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Dear readers,

There have never been more exciting times in endodontics. We live in an era in which almost all manufacturers deliver excellent products that allow us to recreate predictable shapes in the root canal systems that we treat. As such, there is room for creativity and big rewards for discipline. Having this advantage also brings responsibilities. As a specialty, we need to focus now on the value of a well-educated clinician. One that not only has a deep understanding of shapes, tapers and sizes, but dental anatomy. A dentist that gathers the much needed human skill to diagnose wisely and understand what teeth represent and the role they play on the patient’s well-being.

Our challenge is not to allow newer generations of clinicians to “get drunk” on the beauty of shapes, curvatures and white lines and associate those images with success, but to gain from the advantages of clinicians trained in the era of memory-controlled instruments, CBCT and 3-D guided concepts. Blending the technical advantages of this era with the deeper understanding of biology, scientific resources and the plethora of information available will help us evolve into a more mature specialty. We owe this to our generation.

The roots community understands this commitment and embraces it with joy. We are a relentless and untiring group that envisions endodontics and its relationship with the rest of the branches of dentistry as one of the most important links in the chain of the patient-centred dental services that need to be provided.

I would like to take this opportunity not only to welcome you to this wonderful issue of the roots magazine, but also to extend an invitation to our ROOTS SUMMIT 2018, which will take place in Berlin in Germany from 28 June to 1 July. We have invested great effort in bringing you the best scientific programme possible, with some of the world leaders in science-based endodontics, but with a very clinical approach to the challenges we have to face in our offices every single day.

See you in Berlin amigos!

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In an article by business author Jaron Lanier in the Jan/Feb 2018 edition of WIRED UK magazine, he reminds us that Facebook and Google now account for 75 per cent of online advertising spend, globally. In the same article, there is also a fascinating quote about the current problems with the Internet.

Lanier writes: “Something has gone very wrong: it’s the business model. Specifically, it’s what is called advertising. We call it advertising, but that name in itself is misleading. It is really statistical behaviour-modification of the population in a stealthy way. Unlike (traditional advertising), which works via persuasion, this business model depends on manipulating people’s attention and their perceptions of choice. Every single penny Facebook makes is from doing that and 90 per cent of what Google makes is from doing that.”

A prediction for 2018 is that Amazon is determined to get in on the act and carve out a major position for itself in the market. So, if like me, you were busy deleting a flurry of e-mails, between Christmas and New Year, inviting you to partake in all sorts of indulgence and expenditure, please know that those e-mails and other social media messages were not reaching you by chance, but by design.

We are all the targets of algorithms, created to watch over us as we surf the web, noting our habits, bookmarking what we watch or read, remembering where we linger and what catches our attention for more than a few seconds—even anticipating our next move with creepy accuracy. The phrase “statistical behaviour-modification” has me thinking that we are all being assimilated into a “consumer Borg” (Star Trek fans will know what I mean).
We may think that in healthcare, generally, and dentistry, specifically, we will be protected from this advertising manipulation, whether at the delivery end or as patients, but I suspect not. It exists today, even in a simple context, with the race for Google page one visibility in SEO, whether it is a battle with competitors in a given area code (the more densely populated, the more expensive) or the search for domination of a particular treatment modality.

Many dentists invest heavily in SEO and PPC even though the latest research by WIRED magazine indicates that 20 per cent of people searching on Google click on the number one result and 12 per cent on the second, while the rest are not significant enough to track. Even so, the attraction of the digital advertising drug is difficult to resist, especially because it means that you can hand over your money and get back to work, without having to think too much about the numbers game you are playing.

My best friend is the founder of a leading UK digital advertising agency and, having spent over £1 million per annum of his clients’ money on Facebook advertising, has a lot to say about the effectiveness of his methods. He sees the future belonging to those who can tell emotional stories targeted at those “personas” that his tribe now talk about all the time. Indeed, you and I are no longer unique individuals. The agencies and their algorithms want to categorise us by age, gender, education, location and a host of other factors.

A couple of years ago, I said in jest that Facebook was getting me wrong by assuming that, at age 62, I was interested in Saga motor insurance (even though I did not own a car) and Mahabi slippers (even though I already owned a pair). The competition for my attention, and yours, has since evolved greatly over a short period of time. The algorithms are now following the heat map I create as I browse the web and now “they” know that, as I approach 65, I run marathons, read good fiction, take adventure holidays, enjoy red wine and watch excellent TV dramas. My social media channels and my online shopping experiences are littered with a constant stream of interruptions that are based on my browsing history and buying habits. “People like you are buying things like this” has become the advertiser’s new mantra.

I admit that the same mantra will become more important in dental practice advertising and marketing over the next year, with perhaps only a small change in emphasis that it could be something like: “Patients like you are investing in treatments like this.” Will the statistical behaviour-modification of large cohorts of patients perhaps also appear in dentistry?

Frankly, it is already here, with the use of the effective recall system, the daily use of social media channels to publish photographs and videos, the publication of practice blogs as well as the e-mailing of patient newsletters and end-of-treatment interviews. All of these are designed to identify the characteristics of our favourite patients and include them in the process of spreading our brand message.

So far in dentistry, advertising is a manual exercise undertaken by committed internal marketers and treatment coordinators. Perhaps the algorithms created by the larger corporates and retailers to protect and grow market share will soon also arrive in dentistry. This will make for an interesting angle, including the manipulation of patients’ attention and their perception of choice. It sounds ominous, doesn’t it? We’d better get ready to compete.

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“No Anaesthesia”
endodontics in children

Dr Imneet Madan, UAE

“No Anaesthesia” in dentistry for children is one of the best approaches that can help us to overcome the initial fear of the unknown when it comes to first treatment appointments in children. Its uniqueness lies in the fact that the need for numbing is completely exempted. Today’s children like technology playing at its best. Lasers definitely meet that perception of technology.

The routine first visit appointments are usually not a concern as children do not anticipate any intervention. Since they are not in pain, their mindset of approach is not defensive. Rather when there is no pre-biased opinion or fear, there is a pleasant sense of adaptation that allows the smooth flow of the appointment. Any different kind of behavioural exhibit occurs only when kids are anticipating an intervention, when they had been in pain or when in general they come fatigued.

The discussion of needles is considered to be the most common subject just prior to the visit to the dentist. This discussion can become even more intense when there is already a perceived treatment need. Very young children can have the fear of the unknown, anxiety with strange and new places.

The older ones develop extreme fear by talking to peers who have been to the dentist before. Some of them might have had good and some others not so good experience. Sometimes, past unpleasant parental experience can distort the child’s adaptability to the dental appointment. They enter the clinic with the pre-formed image of the dentist which is not very convincing and helpful to the child. These external experiences can lay the foundation of the child’s coping ability in the dental chair.
How can lasers help?

Since laser is not commonly available at all practices, there could be a possibility that there had been no real discussion on the use of lasers in the treatment. Another possibility of having a good experience with lasers can change the perception of the child who is in for the first time.

When laser is introduced to the parents, they are informed about details on the functioning of laser and its benefits. While explaining euphemisms to the child, the laser is shown as “Popping Light”. There is a significant number of children who go awe-inspired to come back and get their teeth fixed.

The whole mindset of the child changes when they are told that treatments do not involve any needles approach.

“No Anaesthesia”

Procedures that can be done without anaesthesia are:
- Restorations: Decays involving occlusal, labial, palatal, buccal or proximal surfaces of the teeth.
- Deep restorations on teeth with decays close to the pulp.
- Pulpotomies in primary teeth.
- Pulpectomies in primary teeth.
- Pulpectomies in primary teeth with abscess, fistula or swellings.

The term “No Anaesthesia” is a misnomer as the procedure is accomplished with few drops of anaesthesia in between, especially when endodontics is involved. The “No Anaesthesia” approach for enamel dentine restorations are the erbium laser Prep mode for restorative dentistry: MX7, 3.25 W, 25 Hz, air, water. There are two commercial settings that can be followed for the most acceptable cavity preparation:
- Rapid Prep: MX7, 5 W, 20 Hz, air 80, water 50. This setting is usually used for enamel caries removal as water content is lesser. Since there is less water in the enamel, higher power is needed for appropriate absorption of laser.
- Comfort Prep: MX7, 3.75 W, 25 Hz, air 60, water 30. This setting is usually advised when we have reached the level of the dentine as the water content in the dentine is higher in comparison to enamel.

Once complete excavation of the decay has been attempted with laser, gentle hand excavation, low speed excavation is attempted. This step should be followed with Bond prep: MX7, 3.25W, 50Hz, air 60, water 30. Following this step, the tooth is isolated and restored with composite (Figs. 1 & 2).

Pulpotomy procedure with erbium laser

When the carious decay is found deep and in close proximity to pulp, exposure of the pulp canals can happen while removing this decay. In such situations, exposed pulp needs to be treated by removing the affected coronal pulp contents. This procedure is referred to as Pulpotomy.

Deep caries are excavated with pre-adjusted rapid prep settings: MX7, 5W, 20Hz, air 80, water 50; and then comfort prep settings: MX7, 3.75W, 25Hz, air 60, water 30 are used as we approach deep into the dentinal caries. As soon as there is pin point pulp exposure, few drops of Lignospan are dropped inside the coronal pulp chamber. This step is followed by opening partial access into the coronal pulp chamber. As we go further deep into the coronal chamber, more anaesthetic intrapulpal infiltration is used followed by complete laser access opening.

