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Have we gone too far with rating our health care providers?

Each of us occasionally has a ‘bad’ day, sometimes it happens that a dentist appointment (or other health care provider) falls exactly that day! Usually you are annoyed and even dissatisfied before you even arrive, not mentioning the very bitter end.

After the appointment you are so filled with negative emotion about this event that you decide to share this horrible experience with the world at large.

You have spewed your revenge over the RateMDs page and felt a moment of relief. Now others who have any common sense and do their homework will know better than to go to Dr X. And that is where the problem starts. Is this rating fair? Does your commentary reflect what truly happened? Was it really a bad experience, worthy of letting others know?

The issue is that there is no rebuttal mechanism. So while common criminals have the luxury of being presumed innocent before being proven guilty, health care providers are sentenced with an inappropriate rating, not even knowing who may have levied the charges against them in the first place.

One might argue that a single negative rating is rather meaningless. If the health care provider is truly stellar at what he or she does, then the weight of the evidence will pull in the individual’s favour and the one or two negative statements should bear no impact on the individual, right? Wrong. Even if one single patient decides to look elsewhere because of a ‘faux review’, then both patient and health care provider suffer.

The age of the internet has brought a level of disrespect to the way we deal with people and people’s issues. Virtually everyone knows someone who is far more aggressive on e-mail then they are in person. Add to that, a system designed to provide anonymity such that anyone can say anything about anyone without consequence.

That all said, I do not mean to purport that there are not legitimate concerns or complaints, but how is one to decipher which ones are worthy of reading and which ones are not if the writer is unknown, and also if the supposed perpetrator of ‘bad service’ does not have an opportunity to respond?

How about a message sent to the health care provider directly from the individual? If the health care provider is worth anything at all, he or she would want to know and perhaps rectify the situation. If they do not know about it, they cannot do anything about it. If someone is unwilling to voice a concern directly, chances are they are not as confident about their position as they appear to be in an anonymous forum.

Perhaps the system Uber has developed should be adopted by the health care world. While I get to rate each driver as I experience a ride, that same driver is rating me as a passenger. The fact that there is mutual evaluation perhaps leads to better mutual respect.

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Rediscovering operative dentistry

Author: Aws Alani, UK

The first thing to come to mind among the majority of the public when dentistry is mentioned is the delivery of fillings or the need for crowns, the management of the bite or the improvement of colour or shape of teeth. This is our core business and is the basis upon which the public is likely to measure the skill of the clinician. Indeed, many a dentist may cower behind the X-ray machine if he or she overhears a patient complaining in the waiting room that “the filling fell out an hour later”. Nothing humbles us more than this sort of dissatisfaction.

Operative dentistry appears to be a lost art among a contract that does not reward and more lucrative cosmetic sidelines outside of dentistry. Indeed, fillings or crowns or methods of achieving maximal benefit from minimal intervention are not marketed as “sexy” in the same way as Botox or aligners are. Despite what the dental spin-doctors want one to believe, restoring teeth optimally and properly will forever remain our utmost and required skill set. Conserving tooth tissue and protecting the pulp or preserving remaining tooth tissue after root canal treatment is invaluable where implants are less successful than we thought and veneers are more invasive than we would ideally like to provide.

Selling health as opposed to selling a product is the successful business model shared across all professions. Indeed, the value of health is priceless for a patient. The minimally invasive movement is rife in more acute and life-threatening situations than dentistry ever was and could be in the future. How many of us would truly prefer open-heart surgery...
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“Ask yourselves what your patients would choose if they understood the difference between destroying tooth tissue and conserving it and the associated biological costs.”

through the slow splitting expansion of a ribcage, like a cooking oyster, as opposed to a stent fed through the femoral vein with the wound the size of a plaster? Destructive dentistry sells because there are those among us who prefer to let our technical (or more talented?) colleagues do the creative work while they vaporise teeth to oblivion.

Like many paradoxical things in life, ignorance is bliss. Ask yourselves what your patients would choose if they understood the difference between destroying tooth tissue and conserving it and the associated biological costs. They would gladly pay more for a procedure that will guarantee less pain and likely prolong the longevity of the tooth as opposed to the restoration. We have to be wary of the root canal treatment crisis at the current time. Secondary care units are oversubscribed with referrals, and primary care is remunerated poorly for a procedure that is cost- and technique-prohibitive, but essential. Saving teeth and preventing pulp necrosis is where the profession should be, but not necessarily can be, in the current climate.

In addition to the threat of bacteria, patients are overworking their muscles and destroying their teeth in the process. Parafunction is rife. From the stressed to the hypomobile, temporomandibular dysfunction is highly prevalent. Indeed, the Brexit caused me some bruxing recently. Owing to the intricacies of the joint, patients can present with a multitude of symptoms and its association with mental well-being means there is a high possibility of psychosocial factors to boot. As such, diagnosis is one conundrum, but treatment options can vary, depending on whom the patient sees and the skill set at the clinician’s disposal.

From advice and exercises to arthroscopic procedures, the spectrum is wide and vacuous. Personally, I have found the tried-and-tested stabilisation splint (otherwise known as Michigan splint) a sensible option when advice on changing lifestyle and self-administered physiotherapy fails. Those patients who have succeeded at abating their symptoms with these devices cannot live without and swear by them. Once again, the minimally invasive prevails over the “occlusionists” (illusionists?) who aim for the perfect patient occlusion among the potentially most imperfect of mindsets. Take heed and beware of the patient who wants his or her bite fixed so that the jaw does not click.

Patients want to retain their teeth however heavily restored. Root canal treated or not, we are all wired to crown teeth to protect remaining tooth tissue. Against a background of widespread parafunction and ever-increasing cracking teeth, the need for crowns is higher than ever. Preparation of a tooth for a crown takes a great deal of skill and awareness of trajectories and angles while providing a preparation that is retentive to achieve a final shape that is conservative of tooth tissue. Those core skills of cutting are important and need not be abused.

Capturing the preparation in its entirety with the aim of providing technical colleagues with enough physical and written information to deliver an optimal restoration is fairly challenging too. Alas, the best crown preparation is only as good as the crown cemented to it. In a number of cases, many a dentist’s head has been scratched when the crown fits the model perfectly, yet looks alien to the patient’s mouth. Understanding why things have gone wrong is of as much importance in operative dentistry as knowing how to do things correctly.

When teeth are lost despite our best efforts, tooth replacement can seem a straight choice between an implant and a denture, as any conventional bridge-work will needlessly destroy the abutments. I still feel conventional bridgework has its place in operative dentistry, but it has been eclipsed by the emergence of resin-bonded bridges. These restorations
have had a mixed reception historically, but I can now say that they are the most predictable method of replacing a single tooth. Good longevity without any tooth preparation whatsoever is money for old rope and any solicitor sniffing is tempered by the lack of any harm to teeth or the patient. The recipe as always is being aware of the indications and sticking to the rules.

As we become progressively engrossed in the digital age, patients are increasingly requesting aesthetic improvements. That bad, bad word (starts with a ‘v’) can still be advocated, but there are easier, kinder and more predictable techniques we can provide for our patients. Whitening and bonding may not always have the same gloss finish as veneers (sorry!), but in the majority of cases, patients are entirely satisfied with a well-planned and executed case. Where residual spacing is closed, the colour is improved and the incisal edges are uniform and straight, the flaws are difficult to find.

The kudos attached to operative dentistry will slowly experience a rebirth as the undoubted need for these skills rises among our patients. One would hope the powers that be have the foresight to realise that an optimally restored and cared for tooth actually prevents the future need and cost for a crown, molar root canal treatment, molar root canal re-treatment, apicectomy, a complicated surgical extraction or a prosthesis._

Editorial note: Aws Alani is leading a two-year postgraduate diploma in operative dentistry at King’s College London Dental Institute www.restorativedentistry.org. More information is available online at www.kcl.ac.uk/study/postgraduate/taught-courses/operative-dentistry-pg-dip.aspx.

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Aws Alani is a Consultant in Restorative Dentistry at Kings College Hospital in London, UK, and a lead clinician for the management of congenital abnormalities. He can be contacted at awsalani@hotmail.com.

www.restorativedentistry.org
With his high-definition photography of complex root canal systems, Dr Craig Barrington, who practices dentistry in Waxahachie, Texas, is developing quite a name for himself. Just check out his presence on Facebook, at craigbarringtondds. In an interview with DTI, Barrington talks about how he captures these high-definition endodontic images and how he uses them to increase his knowledge and help improve the level of care he provides to his patients.

DTI: Please tell our readers a little bit about yourself and your dental practice.

Dr Craig Barrington: I graduated Summa Cum Laude from the University of Texas Health Science Center in San Antonio in 1996. I am a general dentist in Waxahachie, Texas. I have been in my current location for 20 years.

What do you like best about practicing dentistry?

I most enjoy the science, the biology and having a front-row seat in and around the ability to interact with, affect and watch the human body function and heal. I appreciate the ability to solve problems and the ability to work on problems that are yet to be solved. I like being a part of a “past, present and future” continuum that is the overall profession of dentistry. I enjoy having the ability to affect an individual person, from patient to fellow practitioner to dental student, all the way up to having the ability to have a positive effect on humanity across the globe.

Who influenced you most in your career?

First, I would thank Dr Joel B. Alexander. He was an endodontic professor when I was in dental school who encouraged and taught the value of recalling your cases in order to assess your treatment outcomes.
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Deepak Mehta
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Lecturer & Consultant

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Secondly, I would thank Dr Terry Pannkuk. After much awareness, pursuit of and concentration on the topic of mentorship, I certainly believe he is the best doctor alive today. He has done much for our profession from a philosophical standpoint to the actualities of clinical healthcare. He sees the value in this tooth clearing and diaphonization project I am involved in and consistently has provided more support and encouragement than anyone else. He has kept me motivated even if it is just by simply saying “wow, that result is amazing”. I can’t say enough about what he has done for me personally or in my career as my friend and mentor. I continue to learn from him daily and I hope that somewhere along the way, I reciprocate some of the support he has given me over the years.

The tooth on the cover put me in awe. This was the first “cleared tooth” I had ever seen. It is from there that my interest in clearing teeth originated. I just had to figure out what was going on and how and why it worked. Fifteen years later, I am still manipulating processes in the diaphonization of human teeth in search of the “answers”. I have a patent pending in the clearing process, and the knowledge it has provided has become one of the most valuable tools in pre-operative and post-operative evaluation of the internal anatomy of human teeth.

