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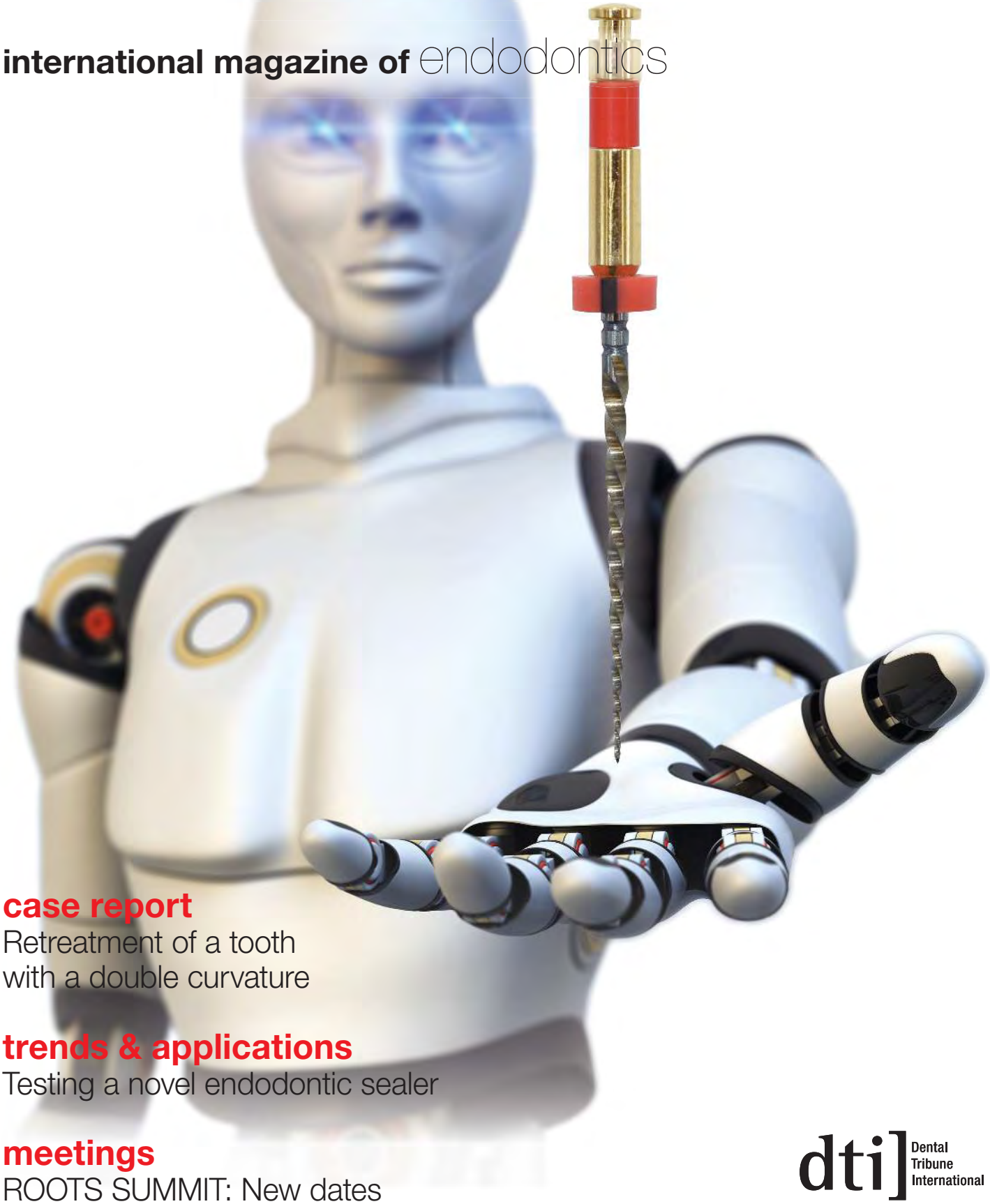
roots

international magazine of endodontics



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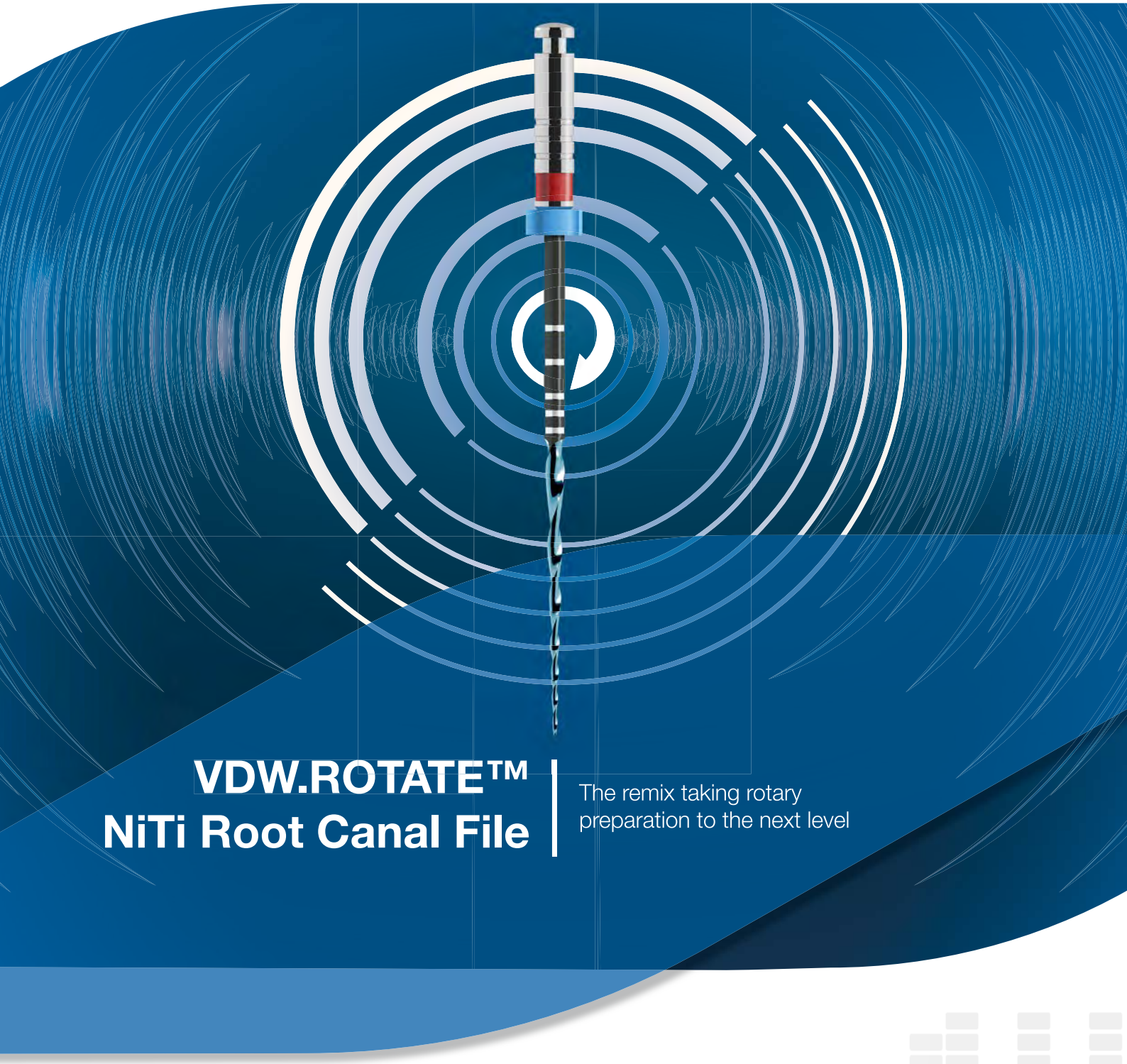

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Dr David E. Jaramillo

Guest editor
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Dear readers,

It is difficult to believe that nearly two years have passed since the last extremely successful ROOTS SUMMIT in Berlin. It is also difficult to believe that it will be one more year until we will meet due to the current issues surrounding the COVID-19 pandemic. The safety and security of all was our primary consideration when the decision was taken to postpone the live ROOTS SUMMIT until 20 to 23 May 2021. As that is far too long to get together and share the numerous scientific and clinical information that has been generated, we will be having an online ROOTS SUMMIT which will take place on 22 and 23 May 2020.

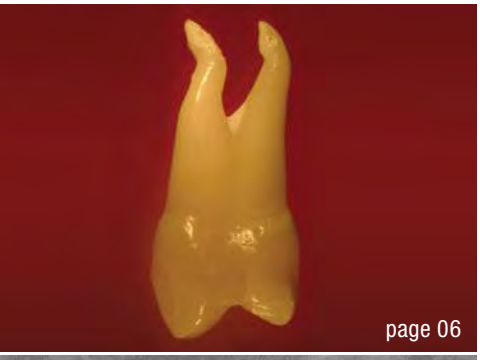
It is an honour to be the scientific director of the event again. As with all ROOTS SUMMITs, we have an outstanding line-up and combination of clinicians and researchers ready to share their results in both areas. We are certain that attendees and viewers will be pleased with and surprised at the advanced surgical techniques and research that will be shared at both events.

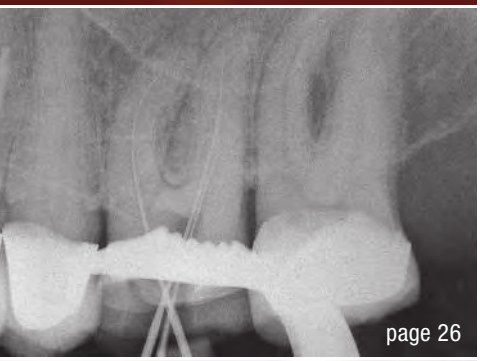
I am also pleased to announce that roots **magazine** is launching a new section containing the latest clinical research—more than worthy of inclusion in any peer-reviewed journal. The first paper is about the importance of knowledge of the root canal anatomy to avoid iatrogenic failures in a two-rooted maxillary premolar. A world-renowned expert on this topic and vertical root fractures, Dr Aviad Tamse, professor emeritus at Tel Aviv University, was gracious enough to submit this paper, and you will not want to miss it.

We hope that you will enjoy this issue of roots. We also hope that you will join us in Prague for our unique online meeting, where all participants see the same presentation and where the camaraderie of our global membership will create yet another outstanding endodontic and social experience.

I look forward to seeing you at the online ROOTS SUMMIT this May, and in person in Prague in May 2021.

Dr David E. Jaramillo
Guest editor
Scientific director of ROOTS SUMMIT





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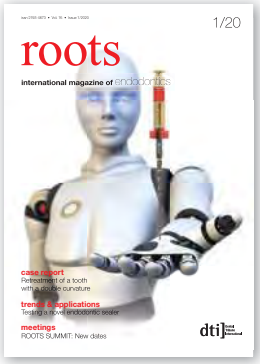

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Buccal root of the bifurcated maxillary premolar—a danger zone during root canal therapy

Dr David E. Jaramillo, USA & Dr Aviad Tamse, Israel

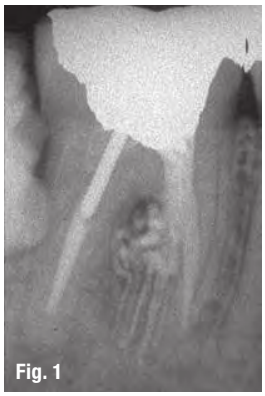
Fig. 1

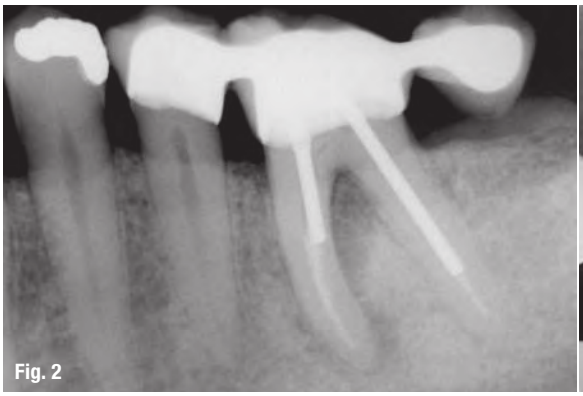
Fig. 2

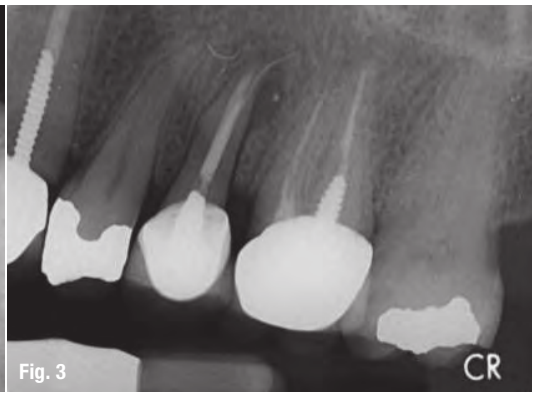

Fig. 3

The purpose of this study is to describe the depression in the buccal root of the bifurcated maxillary premolar as a danger zone during and after endodontic treatment and to recommend clinical modalities to prevent root fractures and perforations in this root.

There are a known number of reasons for complications during and after root canal preparation.[1] Curved roots such as the mesial root of the mandibular molar are a challenge to prepare and clean, and this was especially the case during the era of stainless-steel instruments.[2,3] The curvature in the middle part of the mesial root is still considered a danger zone where either strip perforations (Fig. 1) or perforations from a post can still occur (Fig. 2).

Almost half of maxillary premolars are two-rooted. These roots present a variety of morphological and anatomical appearances, such as roots spreading apart and a variety of locations of bifurcation from the coronoapical direction (Figs. 4a–d). Curved and divergent roots and root canals are difficult to treat endodontically. One major reason for the operator's frustration is the fact that, in bifurcated maxillary premolars, it is extremely difficult to determine the aetiology when a poor outcome is diagnosed.


Fig. 4a


Fig. 4b


Fig. 4c


Fig. 4d

Maxillary premolars are among the teeth most susceptible to vertical root fractures in endodontic treatment.[4,5] This is a common complication of endodontic treatment and most often leads to the extraction of the tooth or root (Fig. 3).[4,5] Although the American Association of Endodontists stated that the combination of a deep probing defect and a sinus tract in the endodontically tooth is pathognomonic for a vertical root fracture,[6] only some vertical root fracture cases manifest these signs and symptoms at the same time. This occurs for a variety of reasons. The signs, symptoms and radiographic features often mimic those of a poor endodontic outcome or periodontal disease, and it may be difficult to correlate the clinical findings to the radiographic manifestations. In a systematic review on this topic, it was concluded that there is a conflict between the clinical importance of timely and accurate diagnosis of vertical root fractures in the endodontically treated tooth and a lack of evidence-based data supporting the usefulness of common clinical and radiographic evaluation methods.[7]

The findings mentioned are especially true in bifurcated maxillary premolars. The major reason is the unfavourable position of the bifurcated premolar in the jaw. The buccopalatal roots are positioned buccopalatally in the maxilla, and if an endodontic complication occurs in one of the roots, whether a vertical root fracture, perforation or even just a poor outcome of an endodontic treatment, it can be extremely difficult at times to establish the reason on a routine periapical radiograph.

This unfavourable position of the roots at times causes a periodontal problem around the tooth. A mesiodistal bifurcation is very difficult for the patient to clean, and if a periodontal pocket occurs, the periodontal disease will advance very rapidly (Fig. 5).