After removing the coronal pulp contents, the chamber is irrigated and dried followed by diode laser sterilisation and coronal pulp filling with zinc oxide eugenol. The tooth is then filled with base Fuji IX and final restoration is done with composite or stainless steel crown.

Pulpectomy procedure with erbium laser

Teeth that have chronic profound caries, active signs and symptoms, and radiographical signs of pulp involvement, are indicated for Pulpectomy. Pulpectomy involves the removal of both coronal and radicular pulp contents.

When the tooth is indicated for pulpectomy or root canal procedure, deep caries are excavated with pre-adjusted rapid prep settings: MX7, 5W, 20Hz, air 80, water 50; and then comfort prep settings: MX7, 3.75W, 25Hz, air 60, water 30 are used as we approach deep into the dentinal caries. As soon as there is pin point pulp exposure, few drops of Lignospan are dropped inside the coronal pulp chamber. This step is followed by opening partial access into the coronal pulp chamber.

As we go further deep into the coronal chamber, more anaesthetic intrapulpal infiltration is used followed by complete laser access opening. Once access has been done with laser, coronal pulp contents are removed. Before gaining access into radicular pulp chamber, few more drops of anaesthesia are dropped in. Complete extirpation of radicular pulp contents is done with rotary instruments.

Continuous copious irrigation is done with saline and chlorhexidine. Canal measurement is done, and as a final step before obturation, both the erbium and diode laser are used for sterilisation. Final step is zinc oxide eugenol obturation, Fuji IX base filling and composite restoration.
Pulpectomy procedure in primary tooth with abscess or fistula

In cases where there are long standing infections or chronic irreversible pulpitis, it becomes invariable to use both diode and erbium laser sterilisation after the laser assisted access and further steps as described above.

Until the point that canals are found completely dry, obturation is deferred. Usually it takes one or two visits to complete the final step of obturation in teeth with abscess or fistula. The entire treatment is completed with intrapulpal drops of anaesthesia when required. No infiltrations or blocks are used in the entire procedure.

This procedure has been practiced as an alternate to pre-times extraction of primary teeth that has to be then replaced with a space maintainer. Most of the parents prefer this approach when compared to extraction, as they do understand that having the natural tooth as the space maintainer is indeed the best approach.

Benefits of “No Anaesthesia” dentistry

- No risk of children having traumatic bite after the procedure is completed. The times when anaesthesia in children was a common practice, it was imperative to let the child and parents know about the numbing effect that would stay for few hours after the procedure. Cotton roll is given to bite on so that it serves as a reminder for the child.
- Despite all these precautions, children may still land up in biting there lip or cheek. Once there is a traumatic bite, there is nothing much that can be done as the traumatized tissue has to self-heal. This can be quite painful for the child, thereby defeating the entire purpose of pain free dental approach.
- Multi-quadrant dentistry can be practiced on the same day, same appointment.
- There is actual saving of chairside time, as there is no waiting period for local anaesthesia to work.
- Children can eat a few minutes after the procedure, which is not the case with dental local anaesthesia.

Conclusion

Practicing contemporary dentistry in children with the appropriate usage of technology and the key tools, is the way forward. The benefits of the “No Anaesthesia” erbium approach far outweighs the existing alternatives. This kind of professional approach can certainly become the gold standard for dentistry in children in the very near future.

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Dr Alfredo Iandolo, Italy, & Dr Dina Abdel Latif, Egypt

Introduction

Bacteria and their by-products are the main causative factors of infections in the pulp and the periapical area. \(^1\) The aim of modern endodontics is to eliminate or reduce the bacterial load to levels compatible with the healing process. \(^2\) This can be achieved by adequate root canal shaping, appropriate 3-D cleaning and finally complete obturation of the complex root canal system with thermoplasticised gutta-percha. \(^3, 4\) The previously listed procedures can treat irreversible pulpitis or eliminate a periapical and/or lateral lesion of endodontic origin. However, even if carried out correctly, a short or long-term success cannot be guaranteed from the structural point of view.

One of the major causes of postoperative root canal therapy failures, leading to extraction of the treated tooth, is tooth fracture due to insufficient remaining tooth structure. For this reason, if correct and modern endodontic treatment is combined with a minimally invasive access design, which provides the room to explore and conserve as much of the tooth structure as possible, greater durability will be assured for the treated tooth.

The success of endodontic treatment depends on identifying, exploring and completely treating all of the complex root canal system. This goal can be accomplished through possessing the requisite knowledge and exploring the anticipated canal system using the newest technologies. Throughout the past few years, minimal access cavity preparation and its disadvantages have been topics of much debate. The objective of this article is to discuss when it is possible to create conservative access cavities in endodontic treatment, how this should be done and why.

When?

A minimally invasive access cavity can be prepared only if the following considerations can be entirely realised:
- direct visualisation of the entire floor of the pulp chamber and ability to fully explore the anatomy of the pulp chamber
- ability to localise all of the anticipated canal orifices
- complete removal of any present calcifications on the floor of the pulp chamber
- ability to prepare the isthmuses in premolars with two root canals
- likewise, ability to prepare the mesial isthmuses in mandibular molars
access allows exploration and cleaning of the pulp chamber without removing the pulp horns and with minimal removal of the roof.

According to these points, we consequently discuss in which clinical situations preparing a conservative access cavity is recommended.

Teeth with irreversible pulpitis or necrosis due to Class V cavities

After removal of the caries, a sound occlusal surface can be obtained. Therefore, in this case, it is advised to prepare a conservative access cavity in order to preserve the tooth structure. This applies likewise to teeth with irreversible pulpitis or necrosis due to proximal caries that does not extend to the occlusal surface. In these cases, after eliminating the entire carious lesion, it is possible to extend the preparation a little bit occlusally to perform the endodontic treatment through a mesial or distal cavity.

Fig. 3a–c: Cleaning the isthmus with an ultrasonic tip for endodontic surgery. The tip was used to remove calcification and shape the isthmus, with mesial access to preserve the occlusal surface. Fig. 4a–c: Cleaning the isthmus with an ultrasonic tip for endodontic surgery. The tip was used to remove calcification and shape the isthmus, with mesial access to preserve the occlusal surface. Fig. 5: Pre-op periapical radiograph of tooth #16, which presented with mesial caries. Fig. 6: Cleaning the pulp horns with an ultrasonic tip. Fig. 7: Post-op periapical radiograph, in which the preserved tooth structure can be seen. Fig. 8: Post-op periapical radiograph, in which the preserved tooth structure can be seen.

Teeth with irreversible necrosis or necrosis caused by preparation below crowns and bridges

In such cases, if the pulpal pathology is due to the preparation of the teeth and provided that no carious lesion exists and the crown or a bridge has definitive margins, it is ideal to prepare a conservative access cavity for structural and aesthetic reasons.
Teeth with irreversible pulpitis or necrosis caused by periodontic-endodontic lesions with no or minimal occlusal caries

Severe periodontal disease can lead to pulpal pathology, while the tooth structure can be intact and sound. In such cases, a small conservative access cavity can aid in maintaining the integrity of the affected teeth. This applies similarly to cases of teeth with irreversible pulpitis or necrosis due to trauma or hazardous occlusal stresses.

How?

The conservative design of access cavities can be applied only when the operator has adequate experience and with the aid of modern technologies, such as a dental operating microscope, ultrasonic tips, modern nickel-titanium rotary files and modern 3-D cleaning. Only under high magnification and with an efficient light is it possible to visualise, through the small access cavity, the entire floor of the pulp chamber, all of the root canal orifices, the main canals, the accessory canals and any obstructions, such as calcifications. Therefore, the use of the operating microscope in preparing such small access cavities is crucial.

Preparing a conservative access cavity is done under the operating microscope and drilling with long shank burs of small diameter (0.8–1.0 mm), for better visibility, to penetrate the pulp chamber. Once in the chamber, irrigation with sodium hypochlorite is done in order to eliminate any debris. Afterwards, using a K-type file of small diameter (0.08 mm), the root canals are probed and explored. Subsequently, any calcifications are visualised under magnification, then removed with ultrasonic tips. If some of the root canals cannot be found at this point, they can be located using ultrasonic tips while cutting into the floor of the chamber.

One of the important points in the conventional extended access opening cavity is the complete removal of the pulp chamber roof (which is important to avoid bacterial contamination from pulp residue). However, with the modern method of conservative access cavity preparation, this excessive removal of dentine can be avoided by completely cleaning all of the roof of the pulp chamber without leaving any pulp residue. This can be accomplished using ultrasonic tips designed for endodontics. In this case, it is advised to use a small ultrasonic tip with a small round diamond end or an ultrasonic tip designed for periapical surgery. Such special ultrasonic tips are able to clean the pulp horns and the remaining roof without removing any valuable tooth structure (Figs. 1 & 2).

An additional point, which was very important in the past, is that the insertion of the files into the root canals must be done in a perpendicular direction to the occlusal surface of the tooth. In order to achieve such an entrance to the canals, sound tooth structure is sacrificed. With the conservative access cavity, we can enter the canals at an angulation that is perpendicular to the coronal one.
third of the canal as illustrated in Figure 1b. Moreover, with the aid of pre-bent modern rotary files, which have super-elastic alloys even in their martensitic phase (rest phase), it is possible to enter root canals with difficult access without sustaining fractures.