“The photography is actually not difficult. It is oil immersion oblique illumination light microscopy, which has been done in histology labs for years.”

You have become known for your high-definition photography of the root canal anatomy. How did you become interested in this area?

That too goes back to Dr Alexander and Dr Pannkuk. Both of these doctors influenced me to recall my work in endodontics and truly take a scientific approach to the question of whether endodontics actually works and whether it actually works in my hands. After recalling many of my own cases, I started to see failures and problems that I was not satisfied with. I started to postoperatively evaluate my work and found that there were clinical aspects I could change to improve my outcomes. It was via the internet that I met Dr Arnaldo Casteallucci. After the interactions we had, I saw the cover of his textbook.

Can you tell our readers a little bit about how you go about capturing these images? It must take some technical skill.

The photography is actually not difficult. It is oil immersion oblique illumination light microscopy, which has been done in histology labs for years. It is, however, a new realization in this area for dentistry. In dentistry, we are familiar with the study of microscopic histologic sections. Teeth, on the other hand, are gross histologic specimens that can understandably be seen via the naked eye; however, viewing of the internal anatomic structures is greatly
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enhanced with microscopic evaluation. Any photographs of the teeth I work with are simply obtained through my “artistic” arrangement of the specimen in either a visually interesting position or in what I would consider an educational interpretation that I think would most benefit the viewer of the photograph.

What have you learned most by taking these root canal photographs?
As Napoleon Hill said: “Whatever your mind can conceive and believe, it can achieve.”

Where I sit today in my understanding of tooth clearing and diaphonization, I at first thought was never possible. It started as a simple question, then the development and realization of a goal. The process has been consistently evolving and delivering information and results ever since.

Today, I see characteristics of the internal anatomy of human teeth that I never thought possible or knew existed. Visualizing the immense variability of human tooth anatomy has changed my clinical practices and improved my clinical results, which benefits the patients I treat.

Do you perform endodontic therapy yourself or do you typically refer cases out?
I do all of my own endodontic treatments in my office. It has taken me years to identify the area of dentistry that I love. Perhaps one day I will take the necessary steps to specialize, but life is currently focused on my family and my children.

Is there anything you would like to see changed about the way dentistry is practiced today?
Absolutely! More than you can imagine or can be covered in this session. In short, we need to work on our ethical standards within the profession itself and move back toward being true, real doctors over the business-focused patient treatment we are seeing overwhelm the practice environment today. The actual care of the patient is always in competition with and in direct contrast to the business and profit. We have to get back to patient-centered practices. The profits are there in mass quantities if we can just take the time to follow our rolls as doctors.”

“We have to get back to patient-centered practices. The profits are there in mass quantities if we can just take the time to follow our rolls as doctors.”

Dr Craig Barrington receives his DDS from the University of Texas Health Science Center San Antonio in 1996 and is a member of Omicron Kappa Upsilon. He is also an associate member of the American Academy of Endodontists. He maintains a practice in Waxahachie, Texas. He has written various articles and publications on the dental operating microscope in general dentistry. For comments, questions or presentation requests, please contact Barrington at cbdds002@yahoo.com.

contact

Dr Craig Barrington uses oil immersion oblique illumination light microscopy to capture high-resolution images of root canal anatomy.

All images provided by Dr Craig Barrington.
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Safe way through risky curves

Author: Dr Rafaël Michiels, Belgium

Introduction

Endodontic management of extreme curved canals sometimes means a great challenge, even for an experienced specialist. In the treatment of such canals, innovative endodontic tools are helpful for achieving true success. The following case report shows how the flexible modular HyFlex CM file system helps to find a safe way through risky curves in root canal preparation.

Case report

Unfortunately, not all root canals are straight. Endo experts regularly encounter unusual curved anatomies with hidden accessory canals or horizontal branches. These curves cause a myriad of problems, including the significant higher risk of an iatrogenic event due to ledging, transportation, perforation of a canal or file separation. Thus, the preparation of such extremely curved canals to achieve both proper shaping and thorough cleaning is a great challenge. The following case illustrates how modular nickel-titanium (NiTi) file systems help specialists to achieve a safe and precise canal preparation, even in complex root anatomies.

Diagnosis

A 28-year-old male patient was referred with pulpitic pain in the upper right mandible. Tooth 15 was previously opened by the referring dentist due to acute pulpitis and the canal was filled with calcium hydroxide at the emergency visit. A diagnostic radiograph, which is essential in determining the treatment strategy, was taken to visualise the anatomy of the roots. The radiograph showed a double curved root morphology, which made endodontic treatment not just difficult, but a real master challenge (Fig. 1).
Double curve management

After applying a dental dam with a Hygenic Fiesta clamp 2 (COLTENE), the first step was to remove the temporary filling and decay. The pulp floor was checked for perforations and all orifices were located. The canals were then scouted, patency was regained and a manual glide path was established in all root canals with the help of small hand files (ISO 06, 08, 10) (Fig. 2).

Actual preparation of the canal was performed using a modular designed NiTi file system by Swiss dental specialist COLTENE. It offers a special modular system called HyFlex CM: in close cooperation with leading universities and international endodontic specialists, the renowned research department of the company developed an extremely versatile concept which meets the various demands encountered in practice. In particular, the HyFlex CM facilitates preparation with rotary instruments for challenging root canal treatments. Thanks to a clever combination of unique material properties, the pre-bendable HyFlex CM files are virtually unbreakable. The reason for this phenomenon is simple: the well-known ‘Controlled Memory’ (CM) effect is flexible enough to find its way around the distorted canals. It improves certain physical qualities of the alloy itself. Similar to classical stainless-steel files, the instruments can be pre-bent, but they do not bounce back like conventional NiTi files (Fig. 3).

This typical characteristic makes CM-treated NiTi files extremely flexible. The file adapts perfectly to prevailing canal anatomies, which considerably reduces the risk of perforation. In addition, the instrument moves perfectly in the centre of the canal. This effectively prevents a shift in course or via falsa. The result is perfect cleaning and preparation of the root canal for subsequent obturation. For this reason, the versatile files are ideally suitable and helpful for the preparation of extreme root anatomies or—in this case—for moving around a double curve.

After use, CM-treated NiTi files can be quickly regenerated by autoclaving and are ready for their next application until they reach the end of their life cycle where they clearly display an uneven, bent shape (Fig 4). The refined NiTi files are very resistant to cyclic fatigue and can be reused safely, as long as they are not unwound.

Single length technique

Endo specialists like us are regularly confronted with challenging root canal treatments. By reliably keeping their pre-bent shape HyFlex CM files enable relatively stress-free work even under difficult conditions—particularly with difficulties to initially get to length, without straightening the canal too much. In the present case the pre-bended HyFlex CM files were inserted already past the first curvature. The following file sequence was used up to the working length in a soft pecking motion: HyFlex CM 25/.08 (only in the coronal part), 20/.04 and 25/.04 (Fig. 5).

This single length technique allows a homogenous and ledge-free preparation of the root canal, particularly in curved canals. Through the application of the pre-bendable files root canals can be shaped safely and comfortably with a comparatively small number of files without making any concessions to the natural anatomy of a given root canal.

To ensure proper cleaning of the canal, a classic irrigation protocol with sodium hypochlorite 5.25%, citric acid 40% and manual dynamic irrigation (cone pumping) was used during canal preparation. Corresponding paper points were inserted to dry the canals afterwards (Fig. 6), followed by an obturation

![Fig. 4: File regeneration by heat treatment (left to right): new file, NiTi file after use, reusable file after autoclaving, uneven shaped files should be discarded.](image-url)
Conclusion

Rotary Controlled Memory NiTi files are essential for the successful treatment of root canal anatomies that have an unusually abrupt curvature. Flexible files like the Hyflex CM can be pre-bent, which helps dentists to operate both confidently and safely, even under challenging conditions. Depending on the clinical situation, endo specialists can choose from a selection of highly flexible and extremely fracture resistant files to ensure accurate centred shaping of the canal without the risk of creating steps. Thanks to their ‘safety through flexibility’ quality, NiTi CM files circle safely around every curve and reach reliably their home—or rather the root apex._

Dr. Rafaël Michiels

graduated from the Department of Dentistry at Ghent University, Belgium, in 2006. In 2009, he completed the three-year postgraduate programme in Endodontics at the University of Ghent. In 2013, he started his own referral practice for endodontics in Hasselt (Belgium). Rafaël is a member of the BAET (Belgian Association for Endodontics and Traumatology), NVE (Dutch Association of Endodontics) and Certified Member of the ESE (The European Society of Endodontology). He gives lectures at home and abroad and has written several articles on endodontic topics.
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Why endodontics?

Bacterial infections of the root canal system are one of the main causes of apical periodontitis. The infection usually enters through the dentinal tubules. Carious lesions, leaky fillings, leaky dental implants, hairlines, traumas, or erosion may be the cause of canal system infections. For the primary and for the secondary infection as well, an intra-radicular mixed bacterial flora was proven. The median bacterial count for the primary infection was $4.6 \times 10^7$ colony forming units (CFU) per apex. For persistent infections, $5.4 \times 10^4$ CFU per apex were determined. Bacteria may enter very deeply into the dentinal tubules and ramifications of the root canal system. Colonies of *E. faecalis*, for example, can be found up to 500 µm away from the main canal (Fig. 1). The bacteria within the infected canal system appear either in plankton form, i.e. swimming in tissue fluid, or relatively "organised" in the so-called "biofilm". This is a conglomerate of various bacterial species, which organise themselves in an extra-polysaccharide matrix that adheres tightly to the canal walls and the dentinal tubules (Fig. 2). The almost symbiotic interrelations among the bacteria within the biofilm results in a much higher resistance of the individual bacterial species against antimicrobial agents. In advanced stages of apical periodontitis, you can therefore always refer to an infectious disease triggered by biofilm. With regard to the preferably complete removal of bacteria from the canal system and the dentinal tubules, the increased resistance of the bacteria embedded in biofilm, together with the extremely strong adhesion due to the extra-polysaccharide matrix, is one of the essential problems in endodontic treatment. In summary, bacteria are the main cause of apical periodontitis. The purpose of any endodontic therapy must therefore be the extensive eradication of microorganisms, infected tissue residues, and infected dental hard tissue from the canal system and dentinal tubules.

