C.E. article
From everyday dentistry to advanced photoacoustic endodontic applications (PIPS)

Education
Control the anatomy; control procedural training

Association news
Peter S. Weber is named executive director of AAE
FOCUS ON PRECISION

With over 69 years of optical experience, Seiler Instrument is a worldwide leader in the field of Microscopy.

Introducing the all New Evolution XR6 LED: With over 80,000LUX, 5800K for a pure daylight look and over 50,000 hours of bulb life, you will see clearer, sharper images every time.

In addition to superior clarity, the XR6 also offers all APOchromatic Lenses, a new ergonomic design for an almost effortless movement, and comes at a highly competitive price.

Don’t be left in the dark, try a Seiler Microscope today!

Come visit Seiler at the GNYM and test drive the NEW LED Microscope at BOOTH #5200.
Exploring a world of knowledge

There is always plenty to learn in our specialty.

In this issue of roots, you can find many helpful articles, including a report on the use of dual wavelength lasers by Dr. Lawrence Kotlow, Dr. Enrico DiVito and Dr. Giovanni Olivi. As their article points out, these lasers have uses in many different clinical situations. Perhaps most impressive is the use of this equipment in root canal therapy. The images on the cover of this issue attest to the effectiveness of lasers in cleansing the anatomy.

Also in this issue of roots, you can learn about the 3-D training replicas available from Dr. L. Stephen Buchanan and his team at Dental Education Laboratories. These tooth models offer many advantages for those who wish to hone their skills.

Every issue of roots magazine also contains a C.E. component. By reading the article on dual wavelength lasers mentioned above, and then taking a short online quiz about this topic at www.DTStudyClub.com, you will gain one ADA CERP-certified C.E. credit.

To learn more about how you can take advantage of this and many other C.E. opportunities, visit www.DTStudyClub.com. You need only register at the Dental Tribune Study Club website to access these C.E. materials free of charge. You may take the C.E. quiz after registering on the DT Study Club website.

I know that taking time away from your practice to pursue C.E. credits is costly in terms of lost revenue and time, and that is another reason roots is such a valuable publication. I hope you will enjoy this issue and that you will take advantage of the C.E. opportunity.

Finally, I would like to mention that with this publication, we are merging the North American and international editions of roots. Welcome to all readers, wherever you are from.

As always, I welcome your comments and feedback.

Sincerely,

Fred Weinstein, DMD, MRCD(C), FICD, FACD
Editor in Chief
C.E. article
06 From everyday dentistry to advanced photoacoustic endodontic applications (PIPS): Er:YAG & Nd:YAG dual wavelength laser
  _Lawrence Kotlow, DDS, Enrico DiVito, DDS & Giovanni Olivi, MD, DDS

education
12 Control the anatomy; control procedural training
  _L. Stephen Buchanan, DDS, FICD, FACD

industry education
16 LVI Core I three-day course is designed for doctors and their teams to learn together
  _Mark Duncan, DDS, FAGD, LVIF, DICOI, FICCMO

association news
17 Peter S. Weber is named executive director of AAE

industry
18 How much money are you wasting?
20 GentleWave: Multisonic Ultracleaning System

22 An industry-first solution from Planmeca: Imaging, CAD/CAM and dental units in one software
24 FKG revolutionizes endodontics with the BT-Race sequence for a biological and conservative treatment

about the publisher
26 imprint

on the cover
Root canal dentinal walls after PIPS laser treatment, shown under magnification. See article beginning on page 6.
TrueTooth®
Not models. Replicas of actual teeth.

“The real value in the TrueTooth Replicas is that our students can appreciate the complexity of the root canal system. We have the benefits of students working on replica teeth that we select, and everyone is working on the same tooth. It levels the playing field and takes away the infection control concerns. We can concentrate our energy on technique instead of tooth selection.”

Donald J. Kleier, D.M.D.
Professor and Chair,
Division of Endodontics, School of Dental Medicine, University of Colorado

Now available in accessed and shaped versions!

“Almost as Good as the Real Thing
Available exclusively through Dental Education Laboratories
Your Premier Resource for Endodontic Continuing Education

“TrueTooth Replicas brought anatomic realism to our preclinical endodontics course!”

Ronald R. Lemon, D.M.D
Coordinator of Predoctoral Endodontic Program and Associate Dean for Advanced Education
School of Dental Medicine, University of Nevada, Las Vegas

No more explaining to students how the anatomy is different than natural teeth. Get real, people.”

Division of Endodontics,
University of Minnesota, School of Dentistry

Replica #3-001
Replica #9-001
From everyday dentistry to advanced photoacoustic endodontic applications (PIPS): Er:YAG & Nd:YAG dual wavelength laser

Introduction

Lasers provide an exciting new technology that allows the dentist the ability to give patients optimal care without many of the “fear factors” found in conventional dental techniques. Used with proper understanding of laser physics, lasers are extremely safe and effective.

Using lasers for caries removal, perio treatment, endodontic treatment, bone management, cutting and shaping, and soft-tissue procedures can reduce postoperative discomfort and infection, and provide safe, simple in-office treatment. As a result, we can improve our efficiency, expand what we can do, achieve better results and increase production.

Lasers represent a real quantum leap forward in the treatment of our patients, including the pediatric patient. The U.S. Food and Drug Administration (FDA) gave approval for the use of the Er:YAG laser in 1997 for both hard- and soft-tissue procedures. The erbium doped (erbium particles placed within the YAG crystal) crystal of Yttrium-Aluminum-Garnet’s (Er:YAG) development and success has made the treatment of children safer and quicker.

Plainly stated, a laser is a piece of equipment that creates a concentrated monochromatic beam of visible or infrared light that can be absorbed by a specific target. Since then, laser-assisted dental care has changed forever the way dentists can prepare diseased teeth, ablate bone and treat soft-tissue abnormalities and disease. An entire new standard of care is becoming a reality.

Lasers and pediatric dentistry are a perfect fit. There are a wide range of hard and soft dental pro-
cedures that may be completed using lasers as an alternative to conventional dental care on adults and, especially, children. Many of these procedures may be treatments dentists historically refer out to other specialists; however, if you understand and use your laser efficiently, you will discover that many of these procedures that every dentist can easily complete.