Only after we have visualised the actual anatomy of the pulp chamber is it possible to precede with root canal shaping, followed by the phases of 3-D cleaning and 3-D obturation. With modern protocols of irrigant activation, it is possible to guarantee a more accurate and thorough cleaning. Among these protocols are ultrasonic activation, sonic activation, internal heating, laser and negative apical pressure.

Why?

Why complicate life? This is one of the most repeated questions when it comes to the conservative access. The answer is simple: because the suggested access design in the current article is not extreme, and when it is performed with experience and with the updated technologies while respecting all of the previously discussed parameters, iatrogenic errors can be avoided. Not only will the tooth be treated in a safe and healthy approach that will preserve valuable tooth structure, but the short- and long-term success will be improved as well. Figures 3–13 illustrate the preparation of a conservative access cavity and its clinical applications in clinical cases.

Conclusion

If through the conservative access cavity, it is possible to eliminate the entire carious lesion, to visualise the whole floor of the pulp chamber, to explore all of the canal orifices, to prepare and to clean the isthmuses, and to remove any calcifications present, then it is possible to obtain short- and long-term success. Above all, valuable sound tooth structure will be preserved in comparison with the conventional access design.

Certainly, in order to prepare these conservative access cavities, it is necessary for the operator to have enough clinical experience. Equally important is the use of modern technologies, in particular the dental operating microscope, ultrasonic tips, modern rotary files and up-to-date protocols of 3-D cleaning. In conclusion, these modern technologies and this conservative access design should be implemented by more endodontists in order to achieve higher rates of success and longevity of root canal therapies.

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

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Root canal therapy and coronectomy

Drs Mirna Hobeika, Ali Hajj Hassan, Edgard Jabbour & Philippe Sleiman, Lebanon

Introduction

Coronectomy is a procedure that generally spares the vital coronal pulp and is performed to avoid the risk of damaging the inferior alveolar nerve (IAN) during the surgical procedure when extraction of mandibular third molars is indicated or needed. Coronectomy is the removal of the crown of the mandibular third molar without exposing the pulp.\(^1\) The coronectomy procedure is performed only on the third molar crown, leaving the roots in the socket. This procedure is now known for its benefits and success rate, in contrast to the contemporary belief that the roots left behind will be a source of problems.\(^2\) Risk factors for nerve injury include root proximity, the surgeon’s experience, surgical procedures, the patient’s age and pre-existing disease. Several studies have shown that coronectomy significantly decreases the risk of iatrogenic injury to the IAN and lowers the complication rate.\(^3\) Coronectomy has been associated with a low incidence of complications in terms of IAN injury (0.0–2.0 %), lingual nerve injury (0.0–2.0 %) and pulp disease (0.9 %),\(^4\) in addition to other rare events, such as swelling, fever, alveolitis, pulpitis and root exposure.\(^5\)

Coronectomy to prevent IAN damage was first proposed by Ecuyer and Debien in 1984,\(^6\) and it remained controversial owing to the possibility of infection and other pathologies arising from the roots left behind.\(^2\) Potential complications include deep dry sockets, local postoperative infections, postoperative pain, pulpitis, root canal necrosis and infection, and an increased risk of IAN infection, which is known as failed IANI.\(^7\)

The point of discussion is whether it is necessary to perform root canal therapy simultaneously with coronectomy if the pulp is going to be exposed during the surgical procedure. A new method combining coronectomy with root canal therapy, when necessary, in order to decrease the risk of infection, pain and other complications is introduced in this paper.

Fig. 1: Partially erupted third molar and inflammation of the gingiva distally. Fig. 2: Pre-op radiograph showing a hook-like curve of the mesial root, as well as the relationship between the pulp chamber position and the bone level. Fig. 3: CBCT scans showing the intimate relation between the mesial root and the IAN and confirming the bone level relative to the pulp chamber. Fig. 4: File in a mesial canal showing the abrupt curvature. Fig. 5: A complete root canal therapy was performed. Fig. 6: Bitewing radiograph taken during the surgical procedure, showing the level of the surrounding bone and the remaining part of the tooth.
Case presentation

A female patient in her mid-twenties was suffering from typical partially erupted third molar complications (Fig. 1). Extraction was advised in order to relieve the patient. A preoperative radiograph was taken (Fig. 2) for the surgeon and endodontist to discuss the shape of the roots and the IAN proximity. At the request of the endodontist, a CBCT scan was performed (i-CAT), as is advised prior to any surgery (Fig. 3). The cross sections revealed an intimate relation between the mesial root and the nerve, and thus indicated that any surgery at this point could cause some trauma to the nerve.

The situation was explained to the patient, who was very concerned about the potential injury to the IAN. However, the patient presented with acute pain, which would require treatment, possibly antibiotic therapy, which in the future would be her go-to in case of a flare-up. This was definitely not an ideal solution, especially in view of the efforts currently being undertaken by the European Society of Endodontology to limit antibiotic prescription for root canal therapy to a reasonable and evidence-based minimum. The alternative solution in such cases is coronectomy.

From discussing this option with the surgeon and studying carefully the radiographs and CBCT data, it was clear that, if the surgeon was to cut the crown below bone level, pulp exposure and partial pulpectomy were inevitable. Therefore, in order to minimise postoperative complications, the decision was made to perform a root canal therapy on the third molar to reduce the risk of pulpitis or infection in the apical part. The patient agreed to this solution.

Endodontic treatment was performed using the TF Adaptive SM (small/medium) procedure pack (Kerr) for root canal shaping. During the treatment, one periapical radiograph was taken (Fig. 4) and it showed the curve on the mesial roots. Irrigation was performed very safely with the EndoVac unit (Kerr), as any extrusion of sodium hypochlorite could have severe consequences for the nerve and the apical area. The root canal therapy was completed in a single visit (Fig. 5), following which the surgeon performed the coronectomy. A bitewing radiograph was taken to check the level of the coronal part after the excision and confirm that it was completely under the bone level (Fig. 6). A reinforced glass ionomer was used to seal the roots, and sutures were placed and left for one week. A small field of view CBCT was taken to check the postoperative outcome of the procedure (Fig. 7).

Two years after the treatment, the patient returned to the clinic complaining of some pressure sensations in the area. A CBCT scan allowed us to investigate the situation, and it revealed a pleasant surprise: the tooth had migrated coronally and gone above the nerve (Figs. 8 & 9). We explained to the patient that the remaining part of the tooth had moved towards the gingival level, which was why she was feeling pressure, and now it would be safe to remove the remaining tooth. The surgeon performed the intervention. Figure 10 shows how much the tooth had migrated over the two years and demonstrates the absence of any infection under the roots.

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

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Mastering flare preparations with One Flare

Description of a new thermally treated instrument that simplifies access to the apex

Dr Franck Diemer, France; Dr Jean-Philippe Mallet, France; Haifa Ben-Rejeb, Tunisia & Dr Walid Nehme, Lebanon

For more than 20 years, the use of nickel-titanium (NiTi) in endodontics has allowed the speed, quality and reproducibility of root canal therapy to be improved. Over the same period, the geometry of the relevant instruments has evolved significantly too. In 2008, the appearance of the asymmetrical cross section with Revo-S (MICRO-MEGA) allowed for fewer restrictions and the cleaning capacity of endodontic instruments to be improved. MICRO-MEGA’s mastering of NiTi machining and changes in cross section and surface treatments (electropolishing and thermal treatment) have created a new instrument dedicated to enlarging root canal entrances.

The corono-radicular junction sometimes produces a particular form of mineralisation that partially obstructs root canal entrances. To give an example, sometimes this triangular mineralisation, at the level of the root canal entrances to the molars, is located opposite the furcation (Fig. 1). In order to prevent it from limiting the use of files and to optimise initial preparation for endodontic treatment, it must be removed (Fig. 2). Generic instruments such as Gates–Glidden or Largo drills have been used for this purpose, but they present a risk of effecting major changes to the root canal anatomy, particularly in the case of the endodontic treatment of multirooted teeth. This challenge was the reason for the development of specific instruments such as ENDOFLARE (MICRO-MEGA) and ProTaper Universal SX (DENTSPLY, now Dentsply Sirona). A new generation of these files, whose design has benefited from advanced technologies related to asymmetry, cross section and thermal treatment, is now available in the form of MICRO-MEGA’s One Flare.

At only 17 mm, One Flare is relatively short in order to be able to work at the root canal entrance at the corono-radicular junction. It features a triple-helix cross section, which has been found to be one of the sturdiest among those that are currently used in clinical practice. Like the one of Revo-S or One Shape (MICRO-MEGA), this cross section is asymmetrical, but with a progression from the tip to the shaft for optimised flexibility. One Flare has a constant cone taper of 9 % and a tip diameter of 0.25 mm. This tip gives the file extraordinary strength while remaining sufficiently thin to be able to easily penetrate after a scouting file.

The sharpened section of the instrument (13 mm) is made from NiTi wire with a diameter of 1 mm. The active section therefore varies from 0.25 to 1 mm, from the tip to the shaft, while the interval and angle of the helix increase. It also undergoes electropolishing treatment to remove machining burrs and give it a smooth surface and straight cutting edges without any snags, as well as thermal treatment to increase its flexibility and resistance to fracture (Figs. 3a & b). This treatment proves particularly significant when enlarging the entrance to a second mesiobuccal canal in the maxillary molar, for example.