Antimicrobial treatment concept

To meet this requirement as best as possible, it is necessary to comply with a strict antimicrobial treatment concept. This includes the imperative application of a dental dam, the removal of potentially infected dental restorations and scrupulously exact caries excavation as well as the preparation of a dentin-adhesive tight pre-endodontic buildup. The preparation of the correct access cavity facilitates all work steps following the pre-endodontic build-up. The direct correlation be-
tween the correctly prepared endodontic access cavity and the success of endodontic therapy has been verified (Fig. 3). After having applied the access cavity and prepared the coronal root canals, we measure the length of the root canal and determine the working length. Given the development of electrometric measurement systems in the past years, electrometric length determination is the measure of choice for this purpose.15

Chemomechanical preparation

As already mentioned above, bacterial infections of the root canal system are the main cause of apical periodontitis. Solely preparing the root canals mechanically does not lead to sufficient reduction of microbial contamination. It was shown that major parts of the canal were not even attended to mechanically by means of mechanical preparation using rotating instruments. The combination of mechanical preparation, activated irrigation by means of antimicrobial and tissue-resolving agents as well as the application of antimicrobial medication between the treatment sessions may reduce bacterial contamination of the canal system considerably.18

Mechanical preparation

Mechanical root canal preparation, depending on the available anatomy of the canal, may be performed with either manual instruments or rotating nickel-titanium instruments. Compared to manual instruments, the use of rotating instruments leads to considerably improved results with regard to the preparation geometry and the preservation of the original topography of the canal. The introduction of a novel preparation pattern, i.e. reciprocal preparation movements, facilitates an even better mechanical preparation. Besides the reduced risk of fracture, better alignment of the files in the canal system and the resulting predictable and repeatable preparation seems to be one of the main advantages of reciprocal movements. Another advantage over fully rotating systems is the effective and thus more rapid canal preparation. Because of the improved mechanical properties of reciprocal file systems, the preparation can be limited to a few file sizes, depending on the available canal anatomy. This makes handling easier for the attending doctor and his/her team.

Chemical preparation—irrigation solutions

The irrigation solutions applied to reduce bacterial contamination must fulfill various tasks in the root canal system:22

1. Antibacterial effectiveness against a broad microbial spectrum
2. Destruction of biofilm
3. Dissolution of potentially infected tissue
4. Removal of the smear layer

The smear layer is debris generated by the mechanical preparation, consisting of die dentin chips, bacteria, infected tissue, organic particles etc. Especially with the rotating or reciprocal preparation, this debris is positively pressed into the dentinal tubules and compacted by the rotational movement. The smear layer thus prevents intra-canal antimicrobial agents and drugs from entering into the dentinal tubules and sub-canals. The combination of sodium hypochlorite (NaClO) and ethylene diamine tetra-acetate (EDTA) is the gold standard for the chemical reduction of intra-canal microorganisms to this day and has been proven in many research studies. The combination of both solutions and the mechanical preparation makes it possible to reduce contamination of root canals by the factor of 100 to 1,000. NaClO has an excellent antimicrobial effect against most of the microorganisms that are significant in endodontics. With regard to the tissue-resolving effect, NaClO is clearly superior to all other known irrigation solutions. This tissue-lytic, effect combined with the excellent antimicrobial effectiveness, are key factors to accomplish comprehensive bacterial reduction in the root canal system. Concentrations between 1 per cent and 5.25 per cent are discussed. The higher the concentration, the quicker the lysis of the tissue. Because of the rapid inactivation of NaClO when it contacts organic tissue, a large quantity of irrigation fluid of at least 10 ml per canal is required. Heating the NaClO increases the effectiveness of the irrigation solution in the canal system. Furthermore, you can improve the effectiveness by a longer reaction time.

Ethylene diamine tetra-acetate (EDTA) serves to remove the smear layer mentioned above. Irrigation
with approx. 5 ml of EDTA in a concentration of 17 per cent leads to the complete removal of the smear layer within one minute. The reason why this effect is so important is that antimicrobial agents like e.g. NaClO can react deeply in the dentinal tubules only after the smear layer was removed. We should also mention that the effectiveness of EDTA against fungi like e.g. Candida albicans has been proven (Fig. 4). The antimicrobial effect of EDTA is of rather minor importance. The combination of the two described irrigation solutions is still the gold standard. Please refer to the related technical literature for more detailed information.

Laser in endodontics

In the past decades, lasers were established in endodontics. Laser is the abbreviation of light amplification by stimulated emission of radiation. They are electromagnetic waves with a high-energy density. In endodontics, lasers of different wavelengths are used. By photothermal and partly photomechanical effects, laser radiation can unfold its bactericidal effect, depending on the wavelength and the associated absorption in the irradiated tissue. Mostly because of heating and the subsequent change of the osmotic gradient within the bacterial cell wall, the cell dies. Lasers used in endodontics so far differ in their wavelengths, which again have critical influence on the interaction with the irradiated tissue.

Nd:YAG lasers function at a wavelength of 1,064 nm, diode lasers within a range between 810 nm and 980 nm, and erbium lasers at 2,780 nm (Er,Cr:YSGG) and 2,940 nm (Er:YAG).

First reports on the application of Nd:YAG lasers in the root canal were published in 1984 already. In this procedure, special endodontic optical fibers were used which could emit the laser light only linearly. For this reason, the optical fiber had to be moved in spirals in the canal to reach as many canal sections as possible. At 15 Hz and 100 mJ, the antibacterial effect may then reach up to 1,000 µm and enter deeply into the dentinal tubules.

Compared to that, the reduction of bacteria using NaClO was proven to a depth of only 100 µm. However, the linear emission and the high energy density in connection with the work in the dry canal had detrimental effects. The antibacterial effect is lower in curved canals because of the linear emission of laser radiation. In addition, heat of up to 38°C developed in the canal, which may cause the dental hard tissue to burn (Fig. 5).

Matusomo et al. explain that, due to the linear emission of the laser beam, on the one hand consistent wall contact was impossible and on the other hand, because of the heat formation, emission over the apex had to be avoided, making the work in the apical third considerably harder. When comparing the disinfecting effect of Nd:YAG lasers with "traditional" disinfection using NaClO and ultrasound, DeMoore et al. arrived at the conclusion that the Nd:YAG laser has no advantage in this respect. The effects described for the Nd:YAG laser apply to the diode laser as well.

Two different wavelengths are differentiated for erbium lasers: 2,780 nm for Er,Cr:YSGG and 2,940 nm for Er:YAG lasers. These wavelengths have their maximum absorption in water and hydroxyapatite. When erbium laser radiation hits the dental hard tissue directly, the water contained in the tissue evaporates immediately and dental hard tissue is ablated "gently" with only minimal thermal effects. With regard to endodontics, experimental studies with erbium lasers proved the removal of the smear layer to be more effective than by other types of lasers and endodontic irrigation solutions. Furthermore, the canal walls were free from debris and smear layer and had mostly open dentinal tubules. Because of the linear emission of the laser beam by the optical fiber and due to the cumbersome handling, the canal walls were cleaned imperfectly.

To resolve these limitations, special endodontic so-called "side-firing" tips were developed, which
are intended to emit irradiation laterally and apically sealed.\textsuperscript{50} Unfortunately, a construction-related requirement for the application was the minimum preparation size of ISO 60, which resulted in the unnecessary sacrifice of dental hard tissue. Because of the apical sealing, the apical cleaning effect was only low.

**Laser Activated Irrigation (LAI)—a revolution**

How can the major advantages of erbium laser irradiation be maintained without having to accept the application-related drawbacks? In 2007, Blanken et al. described for the first time the intra-canal application of a pulsed erbium laser in the canal lumen filled with NaClO.\textsuperscript{51} They observed a few interesting effects: Each laser pulse caused great acceleration of the fluid in the root canal. At the same time, they proved a strong cavitation effect in the root canal.\textsuperscript{52} Both effects combined resulted in vitro in a cleaning effect, which is superior to the passive ultrasonic irrigation (PUI), the previous gold standard of cleaning.\textsuperscript{53} LAI in root canals, however, had some disadvantages too.

Irrespective of the laser tip design, sometimes a lot of irrigation fluid was extruded through the apical constriction. This extrusion was significantly higher than in conventional irrigation systems.\textsuperscript{54} Additionally, the formation of gas bubbles because of the laser pulse may cause the irrigation fluid to vanish from the respective canal section completely, which again may cause thermal damage of dental hard tissue.\textsuperscript{55}

**PIPS\textsuperscript{®}—the evolution of revolution**

In 2010, DeVito presented a novel tip design for the first time, combining all advantages of erbium laser radiation, Laser Activated Irrigation (LAI) and the minimisation of the risk of irrigation fluid being extruded (Fig. 6).\textsuperscript{56}

PIPS\textsuperscript{®} is the abbreviation of Photon Initiated Photothermal Streaming. In this procedure, the PIPS\textsuperscript{®} tip is inserted only into the pulp cavity filled with irrigation fluid. The pulsed laser beam generates shockwaves in the irrigation fluid and cavitation effects in the whole root canal system. The laser pulse may cause the irrigation fluid to vanish from the respective canal section completely, which again may cause thermal damage of dental hard tissue.\textsuperscript{56}

Wavelengths that are badly absorbed by the irrigation fluid may cause damage to the root canal walls, dentinal tubules, or even the periodontal ligament. This is one of the key differences between the two erbium wavelengths. The absorption coefficient of Er:YAG at 2,940 nm is almost twice as high as that of Er\textsubscript{3+}:YSGG. The PIPS\textsuperscript{®} system operates exclusively at the wavelength of Er:YAG of 2,940 nm.

The PIPS\textsuperscript{®} tip design is also a key influence on the effectiveness of cleaning. It is a 9 mm long tip with a diameter of 600 µm, the apical 3 mm of which are not sheathed with polyamide and have a tapered end (Fig. 6). The lacking sheath of the apical 3 mm results in better lateral emission. The tip is connected to the laser source (LightWalker\textsuperscript{®}, Fotona, Slovenia) via a special endodontic handpiece. The free axial flexibility facilitates the application even in difficult anatomic situations (Fig. 8).