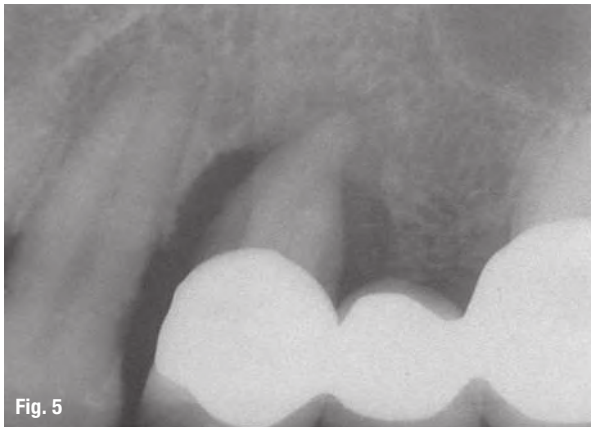
Fig. 5

The bifurcated maxillary premolar has a complex anatomy and morphology as described in the endodontic textbooks and atlases. In the buccal root of the maxillary premolar, there is a unique anatomical feature: a depression (called also a concavity or furcation groove) in the bifurcation (palatal) aspect of the root, located mostly in the middle (Figs. 6a & b). The morphometric characteristics of this depression have previously been described and found to occur in between 78 and 100 per cent of cases.[8–12] Booker and Loughlin claimed that the original thickness in this area is extremely thin.[13] Gher and Vernino speculated that the depression represents a tendency of the buccal root to form two separate buccal roots during tooth development.[12]

In a study of 35 bifurcated maxillary premolars, this depression in the buccal root was found in 97 per cent of the cases.[8] Most of the root canals had a kidney shape, and the mean width of the distance from the deepest areas of the invagination to the canal wall was 0.81 mm. Li et al. found the same results using computed tomography.[11] Therefore, it is thus understandable that it is


Fig. 6a


Fig. 6b


Fig. 7

risky (in terms of fracture or perforation) to remove too much dentine in this area, whether with hand instrumentation or in preparing circular flaring to fit a post (Fig. 7).

A recent study by Chai and Tamse again demonstrated the necessity of trying to maintain the original shape and size of the buccal root canal during endodontic treatment in order to avoid vertical root fractures in endodontically treated teeth.[14] This study looked at the issue of vertical root fracture from the stress and force aspect. The results showed that, although vertical root fracture can occur in the palatal root as well, it was mostly limited to the buccal root. Using a finite element analysis technique, it was shown that, when force from lateral condensation was applied to this root, the stress concentrated at the deepest point of the depression and from this initiation point, the fracture propagated either in a straight line to the canal wall or as two or more curved fractures to the canal walls (Figs. 8a–d).

According to Mamede-Neto et al., no file system is able to achieve perfectly centred root canal preparation, so care should be taken especially when using a reciprocating system.[15] This system presents the most mesiodistal and buccolingual transportations compared with a rotary instrumentation system.

In his histological evaluation, Walton compared instruments and techniques and found that none were able to achieve complete debridement of pulp tissue from inside the root canal system.[16] This is in agreement with Gutiérrez and Garciá, who were the first authors to report the lack of effectiveness of any instrumentation technique in obtaining root canals completely free of pulp tissue.[17] Owing to the impossibility of obtaining complete pulpal debridement, root canal enlargement is the main purpose of the general dentist and endodontist.

Kerekes and Tronstad published a morphometric evaluation on the different root canal sizes of anterior teeth, premolars and molars.[18–20] They found large diameters in all thirds of the root canals of maxillary first and second premolars. These findings may suggest to the operator to enlarge the width of the root canal in order to obtain cleaner and better pulpal debridement of the root canal system. As a result of the excessive reduction of dentine in the most critical areas, strip perforation may occur.

All these findings lead us in the direction of a better knowledge and understanding of root canal shapes and sizes in the various canal locations, in order to prevent over-instrumentation that could lead to weakness of the root and possible root fracture.

The problem of effective cleaning of the root canal system is especially true in those root canals which are not round in cross section, that is, oval root canals in those roots which are also susceptible to fracture, such as the maxillary premolars, the mandibular premolars and the mandibular incisors.[21] In a series of studies, it was


Fig. 8a


Fig. 8b

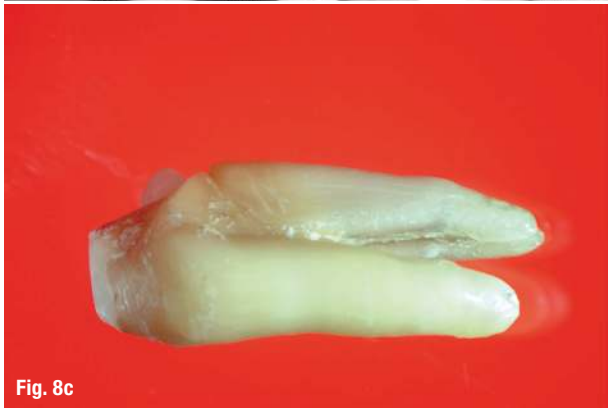
Fig. 8c


Fig. 8d

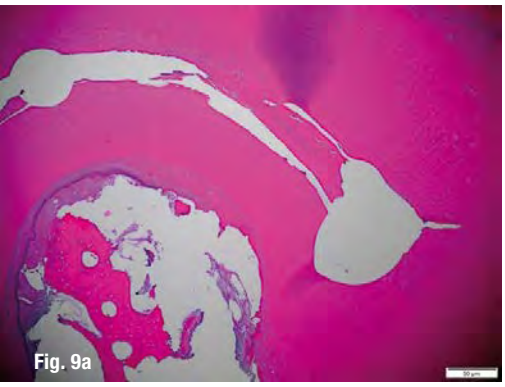
Fig. 9a


Fig. 9b


Fig. 9c

demonstrated that long oval canals are impossible to instrument and clean completely, leaving many areas of the canal walls uncleaned and with debris.[22–24] Extra care should be taken in instrumentation and cleaning in order not to perforate such canals[16] and in order to ensure proper obturation.[23,24]

Weller et al. compared ultrasonic instrumentation and hand instrumentation with ultrasonic irrigation.[25] Their findings were that there was no difference in the debridement efficiency between hand and ultrasonic instrumentation compared with ultrasonic irrigation alone. But when they added ultrasonic irrigation to both (hand and ultrasonic) instrumentation groups, they obtained better results. In summary, the ultrasonic instrumentation technique does not improve root canal debridement. This is only improved when there is a combination of any instrumentation technique and ultrasonic irrigation.

Langeland et al. found hand, sonic and ultrasonic instrumentation to be ineffective in the complete debridement of the curved roots of mandibular molars.[26] Van der Vyver et al. found, independent of the nickel-titanium alloy phase or heat treatment, that all rotary and reciprocating systems produce root canal transportation in all three root canal thirds.[27]

The introduction of newer technology such as the GentleWave system (Sonendo) allows minimal instrumentation of the root canal system with excellent debridement parameters (Fig. 9a) by producing multi-sonication in a de-gased liquid and closed system. The closed system allows the propagation of multi-sonication waves that reach all areas of the complex root canal anatomy.[28]

Minimally invasive instrumentation of the root canal system will increase the possibility of less reduction of tooth structure, thus decreasing the possibility of weakening of the root canal walls. Reducing the risk of file separation, canal perforation and fractures is a further benefit of minimally invasive instrumentation, which results in significantly less presence of debris (Fig. 9b) compared with conventional methods (Fig. 9c).

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

about

Dr David E. Jaramillo, DDS, is Professor in the Department of Endodontics at The University of Texas Health Science Center School of Dentistry at Houston. Former clinical assistant professor of endodontics at the University of Southern California (USC) in Los Angeles (2004–2006). He was an associate professor at Loma Linda University School of Dentistry in California (2004–2014). Actively participated in research at the Center for Biofilms under the direct supervision of Dr William Costerton at USC School of Dentistry and the Department of Electrical Engineering/Electrophysics at USC Viterbi School of Engineering. Dr Jaramillo is scientific director for ROOTS SUMMIT meetings. Former president of Houston Academy of Endodontists, Chair IFEA Grant Research Committee and new member of the International College of Dentists USA Section. He has 2 patents in the US.

Dr Aviad Tamse received his DMD degree from the Hebrew University and Hadassah Faculty of Dental Medicine in 1969, and from 1971 to 1973, he attended the Harvard School of Dental Medicine, Boston, Massachusetts, where he received his endodontic training. Dr Tamse was twice President of the Israel Endodontic Society, Chair of the Endodontic Board Examiners Committee of the Israel Dental Association Scientific Committee, and Chair of the Accreditation Committee of Graduate Dental Programs of the Israel Dental Association. Dr Tamse served as chair of the department of Endodontology Tel-Aviv University School of Dental Medicine from 2000–2008, and in 1982 was a co-founder of the European Society of Endodontology. Currently Dr Tamse is Professor Emeritus at the Department of Endodontology, School of Dental Medicine, and Tel-Aviv University.

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Innovative endodontics using SWEEPS technology

Drs Giovanni Olivi & Matteo Olivi, Italy

The ultimate goal of endodontic treatment is the eradication of microorganisms responsible for endodontic disease.[1,2] Enlarging and shaping the root canals to a size sufficient for delivery of irrigants into the endodontic space allows for pulp tissue dissolution and antibacterial activity in the full space.[3] A stable and hermetic sealing of the endodontic space permits long-lasting success of the therapy. Present-day endodontic research is more focused on instrumentation than on irrigation to improve the success rate of root canal therapy. The newest high-performance nickel-titanium alloys reduced the stiffness and increased the elasticity of endodontic instruments, permitting simplified and faster root canal preparation with reduced diameter and taper and greater preservation of the dental structure. However, Peters et al.,[4] more recently confirmed by other researchers,[5,6] demonstrated the incomplete action of the tested instrument systems, which left 35 % or more of the canal's surface area unchanged. Furthermore, the reduced operating time arising from using new mechanical rotary systems reduces the contact time of decontaminating agents (chemical and mechanical cleansing) with the root canal surfaces, and from this perspective, improving the fluid dynamics of irrigants in the endodontic space appears to play an important role.[7]

Irrigation techniques

The fluid dynamics of the irrigants in the confined canal space is one of the main problems in endodontics and very few innovations have been introduced in this regard. Many techniques are currently used to deliver and activate the irrigants in the endodontic space. A constant flow of irrigants helps to dissolve inflamed and necrotic tissue, to disinfect the canal walls by removing bacteria and biofilm, and to flush out debris and the smear layer from the root canal, and hence is essential for the success of endodontic therapy. The complex macro- and micro-anatomy of the root canal system limits the access, flow and turbulence of irrigants in the endodontic space and finally the deep penetration of antibacterial agents into the dentinal walls, thus limiting their 3D cleaning and disinfecting ability.[8,9] Ricucci and Siqueira reported that chemomechanical preparation partially removed vital and necrotic tissue from the entrance of lateral canals and apical ramifications, leaving adjacent tissue inflamed and infected, and associated with periradicular disease.[10] Sodium hypochlorite (NaOCl) is the most commonly used endodontic irrigant because of its antimicrobial and tissue-dissolving activity. Many factors influence its effectiveness. Optimisation of surface tension, concentration, temperature, agitation and flow can improve tissue-dissolving effectiveness by as much as 50-fold.[11] When the NaOCl was modified with the adjunct of a surface active agent, it showed lower contact angle on dentine, resulting in more effective tissue dissolution compared with conventional NaOCl solutions.[11] Also, agitation and higher temperatures considerably enhanced the efficacy of NaOCl. However, the effect of agitation on efficacy was greater than that of temperature, and continuous agitation resulted in the fastest tissue dissolution.[11]

Comparing the efficacy of different agitation systems on the activity of NaOCl, De Gregorio et al. found limited penetration of the irrigant into lateral canals using an apical negative pressure irrigation system—it was however the most effective in reaching the working length—in comparison with the other tested systems (sonic irrigation; passive ultrasonic irrigation; F-file; and positive pressure irrigation).[12] In contrast, passive ultrasonic irrigation demonstrated significantly greater penetration of irrigant into lateral canals.[12] The efficacy of NaOCl depends on the quantity and reactivity of its free-chlorine form. Macedo et al. verified that Er:YAG laser activation of the irrigant produced a greater reaction rate of NaOCl, producing more active chlorine ions in three times less time than with passive ultrasonic irrigation.[13] In the last ten years, the use of laser in promoting the activity of intra-canal irrigants (laser-activated irrigation) has been investigated and successfully introduced in endodontics.

Laser in endodontics

Lasers are used with different techniques in endodontics (Table 1, Fig. 1). They can be used to directly irradiate the canal walls or to irradiate and activate fluids introduced into the canal (photosensitisers or irrigants), thus performing their clinical action on the endodontic system indirectly.

Wavelength	Laser technique	Target chromophore	Laser–tissue interaction	Laser effects
Near infrared	Conventional direct irradiation	Bacteria pigment	Diffusion	Photothermal
Medium infrared	Conventional direct irradiation	Water content of dentine Bacteria	Absorption	Photothermal
Visible near infrared	PAD indirect irradiation	Photosensitisers	Absorption	Photochemical
Medium infrared	LAI indirect irradiation	Water content of irrigants	Absorption	Photothermal cavitation
Medium infrared	SWEEPS indirect irradiation	Water content of irrigants	Absorption	Photothermal Photoacoustic cavitation Shock wave

PAD = photoactivated disinfection; **LAI** = laser-activated irrigation; **SWEEPS** = shock wave enhanced emission photoacoustic streaming.

Table 1: Classification of laser techniques used in endodontics (modified from Olivi[14]).

Conventional laser endodontics

The term "conventional laser endodontics" was coined by Olivi in 2013 to describe the conventional use of laser fibre inserted inside the canal, up to the working length (–1 mm), to directly irradiate the dentinal walls.[14] The laser fibre inserted inside the canal is activated during the withdrawing movement. Laser irradiation interacts with the canal surface according to the various modalities typical of the wavelength used. The primary effect produced is a photothermal one, followed by a secondary bactericidal effect, but undesired morphological modification of dentinal walls is also generated. The main problems associated with conventional laser endodontics are the irregular fluence supplied along the canal and the inability of laser fibres to passively negotiate the canal without interference with the dentinal walls. Contact of laser fibre with dentinal walls can create thermal damage varying from ablation to melting, and bubbles of recrystallisation of the hydroxyapatite and microcracks.[15]

Photoactivated disinfection

Photoactivated disinfection involves the use of a photosensitiser that is introduced into the root canal and selectively activated by an affine wavelength. The visible wavelengths (from 635 nm to 675 nm) activate toloudine and methylene blue, while the near-infrared (810 nm) wavelength activates indocyanine green. The laser irradiation produces a photochemical effect that activates the photosensitiser solution with release of reactive radicals and singlet oxygen. There is no direct laser interaction with the dentinal surface, eliminating any undesired collateral effect. Owing to the low oxygen concentration inside the dentinal tubules and the prevalence of anaerobic/aerobic facultative bacteria in the root canal system, the use of photoactivated disinfection is considered only an adjunct procedure to the conventional one.[16]

Laser-activated irrigation

Laser-activated irrigation (LAI) involves the irradiation of commonly used irrigant solutions in the canal by a laser. The minimum common denominator of different LAI techniques is the wavelength that can be used: the wavelengths of erbium lasers (Er,Cr:YSGG [2,780 nm] and Er:YAG [2,940 nm]) are the only ones absorbed by water, the main component of common irrigant solutions (17 % EDTA and 5 % NaOCl). The greater the absorption coefficient of the molecule for a wavelength, the lower the

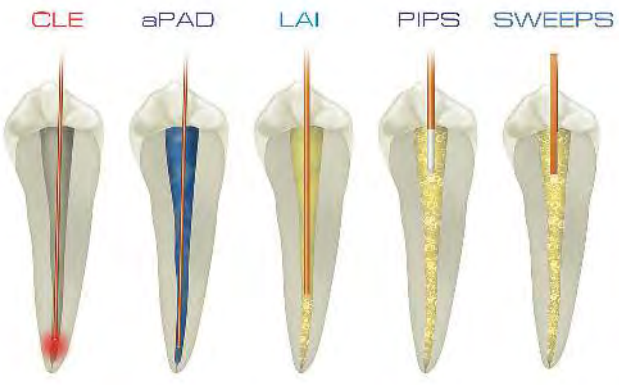


Fig. 1: Graphic representation of various laser techniques used in endodontics: CLE = conventional laser endodontics; aPAD = antibacterial photoactivated disinfection; LAI = laser-activated irrigation; PIPS = photon-induced photoacoustic streaming; SWEEPS = shock wave enhanced emission photoacoustic streaming.

