact ajmdds@yahoo.com or 805-494-3377.

OPPORTUNITY AVAILABLE — New dental office looking for A dentist, OS, Endodontist, Orthodontist, Periodontist to join our office. The right dentist has an option to purchase in the future. Please email your resume to johnvudmd@gmail.com.

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OPPORTUNITY WANTED — I am a licensed general dentist looking for full time or part time opportunities in the SF bay area. I am a 2011 graduate of the University of the Pacific. Willing to do hygiene. Please contact for CV at 510-449-9513.

OPPORTUNITY WANTED — After over 20 successful years, I sold my upscale, private practice and I am looking to relocate to Southern CA. Let me e-mail you my list of advanced CE courses I have attended, as well as testimonials and photos from my previous patients. This will let you get to know a little bit about me, as well as the high quality of restorative and cosmetic dentistry I can provide. I have an excellent chair side manner, my patients and staff really know I care. I have my CA license, and can quickly be wherever needed when the right opportunity arises. I am looking for a long-term relationship in a high quality, patient centered office. Email tamjag@aol.com or call 949-922-5987.

OPPORTUNITY WANTED — I am currently seeking a position as an Oral and Maxillofacial Surgeon. Currently I am OMFS chief resident at Woodhull Medical Center in Brooklyn, NY. Previously I completed an internship at the University of Illinois at Chicago in oral surgery as well as a GPR at UCLA Harbor Medical Center. Originally I am from California. I am interested in an associate position where I can grow and provide a wide variety of procedures as an oral surgeon. I am a diligent, respectful, self-driven practitioner who strives at providing quality care to patients while looking to establish quality relationships with staff members as well as co-practitioners. If interested please email me at dtelles01@hotmail.com or call me at 917-208-9139.

oPPORTUNITY WANTED — Hispanic Dentist looking for PT position in Los Angeles or nearby area. Contact 818-605-1584.

OPPORTUNITY WANTED — DMD: 2003 Tehran University, DDS: 2010 UCLA, GPR (Hospital Dentistry): 2011 WLA VA. Nine years work experience. Looking for a PT job in Los Angeles area. Contact 310-598-0409.

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6008 - MENDOCINO COAST'S FORT BRAGG 2011 collected $725,000. 4-days of Hygiene. 4-ops (each with own computer), digital radiography. Great family community.

6018 - SAN JOSE'S CAMPBELL Successful practice in esteemed Group. Seller averages net production of $440,000 (excludes Hygiene), collections of $430,000 and Profits of $200,000. Group performs at $3.8 Million/year level.

6020 - PEDO PRACTICE - ATTRACTIVE NORCAL FAMILY COMMUNITY 2011 collected $455,000 on 26 hour week with Available Profits of $208,000. 2012 is doing better. $230,000 invested here. Beautiful office. Full price $240,000.

6021 - SANTA CRUZ - "SOLD" Great location. Busy Hygiene Department booked 6+ months. 2011 collected $415,000. Lots of goodwill here.

6022 - SAN FRANCISCO'S NORTH BAY - SEBASTOPOL DENTAL OFFICE 8 miles west of Santa Rosa. Beautiful office in great family community. Total investment of $230,000. Asking $65,000.

6023 - LOS GATOS - "SOLD" 2011 collected $240,000 on 3-days. 6-year office has $215,000 invested. Adec delivery systems, Adec cabinets, digital radiography, digital Pano and paperless charting.

6024 - PERIO PRACTICE – SAN FRANCISCO'S SOUTH BAY Collected $600,000 in 2011 on 19-hour week with 7 weeks off. Great second office or excellent base to build upon.

6025 - MARIN COUNTY Well established, collected $490,000 in 2011 on 3-day week. 3-Ops. 2+ days of hygiene.

6026 - SACRAMENTO Collected $825,000 on 3-day week with no marketing. Great foundation which could be developed into a busier practice.

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

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

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

3283 - PALMDALE/LANCASTER Hi growth area. GP Gross $1.5 mil. 40% Net. Small town! 5 min from Bakersfield. RE available.

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

APPLE VALLEY/HESPERIA Gr $700 to $800 Free Std Bldg Avail Absentee.