The question that is often the major concern and barrier to investing in lasers is the how this investment will pay for itself, more recently described as return on investment (ROI). Will it pay for itself? We prefer to speak of this as the secondary effect. If you understand your laser, it will easily pay premiums on your investment, and the cost factor becomes a non-issue.

The purchasing of lasers is an investment, not an expense, for any dental practice.

Lasers represent a fundamental change in the entire way dentistry has been taught. We can now rethink and often modify G.V. Black’s principle of extension for prevention with the concept of minimally invasive micro-dentistry. We need to understand that laser dentistry is one portion of an entire new way of practicing conservative, pain-free dentistry.

The laser that we call the “all-purpose” laser is the Lightwalker Er:YAG & Nd:YAG laser, manufactured by Fotona and distributed in the United States by Technology4Medicine. The Er:YAG produces its effect at 2940 nm and has as its primary tissue target water and hydroxyapatite. It is very safe, relatively quiet; eliminates the smell and vibrations associated with the dental handpiece and, most importantly, is much more comfortable for the patient, significantly reducing the need for local anesthesia.

The use of the new generation erbium lasers for repair of incipient hard-tissue disease allows the dentist to provide a stress-free means of restoring teeth in a minimally invasive manner, most often with no shot and no numb lip, without the need for any local anesthetics.

The erbium laser can be used for restoring primary and permanent teeth, eliminating or reducing the amount of local anesthetics. In most cases, the patient will not require numbing for Class 1, 2 (sometimes), 3, 4, 5, 6 restorative procedures using bonded restorative materials. Using the concept of minimally invasive restorative procedures, the Er:YAG laser allows the operator to remove only diseased tissue and thus preserves much more of the healthy, unaffected tooth.

In cases where alloy is preferred, the laser’s analgesia effect may also allow the dentist to create a restorative preparation using a conventional handpiece that is not meant for bonding. The erbium laser is effective because of its effect on its target, water within the tooth structure. This effect occurs when the laser heats up water within the target tissue, causing it to create small microscopic explosions (photothermal followed by photoacoustical effects). When applied to soft tissue, bone or teeth and cavities, the explosions then cause the areas to be vaporized.

Er:YAG laser 2940 nm: Soft-tissue procedures

There is a wide array of soft-tissue procedures that can be completed using the all-purpose laser: maxillary and mandibular frenum revisions, lingual frenum revisions, treatment of pericoronal pain or infection, removal of hyperplastic tissue because of drugs or poor oral care in orthodontic patients, biopsies, treatment of aphthous ulcers and herpes labialis, pulpotomies, removal of impacted teeth and, in adults, apicoectomies and bone recontouring.

Pulpotomies

Parents often express concern about the need to take radiographs because of the nature of X-rays and their possible side effects on a child’s overall health. They question the use of alloys because of the chemical makeup of the alloy. Whether these should be a real concern in today’s dental care is open to debate, depending on your individual beliefs. There are also concerns by many, although not as loudly, about the effect of various pulpotomy procedure medicaments used in pulpotomy procedures, such as formocresol.

Lasers provide a safe, non-chemical, effective and alternative treatment for pulpotomies. During the span of eight years, post-treatment results on more than 4,000 pulpotomies using the erbium (2940 nm) laser provide ample evidence that this method is both effective and safe for children without the need for introducing chemicals or using electrosurgery methods.

When the final result of orthodontic positioning of the front teeth results in gingival hypertrophy, the laser can be a useful tool to increase crown length and give the patient a more esthetic smile. This may often be accomplished without the need for local anesthesia. Patients who have medically induced hyperplastic tissue, such as patients requiring dilantin, can also have their tissue reduced and reshaped with the erbium.

In addition to the many examples described in this article, lasers can be used for additional procedures not usually required in pediatric dentistry, such as revisions of the abnormal mandibular frenum, often avoiding the need for soft-tissue grafts, crown-lengthening procedures where bone requires recontouring, apicoectomies, removal of bony exostoses, removal of third molar impactions, removal of root remnants, incising and draining soft-tissue...
infections, advanced periodontal treatments and the latest in advanced endodontic treatment via photon-induced photoacoustic streaming.

**Photoacoustic endodontics using PIPS**

The goal of endodontic treatment is to obtain effective cleaning and decontamination of the smear layer, bacteria and their byproducts in the root canal system. Clinically, traditional endodontic techniques use mechanical instruments, as well as ultrasonic and chemical irrigation, in an attempt to shape, clean and completely decontaminate the endodontic system but still fall short of successfully removing all of the infective microorganisms and debris. This is because of the complex root canal anatomy and the inability for common irrigants to penetrate into the lateral canals and the apical ramifications. It seems, therefore, appropriate to search for new materials, techniques and technologies that can improve the cleaning and the decontamination of these anatomical areas.

Among the new technologies, the laser has been studied in endodontics since the early 1970s and has become more widely used since the ‘90s. Different wavelengths have been shown to be effective in significantly reducing the bacteria in the infected canals, and important studies have confirmed these results in vitro. Studies reported that near infrared laser are highly efficient in disinfecting the root canal surfaces and the dentinal walls (up to 750 microns for the diode 810 nm and up to 1 mm for the Nd:YAG 1064 nm). On the other hand, these wavelengths did not show effective results in debridging and cleansing the root canal surfaces and caused characteristic morphological alterations of the dentinal wall. The smear layer was only partially removed and the dentinal tubules primarily closed as a result of melting of the inorganic dentinal structures.

Other studies reported the ability of the medium infrared laser in debridging and cleaning root canal walls. The bacterial load reduction after erbium laser irradiation demonstrated high on the dentin surfaces but low in depth of penetration because of the high absorption of laser energy on the dentin surface. Also the laser activation of commonly used irrigants (LAI) resulted in statistically more effective removal of debris and smear layer in root canals compared with traditional techniques (CI) and ultrasound (PUI). Additionally, the laser activation method resulted in a strong modulation in reaction rate of NaOCl, significantly increasing production and consumption of available chlorine in comparison to ultrasound activation.

A recent study has reported how the use of an Er:YAG laser, equipped with a newly designed radial and stripped tip, in combination with 17 percent EDTA solution, using very low pulse duration (50 microseconds) and low energy (20 mJ) resulted in effective debris and smear layer removal with minimal or no thermal damage to the organic dentinal structure through a photoacoustic technique called photon induced photoacoustic streaming or “PIPS.” Also the same photoacoustic protocol in combination with 5.25 percent sodium hypochlorite solution has been investigated and shown to reduce the bacterial load and its associated biofilm in the root canal system three dimensionally.