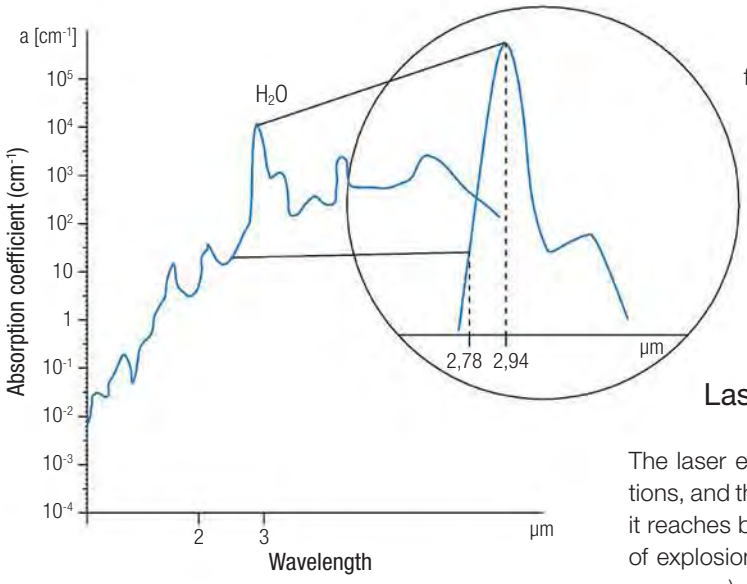
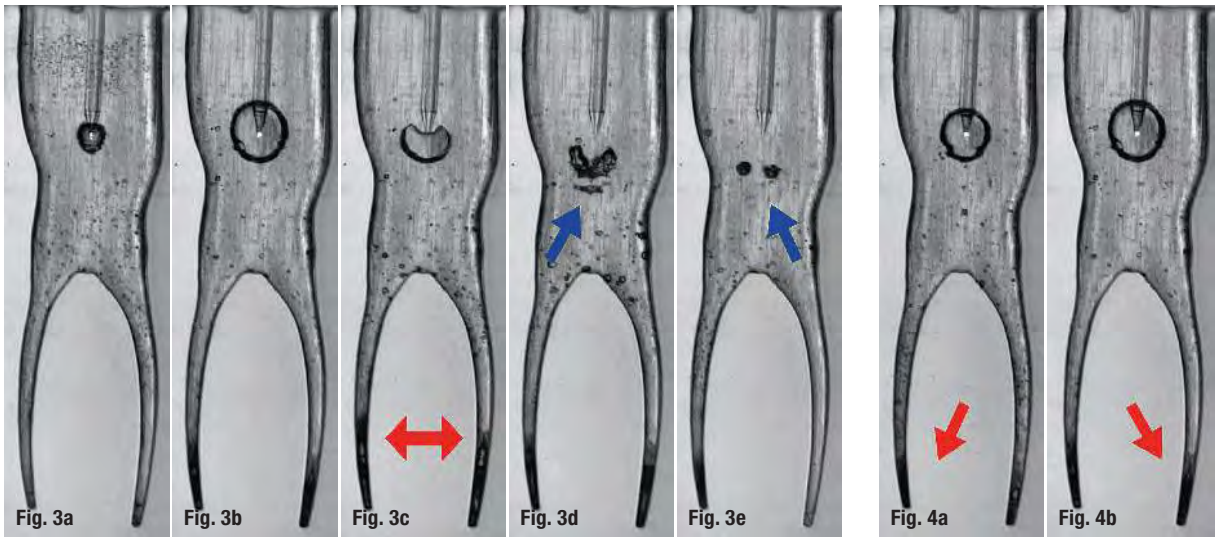


Fig. 2: Different water absorption coefficients in the medium electromagnetic spectrum for 2,780 nm and 2,940 nm. The absorption of Er:YAG laser radiation at 2,940 nm by water is three times greater than that of Er,Cr:YSGG laser radiation at 2,780 nm.

energy required to obtain its absorption (Fig. 2). Specifically, the absorption of Er:YAG laser radiation by water is three times greater than that of Er,Cr:YSGG laser radiation and requires less energy to obtain the same effect.[17] To thoroughly understand the mechanism of LAI, the various devices and settings used, and consequently the proposed protocols in recent years, it is important to consider all the parameters that determine the difference between one laser system and another. Indeed, regardless of the positive results achieved in various LAI investigations, the use of the different protocols can confuse readers. Besides the wavelength specificity (2,940 nm and 2,780 nm) for the target (water), it is important to consider the laser setting used, including energy, pulse repetition rate, fluency, pulse duration and peak power. Also important is to choose the correct laser fibre or tip and position inside the tooth, including tip end design and diameter.

Laser setting

The laser energy is absorbed by the water of the solutions, and the water rapidly increases in temperature until it reaches boiling point (100 °C), forming typical bubbles of explosion (photothermal/photoacoustic primary phenomenon) and thus generating immediate cavitation in the canal (secondary phenomenon; Figs. 3a–e).[18–21] The higher the energy applied, the bigger the bubble size and the more efficient the cavitation produced. However, the application of high energy with the tip inserted inside a canal can have obvious contra-indications owing to rapid vaporisation of liquid from the canal, dry irradiation and consequent undesirable thermal effects on the dentinal walls. A fundamental concept, which explains the efficiency of one system over another, is the peak power emitted by the laser pulse as a function of the energy applied in the time, according to the formula: *peak power = energy/pulse duration*. The goal is to reach a high peak power (400 W) with very low energy applied at subablative levels (20 mJ), to avoid any thermal or ablative effects. This is possible when the pulse duration is very short (50 microseconds), to produce an efficient photoacoustic effect. The higher the peak power of each



Figs. 3a–e: Premolar model showing an Er:YAG laser (LightWalker) equipped with a SWEEPS conical-end tip of 400 µ firing a single 25-microsecond pulse at 20 mJ in water: bubble explosion **(a & b)**, bubble implosion and primary cavitation (blue arrows) **(c–e)**, red arrows show secondary cavitation in the apical third **(c)**. **Figs. 4a & b:** Premolar model showing an Er:YAG laser (LightWalker) equipped with a SWEEPS conical-end tip of 400 µ: single 50-microsecond pulse at 20 mJ in water: bubble explosion at the tip end **(a)**, single 25-microsecond pulse at 20 mJ in water: bigger bubble explosion at the tip end **(b)**.

pulse, the greater the pressure wave generated by the primary bubble explosion (Figs. 4a & b). The pulse duration and the peak power of a laser depend on the technology utilised by the various laser devices. Also, the efficiency of the irrigant streaming depends on the tip used and its position in the endodontic space.

Laser tip

A high peak power, closely related to the pulse duration, of the various erbium lasers used explains the different energy settings used and the different positions of the tip, as reported in the various techniques. During LAI, the tip may be used in motion, up and down, in the canal and withdrawn slowly towards the pulp chamber or may be used in stationary position or with small movements in the apical third or middle third of the canal.[22,23] In contrast, when using PIPS (photon-induced photoacoustic streaming), the laser pulse (of 20 mJ emitted at 50-microsecond pulses [super-short pulse], with the Er:YAG laser LightWalker, Fotona) generates a high peak power (400 W) and creates primary phenomena of explosion and secondary cavitation even at a relevant distance from the area of activation (access cavity), at an average speed of about ten times higher than that measured for passive ultrasonic irrigation.[24] Accordingly, the PIPS technique requires the specific and easy positioning of the laser tip, not inserted into the canal, but held stationary in the pulp chamber, where the irrigant solution is supplied by a syringe.[17] Today, the PIPS technology has been updated, improved and presented as SWEEPS (shock wave enhanced emission photoacoustic streaming) technology (Fig. 5).[25]

SWEEPS technology

SWEEPS represents the technological evolution of PIPS. The laser is the same Er:YAG laser (2,940 nm), now produced in two models (LightWalker and SkyPulse, Fotona). The endo-mode permits emission of energy in two modalities: single pulse and dual pulse. The single super-short pulse modality (50 microseconds; the same as for PIPS) is today accompanied by the ultra-short single pulse modality (25 microseconds, USP) that allows better modulation of the emitted energy, maintaining the same peak power (i.e. 400 W peak power using only 10 mJ) or a more powerful peak power (800 W) using the same energy (20 mJ) as PIPS. In addition, the emission of the dual-pulse modality is now available, firing a second laser pulse after the first in rapid succession. The emission interval between one pulse and another varies randomly from 250 to 600 microseconds (SWEEPS-Auto; Figs. 6a–d). More sophisticated is the emission of the second pulse in resonance with the first (X-SWEEPS); this can happen when the delay of the second pulse permits exact firing when the first bubble is still in the implosion phase, thus implementing the primary cavitation produced. This technology makes it possible to optimise the pressure waves produced depending on the internal volume of the tooth to be treated (molar, premolar, incisor).[25] Also the possibility of modulating the peak power of the single pulse and consequently of the intracanal irrigant pressure wave allows better management of the irrigation in the case of particularly wide canals and resorbed apices of large dimensions.

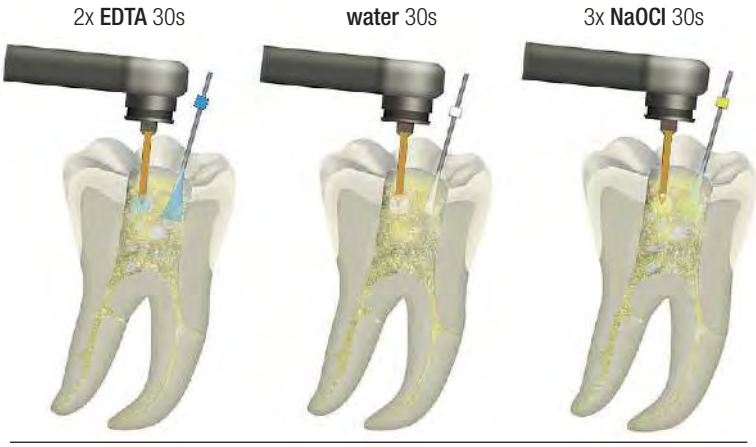
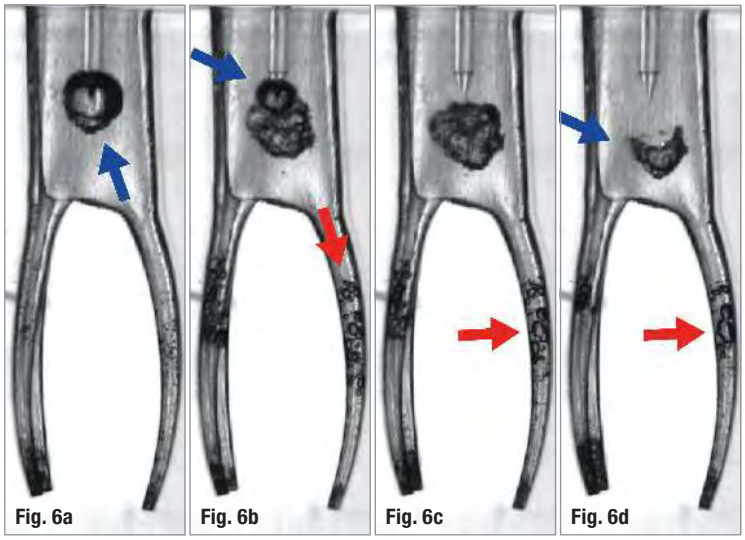


Fig. 5: SWEEPS final irrigation protocol: at the end of therapy, a final irrigation protocol entails two cycles of 17 % EDTA activated by SWEEPS for 30 seconds each, followed by rinsing with distilled water activated by SWEEPS for 30 seconds, then three cycles of 5 % NaOCl activated by SWEEPS for 30 seconds each and a resting time of at least 30 seconds.

Advantages of LAI (SWEEPS)

Laser activation and agitation of irrigants introduced a new standard among the several irrigation methods.



Figs. 6a–d: Molar model showing an Er:YAG laser (LightWalker) equipped with a SWEEPS conical-end tip of 400 µ. Dual-pulse modality at 20 mJ in water: blue arrows show the first bubble **(a)**, the second bubble **(b)** and the induced shock waves **(d)**; red arrows show the secondary cavitation in the middle and apical thirds of the canal **(b, c & d)**.

Fig. 7: SWEEPS tips: conical end and 9–14 mm flat.

Er:YAG laser activation offers various advantages over the other methods and has been validated by several peer-reviewed papers:

- It provides superior chemical activation of NaOCl.[13]
- It produces superior chemical dissolution of pulp remnants by NaOCl.[26]
- It provides superior physical disruptive action on biofilm.[27]
- It provides a superior smear layer cleaning ability to that of EDTA.[28–30]
- It produces a superior bactericidal effect.[31–33]

In addition, the easy positioning of the tip in the access cavity offers new clinical possibilities in endodontics (Fig. 7). LAI in the access cavity can start just after the opening of the access cavity, allowing progressive reduction of the bacterial load, even before scouting and preparation of the canals. Moreover, using NaOCl, it dissolves the pulp tissue, reducing the possibility of irreversible dislodging of pulp remnants laterally and apically in the endodontic space during instrumentation. In addition, it allows irrigation of narrow and/or long canals with the same simplicity as irrigation of wider canals. Furthermore, it produces, in narrow canals, a more effective and faster flow of fluids in the apical direction, but with reduced pressure (hydrodynamic paradox or Venturi effect). Also, it provides irrigation throughout the entire endodontic space, one or more canals, at the same time. Clinically, it greatly helps in calcified canals, in case of a separated instrument, as well as in endodontic retreatment (Figs. 8 & 9).

Conclusion

The Er:YAG laser, at low energy and with ultra-short pulse duration, has been found to perform very well for activation of intra-canal endodontic irrigants. Owing to the lack of uniformity of parameters used in the various studies (including wavelength, pulse duration, energy, frequency and tip design and diameter) confusion still remains in LAI procedures regarding how to achieve the best results. However, there is now an overwhelming published evidence of the benefits of Er:YAG laser-supported root canal irrigation. Of course, in-depth study of advantages and possible complications of the LAI technique is advisable before *in vivo* clinical application.