The manufacturer recommends the following settings for PIPS\textsuperscript{®}: 50 µs pulse length, 10 to 20 Hz and 0.15 to 0.5 W, i.e. peak powers of 400 W up to 1,000 W are achieved with each pulse due to the interaction with irrigation fluid. Air/water spray is not required. These settings triggered the shockwaves and the strong current of irrigation fluid as described above.\textsuperscript{57} The temperature of the root surface increased by only 1.5 °C with the PIPS\textsuperscript{®} activated for 20 to 40 s.\textsuperscript{60} Clinical application should follow the manufacturer’s instructions.
At the end of the preparation, irrigation with 17% EDTA is performed to remove the smear layer. The pulp cavity should be flooded with EDTA. Then the PIPS® tip is inserted into the orifice and activated for 30 seconds (Fig. 9). After rinsing intermediately with saline solution, rinsing with NaClO is performed. This is followed by activating the NaClO twice for 30 seconds respectively with a break of 30 seconds between the intervals. A sufficient quantity of fluid in the orifice is important in this procedure. If necessary, the assistant needs to add irrigation fluid continuously. The research results regarding PIPS® so far have been promising. One study compared the bacterial reduction as well as the biofilm removal between PUI and PIPS® in vitro. The application of PIPS® resulted in the reduction of bacterial contamination by 99.5%, the significantly better reduction of biofilm, and the significantly greater number of samples that are free from bacteria. In another study, Jaramillo et al. compared the removability of biofilm applying various techniques to activate the irritation. Besides PIPS® (LightWalker®, Fotona, Slovenia), these were the passive ultrasonic irrigation (PUI) and sonic activation (EndoActivator). The laser-induced irrigation with PIPS® was significantly superior to all other techniques as regards removing the biofilm (Fig. 10). Another study deals with the removability of calcium hydroxide from root canals. The authors compared as well PIPS®, PUI, and sonic activation of irrigation fluids. After the laser-activated irrigation with PIPS®, all the samples were free from calcium hydroxide, 24 per cent still showed residues in case of PUI. The removal of *E. faecalis* from artificially infected root canals using PIPS® and the sole irrigation with saline solution without activation was the subject matter of another study. The remarkable result of this study was the complete removal of *E. faecalis* from all canals in the PIPS® group, in which the preparation was effected only to the ProTaper® F1 file. This study may be an indicator that minimally invasive canal preparation might be possible because of the good cleaning effect of PIPS®, certainly always depending on the anatomic situation.

**PIPS®—the force awakens**

The eradication of microorganisms and tissue from the root canal system must be the goal of every endodontic therapy. Complete removal of bacterial contamination was achieved only rarely so far due to complex anatomic canal structures and technology-related limitations. The development of PIPS® to reduce bacteria by laser-induced activation of irrigation fluid could have the crucial advantage over all currently known therapeutic procedures. The research results have been promising so far, but further studies should and will be conducted, in particular *in vivo* studies, to consolidate the positive trend. All endodontic treatment steps must be implemented in the therapy using PIPS®. However, the superior cleaning effect of PIPS® seems to realise two key advantages for dentists specialising in endodontics:

1. Improved cleaning effect of the canal systems, which will result in an improved success rate of endodontic therapies.
2. More substance-friendly preparation because of the better cleaning effect. This preserves the dental material, which again influences the fracture behavior of endodontically treated teeth directly.

The integration of PIPS® into a strictly antibacterial endodontic treatment concept might improve the therapeutic success of endodontic therapies again considerably. PIPS® will be in any case a clear evolution in endodontology in a similar way as the introduction of NiTi files. However, the force of laser-induced irrigation has awakened.

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Use of operating microscopy, ultrasound and MTA in periapical microsurgery

Treatment of a persistent endodontic infection

Author: Prof. Leandro A.P. Pereira, Brazil

In most cases, pulpal and periapical pathologies are caused by intra-canal infections and their initial treatment is by conventional endodontic treatment. In cases of teeth without apical periodontitis, the success rate is approximately 98 per cent. If apical periodontitis and primary infections (which may be of bacterial or non-bacterial origin) occur, this rate is reduced to 86 per cent. Endodontic failure is usually associated with technical limitations that prevent adequate intra-canal microbial control in the complex internal microanatomy of the root canal system.

The treatment recommended for cases of primary endodontic infections is endodontic retreatment, which has a success rate of approximately 83 per cent. Thus, even after the endodontic retreatment, owing to the factors of complex internal microanatomy, the failure may persist. In these clinical situations, apical microsurgery has been proven to be an alternative for the clinical treatment of these infections. Various technological advances in the area of apical microsurgery have occurred in recent years. A very important triad has been established for achieving high success rates, consisting of the use of operating microscopy, ultrasound and mineral trioxide aggregate (MTA). When periapical microsurgery is performed traditionally, without the use of microscopy, ultrasound and MTA—that is, in the macro-surgical form—its success rate does not exceed
60 per cent.\textsuperscript{5–8} However, when performed with the contemporary technique of microsurgery, its success rate is over 90 per cent.\textsuperscript{6,9–13} This evolution has made microsurgical endodontic treatment a more viable clinical procedure with greater predictability.

Clinical case

A 42-year-old female patient presented at our clinic with spontaneous pain resulting from apical periodontitis around tooth #36. The last endodontic retreatment had been performed 19 months before. During the semio-technical examination, a negative response to pain was observed in the palpation, and vertical and horizontal percussion tests. Thermal and electric pulpal tests of tooth #36 obtained no response. Responses of the neighbouring teeth were normal. On the radiograph, we detected a metal–ceramic prosthetic crown functioning within acceptable standards, as well as a cast metal intra-radicular retainer. Overall, this was a satisfactory endodontic treatment with good shaping and good obturation.

However, tooth #36 showed apical periodontitis (Figs. 1–3) and the preoperative CBCT scan showed fracture of the vestibular cortical bone (Fig. 4). The proposed treatment was endodontic microsurgery aimed at endodontic retrograde retreatment. In this therapeutic situation, the prosthetic crown and the intra-radicular retainer would be kept; there was no need for new prosthetic rehabilitation. After the evaluation of all the advantages, disadvantages and risks, the endodontic microsurgical treatment was performed.

One hour before the microsurgical procedure, 4 mg of dexamethasone was administered orally for the purpose of pre-emptive analgesia.\textsuperscript{14} The control of pre-operative anxiety was accomplished through conscious inhalation sedation with a nitrous oxide and oxygen mixture at a ratio of 65 per cent to 35 per cent and a minute volume of 6.5 l/min. As anaesthetic solution, 5.4 ml of 2 per cent lidocaine with 1 : 100,000 epinephrine was used, with 1.8 ml each of the solution administered through the traditional technique to block the inferior alveolar nerve and the buccal nerve. Another 1.8 ml of the same solution was infiltrated between the gingivae and mucosa.

After anaesthesia was established, the papillae-based incision was made, followed by a vertical relaxing incision. Using a micro-syndesmotome, the syn-
Desmotomy was performed smoothly to prevent damage to the soft-tissue structures (Fig. 5).

The fracture of the vestibular cortical bone was treated using piezo-osteotomy with an ultrasonic tip (ST3 Bone Surgery Tip, Vista Dental) at full power. The osteotomy exposed the entire periapical lesion (Fig. 6). Subsequently, apical curettage was performed (Fig. 7).

The apicectomy was also performed using a piezo-electric ultrasonic system with a W7 ultrasonic tip (CVDentus) at a power of 80 per cent and under copious irrigation with a sterile saline solution (Fig. 8). The apex was cut at an angle perpendicular to the long axis of the root to allow for removal of possible ramifications of canals located to both the vestibular and lingual directions. After the apicectomy of the medial root, it was possible to observe an infected apical region of the mesial canal, which had not been cleaned and shaped (Fig. 9). With a retro-mirror, an isthmus was found connecting the vestibular mesial canal to the lingual mesial (Fig. 10). This isthmus had not been shaped and disinfected by the conventional endodontic preparation owing to the limitations inherent in the kinematics and design of the endodontic instruments and the auxiliary irrigant chemicals. These poorly cleaned and shaped areas of the canals were identified as the possible cause of the apical periodontitis.

Using JETip JT-1 ultrasonic tips (B&L Biotech), the retrograde preparation was performed, adjusting the ultrasonic power to 30 per cent and under irrigation with a sterile saline solution. The quality of the retrograde preparation was evaluated with a surgical micro-mirror (Fig. 11). The isthmus of the medial root was cleaned using these ultrasonic tips with movements in the vestibular-lingual direction. The retro-prepared canal was irrigated with 2 per cent chlorhexidine, followed by sterile saline with irrigation micro-cannulas (Angelus). The canal was dried using aspiration micro-cannulas on a vacuum pump, leaving it ready to receive the retrograde obturation material.

The canal was retro-obturated with white MTA (Angelus). The placement of the MTA in the retrograde cavity was done with the MAP System (Roydent) and retro-condensed until the canal was completely filled (Fig. 12). In order to prevent the growth of the connective tissue inside the apical bone cavity, it was filled with surgical calcium sulphate (GMReis).

The postoperative control radiographs were taken after 72 hours (Figs. 13–15), six months (Fig. 16) and 12 months (Fig. 17). On the last radiograph, it was possible to see the advanced repair of the bone in the apical region.

Discussion

The use of operating microscopy in combination with ultrasonic tips and MTA-based bioactive retrograde obturation materials has increased the success rates of endodontic microsurgery from 60 per cent to levels above 90 per cent. The enhanced visibility provided by the microscope allows for evaluation of microstructures and details that are not visible to the naked eye. It allows the microsurgeon to refine his or her motor precision. Trauma to the delicate periodontal and periapical tissue can be minimised, leading to better aesthetic results.

The osteotomy needed for access to the apical third had traditionally been performed with chisels or drills and high rotation. In the 1980s, piezo-osteotomy was finally introduced. In this surgical method, the osteotomy is done with ultrasound, which has technical and biological advantages over the use of drills at high or low rotation. Ultrasound is safe, as it only works on mineralised tissue. It preserves soft tissue, such as nerves, blood vessels and mucosa. The amplitude of its micro-movements varies between 60 and 210 μm, allowing for precise cuts into hard tissue, such as bone and tooth.
With the use of ultrasound, acoustic micro-currents in the operating field are formed that clear the surgical area by improving haemostasis. The ultrasonic energy acts on cellular viability in the region operated on, accelerating the first postoperative phases of the bone repair process. The faster increase of bone morphogenetic protein, modulation of the inflammatory reaction and the stimulation of the formation of osteoblasts are physiological benefits that contribute to this improved and faster healing process.