The great flexibility also makes it possible to enter extremely curved canals or ones with extreme changes of direction, all without any risk of fracturing the tip or of creating blockages or stops. The geometry of and treatments used in the production of One Flare allow it to be used with a motor, with or without torque control, and continuous rotation of between 250 and 400 rpm, without pressure or with very low apical pressure.

After the initial scouting and securing using a hand file with a tip diameter of 0.1 mm or a continuous-rotation NiTi instrument such as One G (MICRO-MEGA), One Flare prepares the area of the corono-radicular junction. The instrument uses a conventional wave movement in three successive phases, from the crown to the tip, centred in the canal and allowing it to progress by a few millimetres. After treatment, the file is withdrawn from the canal and...
cleaned. The canal is irrigated once again and negotiated using the steel file used for the initial root canal exploration. Once the instrument has penetrated to a depth of 4 mm (± 1 mm), it can be used with pressure on the walls to selectively collect samples, remove the initial dental irregularities and reduce the initial restrictions to the following shaping instrument (Fig. 4). This penetration (maximum of 5 mm) theoretically allows it to create a root canal entrance of 0.61 mm (maximum of 0.70 mm), which is less than or equal to the diameter of a No. 2 Gates–Glidden drill (0.70 mm).

**Conclusion**

This new flaring instrument offers a new minimally invasive approach to endodontic treatment by selectively eliminating dentine formations at the corono-radicular junction. It meets multiple requirements of endodontic preparation, such as removing initial interferences to root canal preparation instruments, preliminary removal of the first millimetres of a dense pulp, fibro-calcic or even necrotic parenchyma and re-centring of root canal shaping instruments (Fig. 5), as well as ensuring the precision of the apical limit of endodontic preparation and 3-D cleaning or filling of the root canal (Fig. 6).

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

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![Fig. 1: Schilder triangle, mineralisation of the root canal entrance. Fig. 2: Creating the access cavity and radiograph with scouting file in place (MB1 and MB2). The mineralisation of the root canal entrance limited the initial catheterisation. Figs. 3a & b: One Flare: MEB profile and tip view (Dr Franck Diemer). Fig. 4: One Flare eliminates the Schilder triangle and the initial millimetres of the pulp parenchyma in order to permit root canal shaping without any coronal interferences to the instrument after the apical limit has been established. Fig. 5: One Flare ensures the removal of the first millimetres of pulp parenchyma and removes the interferences to files, which are re-centered in the canal in order to facilitate access and the shaping to the apical preparation limit. Fig. 6: The judicious enlargement of the root canal entrances using the One Flare instrument allows endodontic shaping and cleaning in total safety while preserving the root canal anatomy.](image)
More than 20 years ago, Torabinejad et al. first described a new root-end filling material called mineral trioxide aggregate (MTA). MTA showed in vitro better sealing ability than amalgam or Super EBA when used as a root-end filling material. Later, several in vivo and in vitro studies demonstrated more applications for MTA. Pulp capping, apexification, repair of root perforations and root-end filling are commonly described clinical procedures to seal the pathway of communication between the root canal system and the external surface of the tooth. The application of MTA was first described as being achieved with aid of plastic or metal spatulas. Unfortunately, proper placement was not possible in this manner.
Therefore, Produits Dentaires introduced a universal carrier system for clinical and surgical MTA placement. Its Micro-Apical Placement (MAP) System offers different application points for every clinical situation. The Intro Kit and the Universal Kit are for orthograde obturation and the Surgical Kit for retrograde obturation. New NiTi Memory Shape tips can be manually shaped to any required curvature. After autoclave sterilisation, the needle returns to its initial shape. With the use of the MAP System, proper placement of MTA has become an easy task for every dentist.

In combination with the MAP System, Produits Dentaires offers a white MTA specially developed for placement with the MAP System. The optimised practical size means economical application for each treatment. There are many indications for the PD MTA White, and with the MAP System, proper placement is easy in every situation.

**Pulp capping**

Vital pulp therapy has become more popular in recent years. Calcium hydroxide has been the most common material for pulp capping, but MTA has
shown even better results in biocompatibility and outcome.\(^3\) Cases with large carious pulp exposure can be treated successfully with partial pulpotomy and MTA as a capping agent, keeping teeth vital (Figs. 1a–e).

**Apexification**

In order to prevent extrusion of root canal filling material in immature teeth with open apices, MTA is used as an apical plug. The results of many studies have shown that MTA induced apical hard tissue formation more often and its use was associated with less inflammation than with other test materials (Figs. 2a–g).\(^4\)

**Repair of root perforations**

Accidental perforation of the pulp chamber or of the root canal significantly changes the prognosis of the tooth. Perforation repair with a biocompatible sealing material such as MTA may save compromised teeth (Figs. 3a–e).\(^5\)

**Apical surgery**

MTA is the material with the most favourable outcome as a root-end filling material for apical surgery. MTA has been associated with significantly less inflammation, cementum formation over MTA and regeneration of the periradicular tissue (Figs. 4a–f).\(^2\)

*Editorial note: A list of references can be obtained from the publisher.*
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Laser-enhanced endodontic treatment

Dr Gregori M. Kurtzman, USA

Endodontic success is predicated on the ability to debride and clean the canal system. That canal system is a complex array of accessory and lateral canals, fins and other anatomical areas inaccessible to endodontic files (Fig. 1). As practitioners, we are able to clean the main canals with files, either hand or rotary. But they cannot mechanically remove pulpal tissue and debris from the canal anatomy present adjacent to the main canals.

Treatment success requires elimination of the pulpal tissue and associated bacteria from this anatomy, so that it can be sealed during the obturation phase of treatment. As only one thing can occupy a space at a time, obturation material cannot fill areas still occupied by pulpal tissue. Success is dependent on disinfection and debridement of the canal system so that it may be sealed during obturation. Irrigation has long been accepted as a key factor of treatment to achieve those goals.

Yet, complete clearing of residual bacteria especially in the apical portion of the canal system has been difficult to achieve with traditional methods using even sodium hypochlorite (NaOCl) solutions (Fig. 2). Studies have demonstrated that the additional use of an Er:YAG laser to activate the irrigation solution greatly enhances not only the efficiency of the irrigation solutions advocated (NaOCl and EDTA) but also improves disinfection of the canal system, clearing accessory so that it may be sealed during obturation (Figs. 3 & 4).

Irrigation the key to endodontic success

Although, instrumentation with files is important to enlarging the canals and ready them to be obturated, debris consisting of pulpal tissue and associated bacteria is not effectively removed by files. Irrigation with an appropriate solution is required to remove that debris from the canal walls. NaOCl is still the accepted irrigant due to its tissue dissolving ability and antibacterial nature. Yet, it cannot effectively reach far beyond the main canals to remove the residual tissue. Tissue dissolution can be enhanced to more effectively remove pulpal tissue/bacteria and also reach further into the accessory anatomy to allow better sealing of the canal system improving treatment success.

Smear layer within the canal system plays a factor in success in endodontic treatment. The smear layer contains bacteria which when left within the canal anatomy may lead to reoccurrence of infection endodontically. When compared to traditional irrigation methods, laser enhanced irrigation has demonstrated better intracanal smear layer removal. As Enterococcus faecalis has been routinely linked to endodontic failures, and is a common occupant of the oral cavity, elimination of this bacteria is critical to prevention of reinfection of the canal system. NaOCl as an irrigant has not shown to be effective in elimination of E. faecalis, yet when combined with laser enhanced irrigation with NaOCl this bacteria has been eliminated in the canal anatomy.

Fig. 1: Anatomy of the canal system demonstrating accessory canals, fins and lateral canals which are not accessible with endodontic files as shown in cleared teeth.
Laser-enhanced irrigation

Laser energy has been documented to enhance the known effects of NaOCl irrigation through both heating the solution within the canal system and its distant antibacterial effects. But not all laser wavelengths have demonstrated to be equal in effectiveness. The best effects are when NaOCl is combined with an Er:YAG laser as compared to NaOCl alone or when utilised with other laser types. Antibacterial effects were reported to be the best with this combination of irrigant and laser. The higher wavelength of the Er:YAG compared to the Nd:YAG or diode was more effective in smear layer removal, hence, better at bacterial elimination within the canal system. Utilisation of a EDTA as an irrigant alternated with NaOCl provides the best debridement of the canal system with enhancement with a Er:YAG laser, as these two solutions have a synergistic effect complimenting each other’s effects in the canal anatomy.

Additionally, the Er:YAG laser (LiteTouch™, AMD LASERS) creates hydrodynamic pressure following cavitation bubble expansion and collapse when the irrigation solution is activated in the chamber. Placement of the laser tip does not require entry into the canals to achieve the desired effects and activation of the irrigation solution in the chamber is sufficient to affect the entire canal system. The LiteTouch™ Er:YAG laser energy is set at a sub-ablative power level which allows its use without structural changes to the hard tissue within the tooth. This eliminates the risks of ledging and perforation of the pulpal floor allowing safe usage within the tooth.

When the Er:YAG laser is activated, a heat pulse is generated by the laser radiation delivered via a sapphire tip into an absorbing liquid (irrigant). This results in tensile stress with cavitation induced in the liquid in front of the sapphire tip at a distance far below the optical penetration depth of the laser radiation. Bubble expansion and collapse cause the surrounding fluid to flow at a speed of up to 12 m/s travelling throughout the canal system. This causes rapid displacement of intracanal fluid via radial and longitudinal pressures sufficient to drive irrigants into the canal anatomy and clean the dentinal tubules significantly. This photomechanical activation of the irrigants includes a temperature rise in the irrigant increasing its effectiveness in debridement of dentinal walls and its tubules and increases the chemical properties of the irrigants.