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

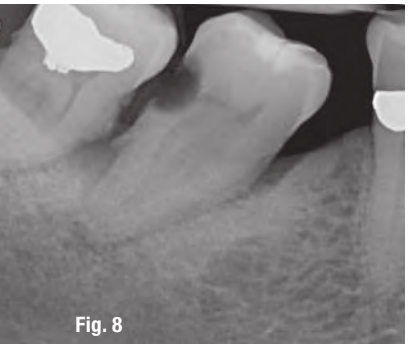


Fig. 8

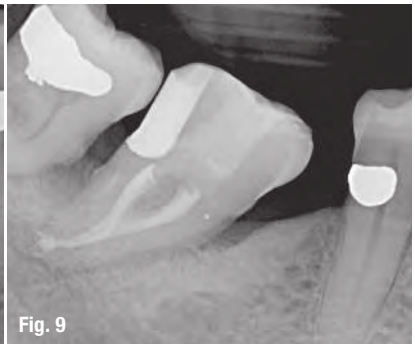


Fig. 9

Figs. 8 & 9: Tooth #47 with deep decay on the distal proximal wall. One-visit therapy was performed with SS White and ProTaper Next X2 rotary instruments. The SWEEPS irrigation technique allowed good decontamination and cleaning prior to the final sealing (EndoSequence BC Sealer, Brasseler).

about

Dr Giovanni Olivi is an Italy-based dentist and internationally published author. He graduated cum laude in Medicine and Surgery (MD) and in Dentistry (DDS) in Rome. He obtained the postgraduate diploma in "Laser Dentistry" from the University of Florence and the Master status from the Academy of Laser Dentistry. In 2007, Dr Olivi was awarded the "Leon Goldman Award" for clinical excellence by the Academy of Laser Dentistry.

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Differences in cyclic fatigue lifespan: WaveOne® Gold vs EdgeOne Fire.™

Background:

Aim of this study is to investigate the cyclic fatigue resistance of the Gold treated WaveOne® Gold and the Firewire treated EdgeOne Fire™ instruments.

Conclusions:

Firewire instruments resulted to be about two times more resistant to cyclic fatigue when compared with identical instruments made with Gold treatment.

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Treatment of the result of chronic activation of substance P

Prof. Philippe Sleiman, Dr Pamela Kassabian, Dr Valerie Batrouni, Lebanon & Dr Alexey Volokitin, Ukraine

Introduction

Pulp stones are primarily a physiological manifestation and may increase in number and/or size owing to local or systemic pathology. The aetiological factors involved in their formation are still not fully apparent; their formation may be associated with some local irritants that are long-standing, such as caries, dental restorations and systemic disturbance.[1] Calcific atheromas and the calcification of dental pulp have a similar pathogenesis, so routine dental radiographs may be useful. If the patient is found to have multiple pulp stones, further evaluation for associated diseases, carotid artery calcification and renal calcification is required.[2]


Fig. 1


Fig. 2

Fig. 3

Calcification can occur in the dental pulp as discrete calcified stones or as a diffuse form. These pulp stones may exist freely within the pulp tissue or be embedded in the dentine.[3] Depending on their microscopic structures, pulp stones were histologically classified by Kronfeld into a true or false form.[4]

Radiographic examinations are not likely to detect pulp stones of less than 200 µm in diameter. Radiographically, pulp stones appear as radiopaque structures in the pulp cavity. The prevalence of pulp stones is higher in females than in males and occurs most commonly in molars than in other tooth types.[1,5]

Implicated factors

The formation of these calcifications is not well understood, and many aetiological factors have been proposed:

- Ageing: With age, the frequency of pulpal calcification increases because of a higher concentration of alkaline phosphatase, which could trigger calcification.[1]
- Excessive occlusal force: Such force causes changes to the pulp (hyperaemia, pulpitis, pulp necrosis, etc.). Tooth trauma causes damage to the neurovascular supply of the pulp and leads to various responses of the pulp, including tertiary dentine formation, pulp revascularisation, pulp canal calcification, chronic pulp inflammation, internal root resorption, pulp necrosis and infection of the root canal system.[6]
- Long-standing irritants, such as caries, deep fillings, chronic inflammation, abrasion and orthodontic tooth movement.

Additionally, a high prevalence of pulp stones has been reported in individuals with cardiovascular disease, kidney stones, gallstones and salivary gland stones. Also,

pulp stones have been observed in females more than in males because they experience sleep bruxism more frequently.[1,5] First molars have a maximum number of calcifications compared with any other teeth because they are the first teeth to erupt and have a greater surface area and occlusal forces, perhaps leading to early degenerative changes.[1,5]

Classification of pulp stones

Pulpal calcifications have been classified by Kronfeld as: (1) true denticles (composed of orthodentine); (2) false denticles (composed of concentric layers of calcified material not resembling dentine); and (3) diffuse calcification (small calcified deposits scattered throughout the pulp tissue). However, most pulpal calcifications are conglomerates of different tissues—orthodentine, and regular and irregular calcified material—so applying this classification becomes nearly impossible.[4] In a calcified pulp, a slight increase in collagen content is present, but there is no evidence of an inflammatory response or the presence of microorganisms.[7]

In occlusal trauma and masticatory function, the dental pulps respond with a neurogenic inflammatory process in which substance P plays an important role in the direct and indirect mechanisms of angiogenesis by activating the neurokinin-1 receptors of cells such as fibroblasts, and endothelial and inflammatory cells, leading to the formation of new blood vessels, which are needed as a defence mechanism, by stimulating the formation of mineralised tissue.[8] These neuropeptides, substance P, neurokinin A and calcitonin gene-related peptide, once released by the sensory fibres, have effects on the blood circulation, inflammatory process, immune responses and connective tissue cells, and therefore they have an important role in inflammation and pulp pain.[9] Further research is needed on the association between these neuropeptides and the pulp state for understanding more about pulp inflammation and dental pain.

Types of calcifications

There are two main morphological forms of pulpal calcifications: discrete pulp stones and diffuse calcification. The discrete form appears radiographically as a round or ovoid opacity, and it is more common in the pulp chamber than in the root canal. The diffuse form is a generalised calcification in a large area of the pulp chamber and canals. It is called calcific degeneration, and it is amorphous and unorganised.[3]

Clinical signs

The clinical signs are (1) a yellowish discoloration or reduced transparency of the crown or even grey discoloration, although not all teeth with pulp obliteration undergo

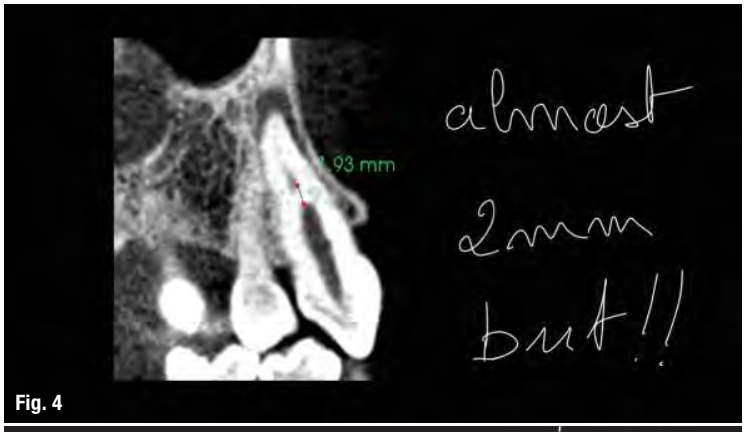


Fig. 4

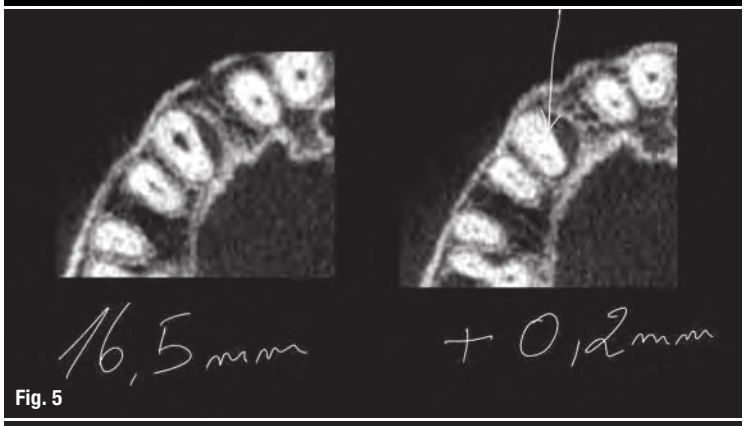


Fig. 5

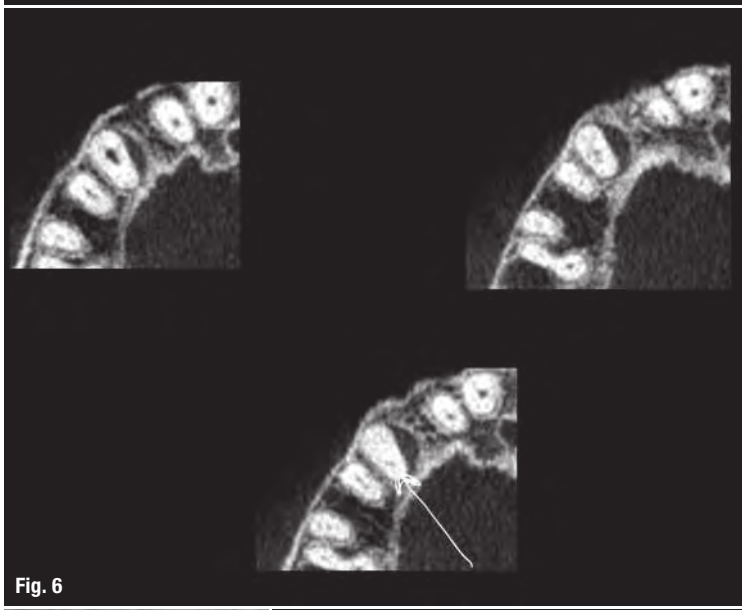
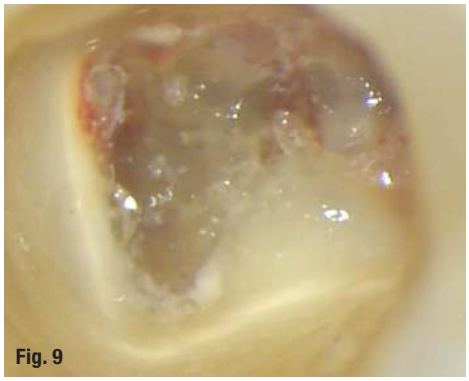


Fig. 6


Fig. 7


Fig. 8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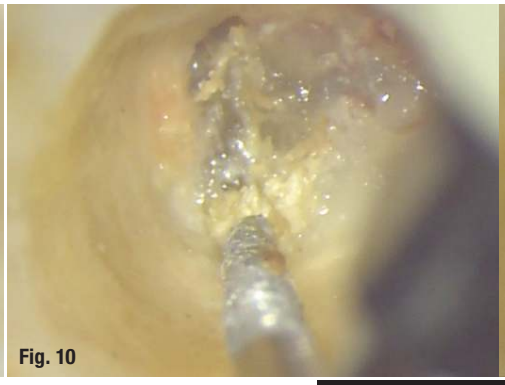
Fig. 10

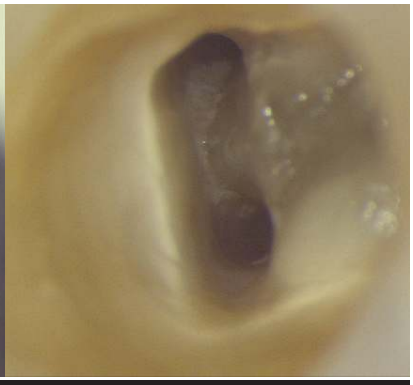


Fig. 11

a colour change;[7] (2) a progressive decrease in the response to thermal and electrical pulp testing compared with adjacent teeth;[4] and (3) generally asymptomatic.[4]

Radiographic findings

Pulp stones are calcified masses present in any portion of the pulp. Coronal pulp stones are more common than radicular ones. Radiographically, they appear as dense radiopaque masses.[5] To identify pulpal calcifications, previous studies have performed research on the prevalence of pulp stones using panoramic, periapical and bitewing radiographs, as well as cone beam computed tomography (CBCT).[1]

Complete or partial radiographic obliteration of the pulp cavity does not necessarily mean the absence of the pulp canal. In the majority of these cases, a pulp cavity with pulp tissue is present.[7]

Treatment

Teeth with a negative response to sensitivity and tenderness to percussion should be treated in cases of pulpal calcification, and any sign of a periapical infection is an indication for root canal therapy. In 2010, the American Association of Endodontists (AAE) advised clinicians to treat teeth with obliteration of the pulp in a careful way through clinical observation and periodic radiographic examination in view of the difficulties envisaged during this treatment.

CBCT presents the tooth in all spatial planes, allowing exploration of the anatomy of the root canal, and can help in the assessment of pulp canal calcification. It is a non-invasive, reliable imaging modality with low radiation doses and has the advantage of reducing processing time. In 2015, the AAE and the American Academy of Oral and Maxillofacial Radiology updated their guidelines on the use of CBCT imaging in endodontics.[10]

When initiating the treatment, the use of a dental microscope is recommended, and during creation of the access cavity, straight-line access to the pulp is better than traditional access using different ultrasonic tips.