3287 - SOUTHERN CALIFORNIA - "SOLD" $6 Million per year. Prestigious Hi identity location. 12,000 sq.ft. $1.00/sq.ft. $30K Cap/mo. Requires substantial net worth. Nets $1+ Million.

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

3297 - SOUTH BAY Location Only. Free standing Dental bldg on main street.

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

ORANGE Grosses $30K+/mth. 5 ops. Beautiful. Rent $2,000. FP $250K.

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

TORRANCE Special Diamond Location. Hi Identity. Will Gr $500K first year. $125K FP.

VICTORVILLE-APPLE VALLEY-HESPERIA AREA Estb 20 yrs. Gr $700K+. Net approx $300K. More vol avail. 8 op. Hi identity shop ctr. FP $650K. Serious Seller. Can do $1 Million.

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

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

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

BEVERLY HILLS Implant Center $1,450,000; 3 ops - 1,450 sq.ft. Beautiful facility access to neighbors CT Imaging Center. Full price $995,000 a bargain - BH most prestigious Dental building. Pride of ownership - Pros would work back for transition. Moving to Desert.

HAWAIIAN GARDENS Hispanic practice. Grossing near $500,000. Beautiful 5 ops in shopping center.

TEMECULA - HEMET Grosses $700,000 part time. 8-ops. Million dollar location.

CORONA HMO Gross $70-to-$80K month absentee. Low overhead.

MARINO VALLEY Gross $600K. Beautiful office. Low Overhead. Absentee Owner.

SAN FERNANDO VALLEY $1,000,000 opportunity to do $2,000,000. Very valuable R.E. Hi identity. Rent or purchase R.E.

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

CLASSIFIEDS, CONTINUED FROM 448

PRACTICES FOR SALE

PRACTICE FOR SALE — Incredible opportunity in a 4 operatory, computerized G.P. office. Three ops equipped, 4th operatory is plumbed. Cash/Ins/PPO/HMO/Denti-Cal patient base. 2011 gross collections $178K+ on a two day week. Building is a freestanding duplex building, has exposure, visibility and parking. The dental suite is incredible. Asking $129,000. Send inquiries to martinezj994@gmail.com or call 626-965-4210.

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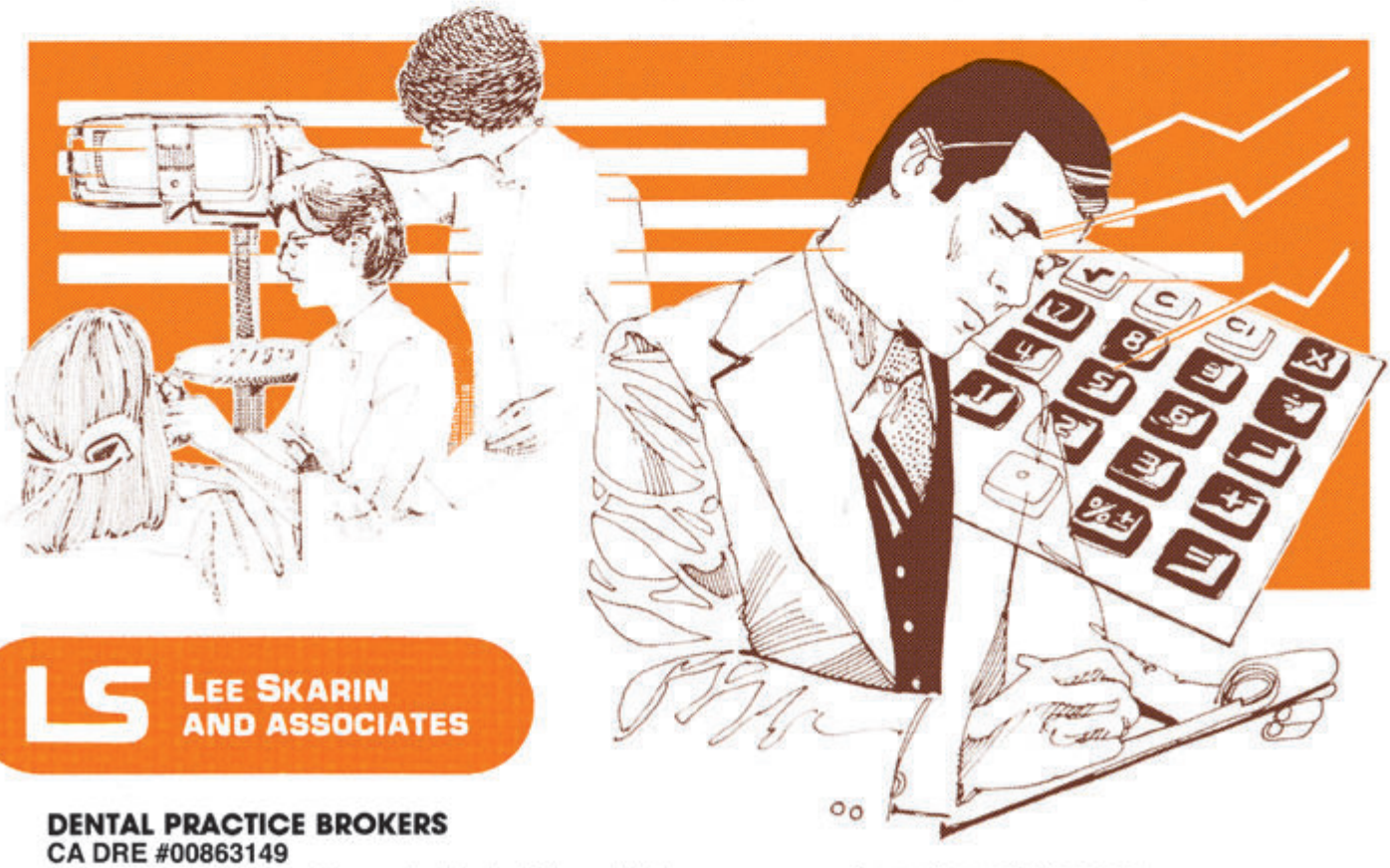