LiteTouch-Induced Photomechanical Irrigation (LT-IPI)

Endodontic treatment is initiated with access to the pulp chamber, which may be performed by traditional methods using burs or by ablation of the enamel and dentine with the LiteTouch™ Er:YAG laser. As the laser is ineffective in removal of ceramics and metals, such as those used in fixed prosthetics and also amalgam, carbides and diamonds are needed create access through these materials. Once dentine has been reached the laser may be utilised to unroof the pulp chamber (hard tissue mode). An additional benefit of the Er:YAG laser to access the pulp chamber is that it provides decontamination and removal of bacterial roots. industry report 25 2018
debris and pulpal tissue to yield a cleaner chamber aiding it identification of the canal orifices (soft tissue mode).

Once the canal orifices are identified, hand files are utilised to establish a glide path to the apical working length in each canal. Canals are then enlarged to the desired ISO canal size with either hand or rotary files (Fig. 5a). Laser-assisted canal irrigation requires canal preparation to an apical preparation ISO 25/30 at a minimum. A canal taper of .04 or .06 for the final instrumentation is recommended. Sodium hypochlorite (NaOCl) is utilised within the chamber and canals during instrumentation both as a pulpal tissue dissolvent and to lubricate the files within the canal, decreasing the potential of file separation that can occur when instrumenting a dry canal (Fig. 5b).

Photo-activation of the irrigant within the canal system is performed using the Er:YAG laser with a 0.4/17 or 0.6/17 mm tip which assists in removal of the debris created by the files. Between each rotary file, the chamber is filled with NaOCl and the tip of the laser is placed into the chamber and the solution activated with the laser at 40mJ at 10Hz with an average power of only 0.5W for 20 seconds (Fig. 5c). The chamber is suctioned and fresh NaOCl is placed into the tooth and the next file is used for instrumentation. It is unnecessary to place the lasers tip into the canals themselves, as activation of the solution within the chamber transmits down the irrigant into the canals to the apical aspect of the roots. Laser activation may also be performed with 17 % EDTA solution alternated with NaOCl. The benefit of EDTA solution is its chelation effect opening canal anatomy so that the next round of NaOCl can reach more pulpal tissue not accessible to the files in fins, as well as accessory and lateral canals.

Following final instrumentation of the canals with rotary files, the chamber is filled with NaOCl and the Er:YAG tip is placed into the chamber again and activated for a minimum of 60 seconds. This allows the photo-activated irrigant to clear debris and remaining pulpal tissue from the complete canal system. The irrigation solution is suctioned from the chamber and fresh irrigant placed and photo-activation repeated until no visible debris (cloudiness) is noted in the chamber fluid. This indicated that all accessible debris has been removed from the canal system. Any remaining solution is suctioned from the tooth and the canals are dried with paper points. Obturation is then accomplished using the practitioners preferred method and materials allowing obturation of anatomy inaccessible by instrumentation with files (Figs. 6 & 7).

Conclusion

The key to endodontic success is two pronged, cleaning the system and sealing it. Although, rotary files have improved the efficiency of instrumentation they are unable to reach any more of the anatomy that handfiles are able to reach. Cleaning of the canal system is keyed to irrigation of the canal system to improve debris removal in anatomy that the files are unable to contact. When anatomy is not fully cleaned, sealer is unable to fill this leaving bacteria to inhabit those areas which may lead to endodontic failure over time. Laser enhanced activation of endodontic irrigants cleans more anatomy adjacent to the main canals so that a more complete obturation of the canal system can occur. An added benefit is that the laser has an antibacterial effect, killing bacteria within the canal anatomy as well as distant to where the irrigation solution may reach essentially sterilising the entire tooth to the periodontal ligament.

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

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RECIPROC blue: The new generation of reciprocation

Dr Ghassan Yared, Canada

The use of mechanical instruments in reciprocation with unequal forward and reverse rotation was introduced in 2008. The RECIPROC series of instruments (VDW) were designed specifically for this type of motion. RECIPROC blue, a thermally treated nickel-titanium instrument, is an improved version of the original RECIPROC. It has increased resistance to cyclic fatigue and greater flexibility.

The present article describes the use of RECIPROC blue instruments for canal preparation without any prior instrumentation and without a glide path. Only one instrument is needed to enlarge the majority of canals to an adequate size and taper regardless of the size of the canal and the degree of canal curvature or canal calcification. Similar to the original RECIPROC series, the RECIPROC blue system includes three instruments, RECIPROC blue 25, RECIPROC blue 40 and RECIPROC blue 50, matching paper points, matching gutta-percha cones, and matching gutta-percha obturators (GUTTA-FUSION) (Figs. 1a–d). The RECIPROC blue instruments have an S-shaped cross section (Fig. 2). The three instruments have a regressive taper starting at 3 mm from the tip. RECIPROC blue 25 has a diameter of 0.25 mm at the tip and an 8% (0.08 mm/mm) taper over the first 3.0 mm from the tip. RECIPROC blue 40 has a diameter of 0.40 mm at the tip and a 6% (0.06 mm/mm) taper over the first 3.0 mm from the tip. RECIPROC blue 50 has a diameter of 0.50 mm at the tip and a 5% (0.05 mm/mm) taper over the first 3.0 mm from the tip.

The instruments are used in conjunction with a motor (Figs. 3a, b) at ten cycles of reciprocation per second. The motor is pro-
grammed with the angles of reciprocation and speed for the three instruments. The values of the forward and reverse rotation are different. When the instrument rotates in the cutting direction (forward rotation), it will advance in the canal and engage dentine to cut it. When it rotates in the opposite direction (reverse rotation; smaller than the forward rotation), the instrument will be immediately disengaged. The end result, related to the forward and reverse rotation, is an advancement of the instrument in the canal. The angles set on the reciprocating motor are specific to the RECIPROC blue instruments. They were determined using the torsional properties of the instruments.

**Technique**

The technique is simple. In the majority of canals, only one RECIPROC blue instrument is used in reciprocation to complete the canal preparation without the need for hand filing or creating a glide path. The requirements for the access cavity and the straight-line access to the canals, and the irrigation protocols remain unchanged. The use of drills or orifice openers is not required prior to starting the canal preparation with the RECIPROC blue instrument.

The selection of the appropriate RECIPROC blue instrument is based on an adequate radiograph just as shown on graphics (Fig. 4). If the canal is partially or completely invisible on the radiograph, the canal is considered narrow and RECIPROC blue 25 is selected (Figs. 5a–c). In cases where the radiograph shows the canal clearly from the access cavity to the apex, the canal is considered relatively large (Figs. 6a–c). A size 30 hand instrument is inserted passively to the working length (verified with an apex locator) with a gentle watch-winding movement, but without a filing action. If the file reaches the working length, the canal is considered large, and RECIPROC blue 50 is selected for the canal preparation. If the size 30 hand file does not reach the working length passively, a size 20 hand file is inserted passively in the canal. If it reaches the working length, then the canal is considered medium in size and a RECIPROC blue 40 instrument is used for the canal preparation. If the size 20 hand file does not reach the working length passively, RECIPROC blue 25 is selected.

Before commencing preparation, the length of the root canal is estimated with the help of an adequately exposed and angulated preoperative radiograph. The silicone stopper on the instrument is set at two-thirds of that length. RECIPROC blue is introduced into the canal with a slow in and out pecking motion without pulling the instrument completely out of the canal. The amplitude of the in and out movements (pecks) should not exceed 3–4 mm. With this flexible instrument, only very light pressure should be applied. The instrument will advance easily in the canal in an apical direction and should not be forced forward. After three pecks, or if resistance is encountered before the three pecks are completed, the instrument is pulled out of the canal to clean the flutes. A size 10 hand file is used to check patency to two-thirds of the estimated length. The canal is copiously irrigated. The RECIPROC blue instru-
ment is then reused in the same manner until it reaches two-thirds of the estimated length. The canal is irrigated and a size 10 file is used to determine the working length with the aid of an apex locator and a radiograph. After that, RECIPROC blue is used as described until it reaches the working length. As soon as the working length has been reached, the instrument is withdrawn from the canal to avoid unnecessary over-enlargement. The RECIPROC blue instrument can also be used with a brushing motion against the walls of wide canals.

With continuous rotation, it is necessary to create a glide path in order to minimise instrument binding and the risk of fracture. Binding is less likely to occur when an instrument is used in reciprocation with unequal forward and reverse angles and with the limited in and out movements as described earlier. Therefore, a glide path is not required in the majority of canals when instruments are used in this manner. It has been shown the incidence of fracture of instruments used in reciprocation with unequal forward and reverse angles and with a pecking motion is very low in comparison with rotary instruments. However, just as with any continuous rotary system, it is possible to use the RECIPROC blue instruments after creating a glide path with, for example, R-PILOT (VDW; Fig. 7), a new reciprocating instrument specifically designed for this purpose.