The apicectomy must be performed at 3 mm from the root apex, thus maintaining the length of the dental root, as well as eliminating the majority of the apical ramifications and lateral canals. The rotational movement of drills or vibrational movement of ultrasound during the apicectomy dislodges the remaining gutta-percha and this often leads to misalignment of gutta-percha with the walls of the canal. This is one of the reasons for the combination of the retrograde preparation and later retrograde obturation. In addition, during the retrograde preparation, removal of the infected dentine and the obturation material and cleaning of the isthmus is done, optimising the intra-canal bacterial control and shaping of the canal and leaving it prepared for the sealing material.

A retrograde cavity must be at least 3 mm in depth inside the root canal along its long axis. If this cannot be achieved, the outcome of the proposed cleaning and disinfection, as well as the prognosis of the treatment, will be uncertain. In the microsurgical technique, the retrograde preparation is always done with ultrasonic tips because it is the only way to achieve preparations of 3 mm or more into the root canal. This is possible owing to the long neck of the ultrasonic tips in addition to a sequence of three to four bends along its length. These bends allow the active tip to gain full accessibility to the root canal. The ultrasonic tips also allow for non-circular movements for better mechanical cleaning of flat areas of the root canals, known as isthmuses. It is possible to observe the elliptical preparation with greater vestibular-lingual extension of the original anatomy of the microanatomy of the medial root. The filling of the elliptical retrograde cavity with MTA was also evident on the post-operative CBCT scan.

Selecting the appropriate retrograde obturation material is fundamental for achieving a high level of success. The ideal material should promote the filling of the region, protect the surgical wound and be radiopaque, biocompatible, impermeable, antimicrobial and osteoconductive. It should also have excellent properties in a moist environment. Various materials, including Cavite (3M ESPE), zinc oxide, eugenol, calcium hydroxide, amalgam, gutta-percha, tricalcium phosphate and hydroxyapatite, have been used in the attempt to seal retrograde preparations. However, none of these materials have been found to be capable of re-establishing the original architecture of the areas affected.

The introduction of bioactive sealant materials such as MTA, the precursor of the group of bioceramics, made a great leap in terms of sealing and biocompatibility. It offers the most desirable characteristics of a repair material, such as tissue biocompatibility, stimulation of neo-formation of cement and biomineralisation. It also promotes superior sealing compared with other materials. Owing to the qualities described, MTA is now the material that best meets the requirements for material suitable for retrograde obturation. It is also the material with the best scientific track record in terms of effectiveness and clinical safety. For this reason, it was the material of choice for the apical sealing in this case.

In the apical repair process, bone repair is expected to occur through neo-formation of bone tissue in the region of the apical periodontitis and the repair is expected to be without scars or periodontal recession.

**Conclusion**

The combination of operating microscopy, ultrasound and MTA allows for extremely precise and predictable treatment. Endodontic microsurgery, when performed in accordance with these modern concepts, can be considered to be a therapeutic alternative for the aesthetic and functional maintenance of teeth with secondary or persistent apical periodontitis._

Editorial note: A list of references is available from the publisher.

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Zero apicectomy in endodontic microsurgery

Authors: Dr Randa Harik, Dr Grace Issa & Prof. Philippe Sleiman, Lebanon

Introduction

Surgical endodontic treatment is a therapy modality for teeth with apical periodontitis and may be indicated for teeth that previously underwent an unsuccessful endodontic treatment, as well as teeth where a non-surgical approach has a high risk of failure. The procedure usually consists of several steps and includes a retrograde obturation, which is performed after root resection followed by a retrograde preparation of the root canal.

Also, presence of true apical cysts requires a surgical treatment as such cysts are less likely to heal by conventional root canal therapy because they are self-sustaining and no longer dependent on the presence or absence of root canal infection. That is why many suggest that surgical intervention is necessary in the treatment of true apical cysts.

The limitations of periapical radiography have led to significant interest in cone beam computed tomography (CBCT) in endodontic applications. It seems that the number of CBCT scans taken every year is growing as awareness and resolution are increased and costs are reduced. CBCT can be helpful, if not instrumental, in the differential diagnostics of cystic lesions. In particular, CBCT images can provide a moderately accurate diagnosis between cysts and granulomas. Simon et al. found that the CBCT may provide a more accurate diagnosis than biopsy and histology providing a diagnosis without invasive surgery and/or waiting a year to see if non-surgical therapy is effective.

In this article, we will describe a new approach in surgical endodontics that focuses on preserving the integrity of the apical part of the root and removing the cyst or cysts completely. We will illustrate this approach with a series of cases showing preoperative condition and postoperative healing.

Zero apicectomy technique

When a patient presents with signs of cystic reaction as evident on the periapical X-ray, a radiolucent lesion involving the apex, with clear radiopaque borders, demonstrating signs of PDL disruption and following signs confirmed by clinical examination that include negative pulp vitality tests, slight mobility as
necrotic pulp signs, presence of cystic liquid drainage when opening the access cavity, a surgical intervention is indicated, and zero apicectomy may be an approach of choice.*

Additionally, such signs as presence of fistula, presence (and recurrence) of swelling with a balloon effect under digital pressure, history of preceding unsuccessful treatment are considered as confirmation of a true apical cyst.

To ensure all diagnostic findings are included, a CBCT scan is performed and evaluated for patients presenting in such status.

When presence of cystic lesions is confirmed and the diagnosis is explained to the patient alongside with treatment options, informed consent for the combined RCT+apical surgery treatment is obtained.

Patients are scheduled for the intervention and instructed to take the first dose of antibiotic medication 1 day before the appointment. Additionally, 30 minutes before the treatment begins patients are instructed to take 800 mg of ibuprofen.

The treatment is performed under local anesthesia with adrenaline 1:100,000, infiltrated under the periosteum. However, if there is no fistula associated with the cystic lesion in question, it may be beneficial to start by opening the access cavity to allow for drainage and decrease of pressure in the lesion, thus making the following anesthesia injection safer.

We then proceed by isolating the tooth or teeth with a rubber dam and move on to access cavity preparation followed by shaping and cleaning the root canal system via an orthograde access. Conventional root canal therapy is a prerequisite for a successful same-session zero apicectomy.

During RCT, irrigation is conducted with the negative pressure technique EndoVac (Sybron Endo) as the system delivers irrigants safely to the apical terminus of root canals. The irrigation is conducted according to ‘A’ sequence of irrigation alternating sodium hypochlorite, sterile water (or saline), and EDTA. As soon as the working length is determined electronically, the irrigation micro-cannula can be placed at the working length, ensuring a thorough cleaning of the apical third and the apex.

After the preparation and irrigation stages are completed, a temporary filling is placed in the access cavity, and the rubber dam is removed. The obturation of the canal is deferred, as the canal cannot be properly dried at this stage.

*Fig. 1c: CBCT axial slices.

Fig. 1d: CBCT 3-D reconstruction demonstrative the extent of the lesion(s).

Figs. 1e & f: Immediate postoperative radiographs of the left incisors (e) and centrals (f).
What follows is zero apicectomy per se: following an intrasulcular or papilla-based incision (depending on the size of the lesion), a full-thickness triangular or rectangular buccal flap is raised. If the cyst has not perforated the buccal cortical plate, a round bur on an air-implanted handpiece is used to drill through the cortical bone and localise the cyst.

The cyst is spooned out with extreme care in order to preserve the cementum of the root and ligament fibres attached to the root surface.

When the totality of the cyst has been removed, the exposed part of the root surface is first rinsed with normal saline and then scrubbed for 30 seconds with citric acid applied with a microbrush.

The whole area is then rinsed abundantly with sterile water or normal saline, and the flap is temporarily put back in place without suturing.

The tooth or teeth are again isolated with rubber dam for the temporary filling to be removed and 'A' full sequence of irrigation with the use of EndoVac to be conducted again.

When this second cycle of irrigation is finished and the root canal is dried, a master cone is adjusted followed by a complete obturation of the root canal system with the warm vertical compaction technique.

A temporary filling material is then placed in the access cavity and the rubber dam is removed.

The final step consists of raising the flap up again and checking for any significant extrusion of the obturating material, which needs removing. When cleanliness of the wound is ensured, the flap is sutured in place with monofilament suturing material 5.0 and/or 6.0, and post-operative medication is prescribed (patients are instructed to continue the antibiotics for 7 days, to continue ibuprofen 400 mg each 4 hours for the following 24 to 36 hours, and to start alcohol-free mouth-wash rinses 24 hours after the procedure).

Discussion

Apical periodontitis (AP) is an inflammatory/immune response in the apical periodontium that is often caused by intracanal microorganisms. The resulting apical bone resorption is a manifestation of the defense mechanism, preventing the spread of infection, and appears radiolucent on radiographs.27,18

Because AP is usually asymptomatic, it is frequently only detected during routine radiographic examination.4 In this sense, radiography is essential for the successful and timely diagnosis of AP, and it historically has been limited to periapical and panoramic radiographs.1
Furthermore, radiographic imaging is essential in all stages of endodontics from diagnosis to long-term assessment of healing outcomes. In conjunction with symptoms, outcome is assessed by comparison of preoperative and/or immediate postoperative radiographs with subsequent radiographs taken at follow-up appointments.12,20

The diagnostic value of pretreatment radiographs depends on how well they reflect the histology of AP. Studies that investigated the correlation between histological appearance and radiographic manifestations found that absence of radiographic signs does not exclude apical inflammation, and radiographic appearance is always smaller than the histological extent of the lesion.21-27 Radiographic signs pathognomonic of AP include radiolucent changes in periradicular trabecular pattern and altered shape and width of the periodontal ligament (PDL) space.3,8,12,14

However, periradicular radiographs and panoramic images have inherent limitations such as superimposition and distortion of important structures that commonly mask lesions.19,22 Additionally, lesions in the cancellous bone cannot be consistently detected with these radiographic techniques.5 Therefore, in some cases, extensive bone resorption may be present even when there is no radiographic evidence of it.7 The appearance of the periradical tissues on a radiograph is influenced by the superimposition of anatomic structures and the variable nature of the overlying bone density and texture.13,20

These limitations of periradical radiography have led to significant interest in CBCT.

Currently, the use of CBCT has made it possible to visualize anatomical structures in 3 dimensions with higher resolution. This has improved the overall diagnostic efficacy and made early diagnosis possible for some specific clinical situations.26,31 In endodontic practice, CBCT imaging with limited field of view (FOV) has been suggested for diagnostics in patients with contradictory or nonspecific clinical signs and symptoms.31

Postsurgical excisional wound healing following periradicular surgery entails dentoalveolar healing (i.e. reestablishment of an apical attachment apparatus) and alveolar healing (i.e. osseous repair of the trabecular and cortical bone).2

Cementum deposition on the root end is considered the critical step in dentoalveolar wound healing.2 Consequently, creating an environment conducive to cementogenesis should enhance the healing process following surgical endodontic treatment.