Clinical Case 1

A fistula between the two maxillary molars was seen by the hygienist during a routine cleaning session of the patient. When the patient was transferred to my room, I inserted a gutta-percha cone into the fistula and took a radiograph (Fig. 1). Upon studying the radiograph (we will not discuss the molar in this article), I saw that the canine had a problem. Legally, we are responsible for all the information revealed by the radiograph or on the area shown by the radiograph, which is why we always need to interpret very carefully the entirety of the radiograph and not focus only on what is considered the main problem. A CBCT scan was taken in order to understand better what was going on (Fig. 2). Looking at one sagittal cross section (Fig. 3), we can see clearly that the canine indeed had an apical infection and that there was a calcification in the middle of the root canal. The calcification was located at almost 16.3 mm, and the thickness of the calcification was almost 2.0 mm (Fig. 4). But this was not all the information that we could gain from the scan: at almost 16.5 mm and a bit beyond, by 0.2 mm, the canal was completely obliterated (Fig. 5). In Figure 6, it can be seen that the canal reopened after 2 mm but from the palatal angulation. This is crucial information, as when we opened the canal, we would need to choose a palatal angulation in order to access the orig-

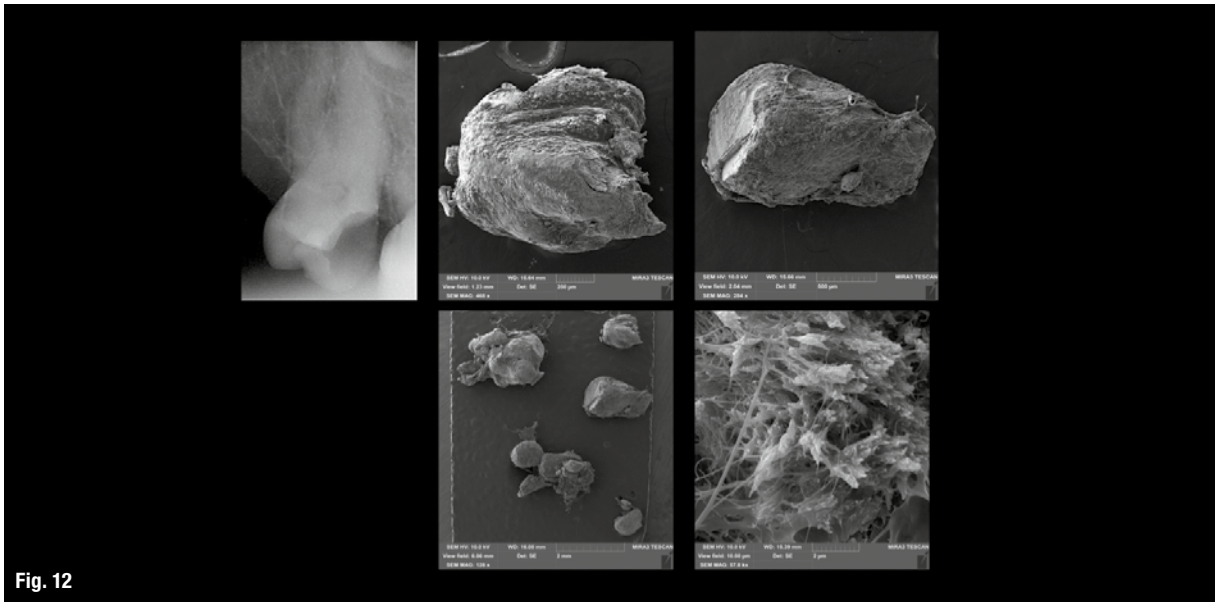

Fig. 12

inal part of the canal and to avoid any perforation in this area. Ultrasonic tips were used in order to open the canal and remove the internal calcification, allowing for the root canal therapy to be performed in a single session (Fig. 7).

Clinical Case 2

A patient was referred to the office with signs of irreversible pulpitis of a mandibular molar. From the preoperative radiograph, we could see a deep filling, a very calcified pulp chamber and calcification extending to the roots (Fig. 8). After opening the access cavity under the microscope, we could see the amount of calcification (Fig. 9). Using the diamond ultrasonic tip, we were able to cut the calcification very carefully and create a second access cavity inside the first one, where, with the help of ultrasonic tips and a clinical microscope, we were able to go as deep as we could inside the canals. Figure 10 shows complete access to both distal canals and a bit of calcification left inside the isthmus between the canals. The treatment was achieved in a single session (Fig. 11). Figures 12 and 13 show the structure of the pulp stones under a scanning electron microscope and the pulp stone blocking the distal root beyond the middle part of the root (courtesy of Dr Alexey Volokitin).

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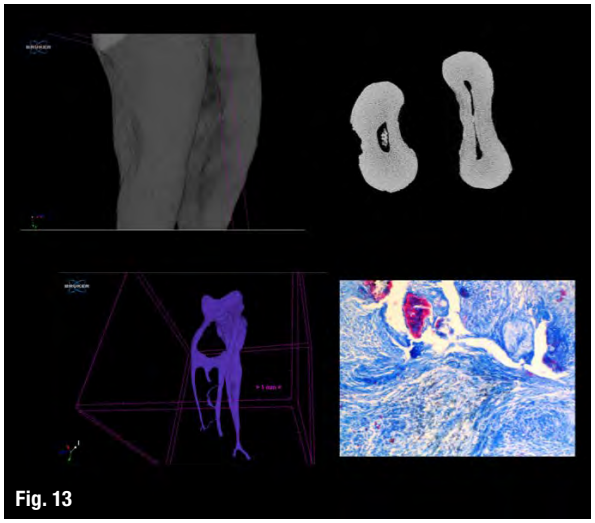

Fig. 13

about

Prof. Philippe Sleiman received his DDS in 1990, his DUA in 1995, and his PhD in 2006 at the Lebanese University School of Dentistry. He also received his CESE in Endodontics at Saint-Joseph University in 1999. He lectures internationally and is currently Assistant Professor at the Endodontic Department of the Lebanese University Dental School. Prof. Sleiman teaches at the Lebanese University and University of North Carolina (USA). He achieved fellowship with the International College of Dentists and the American Association of Endodontists, and maintains private practices in Beirut, Lebanon, Dubai, UAE, and Oman. Prof. Sleiman is an international speaker in endodontics, collaborates in several undergoing research endodontic studies, and has a private practice limited to endodontics.

Root canal therapy with a modular NiTi system: A case report

Dr Vishal P. Gandhi, India

Fig. 1: Pre-op radiographic image of tooth #46. **Fig. 2:** Mesioangular radiograph with five root canals visible.

Once in a while, some cases bring something extra to the operating table: unusual anatomical structures, such as a kind of additional main root canal, can add an incalculable variable to an already challenging 3D structure in the root canal system. The radiographic image in the following case revealed a rare specimen that almost resembled an octopus and required a special treatment with a modular, flexible nickel-titanium (NiTi) system.

Case report: More canals in the pipeline

A 42-year-old female patient presented to our dental clinic reporting problems affecting the mandibular right first molar. A standard cold test of tooth #46 showed a delayed reaction. In the preoperative radiograph, the diagnosis and the amazing anatomy of the tooth became apparent. Although human anatomy differs a great deal from case to case, the typical molar usually has no more than four main canals in its root canal system. However, the mesial root canal pattern of the molar in question showed some substantial side structures. The radiograph almost resembled an image of an octopus with many arms attached to the body (Fig. 1). Acute pulpitis was diagnosed, and the patient consequently agreed to a non-surgical root canal therapy.

Fig. 3a

Fig. 3b

Fig. 3c

Figs. 3a–c: CM-treated NiTi files: new **(a)**; save for reuse **(b)**; and unwound **(c)**.

According to our standard approach, the endodontic treatment naturally started with the isolation of tooth #46. We thus applied the mandatory dental dam to create a clean operating field, before gaining access. The first step then was to remove all caries from the affected tooth. Entering the pulp chamber gave us an idea of the true dimensions of the problem: the mesial canals were totally necrosed. Besides that, it was interesting to discover the unusual root pattern we suspected based on the radiographic images. The mesioangular radiograph showed how important it is to capture radiographs from different angles: it clarified the separate mesiolingual root and helped us to prepare the access properly (Fig. 2). In an unusual, winding root canal system, in general, the greatest challenge would be thorough canal preparation. We opted for flexible NiTi files that would allow for safe and efficient cleaning of the main canals.

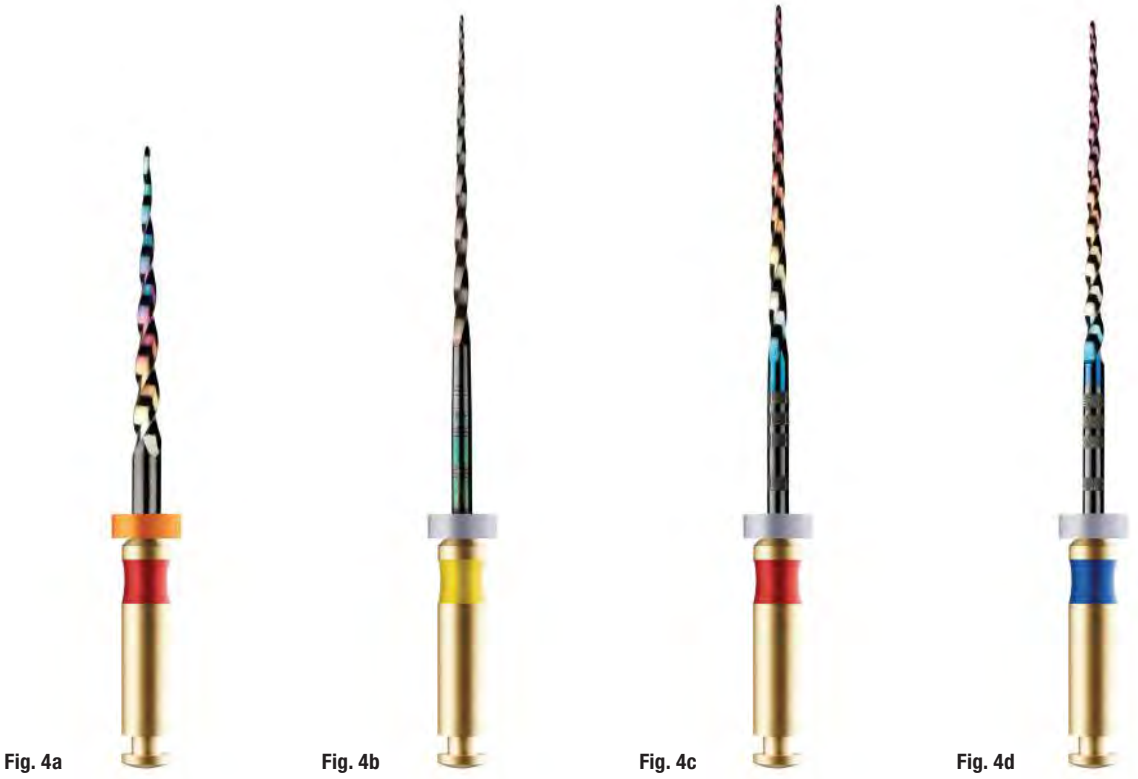

Fig. 4a Fig. 4b Fig. 4c Fig. 4d

Fig. 4a: HyFlex CM 25/.08 orifice opener. **Figs. 4b–d:** HyFlex CM sequence: 20/.04 **(b)**; 25/.04 **(c)**; and 30/.04 **(d)**.

Very early on, international dental specialist COLTENE was one of the first suppliers of fracture-resistant NiTi files with the so-called controlled memory (CM) effect. CM-treated NiTi files are prebendable, but unlike conventional NiTi files, they do not bounce back. Owing to the special production process, certain physical qualities of the alloy are strengthened, making the files both flexible and very fracture-resistant. The practice team can even see with naked eye whether the files can be reused without any problems: CM-treated NiTi files automatically resume their original shape when heated during sterilisation. Coming out of the autoclave, they should look like new with their characteristic winded shape. If they appear to be unwound and sporting an unregular form, they have reached the end of their life cycles and should be discarded immediately (Figs. 3a–c).

Best-fit NiTi files for every canal

Modular NiTi file systems like the HyFlex allow experts as well as beginners to compose their own set of instruments. Depending on their favourite working method and the given anatomical structures, they can choose from a wide range of special and universal files. In the case described in this article, we were able to use an almost identical sequence of HyFlex CM files to prepare all five main canals. To begin with, all the canals were scouted with a size 10 hand file, until a manual glide path was established. Then the actual preparation took place.

For pre-flaring, a HyFlex CM 25/.08 orifice opener (COLTENE) was used (Fig. 4a). Next, the HyFlex CM 15/.04 was inserted into the canal. With a gentle pecking motion, we proceeded up to working length. We then switched to the corresponding size 20 file with the same taper of .04 to approach the apex. The fine-tuning in the three mesial canals was achieved with the help of a HyFlex CM 25/.04. In the distolingual and distobuccal canals, the final instruments in the sequence were a HyFlex CM 25/.04 and the 30/.04 (Figs. 4b–d). The files moved smoothly through the centre of the canal and

Fig. 5: GuttaFlow bioseal automix syringe, 5 ml.

Fig. 6: Post-op radiographic image with visible obturation.

did not become blocked at any point. The high flexibility helped us to gain a good feel of the exact curvature of the canal, as we used the tactile approach to scout the path one third by one third.

It goes without saying that thorough rinsing following a strict cleaning protocol between instrument changes was crucial for a reliable overall result as well. For the chemical irrigation between the mechanical preparation, 5.25 % sodium hypochlorite and 17 % EDTA were used. This procedure also helps to reach side structures that cannot be cleared of debris and bacteria by file preparation alone. In this case, there was a substantial coronal isthmus between two mesial canals, whereas in other patients, lateral canals are far more delicate and particularly difficult to reach.

Different anatomical challenges

The last step was to create a proper seal to prevent microorganisms from re-entering the root canal system and to protect the root from future recontamination. For an efficient and durable obturation, we chose GuttaFlow bioseal (COLTENE; Fig. 5) for the hydraulic condensation technique. The three-in-one obturation material combines fluid gutta-percha with a suitable sealer at room temperature and bioceramics in an automix syringe. This composition results in an easy-to-handle material with excellent flow properties and a working time of ten to fifteen minutes. The gutta-percha is warmed and can be pushed down with a plugger if it has not already begun flowing into all (possibly hidden) the canals itself. After polymerisation, the bioactive material forms hydroxyapatite crystals on the surface, significantly improving adhesion and actively encouraging the regeneration of bone and dentine. Almost like a traditional Indian healer, you thus do your magic and wait for the result to show in the final radiograph. The postoperative radiograph depicts the mighty octopus with its clearly recognisable arms, all reliably filled with gutta-percha (Fig. 6). The long-term documentation will confirm whether we were able to create a durable seal.

At international meetings, my international colleagues and I often observe that the different shapes of root canals never cease to amaze the endodontic expert. No matter how many lateral canals, isthmuses and side structures you have seen in your career, there is always that one case that brings a special challenge to the treatment. On the one hand, such anatomical structures need flexible instruments. On the other hand, such root canals need a reliable obturation material that fills even remote areas and flows into parts of the 3D root canal system that cannot be reached otherwise. In India, many patients wait until the dentinal decay is already far advanced and a major part of the root canal system is necrosed. Sound, revision-safe root canal therapy helps to encourage people to seek treatment at an earlier point, when many conditions can even be resolved or managed far better.

Conclusion

Varying anatomical structures require flexible instruments that adapt to the individual situation in the root canal and move reliably in the centre of the canal. A modular NiTi system like HyFlex CM or EDM files allows endodontic specialists to choose from a range of special files, from glide path files and orifice openers up to finishing files of different sizes and tapers. A bioactive obturation material moreover flows into all kinds of lateral canals and promotes healing.