Other similar studies are in progress for publication and the results are promising and suggest a three-dimensional positive effect of this laseractivated decontamination (LAD) method.

The purpose of this article is to present briefly the experimental background of this laser technique and to introduce the clinical protocol.

**Scientific background**

The microphotographic recording of the LAI studies suggested that the erbium lasers used in irrigant-filled root canals generate a streaming of fluids at high speed through a cavitation effect. The laser thermal effect generates the expansion implosion of the water molecules of the irrigant solution, generating a secondary cavitation effect on the intracanal fluids. To accomplish this streaming, it is suggested the fiber be placed in the middle third of the canal, 5 mm from the apex and stationary. This concept greatly simplifies the laser technique, without the need to reach the apex and to negotiate radicular curves.

Also, the recorded video of the new technique, PIPS, showed a strong agitation of the liquids inside the canals. It differs from the already cited LAI technique by activating the irrigant solutions in the endodontic system through a profound photoacoustic and photomechanical phenomena. The use of low energy (50 microsecond pulse, 20 mJ at 15 Hz, 0.3 W average power, or less) generates only a minimal thermal effect. The study with thermocouples applied to the radicular apical third revealed only 1.2 degrees C of thermal rise after 20 seconds and 1.5 degrees C after 40 seconds of continuous radiation.

When the erbium laser energy is delivered at only 50 microsecond pulse duration through a special designed tapered and stripped 400 microns tip (Fotona LightWalker, Technology4Medicine), it produces a large peak power of 400 watts when compared to a longer pulse duration. Each impulse, absorbed by the water molecules, creates a strong “shock wave” that leads to the formation of an effective streaming of fluids inside the canal while also limiting the undesirable thermal effects seen with other methodologies. The placement of the tip in the coronal portion only of the treated tooth allows for a more minimally enlarged
canal preparation with less thermal damage as seen with those techniques placed into the canal system.

The root canal surfaces irrigated with 17 percent EDTA and laser activated for 20 seconds showed exposed collagen matrix, opened tubules and the absence of smear layer and debris (Figs. 1-3). The rinsing with 5.25 percent sodium hypochlorite and laser irradiation for 20 seconds produced a strong activation of the solution, as reported by Macedo, improving the disinfecting action of the sodium hypochlorite. The disinfecting action of PIPS is very effective both on the root surface, the lateral canals and the dentinal tubules, as confirmed with SEM and confocal studies (Fig. 4).

The profound and distant effect of PIPS eliminates the need to introduce the tip into the root canal system. Unlike traditional laser techniques requiring placement of the tip 1 mm from the apex, or even 5 mm from the apex as proposed for LAI, the PIPS tip is placed in the coronal portion of the pulpal chamber only and left stationary, allowing the photoacoustic effect to spread into the openings of each canal. A new tip design consisting of a 400-micron diameter, 12 mm long, tapered end is used for this technique (Fig. 5). The final 3 mm of coating is stripped from the end to allow for greater lateral emission of energy compared to the frontal tip.

This mode of energy emission allows for improved lateral diffusion with low energy and enhanced photoacoustic effect.

**Discussion**

Laser irradiation is a common technique used in endodontics to improve the cleaning, the debriding and disinfection of the root canal system. Many wavelengths and protocols are used. Near infrared lasers are used for the three-dimensional decontamination of the endodontic system. Nd:YAG and diode lasers use thermal energy to destroy bacteria. Observations reveal a certain grade of thermal injury to the root canal surface and create a typical morphological damage. Moreover, they are not able to thoroughly remove the smear layer.

On the contrary, erbium lasers are used for their effective smear layer removal while their bactericidal activity is limited to the root surface. The placing of the tip close to the apex and its back movement during the activation process is related to the risk of apical perforation, ledging and surface thermal damage, because of the ablation ability of this wavelength. Also a combination of the near and medium infrared lasers has been proposed. A technique, called twin-light endodontic treatment (TET), uses the erbium laser energy first, to clean the root canal surface and remove the smear layer, and the Neodimium:YAG laser second, used in dry mode as the final disinfecting step. All these techniques utilize traditional tips and fibers placed into the canal, close to the apex (1 mm) with all the corresponding thermal disadvantages observed in long, narrow and curve canals.

The erbium lasers are also used as a medium of activation of commonly used irrigants (LAI), avoiding the risk of thermal damage, while increasing the cleaning and disinfecting activity of the fluids. PIPS, in particular, reduces all these risks and disadvantages, thanks to the position of the tip in the coronal orifice only and to the use of minimally ablative energy levels of 20 mJ or less.

The findings of our studies demonstrated that PIPS technique resulted in a safe and effective debriding and decontaminating of the root canal system. Our clinical trials showed that PIPS technique greatly simplifies root canal therapy while facilitating the search for the apical terminus, debriding and maintaining patency.
As a result of the efficacy of PIPS, the final size required for canal shaping can be significantly reduced, often to a size 25/04, allowing for a more minimally invasive and biomimetic preparation that can then be obturated three dimensionally.

**Conclusion**

Lasers are an extremely versatile addition to the dental practice and can be used in many instances instead of the conventional methods employed by the vast majority of dentists. Incorporating a laser in the dental practice should be viewed as an investment rather than a cost. When used with a good knowledge of laser physics, training and safety, lasers provide our patients a new standard of dental care.

**References**


**about the authors**

Lawrence Kotlow, DDS, has been in private dental practice in Albany, N.Y., since 1974. He is board certified in pediatric dentistry. He is a recognized standard proficiency course provider for the Academy of Laser Dentistry. Enrico DiVito, DDS, is an adjunct professor at the Arizona School of Dentistry and Oral Health. He is in private practice at the Arizona Center for Laser Dentistry in Scottsdale, Ariz., in conjunction with MDATG research group. Giovanni Olivi, MD, DDS, is a professor of endodontics at the University of Genoa School of Dentistry, where he is director for the Laser in Dentistry Master Course with Prof. S. Benedicenti. He is in private practice in Rome, Italy.
GOING NOWHERE FAST?