In periodontal surgery, demineralisation of dentin leads to enhanced new connective tissue attachment through splicing of exposed dentinal collagen with new collagen fibres produced during wound healing.
and early deposition of cementum on the dentinal surfaces.10

Demineralising the root surface with citric acid has been shown to increase cementogenesis and promote periradicular wound healing by exposing the collagen matrix, which stimulates fibroblast attachment and growth.10

When comparing citric acid with EDTA and citric acid alone in root conditioning, the latter has demonstrated the best results for smear layer removal and clot stabilisation. EDTA inhibited clot stabilisation on root surface and must have had a residual activity once it has diminished clot adhesion to root even after citric acid conditioning. Thus, EDTA can be used to neutralise citric acid effects on periodontal cells without affecting clot stabilisation, while citric acid use may favor clot stabilisation and may have a beneficial effect on surgical outcomes.24

Other researchers also indicated citric acid to stabilise clots on the root surface, which act as a scaffold for connective tissue cell development.21

As for the manner of citric acid administration, better results for collagen exposure were obtained with brushing application of 25% citric acid for 3 minutes than with other application parameters.9

The irrigation is conducted with a negative pressure device, EndoVac (Sybron Endo), as it ensures a safe delivery of irrigants to the apical terminus of root canals.25

The device consists of a delivery evacuation tip attached to a syringe of irrigant and the high-volume suction of the dental chair. With a macro- (in the coronal and middle third) or microcannula (in the apical third) attached to the suction device, the irrigant introduced into the pulp chamber is pulled by negative pressure down the canal into the tip of the cannula and removed through the suction hose thus avoiding any extrusion of the irrigant outside the root canal area where the PDL barrier is lost and thus the use of conventional irrigating methods could result in pushing the chemicals into the exposed surgical site.25

Case reports

Once there is a positive diagnosis of apical cyst, the patient is informed of the situation and the different steps of the treatment. When/if an informed consent of the patient is obtained, the treatment may begin.

Case 1

A female patient was referred to the clinic with a swelling on the palatal side in regio of the upper lateral incisor on the left (Figs. 1a & b). Axial cuts of 3-D CBCT scans showed an extremely large area of bone loss at the apical level of the upper lateral incisor (Fig. 1c), as well as at the level of the two upper central incisors (Fig. 1d).

After administering anesthesia, a syringe was inserted in the palatal mucosa and a large amount of pus was aspirated.

Having performed the procedural steps of combined conventional RCT and zero apicectomy as described
previously and having removed the cyst, a long part of the roots remained exposed, especially those of the lateral and central incisor. The flap was sutured without any augmentation or grafting of the large defect.

An immediate postoperative radiograph was taken (Figs. 1e & f), and then one-year follow-up radiographs (Figs. 1g & h) to assess the healing process.

The one-year follow-up shows the formation of new bone around the teeth and the formation of a new PDL, while the five-year follow-up radiograph (Fig. 1l) demonstrates no signs of external or internal root resorption, an intact PDL, and a smaller fibrous area, which altogether allows evaluating this outcome of the treatment as successful.

Case 2
A male patient was referred to have his mandibular molar checked. It was essential for the patient to save his molar by all means, even though he had been advised to have it extracted and replaced by an implant.

The preoperative radiograph (Fig. 2a) shows a substantial periapical lesion though the previous dentist had placed calcium hydroxide paste in the canals.

Furthermore, the patient was complaining of tingling in his lower lip.

The i-CAT scan (Fig. 2b) showed the cystic reaction going deep internally and almost reaching the mandibular canal.

The same approach, as described previously, was performed in an attempt to treat and save the molar. Once the flap was elevated, it appeared that the cyst was also present under the periodontium above the cortical bone, and there another cyst was found intra-operatively close to the mandibular nerve (Fig. 2c), which could be responsible for the lower lip sensation the patient reported.

Immediate postoperative X-rays (Figs. 2d & e) were taken upon the completion of the surgical and conventional root canal therapy, and a complete healing was seen in the follow-up radiographs after 1 and 2 years (Figs. 2f & g) with a full reconstruction of the bone. Moreover, within the first 3 weeks upon the treatment the tingling of the lower lip was resolved as well as other clinical symptoms.
**Case 3**

A male patient was referred to the clinic to check the status of his upper anterior teeth. The patient had received crowns several years before, and apparently the pulp of those teeth became necrotic, which led to periapical infections.

On the preoperative radiographs and on the i-Cat scans (Figs. 3a–e), periapical cysts could be easily identified along with massive bone loss.

A zero apicectomy approach was used as described earlier in order to treat all the upper anterior teeth and to remove the multiple cysts, while preserving the bone and roots as much as possible and only to use the bone defect that had been created by the infection to scoop out the cysts (Figs. 3f & g).

Immediate postoperative radiographs (Figs. 3h–j) were taken as well as radiographs for an 18-month follow-up (Figs. 3k & l).

Further follow-up turned out to be impossible as the patient has since been unavailable. However, the follow-up radiographs demonstrate a decrease in radiolucency, which allows us to assume that bone regeneration is in process, and a new PDL is in formation.

**Conclusion**

Zero apicectomy in endodontic surgery is a novel technique that implies the use of high-resolution CBCT visualisation of the apical situation (alongside with traditional radiological and clinical evaluation) with conventional root canal treatment including the safe and efficient negative pressure irrigation, and root surface conditioning in order to allow for the preservation of the apical part of the root *ad integrum* and for the restoration of periodontal health. Biologically, the technique's foundation lies in the thorough cleaning of the root canal system and the area of the cystic reaction, while preserving the residual structures of the root and periodontium and creating conditions for reattachment and regeneration. It also follows the modern philosophy of the minimally invasive dentistry, where less turns out to be more.

Current literature has not described this technique; however, clinical cases, including those presented in this article, have proven successful outcomes of its application.

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The goal of root canal shaping is to allow an effective irrigation that will facilitate the cleaning and to eliminate the pulp, the bacteria. The desired shape should altogether prepare a cavity specific to the root canal anatomy and allow a three-dimensional obturation.

Stephen Cohen, Richard C. Burns – ‘Pathways of the Pulp’

Technological advances and manufacturing processes are allowing the practitioner the ability to get closer to ideal root canal therapy. The ‘perfect’ file should touch all the walls of the canal without changing its shape, while still allowing room for disinfecting irrigation solutions. The aim is to achieve optimal disinfection in a minimally invasive fashion. Thus, both aims of root canal therapy can be achieved: A healthy surrounding periodontium and a strong root with maximal resistance to fracture.

FKG aims to develop advanced endodontic instruments that provide dentists with the best shaping ability, even in curved or oval canals. The XP-endo Shaper is the latest instrument of the FKG’s range of 3-D instruments. It is the epitome of what incremental innovation can create for modern dentistry; it features the combination of a dual technology and a unique expertise.

Firstly, the exclusive MaxWire alloy provides the instrument with an exceptional flexibility and an extreme resistance to cyclic fatigue. It allows the XP-endo Shaper to shape and to progress inside the root canal with agility, while expanding and contracting its shape, adapting itself to the specific morphology of each canal.

In addition, the Booster Tip, thanks to its six cutting edges, guides the instrument easily toward the apical terminus and enables to start the shaping at an ISO diameter of 15, then gradually to increase its working scope to reach an ISO diameter of 30.

Clinical examples

Case 1:
Pulpectomy on a first upper right molar (Figs. 1a & b)—By Dr Kleber K.T. Carvalho, Brazil

A 62-year-old Caucasian female patient presented with a symptomatic pulpitis on tooth 16.

After a glide path of 15/.02 with a hand file, the canals were shaped using the XP-endo Shaper. For each canal, the instrument was used by applying five light up-and-down movements and then removed and cleaned.

After irrigating the canal, five more up-and-down movements were applied and the final size was ver-
Case 2: Treatment (ex-vivo) of a first upper right premolar (Figs. 2a–d)—By Dr Hubert Gołabek, Poland
Endodontic treatment of a first upper right premolar (tooth 14), extracted for orthodontic reasons. The aim of this procedure was to assess the ability of XP-endo Shaper to instrument irregularities of the canal system and prepare it for the filling.

After preparing a glide path to 20/.02, the canals were shaped thanks to the XP-endo Shaper to the desired final size 30/.04. The XP-endo Shaper could get to canal irregularities, and maintained the original shape of the canal.

Finally, the canals were obturated with TotalFill BC Points and TotalFill BC Sealer.

Case 3: Pulpectomy on a first lower right molar (Figs. 3a–d)—By Dr Gilberto Debelian, Norway
A 42-year-old Caucasian male patient presented with a symptomatic pulpitis.

After preparing a glide path to 20/.02, the mesial canals were shaped thanks to the XP-endo Shaper to the final size of 30/.04. The distal canals, which were initially larger than the mesial canals, were also shaped with the XP-endo Shaper, creating a space to adapt a size 40/.04 TotalFill BC Points.

After shaping, disinfection was completed with the XP-endo Finisher for all canals. The obturation was carried out with TotalFill BC Points and TotalFill BC Sealer.

**The one to shape your success**

These technical advantages, combined with high-speed continuous rotation and minimum torque, minimise the stresses exerted onto the canal walls and prevent debris compaction in the dental tubules; they also promote the creation of micro-debris, which can be easily eliminated thanks to the turbulence generated by the instrument. It provides the patient with a non-aggressive, conservative treatment.

This instrument is an amazing new single file system from FKG. It allows for faster treatment in the majority of root canals. With its enhanced flexibility, compared to instruments of the same size and its high cyclic fatigue resistance, shaping becomes a simple, safe and quick process.

This high-tech instrument helps dentists to perform their procedures with reproducible success._

**contact**

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In the field of endodontics, instruments of different sizes and angles and with various handles have been developed for root canal therapy—from simple stainless-steel files to today’s high-tech instrumentation systems. VDW is one of the most well-known manufacturers of endodontic products in the world. Most of the 52 million instruments it produces annually are manufactured in Munich in Germany. For more than 145 years, VDW has been operating from its site in the heart of Europe, where it manufactures endodontic instruments in a shift operation. The company granted Dental Tribune International not only an exclusive look behind the scenes of its 3,000 m² high-tech facility. We also saw the latest generation of RECIPROC® files: RECIPROC® blue, giving dental professionals a unique instrument with enormous flexibility, resistance to fracture and outstanding cutting capacity.