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

This article is part of a three-part series titled So Many Roots to Travel *and developed by COLTENE. In the series, endodontic specialists around the world discuss their most spectacular cases and show how they met the treatment challenge using modern NiTi instruments.*

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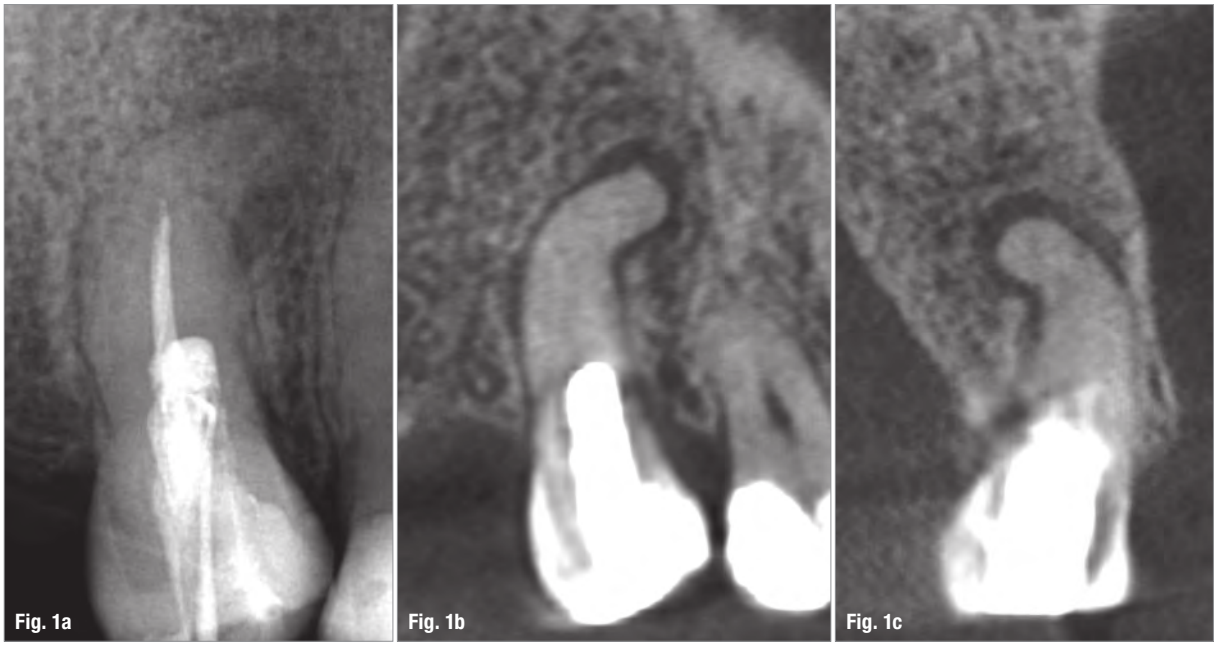
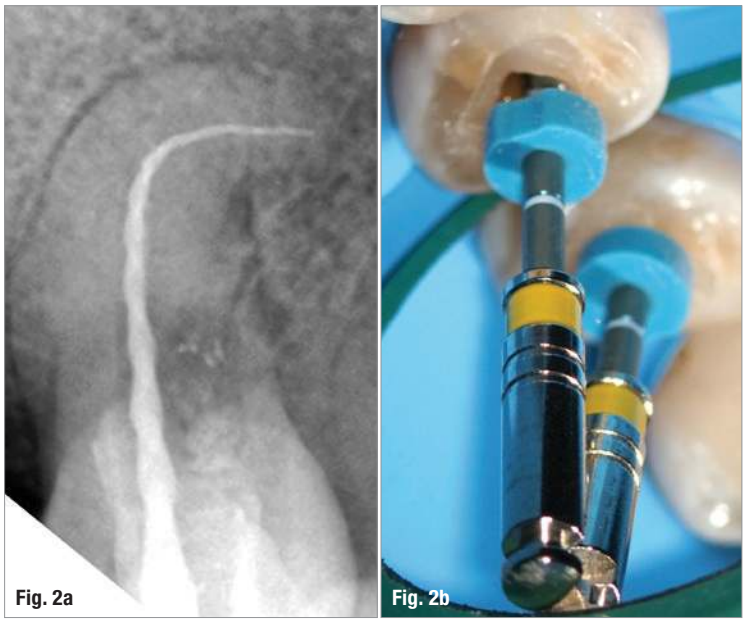
Retreatment of a tooth with a double curvature

Dr Gaizka Loroño, Spain



Figs. 1a–c: Intra-oral radiograph of the periapical area showing the apical lesion **(a)**. CBCT image showing a curvature in the mesiodistal direction **(b)**. CBCT image showing a curvature in the buccopalatal direction **(c)**.



Figs. 2a & b: Radiograph of the periapical area **(a)** and intra-oral view **(b)** with the VDW.ROTATE 20/.05 in the root canal.

Retreatments are a challenge for the majority of clinicians. While there may be various reasons for the primary failure, it always relates to inadequate cleaning of the endodont. It may also be due to a very complex canal system or failure to reach the working length, as in the case described here.

A 51-year-old female patient was referred for treatment. The patient presented a non-contributory general medical history. The specific medical history of tooth #15 was sensitivity to percussion in the tooth and sensitivity to palpation in the apical region of the same tooth. The intra-oral radiograph demonstrated an apical lesion in the periapical area. The suspected cause of this was pathologically altered pulp due to a previous treatment with infra-obturation (Fig. 1a). The cone beam computed tomography (CBCT) image confirmed the suspected apical lesion, and the analysis of the CBCT image identified a double curvature in the mesiodistal (Fig. 1b) and buccopalatal directions (Fig. 1c). The established diagnosis was symptomatic apical periodontitis in a previously treated tooth.


Fig. 3


Fig. 4a

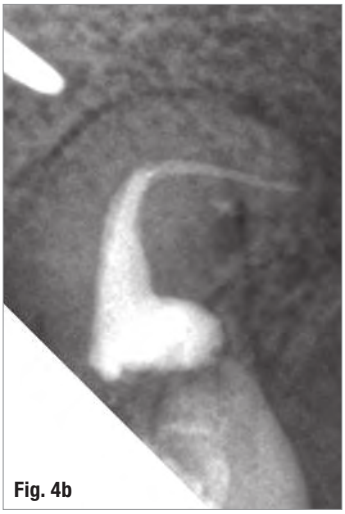


Fig. 4b


Fig. 4c

Fig. 3: EDDY irrigation tip in the root canal. **Figs. 4a–c:** Final obturation with gutta-percha and a synthetic resin-based sealer. Occlusal view **(a)**. Intra-oral distal radiograph of the periapical area **(b)**. Intra-oral orthoradial radiograph of the periapical area **(c)**.

After the administration of a local anaesthetic in the form of 3.6 ml of 2 % lidocaine with the addition of epinephrine (1:80,000), rubber dam isolation and access preparation were completed. Irrigation was carried out during all the preparation with a total of 12 ml of 5.25 % sodium hypochlorite (NaOCl). A size 2 Gates–Glidden bur and a VDW.ROTATE 25/.05 retreatment file (VDW) were used for the coronal gutta-percha removal. As the obturation was much too short, the unintentional creation of a ledge was suspected, and special care was taken at this point to avoid a further worsening of the situation.

After removing the obturation material, the ledge was detected and overcome using pre-curved ISO size 8 K-type files (VDW). Next, the working length was determined with the RAYPEX 5 apex locator (VDW). A glide path was obtained using ISO size 10 and 15 K-type files and then prepared using VDW.ROTATE 15/.04 and 20/.05 (Figs. 2a & b).

The files were not used in the recommended sequence and single-length technique, but in combination with a crown-down technique. The crown-down technique makes it possible to widen the coronal section of the root canal to ease the passage of the file into complex areas and to reduce wall contact and therefore stress for the instruments. For that reason, as soon as VDW.ROTATE 15/.04 had bypassed the curvature, VDW.ROTATE 20/.05 was used to shape the section coronal to the curvature, in order to widen the canal and facilitate the arrival of VDW.ROTATE 15/.04 to working length. After VDW.ROTATE 20/.05 had also reached working length, it was decided to stop the preparation. This decision was made because apical gauging detected an ISO size 20 tugback and it was not necessary to widen the canal further.

Final irrigation was carried out with 3 ml of 5.25 % NaOCl, 1 ml of 17 % EDTA and a further 3 ml of 5.25 % NaOCl. The irrigants were activated with an EDDY irrigation tip (VDW) with a frequency of 6 kHz for 30 seconds each (Fig. 3). After drying of the canal, downpacking and backfilling were carried out with a BeeFill 2in1 (VDW), using AH Plus (Dentsply Sirona) as a sealer (Figs. 4a–c). The tooth was then sealed with a temporary material and the patient referred back for permanent restoration.

> “The crown-down technique makes it possible to widen the coronal section of the root canal...”

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Testing a novel endodontic sealer

Drs Paolo Generali & Francesca Cerutti, Italy

Fig. 1

The aim of endodontic treatment is to eliminate microorganisms and their by-products from the root canal system while avoiding recontamination.[1–3] The outcome of endodontic treatment is strictly linked to several steps: root canal debridement, disinfection protocols and hermetic obturation of the canal space.[4] Root canal obturation in a 3D space with a stable, nontoxic material and the creation of a tight seal are fundamental for the success of the treatment, since the root filling seals communication between the periodontium and the endodontium and, along with shaping and disinfection, allows further bacteriological defence.[5,6]

Sealers should be used to fill the morphological root canal system irregularities in order to avoid gap formation between the dentinal walls and core materials; moreover, sealers should facilitate the placement of the filling core with a lubricant action, penetrate into dentinal tubules to prevent microleakage and entomb any remaining bacteria.[2,7,8]

Many different sealers are available on the market, but all of them ideally aim to have the following features: tissue tolerance, no shrinkage with setting, slow setting time, adhesiveness, radiopacity, bacteriostatic properties, absence of staining, solubility in solvents, insolubility to oral and tissue fluids, and easy handling.[9]

The different endodontic sealers are categorised based on their main components: zinc oxide eugenol (ZOE), calcium hydroxide, glass ionomer, resin-based, polydimethylsiloxane-based and bioceramic-based sealers. Resin-based sealers became popular because of their adhesive properties and have been reported to be used with the single gutta-percha cone technique for canal obturation;[10] even bioceramic sealers can be used with this last technique.[11]

The most commonly used sealers in root canal therapy are ZOE-based sealers, modified for endodontic purposes based on Grossman's or Rickert's formula. The powder of these sealers contains zinc oxide, which combines with a liquid, generally eugenol. Zinc oxide is an environmentally friendly material with antibacterial properties and favourable characteristics in terms of biocompatibility, and it has been used widely in medical applications. Unlike resin-based sealers, which are subject to shrinkage, the setting reaction of ZOE-based sealers is chelation between eugenol and the zinc ion of the zinc oxide; this reaction might also occur between the zinc oxide phase of gutta-percha and the calcium ions of dentine. This might explain the decreased setting shrinkage associated with ZOE-based sealers.[10] Michaud et al. have shown that volumetric expansion of gutta-percha (almost 135.35 per cent) occurred in contact with eugenol during a 30-day period, and a pilot study done earlier showed a remarkable increase in the gutta-percha dimensions when placed in eugenol that continued even after 4.5 years.[12]

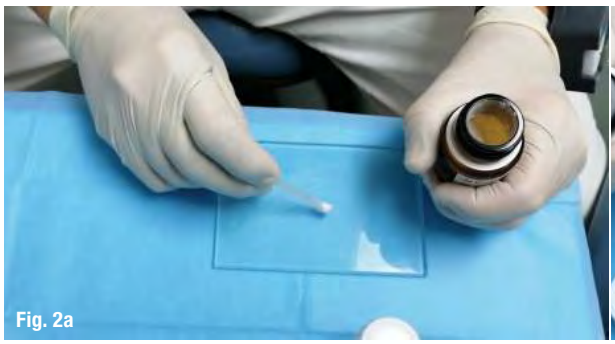

Fig. 2a

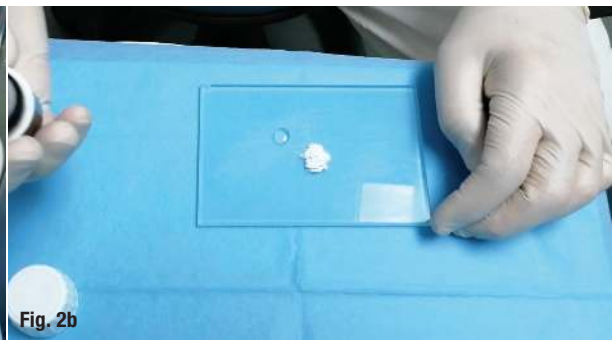

Fig. 2b

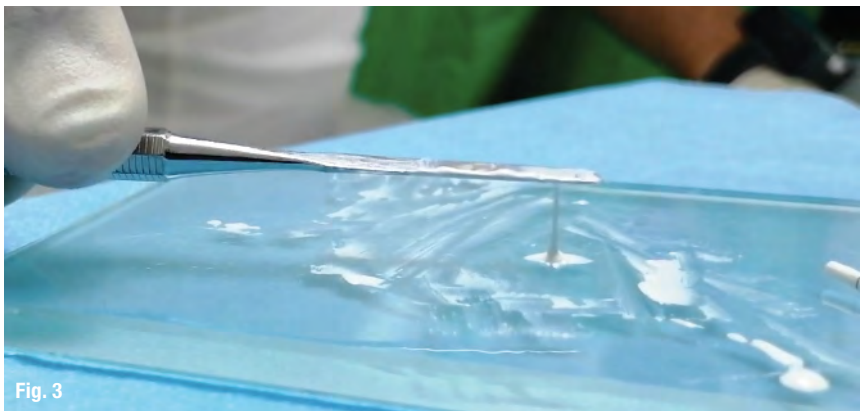
Fig. 3


Fig. 4

Theoretically, sealer penetration into dentinal tubules could improve sealing of a root filling by increasing the surface contact area between the root filling materials and dentinal walls. Furthermore, retention of root filling material might be improved by mechanical locking. However, contrary to common belief, a positive correlation between sealer penetration into dentinal tubules and sealability has never been established.[13]

Penetration refers to the amount of sealer entering the dentinal tubules, and adaptation qualitatively describes the way in which the sealer conforms to the dentinal wall. Penetration and adaptation depend on many factors, including the patency and density of the dentinal tubules.[14] Russell et al. investigated the penetration and adaptation of common types of root canal sealers (AH Plus, Pulp Canal Sealer, MTA-FILLAPEX and EndoREZ) in cross sections of tooth roots exhibiting the butterfly effect to determine whether this differs between coronal and middle root sections.[15] Penetration and adaptation quality varied between obturation material groups, but this did not reach significance. AH Plus was reported as the best-performing material of the tested cements, and Pulp Canal Sealer and EndoREZ as the worst-performing.

The superior adaptation and penetration of a sealer may be attributed to its pseudoplastic behaviour inside root canals; this has been described as a decrease in viscosity and an increase in flow parallel to an increase in shear rate during filling procedures. When using gutta-percha with sealer as a core material for filling the canal space, the amount of sealer should be kept to the minimum, whereas the amount of gutta-percha placed into the canal must be maximised.[16] To reach the ideal consistency of the sealer, it is important to calibrate the powder–liquid or paste–paste ratio of the mixed cement, because even small alterations to this ratio may cause a change in thickness and flow of the material, affecting its penetration and adaptation to the dentine.

ZOE cements have some drawbacks, such as the capability of staining the tooth and a setting time dependent on the heat or humidity of the environment. Many attempts have been made to improve ZOE powder–liquid sealers, adding various substances or substituting eugenol in the liquid component. This has given rise to a number of zinc oxide non-eugenol-based sealers.