"I've gone from wanting to quit dentistry to a new and constant learning experience after 27 years of practice - WOW!!"
- Dr. Gary Seener, DDS | Edmonton AB

"Being right out of dental school and this being my first course with LVI, it was an absolute eye-opener. Great for both new and old dentists!"
- Dr. Neesal Patel, DDS | Darien, Illinois, IL

LET LVI SHOW YOU A MORE REWARDING & SATISFYING WAY TO PRACTICE

You will leave Core more excited about your profession or LVI will return your investment

888.584.3237 | LVIGlobal.com

ADA CERP®: Recognized Education Provider
LVI Global is a certified ADA CERP provider. ADA CERP is a service of the American Dental Association. TheSplitter

LVI Global
Control the anatomy; control procedural training

New teaching paradigms from 3-D printed procedural training replicas

Author L. Stephen Buchanan, DDS, FICD, FACD

We buy “New Tech” when we perceive that some part of our personal or professional lives could be managed more easily with this new tool. We bought billions of cordless and then wireless phones because we wanted to talk to anybody, any time, regardless of where we happened to be when the spirit moved us. And it was good. Beyond good was when Steve Jobs shoved computing power, endless content and the whole wide-world Internet through our mobile phones. Who knew?

That’s how I have experienced every one of my New Tech adventures. First, I use it to imitate what we did before — i.e., replacing slide carousels with computers — only later to find creative possibilities never imagined. In my example, it was discovering the power that clinical video footage can bring to lectures.

In that transition, my first concern was how to fill a 10-by-30-foot screen with a single video projector, without the three side-by-side stacks of slide projectors we used before. After worrying that one to death, I realized that the greatest storytellers on earth — Hollywood, Bollywood, etc. — pitched their $100 million stories on a single screen — so why did I need three? After that small epiphany, I concentrated my efforts on how to do what they do, and now I can do much of what these masters of the entertainment universe do, in ultra-high-def, with just a laptop computer.

So has been my experience with 3-D printed tooth replicas. I went into stereolithography looking for a simpler method of teaching endodontic procedures, a way around the grossness — they are discarded body parts, after all — as well as the unpredictable nature of teaching RCT in the random anatomic forms found inside the extracted teeth that course attendees gather. What I encountered was much more profound than just having a training model that didn’t smell.

After about six months of experimentation, numerous experiments in polymer chemistry and a seemingly endless series of plugged-up print heads, we learned how to make clear TrueTooth® replicas that were radio-opaque with a pulp-colored medium inside each canal space that can be digested with sodium hypochlorite. TrueTooth procedural training replicas were born (Fig. 1).
Here are the things I have learned about their use in the past year of teaching hands-on courses with them:

1) We can now, for the first time, teach RCT to dental students and dentists in an iterative manner, the same way astronauts are trained: by repetition.

Previously, in extracted teeth, a student faced with an anatomic endo challenge only got a single chance to get it right. No repeat attempt was possible because no other tooth would ever be found with the same challenge, so procedural endodontic training had always been a random walk through the endo anatomy of patients’ teeth. In the endodontic training era that just expired, it took about 250 to 500 RCT cases (me, too) before the frequency of getting surprised by a new anatomic challenge began to wane.

Now, students can launch themselves at the same anatomic challenge as many times as it takes for them to have it nailed. Attack the same 90-degree apical impediment in a DB root canal of an upper molar 15 to 20 times — with the same, exact challenge every time — and you will be the king of 90-degree apical canal curvatures thereafter. Attack the same apical impediment in the same DB root canal of a patient’s tooth 15 to 20 times — with the same, exact challenge every time — and you will be the king of 90-degree apical canal curvatures. In the endodontic training era that just expired, it took about 250 to 500 RCT cases (me, too) before the frequency of getting surprised by a new anatomic challenge began to wane.

Now, students can launch themselves at the same anatomic challenge as many times as it takes for them to have it nailed. Attack the same 90-degree apical impediment in a DB root canal of an upper molar 15 to 20 times — with the same, exact challenge every time — and you will be the king of 90-degree apical canal curvatures thereafter. Now, even orthodontists can learn to do a mean RCT. This is a serious game changer for endodontic educators.

2) TrueTooth replicas are very effective when used in clear and then opaque form to teach mental imaging skills.

I begin each of my hands-on courses with a mental imaging exercise in a clear TrueTooth replica of a maxillary central incisor that has an apical canal bifurcation. I teach course attendees how to accurately bend K-files to enter and traverse that accessory canal, and I have seen this particular use of these replicas shorten students’ timeline to competence as they watch all the idiosyncrasies of file function while working in an anatomically accurate canal space.

Students are able to see the bent file tip snapping past the accessory canal orifice at the same time they distinctly feel the attendant “click” of the file tip dropping into the secondary canal, and after a couple of tries, they become proficient in negotiating into accessory canals with visual and tactile feedback.

The next challenge is to remove the visual feedback loop by changing to an opaque TrueTooth replica, and invite the students to enter the same secondary canal anatomy by just feel instead of vision and feel. After conquering that challenge, they know how to correctly bend files and blindly sneak them into secondary anatomy using mental imaging to interpret the tactile feedback coming through the handle of the file.

After this exercise, it is a relatively short path to accomplishment of the same in a patient’s root canal system. Mental imaging is the most important skill a dentist can bring to bear during RCT. For the first time, we have a reproducible method of transferring this critical skillset. A game changer for sure.

3) While softer than extracted teeth, the heat-resistant polymer used to print TrueTooth replicas cuts crisply with high-speed handpieces — without gumming up burs.

At Dental Education Laboratories, we set the HS handpieces at one-third the typical RPM — giving the participant more authentic tactile resistance feedback.

‘This new technology can easily replace extracted teeth and unauthentic models in endodontic training.’
during access procedures. Also, while the TrueTooth replicas are more easily ledged than extracted teeth, I have found they are the equivalent of swinging two baseball bats on deck before going up to the plate against a pitcher.

If you can navigate these anatomically authentic replica canals without ledging any of the natural irregularities contained within, you are ready for prime time in real teeth, as you will have developed the requisite light touch all successful endodontists have. This is a more subtle advantage than those mentioned above but no less helpful to educators, nonetheless.