Every dentist knows that optimal root canal preparation requires a highly flexible file system with extremely good cutting performance and low material fatigue. Furthermore, the file system must be easy and quick to use and suitable for preparing even severely curved root canals. Today, there is a range of systems available to dental specialists including those based on reciprocating or continuously rotating motion, as well as hand instruments. With its single-file reciprocating system RECIPROC®, for example, VDW offers a safe solution for optimal root canal preparation. Apex locators, obturation systems such as GUTTAFLUSH, an ultrasonic device and materials for filling root canals all reflect the company’s reputation as a specialist for complete endodontic solutions and systems.

A commitment to German quality

Author: Marc Chalupsky, DTI
Visions of endodontic heaven

DTI was granted direct access to operations at one of the most innovative manufacturers in the field of endodontics. While the company has a 145-year history, the well-maintained business premises look very modern. VDW was one of the first European manufacturers of endodontic instruments, and today offers products for the entire treatment process—including preparation and irrigation, root canal filling and post-endodontic maintenance. VDW emphasises simplicity and efficiency in its systems, allowing both general practitioners and specialists to provide optimal treatment in a few steps. At the facility in Munich, Gregor Picard, Director of Operations at VDW, took us through the entire production process for the company’s manual, rotating and reciprocating instruments.

The tour began with the machines for cutting and straightening the wires. Most file systems use highly flexible, fracture-resistant stainless steel combined with a special alloy. For almost 30 years, the industry has relied not only on chromium-nickel-stainless-steel alloys but also on nickel-titanium alloy (NiTi), known for its pseudo-elasticity. NiTi files are used particularly in severely curved root canals. Owing to other beneficial properties, including shape memory (the material returns to its original form), super-elastic behaviour and good biocompatibility, dentists are increasingly opting for NiTi files, but not dispensing with stainless-steel files. “We are constantly working on new alloys, materials and geometries. However, it is just a question of refinements these days; the conical tapered form of the instruments and the NiTi alloy have proven themselves,” said Picard.

The wires are subsequently machined. Straight after this procedure, an employee checks the finished instruments using a digital measuring system and visually inspecting them under a microscope. This system, like the entire production process, is fully automated. The process is properly validated to ensure that VDW can always provide the same quality and reliable monitoring. The washing plant cleans the instruments and completely removes the oil used in production, for example. A gripper then takes the deposited instruments and machines in the ring marking. The colouring is done within a few seconds. The ink is then dried and the instrument is inspected again by camera. The next procedure is attaching the handle. The robot trims the instrument at the top so that it is wide enough to connect the wire firmly to the handle.

“This step is often left out with fake copies so that the handle slips off,” said Picard, referring to the counterfeit products on the market, which is a global concern for both manufacturers and dentists. This is followed by the injection process to form handles around the wires, which are first placed into moulds, depending on the ISO diameter of the instruments. The plastic used is a high-performance polymer that can be sterilised repeatedly and can therefore be used in autoclaves. The granules are recycled to a certain extent. Injection moulding is applied gently, but extremely quickly. The precise injection moulding machines are some of the fastest in the industry. Injection moulding of the handles requires a great deal of expertise and experience. The high-performance robot produces 16 instruments in 14 seconds.

The instruments are printed on using tamography (pad printing), a special process used for printing on the front and side of the instrument. The silicone stoppers are then applied according to instrument length. The stopper is brought from the hopper machine in an automated process and a collet chuck holds it firmly while the instrument is pushed through the stopper. The instruments go into large machines during the washing process, and here a technician must constantly ensure a sterile environment. Therefore, a machine creates a clean room environment in order to allow sterile packaging after the washing procedure. An automated packing facility sorts all of the instruments into boxes and blister packs. The instruments are then deposited into crates within the clean room environment. Employees line these with sterile bags and they are then sealed with lids in the clean room area and sent for final packaging. They are marked to indicate sterilisation status. VDW sends the goods for sterilisation again before shipping in order to ensure that there are no bacteria when they leave the warehouse. If desired by a customer, a small laser can be used to mark the blisters for individual needs. Finally, the warehouse system tracks the available spaces, scans the goods and knows automatically when sufficient goods have been removed. In the storage, the DTI team receives a blister with instruments shining in blue. More about that later.

Everything is monitored

Even more impressive than the almost fully automated production is the monitoring technology. The specially developed camera system is probably one of the most advanced in the dental industry. One example is the ring marking. Each ring is checked for diameter, width and colour application. The system will then indicate “green”, signifying that all is OK, or “red” to flag a problem. Instruments with no ring colour are automatically removed. Another camera checks the twisting of reamers and files according to length and degree of twisting, preventing any warped instruments from going any further in the production process. Yet another camera checks the bars on the broaches. A further camera monitors the status of the boxes and blisters and verifies the
geometries of the instruments and their colours by means of images.

In accordance with the strictest medical devices regulations, the camera detects the tiniest deviations in the instruments and packaging—even individual particles—and these packs are separated automatically. Another camera checks the labels. If there has been a printing error or an incorrect label has been used, the affected item is immediately separated by the machine. In this way, the company guarantees the safety and quality of its products and fulfils all regulatory requirements.

As a result, a new technology centre is created almost every two years. Achieving German quality requires German thinking.

The breakthrough is blue

German precision and commitment to quality also provided the basis for VDW’s latest product: RECIPROC® blue. In August 2016, the company announced this next generation of root canal preparation instruments, reducing the possibility of file breakage even further. Owing to a new production process, the files are significantly more flexible, and the dentist can pre-bend the instruments in order to gain easier access to severely curved canals. These new properties are made possible by a particular heating protocol. Once the RECIPROC® instruments have been manufactured according to the proven process followed, they are subjected to a heating process that is specified in detail. This changes the molecular structure of the NiTi in such a way that the RECIPROC® instrument acquires the additional properties described. The colour of the file changes to blue owing to the heating process. Otherwise, the application of RECIPROC® blue is the same and it can be used with the tried-and-trusted VDW endodontic motors.

According to VDW, RECIPROC® blue instruments are suitable for both experienced and new users of the reciprocating system. And this seems to be the case when asking dentists around the world: “Reciprocation offers a whole new world in the mechanical preparation of the main root canals. It is safer, faster and most likely cheaper, since there are fewer files involved,” says Dr Sergiu Nicola who runs an established practice limited to endodontics in Bucharest. “If dentists want to try a reciprocating system, why not start directly with the best system currently available on the market, in my opinion RECIPROC® blue?” Dr Grzegorz Witkowski, an established dentist from Poland, adds: “I have been testing RECIPROC® blue for quite some time. Most importantly, I really like the flexibility of the file. In addition, RECIPROC® in my experience is about 60 per cent faster than multiple file systems. I loved RECIPROC® when I started to use it, but now I never want to switch back from RECIPROC® blue.”

RECIPROC® blue is launched to be globally. However, Germany and Europe remain home and the most important market for VDW. Therefore, the company’s production facilities in Munich will remain and be steadily expanded, reflecting the company’s commitment to German quality.

Readers can learn more about VDW at the upcoming IDS 2017 in Cologne in Hall 10.1, Booth B051/C051.
Dentsply Sirona introduces another integrated solution to the market: a new 3D imaging software to improve the planning and workflow of endodontic procedures. With the largest research and development organization Dentsply Sirona is committed to its mission of empowering dental professionals to provide better, safer, faster dental care.

Dentsply Sirona has developed yet another innovation in endodontics: 3D Endo is the first CBCT-based software that enables endodontic treatments to be preplanned and optimized in combination with the imaging data from the Orthophos units. This new advancement is also the first software project to combine the know-how and experience of Dentsply Sirona’s market leading engineers, scientists and software developers in both its endodontics and digital radiography units. Based on the 3D data and their specific visualization, the practitioner can case-specifically recognize the demands on the treatment of the root canal, analyze the natural shape of the root canal and select the appropriate files using the integrated file database. As a result, the endodontic treatment is more efficient and significantly improves patient communication. With the help of a planning report or directly in the software, the practitioner can clearly explain the initial situation and the appropriate treatment to the patient. Dentsply Sirona plans to introduce this software in the coming months upon the receiving the necessary regulatory approval.

For years, Dentsply Sirona has been collaborating and creating integrated solutions in the area of Endodontics. Back in 2014, Waveone by Maillefer and RECIPROC by VDW, both leading reciprocal file systems, were first integrated into the TENEO treatment centers and more recently into the SINISUP centers, which considerably improved the workflow of the Endo function. Now, with new 3D Endo software, Dentsply Sirona will offer an even more comprehensive integrated approach to endodontics which will be available on the market this fall.

“Dentsply Sirona is working to shape the future of endodontics worldwide by continuously striving for better patient outcomes and by empowering dental professionals with world-class innovative solutions, education programs and clinical procedures. This new software is yet another way in which our platform will redefine endodontic care for dental professionals and patients by setting new treatment standards in efficacy, safety and simplicity”, says Dominique Legros, Group Vice President, Dentsply Sirona Endodontics.

“Using our new software in combination with our Orthophos units will provide practitioners the best image quality at the lowest dose and significantly improve their endodontic workflow. By working collaboratively with the Endodontics team, we were able to best identify and address an unmet need and develop an easy to use, integrated solution for our customers”, says Dr Stefan Hehn, Group Vice President, Dentsply Sirona Imaging.

www.dentsplysirona.com
EQ-V: Your choice for continuous wave obturation

Meta Biomed has now established its European headquarters in Mülheim in Germany and, with the move, the Korean medical technology company is aiming at increasing its presence throughout Europe. Meta Biomed has a deserved reputation of being one of the dental industry’s primary innovators, as the company’s focus on research and development has achieved continual breakthroughs in the quality and performance of its medical devices and biomaterials. The focus of improvement through innovation continues with the launch of Meta Biomed’s new EQ-V endodontic obturation system, which promises to deliver reliable, convenient and precise root canal obturation.

The decision to base Meta Biomed in Mülheim has been warmly welcomed by local economic development company Mülheim & Business and state-owned economic development agency NRW.INVEST, both of which have supported Meta Biomed throughout the expansion process. As a company with more than 1,000 employees worldwide, establishing itself in Germany is recognition of the “made in Germany” label as an international signifier of high quality. This emphasis on providing exceptional products reflects the company’s own corporate ethos.