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DR. BOB, CONTINUED FROM 454

This hormone is about the size of a small pea and is said to taste somewhat like orange Kool-Aid. Upon release, it assumes an unwarranted stature and commands the nearby pituitary gland in an international code to which only endocrinologists are privy, to release a follicle-stimulating hormone. The pituitary, not conversant with the term "follicle" and failing to see why one would need stimulating anyway, promptly dumps it into the bloodstream.

The overburdened bloodstream, already pulsing busily with platelets, antigens and algorithms, feels the same and shunts the GnRH off to the testes. This is a big mistake, because the testes are infamous troublemakers. They begin to enthusiastically produce testosterone, a high-octane unstable substance in accordance with a covert agreement arrived at earlier with the wrong side of the brain. Production of testosterone can remain in effect well into the age of 90 in some men, becoming a source of annoyance to everybody.

Until the onset of puberty, a man's mother is responsible for keeping him presentable and his baser instincts subdued to a level where they won't reflect badly on her whenever she is forced to take the compliant kid out in public. Eventually, the boy asserts himself, thanks to the new gift of testosterone. He insists on his individualism just like the other kids, i.e., disreputable, or he might as well enroll in Mrs. Bleisteft's ballet class, or compete in intramural girls' volleyball.

The other kids are expressing their own uniqueness by replicating their peer's couture and the net result is what you see at recess in middle schools today and exacerbated in high school to a level of retro-hippie. The aggrieved parents — even if they had been participants themselves at Haight-Ashbury — are not necessarily thrilled at this resurrection.

Considering all this circulatory activity, small wonder boys are restive. Girls are acting strangely, too, but I have already denied any knowledge of what they are up to. If you want to know any more about this, you will have to ask another woman.

A boy now enters a turbulent era far worse than the Terrible Twos, because it lasts 15 years or longer. He has discovered HAIR that has until now been under the aegis of his mother. She's toast. From now on until the hair disappears of its own volition starting about 30, even in future kings and titans of industry, only a new girlfriend wields enough power to influence him. His wife is too busy agonizing over her own hair, its arrangement, color and style, time that could be more profitably spent at Nordstrom's.