When students use training models with canals that resemble a soda straw, students gain no experience in ledge avoidance — a vital skill they desperately need as they move from pre-clinical lab to clinic and start invading their patients’ teeth. These replicas deliver anatomically accurate training in a way never previously possible.

4) Now, educators can develop a procedural training curriculum around a series of classic anatomic tooth forms that walk undergraduate dental students through the most common endodontic challenges they will encounter in practice, as well as more difficult cases that can lead graduate students through a range of anatomic challenges they could not meet in five years of practice.

Now, course objectives met by each student are easily documented, a necessity for accreditation review.

5) Replicas can be designed and printed for surgical training, complete with soft tissue that can be incised, reflected and sutured; hard and soft bone tissues, as well as roots and their canals — all printed together with no assembly required — are encountered exactly as they are in a surgical procedure (see “A new paradigm in surgical training,” roots, Issue 1, 2014).

6) Replicas can be created with multiple versions at the same level of difficulty to provide a diversity of experience for students, and still other versions for testing replicas that are only available to educators and examining boards. For procedural testing to be fair to students, educators and examiners, they are all served by authentic, reproducible 3-D printed replicas.

With our modeling engineers and our new multi-ink printer, our goal is to build replicas of quadrants and full arches with different TrueTooth replicas in every tooth position.

I’ve made the case that this new technology can easily replace extracted teeth and unauthentic models in endodontic training. Dental education just got better, but the home run of this new tool will inevitably bring educational applications never before imagined. Dental education will never be the same.

The Dental Education Laboratories website, DElendo.com, has a complete catalog of the 30-plus different TrueTooth replicas currently available; however, if you don’t see a TrueTooth replica that rings your chimes — whatever the need — let us know.

L. Stephen Buchanan, DDS, FICD, FACD, is a diplomate of the American Board of Endodontics and an assistant clinical professor at the postgraduate endodontic programs at USC and UCLA. He maintains a private practice limited to endodontics and implant surgery in Santa Barbara, Calif., and is the founder of Dental Education Laboratories, a hands-on training center serving general dentists and endodontists who want to upgrade their skills in new endodontic and implant technology. Dr. Buchanan can be reached through his business, Dental Education Laboratories, www.DElendo.com, info@endobuchanan.com.
ROOT CANALS
CLEAN
AT THE SPEED OF SOUND™

GentleWave™ ultracleans the *entire* root canal system. Quickly. Thoroughly. Comfortably.

GentleWave’s patented multisonic technology takes you where no file has gone...ever. For the first time, simultaneously ultraclean all canals within minutes—including isthmus, lateral canals, and tubules. Effective in the simplest procedure to the most complex, GentleWave lets you schedule your day with confidence. Imagine giving your patients a cleaner and more comfortable root canal therapy.
As a patient, I expect the best care I can find. As a doctor, I want to deliver the best care possible. That takes us to the power of continuing education, and as doctors we are faced with many choices in continuing education.

As a way to introduce you to the Las Vegas Institute for Advanced Dental Studies, or LVI, I want to outline what LVI is about and what void it fills in your practice. The alumni who have completed programs at LVI were given an independent survey, and unlike the typical surveys, 99.7 percent said they love practicing dentistry, and of those surveyed, 92 percent said they enjoy their profession more since they started their training at LVI. That alone is reason enough to go to LVI and find out more.

While the programs at LVI cover the full breadth of dentistry, the most powerful and life-changing program is generally reported as being Core I, or “Advanced Functional Dentistry — The Power of Physiologic-Based Occlusion.” This program is a three-day course that is designed for doctors and their teams to learn together about the power of getting their patients’ physiology on their side. In this program, doctors can learn how to start the process of taking control of their practice and start to enjoy the full benefits of owning their practice and providing high-quality dentistry.

Whether he or she works in a solo practice or in a group setting, every doctor can start the process of creating comprehensive care experiences for his or her patients.

We will discuss why some cases that doctors are asked by their patients to do are actually dangerous cases to restore cosmetically. We will discover the developmental science behind how unattractive smiles evolve and what cases may need the help of auxiliary health care professionals to get the patient feeling better. The impact of musculoskeletal signs and symptoms will be explored and how the supporting soft tissue is the most important diagnostic tool you have. Not simply the gingiva, but the entire soft-tissue support of the structures not just in the mouth but also in the rest of the body.

A successful restorative practice should not be built on insurance reimbursement schedules. An independent business should stand not on the whims and distractions of a fee schedule but rather on the ideal benefits of comprehensive care balanced by the patients’ needs and desires.

Dentistry is a challenging and thankless business, but it doesn’t have to be. Through complete and comprehensive diagnosis, there is an amazing world of thank-yous and hugs and tears that our patients bring to us, but only when we can change their lives. The Core I program at LVI is the first step on that journey.

That’s why when you call, we will answer the phone, “LVI, where lives are changing daily!”
Peter S. Weber is named executive director of AAE

Author: AAE staff

_The American Association of Endodontists’ Board of Directors has selected Peter S. Weber, MS, CAE, as its new executive director. Weber brings nearly 28 years of experience in professional association management to the table._

“After an extensive nationwide search, the AAE board is pleased to announce Peter as our new executive director,” said AAE President Dr. Robert S. Roda. “Peter brings a wealth of experience in association management and has demonstrated success in membership growth and satisfaction, support for professional development and public policy advocacy.”

Weber comes to the AAE from the Illinois State Veterinary Medical Association, where he served as executive director since 2003. Under his leadership, the association experienced 250 percent membership growth and 500 percent financial growth.

“[I] came here because I believe AAE has a very talented and hardworking staff and volunteer leaders committed to the organization’s mission,” Weber said. “My goal is to empower and motivate every person at AAE to do magnificent things with our united vision and combined work ethic. Our efforts will ultimately improve the endodontic profession. I am inspired by what [they] have already accomplished and strongly believe that, together, we will continue to make a tremendous difference.”

A certified association executive, Weber is an active volunteer in the American Society of Association Executives and the Illinois Society of Association Executives, and frequently lectures and writes about association management issues._

Peter S. Weber, MS, CAE, is the new executive director of the American Association of Endodontists. (Photo/Provided by AAE)
How much money are you wasting?

Author Dr. Barry H. Korzen

One definition of “waste” is to use, consume, spend or expend thoughtlessly or carelessly, but wasting money is incredibly easy. Especially in a dental office, where there is often hesitation in making any change, whether in technique or in manufacturers, especially when things are running smoothly.