A glide path should be created with R-PILOT prior to using RECIPROC blue in some canals, or for example when the RECIPROC blue instrument stops advancing in the canal or if advancement becomes difficult. In such a canal, apical pressure should not be exerted on the RECIPROC blue file. The instrument should be removed from the canal and the canal should be irrigated. Patency is then established to the working length with a size 8 file and the R-PILOT instrument is used to create a glide path to the working length. The RECIPROC blue instrument can then be used safely to the working length. The R-PILOT instrument is used with the same reciprocating motor and settings, with a light and short pecking motion similar to the use of RECIPROC blue. A glide path can also be created with R-PILOT to reduce the stresses on the RECIPROC blue instruments, for example in canals with difficult access or canals presenting with a curvature in their coronal thirds (Fig. 8).

Access to the orifices of some canals, such as the mesiobuccal orifice of a mandibular second molar, may be difficult. Owing to the thermal treatment of the RECIPROC blue files, it is safe to gently pre-curve their tips in order to make the access to these orifices easier. If an increased apical enlargement is required, a larger RECIPROC blue instrument or a nickel-titanium hand or rotary instrument can be used.

In conclusion, the use of instruments in reciprocation with unequal forward and reverse rotation and with a limited pecking motion has been shown to be very safe. The introduction of the RECIPROC blue instruments with enhanced physical properties makes the procedure even safer with respect to instrument fracture and maintenance of canal curvature (internal evaluation; Figs. 9a–c).

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

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Dr Ghassan Yared is an endodontist practising in Guelph and Waterloo in Ontario in Canada. He has been extensively involved in teaching. He joined the Department of Endodontics at the University of Toronto in Canada in 1999 for a full-time position as assistant head and director of the endodontic undergraduate programme. He remained in this role as an associate professor until summer 2004. Dr Yared is an internationally recognized educator, focusing on clinical interdisciplinary endodontics and reviewer for several international scientific magazines. He is also a Fellow of the Royal College of Dentists of Canada, and a member of the Canadian Academy of Endodontontology and the American Association of Endodontists.
Simply one step ahead

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Simple, but effective: The new RECIPROC® blue file generation combines the ease of the original RECIPROC® one file endo concept with enhanced safety in root canal preparation and retreatment for patients. An innovative heat treatment makes RECIPROC® blue particularly flexible to ensure a smoother and safer progression in the canal and gives it in addition its characteristic blue color.

A great file. Even better.
When it comes to root canal therapy, clinicians strive for reliable results. To achieve this, they need products that are safe, efficient and proven. Although there have been several innovations to support dentists in every phase of endodontic treatment, it is still a challenge to disinfect narrow root canals thoroughly, especially because undetected debris oftenpromotes further infection. Endodontist Dr Katrien Carnotensis, who works in a group practice in Antwerp in Belgium, learnt about VDW’s EDDY irrigation solution at an event in Brussels in Belgium and has been using it in her practice since then.

EDDY tips are used for 3-D sonic-powered irrigation. The innovative tips are made of a safe and flexible polymer material and, powered by an air scaler, produce a highly effective oscillation in the irrigant that triggers two cleaning effects: cavitation and acoustic streaming. In the following interview, Dr Carnotensis talks about her experiences with the product.

How important is it to clean the canal thoroughly prior to obturation? How can you be certain that you have cleaned the canal thoroughly?

I have conducted endodontic treatments under a microscope for several years already, but it was always frustrating to see that, even after extensive rinsing, there was a lot of debris visible on the canal walls. The bacteria in the debris are likely to cause short- or long-term failure and can have a negative influence on the endodontic treatment. That is why I was looking for a better system with which to clean the canal, especially in the case of canals with a complex anatomy, resulting in debris adhering to the isthmus and oval or figure eight-shaped canals.

What is your disinfection/irrigation protocol? How did you activate your irrigant before using EDDY?

Actually, I use a 5% sodium hypochlorite and citric acid and I had tested many systems for activation before, such as IRRI S (VDW) and EndoActivator (Dentsply Sirona). Before I had the opportunity to try EDDY, I had problems with breakage of instruments, ledging and insufficient results concerning the cleaning.

Is a flexible tip important?

Yes, I like to take the tip to 2 mm from the apex, so flexibility is very important. Since the EDDY tip is so flexible and soft, I no longer have any trouble with ledges. I can use it safely almost to working length.

How did you learn about EDDY, and what made you want to try these tips?

I learnt about EDDY at an event in Brussels. Nevertheless, I had to wait before I had the opportunity to use it myself because the product was not available in our market yet. After the product launch, I received a few samples, which I tested immediately.

What were your thoughts when you first tried EDDY?

It is so easy and practical to use. I appreciated these qualities from the very first day! The attractive and sterile packaging is an advantage too.

Have you seen a difference on radiographs since using EDDY?

“Since the EDDY tip is so flexible and soft, I no longer have any trouble with ledges.”
Since I have been using EDDY, I assert that there has been a significant improvement concerning the obturation of lateral canals. There has been a difference especially in the results in the front region. In cases of open apices or wide apical foramina, it is still advisable to work very carefully.

Would you recommend EDDY to colleagues?

Of course, I would. The system is eminently user-friendly. Therefore, it is comfortable and reliable to use, even without a microscope. With a minimal investment for EDDY, dentists can achieve higher quality and efficiency in root canal therapy. Actually, I use it to apply the cement too.

Can you describe any clinical cases to demonstrate the advantages of EDDY?

I remember a special case: a 17-year-old male patient came to my dental office suffering from severe pain of tooth #16 (Figs. 1a–c). The last treatment had taken place one year before, conducted by another dentist. The patient complained of constant pain, pain on percussion and swelling. Looking at the radiograph, an infection of the mesiobuccal and distobuccal canals was clearly visible. When I opened the tooth and removed a part of the gutta-percha, I noticed a fourth canal, but I was not able to access it, so I started to clean and shape the other three canals. I rinsed and used EDDY to remove as much of the old gutta-percha as possible. After cleaning with EDDY, it was much easier to gain access to the fourth canal. It seemed that the sonic cleaning had opened the canal. In the final radiograph the lateral canal in the palatal root is precisely visible.

I have another interesting example of the successful application of EDDY: a patient with poor oral hygiene came to the practice with severe pain of tooth #15 (Figs. 2a–c). A radiograph visualised a large old composite restoration. When I opened the tooth, I detected two root canals. They were very long and narrow (25 mm), so I used EDDY to ensure that the sodium hypochlorite reached the tips of the roots. The final radiograph shows the result: a clean apical delta.

Thank you very much for the interview.

Images courtesy of Dr Katrien Carnotensis.

Cracking the code of fractured teeth

Aws Alani, UK

The need for an endodontic skill set within the profession is higher than it has ever been. Culturally and socially, there have been significant changes in patient perception to the news that a tooth is in trouble, where the solution is either root canal treatment or removal. I am old enough to have treated patients who needed the replacement of complete dentures that were a “wedding gift” in their youth. As a gesture of goodwill to the bride in waiting, wholesale extractions and the provision of complete dentures were gifted to ensure the absence of dental problems or expense throughout their new found love.

How things have changed. Patients can now attend seemingly determined and adamant that they will not have teeth removed, despite our professional opinion that unfortunately may be wholly different to what they want or would like. Indeed, if a tooth is clearly unrestorable, exhibiting a lack of coronal tooth tissue or a significant apical lesion, patients may already be sensitive to the fact that it cannot be saved. A resigned look may come over their faces, confirming their fears. What could be a more difficult patient and professional situation in endodontics? The cracked tooth.

We are aware that cracked teeth are difficult to diagnose owing to the clinical picture being variable and inconsistent between patients and their presentations.

“We are aware that cracked teeth are difficult to diagnose owing to the clinical picture being variable and inconsistent between patients and their presentations.”

Cracked teeth provide patients with an odd experience. The pain is brought on when they eat a Snickers with their coffee on a Tuesday morning (between 7.30 and 7.32 a.m.), chewing from side to side, and on the fifth stroke of their mandible from left to right they get a shooting pain. Forget simple hot and cold sensation; the pain can be brought...
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on by things that the patient likes eating the most. So, you are there looking at the patient, looking at the tooth, back at the patient hoping that tapping this tooth will provide a reaction to aid your tentative diagnosis of apical periodontitis. Nothing from the patient, not even a whimper. “Hmm. Let’s take an X-ray … Long-cone periapical please.” You take your Hubble Telescope-type magnifiers and examine the radiograph. You change the contrast in the hope of seeing something of note, nothing. The patient protests: “I get the pain every now and then, but when it happens, it’s really something else … can’t you see anything?” You sit the patient back down again and look at the amalgam filling with the suspicious eye. It looks the same as every other asymptomatic amalgam you have ever placed during your career; your thumbprint is uncanny. As your senses have been sparked, the eye of faith takes over: there is a bit of faceting on the cusps, there are some craze lines, the patient does tend to wear her restorations. “It’s cracked, the tooth is cracked.” Your patient creeks their neck up to look at you more intensely: “Can you fix it?” You sit the patient back down again and look at the amalgam filling despite being fairly unconvinced with your antics. The next riddle is how to treat, if at all. Although you cannot be 100 per cent sure that there is a crack, it might not propagate, it may stay the “same” and the patient may not need any treatment as long as he avoids the tooth. What about their Snickers though?