What is all this mania about hair? Opening on Broadway in 1968 was the smash hit lovingly called *Hair — the American Tribal Love-Rock Musical*. Things have never been the same. If you favored the clean-cut look for males, you were an endangered species. Females of all ages, who could have pulled the plug easily at the time, *loved* hair, the more the better.

Unfortunately for males, cranial hair finally vanishes forever after the owner gives up trying to arrange a few stragglers into a sad concept called "the comb-over." At this point, he may opt for a hairpiece replacement that resembles road kill, or a more expensive version that fools almost everybody beyond a radius of 100 feet.

Paradoxically, facial hair is another story and not a pretty one. Boys awkwardly plunging into manhood, start a sanguine experiment with shaving or trying to grow beards, mustaches or pathetic little tufts below their lower lips called "soul patches" in a futile attempt to look more mature like Jack Sparrow without having to act accordingly. Again, women, the enigmatic gender, could have effectively vetoed the idea, but were selfishly rearranging their eyebrows and putting Revlon and Maybelline on the map.

A man can't kill facial hair with anything short of electrolysis. Shave it off in the morning and it is well on its way back at 5 p.m. If he should survive to a 105, it will still be there, having recruited new follicles in his ears as a bonus.

This is why today we are faced with the largest contingent of unkempt men since the Stone Age, or perversely, the exact opposite offered in the über-kempt persona of Mr. Clean.

And that's why I no longer understand my own sex. Because hair maintenance can be such a drag, many men, even those guys young enough to have a plentiful supply, opt to shave it all off, right down to the bone. The comparison to Humpty Dumpty is apt, if not complimentary. Clean, yes. Shiny, indeed, but the only women I have ever heard of who did this on purpose would never, ever get an invite to the Senior Prom, let alone Bingo Night at the Home.

In stark contrast is the Scruffy Look that is well past its Use-By date. Unknown is the first gentleman who thought a perpetual five-day growth of beard entitled him to attend formal weddings, display himself in HD on national television and eat at restaurants featuring cloth napkins. The usual companion to permanent facial shrubbery is the carefully tossed combless bed hair if one can afford one's own hairstylist. Anybody else would immediately be offered a complimentary comb and a shave and haircut at the Midnight Mission. Hard to fathom is the fact that a trendy guy wearing an Armani suit, driving a rag-top Bentley and has embraced the shaved dome as well, will be welcomed everywhere. Except at home. Should he ever drop by there, his mother would put things right in a hurry.

Until then, I predict the Clean Cut Look will make a comeback, possibly toward the end of this century when women tire of 5-inch heels and the universal acceptance of dark roots. ■■■■

CDA JOURNAL, VOL 40, Nº5

Hair Is His Mane Point

The brain of a preadolescent boy is very small, minuscule some might say. The hypothalamus is even tinier.

Robert E. Horseman, DDS

ILLUSTRATION BY VAL B. MINA

By my ninth decade, I should have accumulated a vast store of understanding and wisdom based on experience and observation. If that were true, I would then be in a Yoda-like position to dispense this knowledge on *Jeopardy*, winning the Daily Double and all the marbles.

I'm still waiting, which is probably just as well because somebody, sooner or later, would ask me to explain women. The man who admits he doesn't understand women must have had considerable experience with them. You ogle them, but you can't Google them.

Blessed with a wife, two daughters and two granddaughters, I am overqualified in the experience department, but woefully inadequate in comprehension and insight. Like many, if not all, males, I am frequently maddened by a dark, neurotic compulsion to say the wrong thing at the wrong time. Even the family dog (female, of course) concurs when I can't differentiate in an instant her demand to go out versus an impassioned request for dinner.

Early in our union, my dear wife complimented me on my clearheadiness. Eventually, when Webster confirmed there was no such word, I came to understand that this approbation simply meant she could see right through me. Never mind—at least by virtue of being one, I could understand men, or thought I could.

Deep inside the brain of every boy is a small structure called the hypothalamus. The brain of a preadolescent boy is very small, minuscule some might say. The hypothalamus is even tinier. At some point—possibly a Friday afternoon—the hypothalamus begins producing without a signed release from the thinking part of the brain, a gonadotropin-releasing hormone (GnRH, pronounced *gun-arch*).

CONTINUES ON 453

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