One of the most common areas in dentistry where the high cost of supplies has been with us for so long that we have begun to accept this as the norm is endodontics.

When the manufacturers are questioned about the prices they are charging, the standard responses are, “The market for these goods is limited,” “The cost of researching new products is high,” “The cost of the raw materials continues to increase,” etc.

What they don’t tell you is that their primary expense is advertising, followed closely by the commission being paid to their salespeople.

And if you question one of the salespeople, it’s not uncommon for them to say, “Yes, our NiTi files are expensive. But they only cost $XX. And look at the fee you are getting for that root canal.”

Or if you question the very high prices being charged for MTA, they quote the number of treatments that can be made with the amount of powder their container holds, forgetting to mention that once opened the powder begins to absorb moisture from the air, making it more and more unusable as time goes on. So that in reality the number of uses from a container can be substantially less than what you have been told.

Warren Buffett has been quoted as saying the, “Price is what you pay. Value is what you get.”

We founded www.ZendoDirect.com to bring you value for every purchase that you make from us. And we did this by convincing manufacturers that you know and trust to offer you European-quality instruments and supplies at unbelievable prices.

We have created a line of products that I am personally proud to stand behind. For example, Micro Mega in Besancon, France, manufactures our entire NiTi product line.

It’s time to take Mr. Buffett’s advice and insist on value for the price you pay for your endodontic supplies.

You likely will be shocked at how much you are currently overpaying.

About the Author

A graduate of the University of Toronto Faculty of Dentistry and the Harvard University graduate endodontic program, Dr. Barry H. Korzen is the founder of The Endo Academy (www.TheEndoAcademy.com) and Zendo Direct (www.ZendoDirect.com). He was an associate professor, assistant dean and former head of the Discipline of Endodontics at the University of Toronto Faculty of Dentistry. Besides writing numerous papers, Korzen has spoken to dental societies and organizations around the world and has delivered lectures at more than 20 universities. He has received fellowships from the American College of Stomatologic Surgeons, the International College of Dentists and the Pierre Fauchard Academy. Korzen is a past president of both the Canadian Academy of Endodontics and the Ontario Society of Endodontists and has been a longstanding member of the American Association of Endodontists and the Alpha Omega International Dental Fraternity. He can be contacted at b.korzen@ZendoDirect.com.
Clinically Proven 2Seal easymiX Root Canal Sealer.
Same Great Sealer, Fresh New Look!

Now with Slim, 360° Flex Tip

Take the mess out of mixing
Convenient auto-mix syringe with 360° Flex Tip
✓ Automatic 1:1 mix ratio
✓ Mix tip creates less waste than manual mixing
✓ Dispenses only the small amount of sealer needed
✓ Consistently delivers controlled, precise mix
✓ Easy to use with slim adjustable 360° flex tip.
✓ Works with all obturation techniques; warm, cold and thermal.
✓ Can be applied directly into the root canal system, or on a traditional mix pad
✓ Precise application even in canals with difficult access
✓ Easy to use

SPECIAL LIMITED TIME OFFER!
Buy 1 box of 2Seal easymiX, get 5 packs of Flexicut Files.
Promocode RJX

- Working time: 4 hours
- Setting time: 8 hours
- Radiopacity: 13.6 mm/mm Al
- Flow: 36 mm
- Film thickness: 26 µm
- Shrinkage: 1.76%
- Solubility: 0.31%

Roydent Dental Products
roydent.com • 1.800.992.7767

Visit roydentlearning.com for immediate access to our multimedia training library where you can learn about new techniques and products.

Send your dealer invoice for redemption no later than February 15, 2015. Redemption Email: promo@Roydent.com or fax 888-769-1348. Attention: Coupon Coordinator. Please allow 4-6 weeks for delivery of free products. Please note size of Flexicut files desired. Available in the USA. Offer is available to all Roydent customers, including contract & Formulary.
Sonendo® has developed a system — called the GentleWave™ — that delivers broad-spectrum sonic energy through a disposable dental handpiece to the root canal system. This closed-loop, fluid-based Multisonic Ultracleaning System™ quickly, easily and safely loosens and removes all the pulp tissue, debris and bacteria from the entire root canal system.

The system employs advanced fluid dynamics and hydro acoustics to generate a wide spectrum of waves and deliver them via a liquid medium throughout the root canal system. Unlike ultrasound — where only one frequency of sound is applied — the GentleWave delivers multiple, various and specific wavelengths ranging from large (e.g., tissue scale) to small (e.g., cellular scale). These waves are distributed over a broad range of frequencies and remove unhealthy pulp tissue and bacteria safely, regardless of the complexity of the canal system.

Every aspect of the GentleWave is acutely focused on addressing the major challenges that continue to exist within root canal therapy, including: cleaning of the entire canal system fully, including the isthmus, lateral canals, etc., all the way to the apex; complete removal of the smear layer created during shaping; complete removal of tenacious biofilm; and deep penetration and removal of bacteria within the dentin tubules.

In short, the Multisonic Ultracleaning System greatly optimizes the treatment fluids being used (NaOCl, EDTA). This allows for rapid tissue dissolution and bacteria removal within the entire canal system, in only a few minutes.

The GentleWave System (Fig. 1) provides an exciting option for endodontic therapy. Presenting a slender and elegant profile, the console complements and enhances the modern dental practice as a statement to the patient that the practitioner is serious about integrating cutting-edge technology into the office.

**Simple steps**

After rubber dam placement and tooth preparation including access, all that remains is some minimal shaping before a closed-loop system is prepared that connects the Sonendo handpiece (Fig. 2) to the tooth being cleaned. Sonendo has proprietary aids and techniques available to rebuild the tooth and create a closed-loop system. Then within minutes, simultaneous cleaning of the entire canal system is achieved.

A self-guided menu takes the clinician through the steps needed to prepare the system prior to use. During the treatment, an on-screen display (Fig. 3) illustrates the progress of the treatment.

The GentleWave system is available in limited commercial release today. The device is FDA cleared. Located in Laguna Hills, Calif., Sonendo currently employs more than 80 engineering, marketing and research professionals. For more information, contact Sonendo at info@Sonendo.com.
How much money are you wasting?
Dare to compare. Save thousands by switching to Zendo.