In 2019, a new sealer containing tea-tree essential oil (EssenSeal, Produits Dentaires) was launched on the market (Fig. 1). Tea-tree oil is obtained from the native Australian Melaleuca alternifolia tree, or tea-tree, indigenous to northern New South Wales and southern Queensland.[17] Tea-tree oil is a complex mixture of essential oils, comprising approximately 100 components, most of which are monoterpenes and sesquiterpenes and their related alcohols.[18] Tea-tree oil has been shown to possess a number of therapeutic properties, including anti-inflammatory activity;[18] antimicrobial activity against a wide spectrum of microorganisms, for example *Staphylococcus aureus*;[19] a range of oral bacteria;[20] certain viruses, including herpes simplex and influenza viruses;[20] and many fungi, including some azole-resistant yeasts.[21] Tea-tree oil has also demonstrated potential biofilm-inhibiting activity.[22] In an animal


Fig. 5

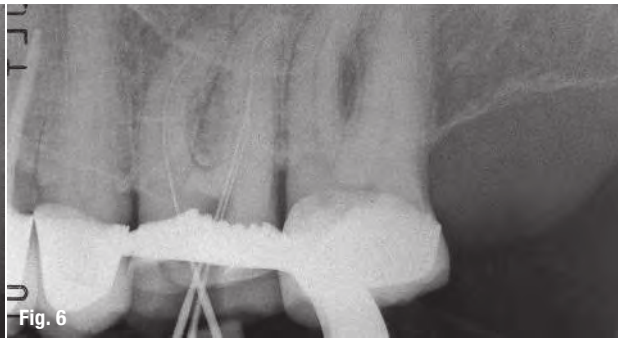
Fig. 6


Fig. 7


Fig. 8

study, tea-tree oil promoted healing of the extraction sockets and prevented alveolitis.[23]

According to Siqueira, the microbial flora present in failed canals has unique characteristics, consisting of extremely resistant bacterial strains and even yeasts, and these pathogens can survive in an inhospitable environment, often organising in biofilms.[24] Incorporating plant extracts or purified compounds derived from plants has become an emerging area of great interest in the medical and scientific community. Antibiotic resistance has directed researchers toward alternative therapies, including traditional plant-based medicines. Many such plants are those traditionally used by indigenous communities to treat infectious diseases.[25] This is the case of tea-tree oil, which has been used therapeutically for a long time, being one of the plants used in traditional medicine by the Bundjalung Aboriginal Australians of northern New South Wales.[26] Its use in an endodontic sealer for endodontic retreatment could be an example of the new trend towards the use of natural products derived from plants in association with conventional means in order to overcome problems due to microbiological resistance.

EssenSeal is a highly flowable powder–liquid cement with a low paste thickness and should be mixed according to the manufacturer's instructions: one drop of liquid to one spoon (provided) of powder. The clinical impressions of this sealer are positive: mixing and manipulation of the cement are easily done (Figs. 2a, 2b & 3), and the final product has a smooth consistency that allows easy placement of the gutta-percha cone into the root canal. The good flowability of the sealer and its capability of adapting to the canal preparation are appreciable and promote 3D sealing of the root canal system. In addition, this sealer diffuses a pleasant scent during manipulation and its white colour should prevent discoloration issues. A procedure performed on a freshly extracted tooth showed good penetration of the root canal anatomy and sufficient radiopacity (Fig. 4). A clinical case shows the good penetration of the sealer into the root canals and the absence of voids (Figs. 5–8).

The white colour, the pleasant scent and the good handling make this product suitable for everyday endodontic treatment. In addition, the interesting properties of tea-tree oil against resistant microorganisms and biofilms particularly recommend its use in retreatment procedures.

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

about

Dr Francesca Cerutti graduated from the University of Brescia in Italy in 2007. In 2013, she obtained her PhD in materials for engineering from the same university, and in 2016, she completed a master's degree in aesthetic medicine. She collaborates with Prof. Dino Re at the University of Milan in Italy, where she conducts clinical research and, since 2018, has been a visiting professor. She has published several articles in peer-reviewed journals and has co-authored books on restorative dentistry and endodontics.
Dr Cerutti has spoken at national and international congresses on post-endodontic restoration and aesthetic reconstruction of teeth. She is a reviewer for international journals such as the *Journal of Adhesive Dentistry*, the *European Journal of Paediatric Dentistry* and *Biomaterials*.
Dr Cerutti is a member of the Italian Society of Endodontics and served as editorial coordinator of the *Giornale Italiano di Endodonzia* from 2008 to 2011. She is a silver member of Style Italiano Endodontics.

Dr Paolo Generali obtained his MD cum laude from the University of Pavia in Italy in 1983 and DDS from the University of Parma in Italy in 1987. He was a visiting professor in restorative dentistry at the University of Modena and Reggio Emilia in Italy from 2004 to 2009 and again from 2017 to 2018. He also lectured in the postgraduate courses of restorative dentistry, and clinical and surgical endodontics at the same university. He taught the master's course in prosthetic dentistry at the University of Bologna in Italy from 2009 to 2013 and the master's course in endodontics and restorative dentistry at the University of Siena in Italy from 2016 to 2018.
Dr Generali is an active member of the Italian Society of Endodontics and a gold member of Style Italiano Endodontics.

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Retractors for endodontic microsurgery

Penn endo retractor set by Dr Syngcuk Kim

These specially designed retractors for endodontic microsurgery have many special features not found in regular retractors (Fig. 1). The tips of all the retractors have a miniature 90° angled wedge of steel with serrations on the tips of the blades to provide an excellent grip on the bone without slipping. Regular retractors do not have this feature, making them very prone to slipping, causing damage to soft tissue (Fig. 2).

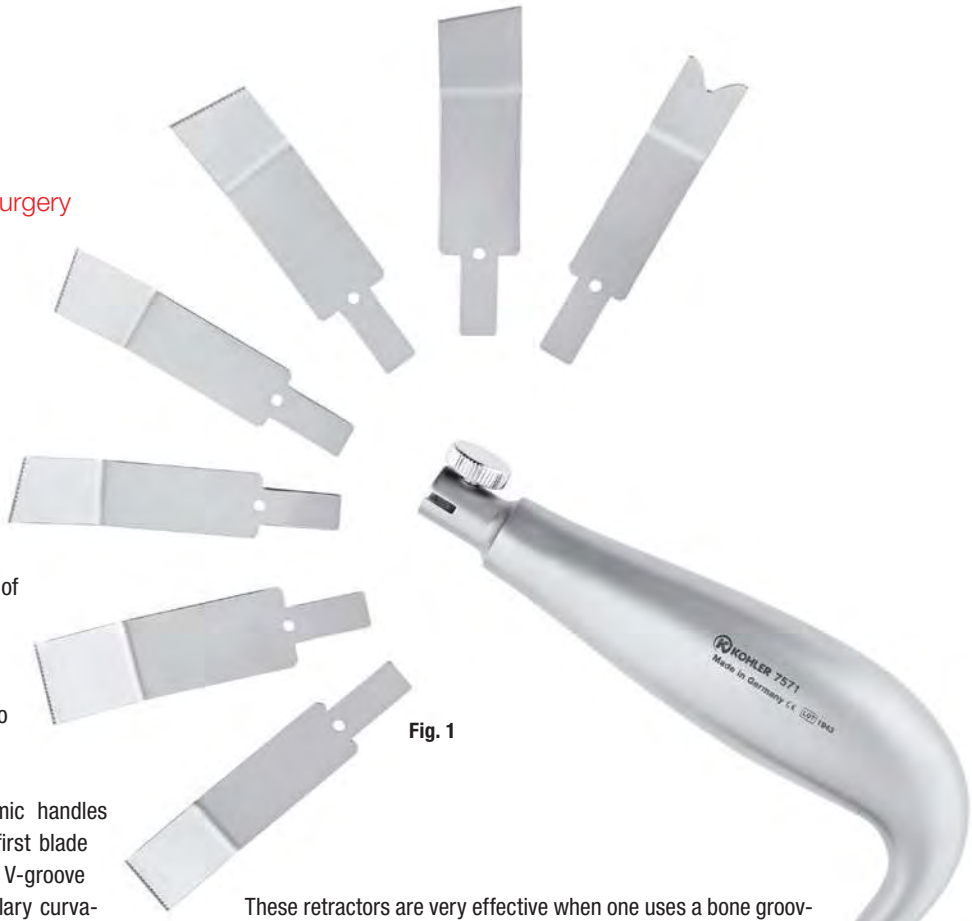

Fig. 1

The retractor set includes two ergonomic handles (Fig. 3) and seven retractor blades. The first blade is 12 mm wide, is angled at 15° and has a V-groove (Fig. 4). It is designed to follow the maxillary curvature, being convex and concave where the bone is not flat. The remaining six blades range from 12 to 15 mm in width, are angled at 15° or straight, and notched to the right or left (Fig. 5). During surgery, it is difficult to keep the jaw horizontal. As the jaw drops a bit during surgery, one needs a retractor to compensate for the minor tilt. These retractors are especially important for mandibular posterior surgery.

These retractors are very effective when one uses a bone grooving technique, especially in the mandibular posterior area. A small, thin groove is made preferably using a piezo-surgery saw. The retractor tip is then engaged in the groove, keeping the retractor stable during the surgery.

Kohdent Roland Kohler Medizintechnik
www.kohler-medizintechnik.de

Fig. 3

Fig. 2

Fig. 4

Fig. 5

Excellent overview of treatment materials

VDW.FLO Endo Organizer

Fig. 1

Fig. 1: The 16 trays are designed for common packaging sizes. **Fig. 2:** The VDW.FLO Endo Organizer. **Fig. 3:** Blank and preprinted stickers facilitate the individual's own organisation scheme.

Fig. 2

VDW, one of the world's leading manufacturers of endodontic solutions, began 2020 with the launch of its VDW.FLO Endo Organizer. This multifunctional plastic insert for drawers and equipment trolleys was specially developed to bring order to the materials used for endodontic treatment. The organiser fits the standard drawer and table sizes, and its compartments are precisely matched to the packaging of the relevant materials.

At the beginning of February, VDW launched the VDW.FLO Endo Organizer on the global market. The multifunctional insert for drawers and equipment trolleys organises loose instruments and irrigation, obturation and post-endodontic materials in order to create a clear overview of the inventory. Used on a table, the organiser keeps all necessary materials tidy and readily at hand during treatment. Its 16 small, medium and large compartments are specially designed for common packaging sizes. The VDW.FLO Endo Organizer can be adapted to individual workflows with the aid of the corresponding labelling set of blank and preprinted stickers. The VDW.FLO Endo Organizer is made of easy-to-clean, robust plastic and features a non-slip silicone underside to facilitate compliance with hygiene measures in practice.

Integrated solutions for endodontics

For over 150 years VDW has represented experience in the development and manufacture of products for endodontics. VDW develops innovative ideas and produces optimised solutions to improve the clinical success of endodontic treatments. Today, VDW provides a holistic range of solutions covering the entire endodontic treatment spectrum, from obturation to post-endodontic care. The company also offers numerous application-related advanced training programmes in endodontics.

VDW
www.vdw-dental.com

Fig. 3

Successful communication in your daily practice

Part X: How to improve your own punctuality

Dr Anna Maria Yiannikos, Germany & Cyprus

This series covers the most common and challenging scenarios that might arise in your dental practice and presents successful ways to deal with them in order for you to enjoy greater peace of mind. Each article of this series teaches you a new, easy-to-use specialised protocol which can easily be adapted to your own dental clinic's requirements and needs right from the start. Today's challenging topic: how to improve on delays that might occur in your dental practice owing to poor time management and find ways to be more punctual instead.

In the following, I will provide five essential steps to manage it. Being on time is significant—not only for you as a dentist, but for your practice staff and patients as well. They only feel respected if you are on time and don't keep them waiting. Always keep in mind that they have more important things to do than being kept waiting in the reception area of your dental practice. Your schedule might easily go off the rails if a patient still needs to be taken care of, but the next one is already waiting.

Consider the following scenario: you are preparing for a normal and—usually—easy tooth extraction. However, the procedure turns out to be more complicated than you thought and now you have to perform a complicated and time-consuming surgery instead. This situation becomes even worse when the next patient arrives on time for his or her scheduled appointment and you still have to treat the patient sitting in front of you. The patient left waiting will probably be angry and frustrated and you might lose him or her as a loyal patient.

5 essential steps

In order to cope with situations like the one that I have just described more effortlessly and effectively, follow these five steps:

1. Say that you're sorry
Immediately express your apologies to the patient who has been kept waiting and state how deeply sorry you are. If necessary and possible, interrupt the still ongoing previous appointment in order to do that. Here's what you can say: "I promise that, next time, you will get the first appointment of the day, so that there cannot be any delays whatsoever."

> "The best dentist is the one that respects his or her patients by being punctual."

2. Avoid excuses
Don't try to wriggle out of the situation by giving drawn-out explanations for why there are delays. It's unprofessional and the patient probably won't care anyway; he or she just wants to be treated. Patients come to you to have their problems fixed and not the other way around.

3. Give in order to receive
Replace bad news with good news. For instance, tell the patient who has been kept waiting that he or she will receive a free laser-assisted treatment session to make up for the inconvenience caused. However, be prepared for possible negative reactions towards your offer. If that happens, show understanding and compassion.

4. Make use of your assistant
Instruct your assistant to always remind you of an upcoming appointment five minutes ahead. Your assistant can become your personal alarm. If there are any delays, also instruct him or her to let your next patient know for how long he or she will probably have to wait. By doing so, possible annoyance and irritation from the patient's side can be avoided.

5. Make a change
Start your daily programme earlier than usual each day. In addition, schedule some extra time for every appointment, even if you don't end up needing it. For instance, if you schedule 20 minutes per appointment, now plan for 30 minutes instead. I'm aware that, in the beginning, you probably won't like it, but by doing so, you are already allowing for possible delays.

Isn't that easy?

Implement the above-mentioned steps as a protocol in your daily practice and you will soon notice that you are in control again of time-related issues in the day-to-day work of your practice. Now knowing the exact steps to avoid and resolve unwanted situations created by poor time management, you will gain greater peace of mind in the long run. Moreover, I'm certain that you won't end up losing patients (and possibly their families too) when following these steps. Just try them out and let me know what you think!

I am sure that you are already looking forward to the next issue of the roots magazine, in which I will present the 11th part of this unique series of communication concepts and touch on further useful and interesting topics. Are you curious about what's next? We will discuss how to attract patients from abroad and extend your patient base on an international scale. Wouldn't you agree that the topic of medical tourism is extremely interesting? In addition to discussing the subject, I will provide seven crucial methods to achieve your goals.

Until then, remember that you are not only the dentist at your clinic, but also its manager and leader. For questions and further information and guidance, don't hesitate to reach out by sending me an e-mail at dba@yiannikosdental.com or via our website, www.dbamastership.com. I am looking forward to our next step towards business growth and educational development!

about

Dr Anna Maria Yiannikos (DDS, LSO, M.Sc., MBA) is one of the first two women worldwide to have obtained a master's degree in laser dentistry. She has owned a dental clinic for 23 years now and is the leader of the innovative Dental Business Administration Mastership Course at RWTH Aachen University in Germany.

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"As dental coaches, we are servants in a noble profession"

An interview with Kirk Behrendt, founder and CEO of ACT Dental. By Iveta Ramonaite, DTI

Kirk Behrendt is founder and CEO of ACT Dental, a practice performance coaching company that helps dental practices increase their profitability. *(Image © Kirk Behrendt)*

Dental consulting and coaching services provide advice on dental management and marketing and help dentists grow their practices. Just recently, Dental Tribune International spoke with Kirk Behrendt, founder and CEO of ACT Dental, about his experience as a dental coach. In this interview, Behrendt talks about some common mistakes in dental practice management and discusses the role that social media and continuing education play in dentistry.

Mr Behrendt, could you tell us something about yourself and about what prompted you to found ACT Dental?
I fell into the dental profession by accident. I worked for a few dental labs after graduation and this experience lit my fire for the dental profession. I love people and I've always wanted to be a teacher, so I wanted to create value for the people in this awesome profession. I spent a few years at a consulting firm, where I had a ton of fun and became one of the top sales representatives. It was actually when I saw the movie *Jerry Maguire* that I realised that I could do this on my own. I grew ACT Dental one client at a time, and here we are, 23 years later.