Some patients may accept this. Generally, patients are in two camps with whatever diagnosis we provide them with. Some are proactive “Right there’s a crack, you can’t mend it. Let’s whip it out—I’ve still got another six teeth in my top jaw I can chew on, no worries”, while others are reactive “You know, let’s just sit on it and if it gives me a problem, then I’ll come back”, to which you may reply it could catastrophically snap or fracture. The alternative, and the evidence for this is fairly light on the ground at the current time, is to instigate strategies to reduce the likelihood that the tooth will become more symptomatic—in other words, you want to brace the crack. Similar to my uncle’s wrinkly belt and his ever expanding waistline, you can hear the leather strain as he tucks into his pie. What did we get taught? Use a copper band or an orthodontic band, both of which may be difficult to source in primary care. Or we could crown the tooth and risk it going pulpitic. I imagine that to be so humbling. Having fitted the crown, you drill straight through it two days later. Indeed, whatever you do, the tooth may be unsaveable.

“Patients need to stop themselves from grinding their teeth needlessly during the day and have to instigate strategies to reduce the likelihood of parafunction in the night.”
A dental nurse in a specialist setting complained of toothache all of a sudden with no prior warning or preamble. The pain was excruciating; it was visible on her face. Her expression was tethered on the side of this incredibly painful upper first molar. She would hold the suction with one hand and her cheek with the other. She could not bite or chew and the dentists she worked with all sympathised. She saw one endodontist in the unit and, despite all the signs being inconclusive at the time, he suggested a crack (Fig. 1). Of course, it was at the back of everyone’s mind that this tooth was unrestored and she had a pristine mouth. She saw a second endodontist in the practice owing to the escalation of her symptoms. By this time, she wanted the tooth extracted, but the romantic amongst us all felt the tooth could be saved, so it was extirpated! The pulp positively nuked and the tooth dead. That should have sorted it right? Unfortunately, her symptoms continued. Could it have been something atypical? She had been stressed and grinding. More deliberation, still no further was the diagnosis. The tooth was dressed once again, with a change in the medicament. Still no joy. A restorative dentist then proceeded to drill the crack out and restore with composite. Still no joy. The tooth was taken out of occlusion when one dentist noticed the development of periodontal ligament widening on one of the long-cone periapical radiographs. The root canal treatment was completed jointly by two excellent endodontists and the second mesiobuccal canal was located. Under any other circumstances, it was a fantastic clinical outcome. Unfortunately, the pain was unabating (Fig. 2). Let us see as much as we can. A CBCT scan was taken that was also inconclusive (Fig. 3). Was it something to do with the sinus? The radiographic report was suggestive, but again nothing conclusive. Towards the end of the two weeks, the patient marched herself into the office of the exodontist to have the tooth extracted. Misery. We had failed.

With the tooth in hand and a wry smile, the nurse dipped the tooth in disclosing solution, which identified one large crack in the furcation area of the palatal root with several accessory ones (Fig. 4). The relief was palpable on her face. Despite losing a tooth, the culprit had finally been identified. It seems as though the mechanical failure of teeth, unlike our old adversary, bacteria, has the ability to trump us, from diagnosis through to treatment, despite our best intentions, knowledge and experience.

The question that crosses my mind as I see the slow but steady increase in “crackitis” is how are we going to manage this contemporary problem? Will we see the emergence of crackologists? The first step is raising awareness among patients and the profession. Patients need to stop themselves from grinding their teeth needlessly during the day and have to instigate strategies to reduce the likelihood of parafunction in the night. One emerging issue is psychological health. Patients are increasingly stressed and depressed, which is a recognised risk factor. One fairly paradoxical issue is that medication may actually increase the likelihood of bruxism, so the pharmaceutical industry may be perpetuating the problem in that stressed people who already grind are medicated and grind even more.

Cracking the code of fractured teeth is going to be difficult and will be a contemporary challenge for us all. One of my trainers from yesteryear, who had more wisdom than Yoda, once said, “From these words never depart, lips together and teeth apart”.

**Contact**

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Successful communication in your daily practice
Part II: Curious patients

Dr Anna Maria Yiannikos, Germany & Cyprus
Welcome to the 2nd part of the new communication series; the series that includes the most popular and challenging scenarios that might occur in your dental practice with helpful tips of how you can deal with them so your patients always leave your practice feeling: “My dentist is THE BEST!” Each individual article of this series will teach you a new specialized protocol that you can use easily, customise and adapt from the same day on to your own dental clinic’s requirements and needs. I am here to teach you all the solutions for daily communication problems you are facing with your patients that bring you into a difficult situation, make you lose your sleep or even trust to your own self!

Let’s face it! We are not only dentists—we have a business to run! Are you ready to find solutions to all these problems? Let’s start with today’s amazing brain-melting topic which is: How to shush patients that have too many questions? Five steps to solve the problem with courtesy and caring!

How to shush curious patients

How many times have you been delayed by a patient that is constantly asking questions? Maybe it is because he wants to feel that he is in control or maybe he is afraid of the treatment or even he does not trust you enough.

Whatever the reason is, you cannot spend the whole day answering his questions! And this is a real fact! On the other hand, you do not want to be perceived as rude. So, my gift for you today is a protocol to deal with this annoying patient habit nicely and at the same time effectively!

5 steps for a successful communication

Here is how it goes:

Step 1: Be in charge of the conversation

Before you start the treatment, spend five to ten minutes sitting with your patient at your office area and explain the proposed or upcoming treatment.

Important tip: Explain already beforehand the available time and reason for this meeting. For example, you could say: “George, I would love to sit with you today and spend five minutes of our time to explain the treatment that will follow in detail.”

Step 2: Ensure him

Tell him the format of contact. In case he has questions, he can ask them either during the meeting at your office, or after the treatment, or he can call your well-trained and qualified assistant or even e-mail you at own convenience for further details.

Step 3: Keep in mind the following

If during treatment, he wants to interrupt you and ask you more questions, just use the following phrase: “I am all ears, but believe me it is better if we now concentrate on the selected treatment. Me and my staff will give you more time after the completion to ask for more information about the treatment, so let’s proceed…”

The above said words will relax him a bit, so you will be able to do your job, which is: treat him!

Step 4: After the treatment

You can shortly explain your findings and how you are going to proceed, ask him if he wants anything else from you and simultaneously bring your assistant in. You must continue the show…! Go into the treatment room and serve the next patient!

Step 5: Necessary documents and info

Your assistant will provide the patient with the follow-up instructions, your clinic’s e-mail, etc. It is better, for your peace of mind, to not give him your private cell phone number, for obvious reasons: You do not want him calling you for unnecessary reasons (whether it is the appropriate time to take his lunch, or when he should change the gauge, etc. Correct?).

Just do it!

It is not so hard to apply the above presented 5 steps for successful communication in your daily practice. I encourage you to start doing it from today on, as part of your clinic’s script! I am sure, it will give you greater peace of mind as well as more time and energy for your next patient!

In the next issue of roots magazine, I will present to you the third part of this unique new series of communication concepts that will teach you with 7 simple steps how to attract, communicate and retain millennial patients—who are our present and future patients. Until then, remember that you are not only the dentist of your clinic, but also the manager and the leader. You can always send me your questions and request for more information and guidance at dba@yiannikosdental.com or via our website www.dbamastership.com. Looking forward to our next trip of business growth and educational development!

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Easy to learn, easy to use

Strength and flexibility with a silky-smooth feel

Japanese manufacturer MANI, specialising in surgical and dental instruments, recently introduced the MANI Silk nickel-titanium endodontic instrumentation system. MANI Silk is anatomy-based, tactile and smooth, and provides efficient and safe canal shaping with a minimal number of instruments. Owing to the unique cross-sectional tear-drop design, the screwing-in effect common with many other systems is eliminated and the files cut exceptionally well and resist fracture, while removing debris effectively and reducing instrument stress. Moreover, the groundbreaking proprietary heat treatment of the files provides excellent flexibility without sacrificing efficiency or safety.

Easy to work with
MANI recommends single use of MANI Silk files with any motor that provides 500 rpm with an automatic reverse torque. Moreover, MANI Silk files can be used in reciprocal motion on any clockwise-cutting reciprocating motor.

Using the Standard Pack as an example, after creating straight-line access, removing the cervical dentinal triangle (using the 0.08/25 orifice opener—the file on the left side of the pack) and preparing a glide path, MANI Silk files are used from left to right in the pack (from 0.06/20 to 0.06/25) until the 0.06/25 reaches the true working length.

More information, as well as a demonstration video, is available on the manufacturer’s website.


FKG Dentaire presents its new Rooter S endodontic motor. The outstanding feature of this new instrument is its ability to be used both on its own and in combination with the new apex locator from FKG, S-Apex. Rooter S has various automatic controls that guarantee greater safety for the user.

Convincing functions in practice
With its modular capabilities, the new endodontic motor from FKG provides users with maximum flexibility during treatment. Weighing only 103 g, the elegant endodontic motor can be used without fatigue. In addition, the contra angle can rotate 290° to ensure optimum visibility in all quadrants. This is assisted above all in the molar region by the extremely small head, which has an integrated file electrode. With speeds of 50–1,000 rpm, users have a choice of 11 speed settings to suit their individual needs.

The user can adjust all of the functions at the push of a button and store six combinations of settings. The easy-to-read colour display shows all of the relevant information and settings and can be rotated 180° for left-handed users. Acoustic signals further assist in root canal preparation, as the user does not have to keep looking at the instrument’s display.

Rooter S and S-Apex combination
Rooter S combined with S-Apex offers an additional safety function: “Auto Apical Slow-down”, which reduces the rotational speed automatically as soon as the file tip approaches the reference point. This means that the instrument can guarantee the highest possible safety for both user and patient because it prevents the critical point in the apical area from being exceeded.