<table>
<thead>
<tr>
<th>Cases per Week</th>
<th>Cost per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>$43,000</td>
</tr>
<tr>
<td>15</td>
<td>$32,000</td>
</tr>
<tr>
<td>10</td>
<td>$22,000</td>
</tr>
<tr>
<td>5</td>
<td>$11,000</td>
</tr>
</tbody>
</table>

Visit [StopWastingYourMoney.cash](http://StopWastingYourMoney.cash) to compare how much you are wasting on your current Endodontic supplies.

$29.95

Any Zendo NiTi endodontic file pack
Including the ZONE 2.0 – one single instrument to shape the canal. No need to change your current technique.

European Quality at Unbelievable prices.
To order, visit: [Zendodirect.com](http://Zendodirect.com)

---

Money wasted per year when buying from market leader compared to buying from Zendo

---

ZENDO
European Quality at Unbelievable prices.

Valid for licensed dental practices only. Must be a licensed dentist to purchase. Compared to market leader based on MSRP as of August 2014. All NiTi endodontic packages contain five (5) files. Visit www.zendodirect.com for full details on offers.
An industry-first solution from Planmeca: Imaging, CAD/CAM and dental units in one software

Author: Planmeca staff

Planmeca Romexis® is the first software in the world to combine 2-D and 3-D imaging, CAD/CAM work and dental unit information. This pioneering, all-in-one software solution brings together all the devices at a dental clinic, improving time and cost efficiency and enabling new kinds of data combinations.

Planmeca’s revolutionary Planmeca Romexis® software solution is a unique, all-in-one concept for dental clinics of all sizes. It offers a vast selection of features designed for the needs of different specialists. Besides supporting the most versatile range of 2-D and 3-D imaging modalities, the software integrates the entire chairside CAD/CAM workflow from intraoral scanning to prosthetic designing and milling. In addition, the Mac OS- and Windows-compatible software offers valuable, real-time information on dental and X-ray unit usage for clinic monitoring purposes. To complete the all-in-one user experience, the Planmeca iRomexis™ mobile application allows easy access to patient images from any location.

Thanks to the unique integration of imaging and CAD/CAM, all patient images, ranging from intraoral scans to CBCT images, are stored in one centralized database and are conveniently available through the same user interface. This enables new kinds of 3-D data combinations for different diagnostic and treatment planning needs.

In Planmeca Romexis, intraoral scans acquired with Planmeca PlanScan® — the world’s first dental unit integrated intraoral scanner — can be combined with CBCT images acquired with Planmeca ProMax® 3-D imaging units. The combination of CBCT and STL data provides an artifact-free model of the patient’s dentition, including crowns, soft tissue and bone. This virtual 3-D patient provides valuable information, for example, for implant planning and other diagnostic needs.

For a completely digital chairside CAD/CAM workflow, the dentist can design restorations with the Planmeca PlanCAD® Easy design software, which is also part of Planmeca Romexis. The software can be used to design crowns, inlays, onlays, veneers and small bridges. The completed design can then be sent to the Planmeca PlanMill® 40 milling unit for quick and accurate chairside milling. Alternatively, the open STL data produced by Planmeca PlanScan can be sent to a lab digitally through Planmeca Romexis Cloud, a secure image transfer service for Planmeca Romexis users and their partners.

“Thanks to Planmeca’s completely open CAD/CAM system and all-in-one software, the transfer of patient information, 2-D X-rays, CBCT images and digital impressions between a clinic and a dental lab has never been so easy,” says Helianna Puhlin-Nurminen, vice president of the Digital Imaging and Applications division of Planmeca. “The unique combination of CBCT and CAD/CAM can also be used for other diagnostic purposes besides planning restorative treatments and implant cases. For example, the digital model replaces traditional gypsum models and can be used for orthodontic treatment planning and analysis and for designing custom orthodontic appliances.”
Invest into Dental Equities - and you will get great return on your capital, PLUS a “green card” in the USA for you and your family, and a US Citizenship thereafter - through the US Government’s EB-5 immigrant visa program.

Minimum investment required with Dental Equities in order to obtain a “green card” through investment is $1,100,000. There is no upper limit for the amount of investment.

There is a limited number of EB-5 immigrant visas (“green cards”) available every year, and they run out fast.

Do not delay - invest with Dental Equities at least $1,100,000, and receive your “green card” first, and US citizenship 5 years later.

Customized by, of and for Dental Healthcare Professionals

Contact Dental Equities Today

Phone: +(949) 732-0033 | Website: www.DrEb5.com | Email: Info@DentalEquities.com
FKG Dentaire SA of La Chaux-de-Fonds, Switzerland, is putting its expertise to work on behalf of dentists and endodontists. To ease clinicians’ work and to improve patient comfort, FKG is bringing the BT-Race range to market. BT-Race is a sterile, single-use, high-performance sequence, enabling the treatment of most canals with just three instruments — and ensuring a finish of ISO 35/0.04 in complete harmony with established biological concepts.

Endodontic treatments require absolutely unfailing hygiene. Up until now, the practitioner has had to clean and sterilize every instrument at each use — to say nothing of the need to store them between treatments.

FKG Dentaire’s new instruments are packed in a clean-room environment, sterilized with X-rays, delivered in scored packaging — and offer considerable gains in time as they eliminate the need for handling and sterilization, as well as the associated costs. Single-use means that patient cross-contamination is avoided and stress on instruments (both cyclical fatigue and torsion) is reduced, bringing down the risk of breakage.

According to Thierry Rouiller, CEO of the La Chaux-de-Fonds firm: “FKG has developed files with a tip that has several exclusive technical advantages. For example, the BT tip comes with six cutting edges, instead of three, enabling work with a shorter sequence while avoiding micro-cracks. The Booster Tip enables the instrument to start cutting at an ISO diameter far smaller than that of the instrument.”

“Another innovation,” Rouiller added, “is that the sequence contains an instrument with no taper. Despite its diameter, this file is extremely flexible, which enables preparation of the apex to ISO 35 in complete safety while ensuring a minimal weakening of the tooth. It also offers an excellent quality of cut thanks to its BT tip.”

For finishes larger than 35/0.04, FKG Dentaire’s BT40 and the BT50 are available in sterile and single use. They use the BT tip to work to finishes of ISO 40/0.04 and ISO 50/0.04.