Meta Biomed’s EQ-V is a brand-new system that offers a revolutionary and convenient option for continuous wave obturation. With the user in mind, both the EQ-V Pack and Fill are lightweight and ergonomically designed to allow for comfortable handling. Each is protected with chemically proven housing material and offers outstanding heating performance, as the fill needs just 35 seconds to reach a temperature of 200 °C. A highly efficient and replaceable lithium battery ensures that the EQ-V has an extended battery time, making it ideal for longer and more complicated procedures. The device’s unique 360° rotating cartridge provides dental professionals with unparalleled access and precision, and comes with the added benefit of being easily replaceable and disposable. All in all, the EQ-V is a product that embodies Meta Biomed’s commitment to providing low-cost, high-quality solutions for everyday dental procedures.

Meta Biomed is inviting dental professionals to join the company at the 2017 International Dental Show, to be held in Cologne in Germany, from 21 to 25 March. There is a great level of excitement at Meta Biomed about showcasing its industry-leading endodontic products to such a large audience. “We will be located at Booth B060 in Hall 11.1 and are looking forward to meeting our customers and answering any questions they may have,” said Ian Yun, Managing Director at Meta Biomed.

http://www.meta-biomed.com/eng/

advanced endodontics

Swiss quality dental products

Operating in more than 100 countries worldwide, Produits Dentaires SA (PD) offers dentists a wide range of high-quality products for use in endodontics, restorative dentistry, prophylaxis, prosthetics and periodontology. The MAP System (Micro Apical Placement) for example is a unique method for effectively placing root canal repair materials, either by orthograde obturation for the treatment of perforations, root end fillings and pulp-capping using curved or NiTi memory shape needles, or by retrograde obturation after apical resection using specially designed, triple-angled needles (left- and right-angled) and/or hooked needles.

The company’s easy-to-mix and fast setting PD MTA White, supplied in packets containing four sachets of 140 mg, is the most reliable repair solution for obturations with the MAP System. Owing to the perfect combination of the MAP System and PD MTA White, the placement of repair material has never been as easy and cost efficient, the company said. Solutions for endodontists also include the Opacal calcium hydroxide paste, desobturator eugenates, resin removers and disposable plastic pipettes, among other products.

Produits Dentaires’ glass-fibre posts with composite FIBRAPOST feature an improved composition (urethane dimethacrylate-based resin matrix, bis-phenol A free) with pre-silanisation, higher radiopacity, optimised adhesion to sealing composite and improved mechanical resistance and flexural strength. The Prophycups Snow & Fire, as well as their traditional Rubber cups offer both dental hygienists and dentists the best selection of polishing cups for both regular cleaning and heavy duty stain removal. Together with the company’s refined dental sticks, floss and cotton pellets, professionals will find everything they need under one roof.

PD provides information and support worldwide through its worldwide network of distributors and speakers, with whom the company also regularly organises workshops and conferences. The company constantly invests in the development of new products which are based on the latest knowledge. As a Swiss manufacturer, they always strive to present innovations to dentists which meet their high-quality standards and improve their daily work. In addition, existing products are continuously evaluated and improved further. The company works closely with a national and international expert team of dentists, dental hygienists and other specialists from the medical field. In addition, several research projects are running in close cooperation with universities and colleges in Switzerland and worldwide.

Produits Dentaires SA, Switzerland
www.pdsa.ch
new iPad app for patient communication

Sidexis iX: Better communication of treatment proposals

The Sidexis iX iPad app visualises X-rays and intraoral images, and facilitates excellent communication between dental practitioners and patients. At the International Dental Show (IDS), Dentsply Sirona Imaging will present the first iPad app that makes it possible to navigate through an actual X-ray volume.

Understanding 3D images is a standard work tool for dentists, but for patients it is difficult to understand because they are not accustomed to viewing and evaluating X-ray images. “Experience from the daily practice routine shows that patients can more easily understand X-ray images and the resulting treatment proposal when the data files are given to them. The iPads have proven to be a huge advantage for patient communication,” said Dirk Rudek, responsible product manager at Dentsply Sirona Imaging. Dentsply Sirona is therefore working both on further development of the proven standard Sidexis imaging software, as well as the iPad version for viewing X-ray data.

The new version 3.5 for Sidexis iX has been available in the Apple app store since January 2017. It allows access and viewing of the existing 2D data records in the Sidexis database. Different types of generic implants can also be placed as well as positioned, scaled and rotated in 2D X-ray images with typical iPad gestures. Dental practitioners can also send screenshots with implants and freehand annotations to the Sidexis 4 database so they can be displayed in the timeline of the patient and in the light box. While the proven Galileos Implant software, which runs as an extension of Sidexis 4 on a PC, allows sound 3D implant planning, Sidexis iX provides practitioners with the perfect additional tool for outlining the implant treatment to the patient very quickly.

First true 3D representation of X-ray data for the iPad

At the IDS 2017, Dentsply Sirona Imaging will introduce the new Sidexis iX 4.0. This version makes it possible for the dentist to depict three-dimensional X-rays as a 3D-rendered image and an axial, coronal or sagittal section view on the iPad. In the section views, users and patients can use their finger to navigate through the individual views—similar to how the mouse is used in Sidexis 4 to navigate a 3D data record on the PC. Additionally, users can zoom with the familiar two-finger gesture known from other iPad applications. Sidexis iX 4.0 will be the first iPad app able to depict an actual volume on the iPad.

The X-ray images are downloaded from the Sidexis 4 database via WLAN as customary and stored locally on the iPad. The clever compression technique allows quick transfer of the large data volume, which remains on the device until deleted. The volume loads in seconds when opened again to help facilitate patient communication in a modern way.

Visit Dentsply Sirona at the IDS 2017 in Hall 10.2 and 11.2.

www.dentsplysirona.com
At the end of November 2016, over 300 people from over 45 countries gathered at the Crowne Plaza hotel in Dubai for the 2016 ROOTS SUMMIT. For the past 15 years, the meeting has been an open and inclusive global learning forum, accessible to anyone involved in the practice of endodontic therapy. Featuring 20 distinguished speakers and a comprehensive industry exhibition, the 2016 summit was one of the most important events of this year’s endodontics calendar.

According to co-chairman Stephen Jones, the audience at the 2016 ROOTS SUMMIT was the most geographically diverse in the history of the event. It saw a large number of people from the Middle East and North Africa, as well as many attendees from Europe and India. Some members even travelled to Dubai from Brazil, Chile, Australia and Paraguay.

During the promotion of the event, the organizers encouraged all dental professionals who have an interest in endodontics to attend. This resulted in not only endodontic specialists attending, representing about half of the participants, but also a considerable number of general dentists, oral surgeons, prosthodontists and dental students joining the meeting.

On 30 November, participants had the opportunity to attend a number of pre-congress hands-on workshops. Over the next three days, the scientifically and clinically relevant lectures, covering topics such as roots canal treatment planning, complex anatomy, clinical cases, irrigation, efficacy of treatment options and obturation, were all well attended. In addition, almost 20 companies showcased their latest products in the field of endodontics at the ROOTS SUMMIT industry exhibition.

The meeting originally started as a mailing list of a large group of endodontic enthusiasts in the 1990s, and has since 1999 evolved into organized ROOTS SUMMITS around the world. The summit has taken place in Canada, the US, Mexico (in conjunction with the Asociación Mexicana de Endodoncia), Spain, the Netherlands, Brazil and in India last year. Since the establishment of a dedicated Facebook group in 2012, the ROOTS SUMMIT has increased its membership from just under 1,000 participants to its current level of more than 23,000, including many global endodontic opinion leaders. Well over 100 countries are represented in the group. Members of the community engage in discussions regarding endodontic treatment, the various issues that affect the patient, prognoses, current literature, new equipment, as well as new procedures and protocols, among others. The online community is also moderated by a volunteering group of endodontists.

In addition to this English-speaking, global ROOTS community, the Spanish-speaking global endodontic Facebook forum Endolatinos, which currently has 13,000 members, was established in 2010 from a mailing list of about 2,500 people. In 2013, Endolatinos organized the pre-congress of the Asociación Española de Endodoncia, the Spanish endodontic society, and about a month ago, the Asociación allowed Endolatinos to create the scientific program for its annual meeting, which was attended by 1,300 people.

The 2016 ROOTS SUMMIT was organized in collaboration with Dental Tribune International. At the closing ceremony, the organizers already disclosed that the next meeting will be held in 2018 in the German capital of Berlin. The exact dates are still to be announced.

Dental professionals are invited to join the ROOTS Facebook group and like the ROOTS SUMMIT 2016 Facebook page.
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In addition, images must not be embedded into the MS Word document. All images must be submitted separately, and details about such submission follow below under image requirements.

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Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

Text formatting

We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers. Please do not use underlining.

Please use single spacing and make sure that the text is left justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

Image requirements

Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate these in a group (for example, 2a, 2b, 2c).

Please place image references in your article wherever they are appropriate, whether in the middle or at the end of a sentence. If you do not directly refer to the image, place the reference at the end of the sentence to which it relates enclosed within brackets and before the period.

In addition, please note:

- We require images in TIF or JPEG format.
- These images must be no smaller than 6 x 6 cm in size at 300 DPI.
- These image files must be no smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger image files are always better, and those approximately the size of 1 MB are best. Thus, do not size large image files down to meet our requirements but send us the largest files available. (The larger the starting image is in terms of bytes, the more leeway the designer has for resizing the image in order to fill up more space should there be room available.)

Also, please remember that images must not be embedded into the body of the article submitted. Images must be submitted separately to the textual submission.

You may submit images via e-mail, via our FTP server or post a CD containing your images directly to us (please contact us for the mailing address, as this will depend upon the country from which you will be mailing).

Please also send us a head shot of yourself that is in accordance with the requirements stated above so that it can be printed with your article.

Abstracts

An abstract of your article is not required.

Author or contact information

The author’s contact information and a head shot of the author are included at the end of every article. Please note the exact information you would like to appear in this section and format it according to the requirements stated above. A short biographical sketch may precede the contact information if you provide us with the necessary information (60 words or less).

Questions?

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following root canal obturation with GP+Endoseal MTA
SEM image: 300 x 450, 40k, section at 5mm below the root apex

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- Fast setting time
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