S-Apex carries out an exact length measurement during treatment so that the user can prepare the root canal safely. This is particularly important in order to prevent any later complications.

Rooter S can also be connected to the apex locator by a data transfer cable in order to provide additional functions, such as “Auto Start/Stop” or automatic stop once the file has reached the reference point (“Auto Apical Stop”).

www.fkg.ch
Strengthened composition and rounded cross section

GL153 Safe10 series: Stay true to form

An unavoidable truth of endodontics is that the root canal is a complex space to work in. Shaping root canals helps to make navigation easier, but the files used in this process can be prone to fracture as a result of cyclic or torsional fatigue. META BIOMED’s new GL153 Safe10 series is a set of instruments with exceptional resistance to fatigue, allowing you to navigate and clean long, tapered and complex canals more easily than ever before.

The GL153 files undergo a proprietary thermomechanical treatment that gives them a much greater resistance to fatigue. The controlled memory wire used in their manufacture has been verified by an independent scientific study to significantly increase the number of cycles before failure compared with other files on the market.

The strengthened composition and rounded cross section of the GL153 work to create a smooth, efficient path, shaping the root canal and preserving the surrounding tooth structure without risk of file separation.

META BIOMED’s standing as one of the dental industry’s primary innovators ensures that the GL153 is optimally designed for the practitioner’s and patient’s safety and comfort. The flute design of the files reduces the screw effect, greatly decreasing the likelihood of over-instrumentation. In addition, no elastic limits are exceeded, and there is no risk of taper lock when used in the recommended reciprocating motion with a constant downwards pressure.

“With its unlimited flexibility and excellent resistance to fracture, the GL153 Safe10 series represents our commitment to providing high-quality solutions for everyday dental procedures at a low cost,” said Ian Yun, Managing Director at META BIOMED.

www.meta-biomed.com

XP-endo Shaper Plus sequence

A new generation of Swiss-made instruments enables safer and more effective root canal therapy, owing to its unique 3-D extension capabilities. The XP-endo Shaper Plus sequence, launched by leading Swiss endodontic company FKG Dentaire, solves a common problem for dentists: how to treat complex root canal systems without causing damage to the dentinal structure. Combining exceptional adaptive core technology with 3-D design, FKG has created instruments that can easily adapt to the canal anatomy to clean areas that were once impossible to reach. The result is enhanced debris removal and irrigation for a more gentle, conservative treatment compared with instrumentation using conventional nickel-titanium files.

“The main problem with conventional files is their lack of flexibility, which means that dentists can’t remove all the debris, but sometimes end up taking off too much healthy dentine,” explained FKG Dentaire CEO Thierry Rouiller, “but that all changes with this XP-endo generation of instruments.”

FKG’s patented MaxWire alloy from which the files are made reacts to the body’s temperature, making the tools highly flexible compared with instruments of the same final size. A small, free-floating adaptive core designed in 3-D allows the instruments to expand and progress with agility along the canal while resisting cyclic fatigue.

In the XP-endo Shaper Plus sequence, the dentist uses a size 10 K-type file and size 15 K-type file for glide path creation. The XP-endo Shaper then performs 3-D debridement of the canal while respecting its natural shape. Finally, the XP-endo Finisher achieves 3-D cleaning and biofilm removal, including in areas impossible to reach with conventional files.

The instruments are delivered in a sterile blister pack designed for single-patient use, thus maximising safety.

www.fkg.ch
META BIOMED, manufacturer of endodontic and restorative dentistry products, is involved in many relief activities. Recently, the company participated in a charity project initiated by its key opinion leader in Latin America, Dr Jenner Argueta from Guatemala. META BIOMED donated 10 per cent of its profits from the 2017 Greater New York Dental Meeting (GNYDM) to the Guatemalan Association for Development in Zacualpa (ADIZ).

ADIZ is a non-governmental organisation led by Fredy Argueta, Dr Argueta’s father. ADIZ is involved in school development projects and scholarship programmes in the Quiché district of Guatemala. It was not the first time that META BIOMED donated part of its profits to ADIZ; the company took up a similar charitable initiative after the Chicago Dental Society’s Midwinter Meeting in February 2017. According to Managing Director Ian Yun, this is only the beginning of META BIOMED’s cooperation with ADIZ. “We are excited to continue working with them in the future,” he added.

Helping ADIZ is not the only relief project backed by META BIOMED. The company supports organisations and clinics with charitable goods and has been involved in the annual MOM-n-PA event run in Pennsylvania in the US, along with universities and clinics. The MOM-n-PA foundation provides dental care for the relief of pain to thousands of the most needy. It is a large-scale dental clinic where treatment is provided at no cost to individuals who cannot afford dental care. In the US, META BIOMED has also donated products to the University of California, San Diego, and its clinic and given funding to the Anderson Cancer Institute is the Memorial Health foundation.

Furthermore, the company supports Compassion International, which is the world’s leading authority in holistic child development through sponsorship. Compassion is a child advocacy ministry that pairs compassionate people with children living in poverty. The ministry seeks to release children from spiritual, economic, social, and physical poverty with the goal of each child becoming a responsible and fulfilled adult. Each member of the META BIOMED team has his or her own sponsored child with whom he or she communicates via letters, pictures, and emails. Their responsibility to them is just as important as their responsibilities to the company.

The company’s philosophy is to deliver not only the highest quality of products but also the highest quality of life, and to share its success and passion with those in need.

Established in 1990, South Korean company META BIOMED now has over 1,000 employees and branches in Cambodia, China, Japan, US and Europe. In its pursuit of leading technological innovation in dentistry, it has placed a strong emphasis on research and development and has continued to achieve breakthroughs in dental and surgical products and biomaterials.
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ROOTS SUMMIT calls for abstracts and poster presentations

by DTI

The ROOTS SUMMIT which will be held in the German capital of Berlin from 28 June to 1 July 2018, provides not only a great lecture programme with some of the best endodontists in the world but also the perfect opportunity to participate. Therefore, the event organisers are inviting anyone interested in attending the summit in Berlin to submit their own work in the form of posters or oral presentations by 30 April.

Each participant may only submit one abstract (which must be in English) as a presenting author. The presenting author must assume full responsibility for the content of the abstract and must ensure that all other authors are aware of the content before the abstract is submitted. Presenters can give oral presentations or display posters. In the oral presentation category, case reports may be submitted. Each oral presentation will be followed by a five-minute question-and-answer session.

Presenting authors are required to register for the congress should their abstract be accepted. All abstracts must be submitted via e-mail to Dr David E. Jaramillo, ROOTS SUMMIT 2018 Scientific Chairman, at abstracts@roots-summit.com. Abstract acceptance will be communicated via e-mail by no later than 1 June.

The ROOTS SUMMIT, which started as a mailing list of a large group of endodontic enthusiasts in the 1990s, has grown significantly over the last few years. With currently more than 24,000 members from over 100 countries, the ROOTS SUMMIT evolved into one of the most prominent global learning forums in the dental industry.

Previous conferences have been held in Canada, the US, Mexico, Spain, the Netherlands, Brazil and India. The 2016 ROOTS SUMMIT took place in the UAE and was one of the most important events in endodontics, drawing over 300 dental professionals to Dubai. All these meetings have been known for their strong scientific programmes.

Sign up to the finest e-read in dentistry
Seoul prepares for World Endodontic Congress

by DTI

Preparations are under way for the 11th scientific congress of the International Federation of Endodontic Associations (IFEA), which will take place from 4 to 7 October in Seoul in South Korea. The theme of this year’s meeting, hosted by the Korean Academy of Endodontics, is “Endodontics: The utmost values in dentistry”.

The congress will feature prominent international speakers, both clinicians and researchers, and introduce the emerging endodontic stars from IFEA member countries, ensuring a stimulating, varied and enriching programme to benefit all attendees.

According to Dr Eui Seong Kim, chairperson of the organising committee, the importance of saving the natural dentition is a topic of current emphasis in dentistry and among the public and will be discussed at this year’s congress. “Current knowledge and technologies of endodontics have enabled the predictive, successful prevention and healing of apical pathosis. Our hope is that WEC 2018 Seoul will give participants valuable scientific evidence and profound discussions in basic science, clinical research, new technologies, and future directions,” he added.

The event has received support from a number of industry competitors, including global companies like Dentsply Sirona, COLTENE, FKG, MICRO-MEGA and META BIOMED, as well as a number of local companies and dealers. They will all be showcasing the latest advancements in instrumentation and materials for root canal therapy.

Established in 1986, IFEA is based in the US and its membership comprises endodontic associations in over 35 countries. Previous presidents and officers of the federation have come from a wide range of countries and this has ensured a global approach to the challenges of meeting the needs of the membership and attracting new members. Countries that have had representatives serve as officers of IFEA include Australia, Belgium, Canada, France, Israel, Italy, Mexico, South Korea, the UK and the US. According to its policy statements, IFEA aims to promote collaboration between endodontic specialists and bodies worldwide. It also supports continuing education and research in the field through scholarships, like its annual IFEA Jean-Marie Laurichesse Research Award.


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Yoshi Terauchi
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Predictable and minimally invasive method to retrieve a separated file

Andreas K. Braun
The Netherlands
Root resorption after dental trauma - findings and treatment possibilities

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How to send us your work?

Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:

- the complete article;
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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.

Text length

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.

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We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasize 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.

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Questions?

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