Technical highlights are as follows:

• Sterile and single-use.
• The BT’s revolutionary shape, with six cutting edges, cuts to an ISO diameter smaller than the instrument.
• No screw-in effect.
• Increased resistance to torsion and cyclic fatigue, thanks to the electrochemical polishing.
• Sharp cutting edges for an optimal cutting efficiency.
• BT-Race sequence for an ISO 35/0.04 finish; further instruments available for a 40/0.04 and 50/0.04 finish.
• Available lengths: 21, 25 and 31 mm.

The FKG team is happy to answer any questions you may have. For more information, contact the company at FKG Dentaire SA, Crêt-du-Locle 4, 2304 La Chaux-de-Fonds, Switzerland, +4 (132) 924-2244, info@fkg.ch, www.fkg.ch.
Planmeca ProMax® 3D
Endodontic imaging mode – a new era in precision

- Extremely high resolution with 75 μm voxel size
- Noise-free images with intelligent Planmeca AINO™ filter
- Artefact-free images with efficient Planmeca ARA™ algorithm

Perfect visualisation of the finest details

Other unique features in Planmeca ProMax® 3D family units:

Ultra low dose imaging
CBCT imaging with an even lower patient dose than panoramic imaging.
Adult female, 40V 0200 x 170mm
Effective dose 0.3 mSv
Planmeca ProMax® 3D Mdx

Create your virtual patient
A world first: One imaging unit, three types of 3D data. All in one software.
CBCT + 3D model scan + 3D face photo

Find more info and your local dealer
www.planmeca.com
roots
the international C.E. magazine of endodontics

U.S. Headquarters
Tribune America
116 West 23rd Street, Ste. 500
New York, NY 10011
Tel.: (212) 244-7181
Fax: (212) 244-7185
feedback@dental-tribune.com
www.dental-tribune.com

Publisher
Torsten R. Oemus
t.oemus@dental-tribune.com

President/Chief Executive Officer
Eric Seid
e.seid@dental-tribune.com

Group Editor
Kristine Colker
k.colker@dental-tribune.com

Roots Managing Editor
Fred Michmershuizen
f.michmershuizen@dental-tribune.com

Managing Editor
Sierra Rendon
s.rendon@dental-tribune.com

Managing Editor
Robert Selleck
r.selleck@dental-tribune.com

Education Director
Christiane Ferret
c.ferret@dtstudyclub.com

Marketing Director
Anna Kataoka
a.kataoka@dental-tribune.com

Product/Account Manager
Humberto Estrada
h.estrada@dental-tribune.com

Product/Account Manager
Will Kenyon
w.kenyon@dental-tribune.com

Feedback & General Inquiries
feedback@dental-tribune.com

Tribune America is the official media partner of:

roots_Copyright Regulations

roots is the international C.E. magazine of roots published by Tribune America is printed quarterly. The magazine’s articles and illustrations are protected by copyright. Reprints of any kind, including digital mediums, without the prior consent of the publisher is inadmissible and liable to prosecution. This also applies to duplicate copies, translations, microfilms and storage and processing in electronic systems. Reproductions, including excerpts, may only be made with the permission of the publisher.

All submissions to the editorial department are understood to be the original work of the author, meaning that he or she is the sole copyright holder and no other individual(s) or publisher(s) holds the copyright to the material. The editorial department reserves the right to review all editorial submissions for factual errors and to make amendments if necessary.

Tribune America does not accept the submission of unsolicited books and manuscripts in printed or electronic form and such items will be disposed of unread should they be received.

Tribune America strives to maintain the utmost accuracy in its clinical articles. If you find a factual error or content that requires clarification, please contact Group Editor Kristine Colker at k.colker@dental-tribune.com. Opinions expressed by authors are their own and may not reflect those of Tribune America and its employees.

Tribune America cannot assume responsibility for the validity of product claims or for typographical errors. The publisher also does not assume responsibility for product names or statements made by advertisers.

The responsibility for advertisements and other specially labeled items shall not be borne by the editorial department. Likewise, no responsibility shall be assumed for information published about associations, companies and commercial markets. All cases of consequential liability arising from inaccurate or faulty representation are excluded. General terms and conditions apply, and the legal venue is New York, New York.
Discover the many options of American Eagle Instruments Inc

Quik-Tip™ Cone Sockets
- Significant cost savings
- Cone socket system allows for easy replacement when tip becomes dull
- Eight handle colors to choose from - completely customizable
- Available in Talon Tough™ stainless steel and SHARPEN-FREE XP Technology

XP® Composite Instruments
- No sticking or pull back
- Faster procedures
- Superior defect-free surface
- Exclusive series including Dr. Ron Jackson series and Dr. Mark Colonna series (highly rated in CR Clinical Trials Volume 4 Issue 3, July 2011, Page 6)

Close up magnification* tells the story. Compare how XP stacks up to other composite instruments.
- HU Frieby 65% rougher
- PDT 343% rougher

XP® Technology
- The world's only SHARPEN-FREE instruments.
- Require no sharpening for the useful lifetime of the blade.
- Patented surface-engineered process that enhances the instrument's surface.

SHOW SPECIAL
During Greater New York Dental Meeting, buy 12 instruments and get 3 FREE (excluding surgical and cassettes), including XP Technology! Offer valid from 11/24/14-12/14/14.

American Eagle Instruments Inc
1-800-551-5172
Booth: 1700

*All magnification is at 6x9ox
CALASEPT® Endo-line

NEW

CALASEPT® Irrigation needles
Double side vent

CALASEPT Irrigation Needles
* Double side vented
* With luer lock hub
* Bendable
* High quality stainless steel
* Sterile and disposable
* Easy for cleaning out the canals
* Container packed

CALASEPT® Plus
Calcium Hydroxide
NEW

CALASEPT PLUS
* More than 41% calcium hydroxide
* Optimal calcium release
* Strong bactericidal effect pH 12.4
* Flexi-needle for precise and deep application

Call Wykle Research for a Free sample of our Calapsept products 800-859-6641

Made by:
Nordiska Dental

Distributed by:
WYKLE RESEARCH, INC.
2222 College Terrace
Carson CIn., NY 10566
Tel. 860.855.6641
Fax. 818.330.9088
www.wykleresearch.com