As dental coaches, we are servants in a noble profession. I'm so grateful for the opportunities that have led me here. Our tagline "better practice, better life" rings true every day. We're so excited to be doing purposeful work, truly helping to change people's lives.

In your experience, what are some of the biggest management mistakes that dental practices make?
The biggest mistake that a dental practice can make isn't a tactical decision; instead, it involves thinking. It's not really the problems themselves that matter, but rather how the team looks at those problems. Dentists limit themselves with thoughts like "I have to practice in an insurance-only environment" or "I purchased this business, so I need to run it as it was always run." These aren't actual problems once you sit down and decide how you want your business to operate.

The most catastrophic scenario for a dentist is waking up to realise that the practice isn't being run in the way he or she wants to run it. People go into dentistry for a reason, and part of that reason is often the flexibility it affords you outside of work. It's up to you to create the practice you have envisioned and to build the perfect team.

Social media is an integral part of the digital age. How can dental professionals effectively use social media to build their dental practice?
Like it or not, your online presence is something patients take into consideration when choosing a dentist. They are seeking out your digital footprint. Regardless of whether you participate, they are making assumptions about you and your practice based on what they find on the internet. Authenticity is critical to building a strong social media presence. If there's a misalignment between what's on your social media and what's on your

> "The biggest mistake that a dental practice can make isn't a tactical decision; instead, it involves thinking."

site or in your office, people will pause. Telling your own story and using your own images will help to build trust between you and your patients before they even set foot inside your office.

What role does continuing dental education play in ensuring high standards of care in dentistry, and what opportunities are open to dental professionals who want to engage in continuing professional development?

Continuing education is crucial to the future of dentistry. Once you assume you know it all, you're dead. It's important to keep learning, to keep thinking and to keep challenging yourself. Dentists must continually refine their thinking both in order to learn about changes in the field and to keep growing personally and professionally.

"Authenticity is critical to building a strong social media presence."

Fortunately, there are now more opportunities than ever for continuing education in a variety of formats. We're no longer constrained by time and geography. Webinars, virtual conferences and online courses are all easily available. But continuing education can also be as simple as creating a Facebook group with your colleagues to share the latest news and to ask each other for help. Dentistry is a profession of passionate lifelong learners, and the opportunities are endless.

“Diets rich in plant foods are increasingly associated with longevity and healthy ageing”

An interview with Prof. Marcello Iriti, Milan State University, Italy. By Kasper Mussche, DTI

Prof. Marcello Iriti

“The world of plants is fascinating,” Prof. Marcello Iriti says, in starting off the interview. “Since the beginning of humanity, plants have represented, and still represent, an unlimited source of food and medication. Studying plants is equally fascinating and stimulating,” he adds. A life scientist at the Faculty of Agricultural and Food Science of Milan State University in Italy, Iriti mainly researches medicinal and food plants, with an emphasis on their biological activities. The health benefits of such plant compounds are only just beginning to be realised, and it appears that our diet—and the Mediterranean diet in particular—may harbour some secrets in this regard.

I would like to talk about the link between the prevention of disease and nutrition. It seems that polyphenols are key here. Can you explain what they are?
First of all, polyphenols are exclusively produced by plants, so plants and plant-based foods are naturally rich in these secondary metabolites. Polyphenols are a group of phytochemicals, which are part of the plant’s innate immune system involved in defence against infections, insect attacks and abiotic stresses—such as ultraviolet radiation, environmental pollutants and weather conditions. Consequently, the polyphenol levels in plants can vary depending on the harvest year, and post-harvest conditions too can further modify the polyphenol levels in plant foods.

In recent decades, diets rich in plant foods have been increasingly associated with longevity and healthy ageing. Dietary patterns involving plenty of fruit, vegetables and legumes have been associated with reduced risk and incidence of chronic degenerative diseases, such as Type 2 diabetes, metabolic syndrome, cardiovascular disease, neurodegenerative disorders, certain types of cancers and periodontal disease.

Is it true that the Mediterranean diet, in particular, is a typical example of such a diet?
The Mediterranean diet can be considered the archetype of a health-promoting diet in this regard. This is due to

high intake of low-fat dairy products and healthy lipids—mainly from seafood—as well as low consumption of refined sugars, red meat and saturated fats. The beneficial effects of diets rich in plant foods—such as the Mediterranean one—can be ascribed, at least in part, to the huge phytochemical diversity of plant foods. Food plants typically contain hundreds of bioactive phytochemicals, including polyphenols. Probably, polyphenols, a class of widespread phenylalanine derivatives, including flavonoids, stilbenes and proanthocyanidins, have been the most investigated dietary phytochemicals in recent decades and represent a paradigm of the relationship between food and health.

What are some examples of food sources rich in polyphenols?
All plant-derived foods and beverages are significant sources of polyphenols, including fruit, vegetables, pulses, coffee, tea, cocoa and red wine. As I previously said, these metabolites arise from phenylalanine, an aromatic amino acid produced exclusively by plants. This implies that meat does not contain polyphenols, even though it is essential for a well-balanced diet.

You described polyphenols as bioactive components. What does that mean for our health?
Dietary polyphenols possess a number of well-demonstrated biological activities, since they are powerful *in vitro* antioxidant, anti-inflammatory, vaso-dilating, anti-thrombotic, antimicrobial and anti-cancer agents. This means that they can play a role in the prevention of cardiovascular disease, neurodegenerative disorders and certain types of cancers. Indeed, oxidative stress and inflammation are mechanistically involved in the aetio-pathogenesis of the main chronic degenerative diseases, including some oral diseases, such as periodontitis.

"Antibiotic resistance is one of the biggest threats to global health, as is anti-cancer drug resistance. In this scenario, polyphenols could be promising natural antibiotics."

You were the first researcher to touch upon the role plant compounds could play in periodontal regeneration.
The ultimate goal of periodontal treatment is to achieve periodontal soft- and hard-tissue regeneration. In this regard, polyphenols can be considered as bone tissue protectants, suppressing osteoclast differentiation and activation, impairing bone resorption and improving bone anabolism–osteoblast activity and bone matrix synthesis.

Polyphenols are strong antioxidants and are present in red wine. Is there any hope for wine lovers that red wine could benefit oral health?
Red wine is an alcoholic beverage, and obviously, I advise against using it to cure oral disease. Some years ago, we suggested that melatonin, another compound significantly present in some typical Mediterranean foods and beverages as well as, more generally, in many plant foods, could explain, at least in part, the health-promoting effects of the Mediterranean diet by acting in synergy or additively with polyphenols and other bioactive phytochemicals, such as carotenoids and glucosinolates.

Melatonin, present in red wine, is a powerful antioxidant and anti-inflammatory agent promoting bone metabolism in the oral cavity.

Morbidity and mortality due to cardiovascular disease are low in Mediterranean countries. Epidemiological data indicates that the Mediterranean diet and polyphenol intake are cardioprotective factors.

Remarkably, melatonin is a powerful antioxidant and anti-inflammatory agent promoting bone metabolism in the oral cavity. Therefore, a certain degree of synergy between melatonin and polyphenols has been hypothesised. However, the melatonin and polyphenols we get from our diet are far from effective in the oral cavity, because they should be administered as topical formulations to reach pharmacologically active concentrations in saliva and oral tissue and also bypass the Phase I and Phase II metabolic transformation by our digestive system. Low oral bioavailability represents the major drawback of dietary phytochemicals.

Nonetheless, morbidity and mortality due to cardiovascular disease are low in Mediterranean countries, and epidemiological data indicates that adherence to a Mediterranean diet and polyphenol intake are cardioprotective factors. As vaso-dilating, anti-thrombotic and antioxidant agents, polyphenols can mitigate endothelial dysfunction, reduce low-density lipoprotein oxidation and prevent atherosclerosis. Regular low to moderate red wine consumption at main meals has shown to be cardioprotective.

> "Dietary patterns involving plenty of fruit, vegetables and legumes have been associated with reduced risk and incidence of chronic degenerative diseases."

Are there examples of organic plant compounds that have already become commonplace in the treatment of disease?

A plethora of dietary supplements based on botanicals and nutraceuticals have been developed. However, these products are not drugs and care should be taken not to try to cure major diseases with dietary supplements. With regard to oral health, aloe vera gel and *Melaleuca alternifolia* (tea-tree) essential oil have proven to be effective as antimicrobial and wound-healing agents.

Antibiotic resistance is becoming an increasingly common problem. Do you think a transition towards more organically sourced polyphenols in oral care products could offer a solution here?

This is a very relevant topic. Antibiotic resistance is one of the biggest threats to global health, as is anti-cancer drug resistance. In this scenario, polyphenols could be promising natural antibiotics. Indeed, plant extracts rich in polyphenols can be active on different bacterial and fungal targets, thus reducing the risk of selecting resistant microbial populations. In addition, polyphenols can reverse chemoresistance by targeting some microbial resistance mechanisms. In this regard, polyphenols could be used as adjuvants in combination with conventional antibiotics with the goal of slowing down the occurrence of resistance.

Lastly, has your research changed the way you eat and live?

Yes, of course, even though I was already "Mediterranean" before becoming a researcher. I am Italian and come from a southern region where traditional Mediterranean dishes are part of everyday life. The Mediterranean diet is one piece of the puzzle, but the Mediterranean lifestyle also includes sociocultural aspects relevant in terms of well-being, such as low- to moderate-intensity physical activity and of course conviviality.

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“We aim to prepare dentists for care of the ageing population”

An interview with Makoto Nakao, GC, Japan. By Kasper Mussche, DTI

Nakao Foundation founder and office representative Makoto Nakao with his wife Makiko Nakao, who serves as the foundation’s president.

As people worldwide are living longer, the proportion of elderly people is increasing. In 2015, 900 million people were 60 years or older. This number is expected to reach a staggering two billion by 2050. The consequent pressure this puts on the medical profession is significant, and dentistry is no exception. A third-generation GC Group owner, Makoto Nakao served as CEO of GC Corp. for most of his life and is still active in the company as Chief Corporate Advisor. The demographic situation in his native Japan, as well as his retirement from his position as CEO at age 70 inspired him to establish the Nakao Foundation, which aims to promote healthy ageing through oral disease prevention, education and research.

Mr Nakao, why was the Nakao Foundation founded, and what is its mission and philosophy?
In 2000, GC was the first dental company to introduce the concept of minimally invasive dentistry, and since 2015, we have supported the Oral Health for an Ageing Population project of FDI World Dental Federation. As a Japanese company, this topic is especially relevant to us given our demographic situation as a super-ageing society. Through the Nakao Foundation, we aim to prepare dentists for care of the ageing population and their geriatric patients, to promote oral disease prevention on a global scale, to support and spread clinical research regarding the importance of oral health, and to invest in education and scientific research. We also aim to make sure that developments in dentistry find their way to dentists and the general public.

Actually, I first attempted to establish the foundation with my mother, Reiko Nakao, almost 30 years ago. Since then, the idea of the 100-year life, which refers to people on average living to an older age, has become a popular topic, so it was no coincidence that I finally established

the Nakao Foundation right after my 70th birthday and final retirement from the board of directors of GC Corp.

Which problems are associated with an ageing population? What can we, or the Nakao Foundation, do to be prepared?
While an ageing population is a long-term and global development, it is important to note that the impact and quality of this ageing can vary greatly. A healthy person will age differently than a sick person in terms of physical strength, quality of life, and cost of and possibility of requiring medical care. That is why the Nakao Foundation is seeking to promote oral disease prevention and healthy ageing through identification, prevention, disease management and education.

How can the experience and knowledge gained at GC aid the Nakao Foundation? What is the synergy between the two?
The mission of GC is to develop and supply the products and information that practitioners need. Therefore, we believe that we are in a great position: being able to respond appropriately to requests and developments from our foundation's research support programme and being able to promote the mission of the Nakao Foundation through GC.

"We want to support academic research, not for profit but because we believe this will make a significant and sustainable impact on people's oral health."

The foundation is about to launch its first activities. What can we expect?
Yes, we are now at kick-off stage and just closed two board meetings, one with the foundation's board and another with the management board, in which six world-renowned experts finalised a detailed procedure as well as the criteria for applying for funding. We will be starting the application process soon and encourage researchers to visit our website (www.foundation-nakao.com) on regular basis. The call for applications will also be forwarded to all International Association for Dental Research members. We want to support academic research, not for profit but because we believe this will make a significant and sustainable impact on people's oral health.

Thank you very much.

AAE announces its 2020 award winners

By American Association of Endodontists

The American Association of Endodontists (AAE) is announcing the recipients of its awards, to be formally presented at the next association's annual meeting.

"The AAE is comprised of thousands of members who are all committed to promoting the dental specialty, best standard of patient care and professional development through academia, research and service," said AAE President Dr. Keith V. Krell. "These particular individuals that the association is honoring are among the best within the endodontic field and it's various arenas. It is my honor to announce these winners."

Clara M. Spatafore, DDS, MS, will receive the Edgar D. Coolidge Award at the annual meeting of the American Association of Endodontists in Nashville in April. The award is the AAE's highest honor. *(Image © AAE)*

Clara M. Spatafore, DDS, MS, will receive the Edgar D. Coolidge Award. Named for Edgar D. Coolidge, a pioneer in endodontics, recipients of this award—the AAE's highest honour—are an elite group of individuals who serve as role models for the entire endodontic community.

Spatafore is the department chair of endodontics at Virginia Commonwealth University School of Dentistry. She attended West Virginia University, where she received her undergraduate degree in medical technology. Spatafore then earned her DDS, MS and Certificate in Endodontics from West Virginia University School of Dentistry.

She has been a member of the AAE since 1987 and held a variety of leadership roles with the organisation's board, including president, president-elect, vice president and secretary of its Executive Committee as well as a director. Spatafore is an accomplished author and lecturer. She served in the U.S. Navy and was a lieutenant commander. She is a recipient of the Distinguished Dentist Award from Pierre Fauchard Academy, the Italian Woman of the Year from Italian Heritage Festival, WVU School of Dentistry's Distinguished Alumni Award. Spatafore earned two Letters of Commendation from the United States Navy.

Kenneth N. Namerow, DDS, is winning the I.B. Bender Lifetime Educator Award. This award acknowledges a member whose contributions to endodontics in the area of education have demonstrated excellence through selfless commitment to full-time educational pursuits, and whose valuable contributions have instilled in his/her students the desire to pursue excellence in their careers.

Namerow is department chair of endodontics at Nova Southeastern University College of Dental Medicine. He is a past president of the College of Diplomates and has published dozens of articles. He served in the U.S. Army, provided donated dental care to underserved communities across the world and secured a $700,000 endowment for a professorship at the NSU College of Dental Medicine which bears his name. Namerow was named Professor of the Year in 2013–2014 at Nova Southeastern University CMD.

Anibal R. Diogenes, DDS, MS, PhD, is being bestowed with the Edward M. Osetek Educator Award. This award is given to a member that has been a full-time educator for up to 10 years; has demonstrated status as an outstanding educator by earning the esteem and respect of his/her students and faculty associates; by the quality of former/current students and their impact on endodontics; and by receiving invitations to present endodontic seminars, lectures or workshops at other educational institutions.

Diogenes is an associate professor and the director of the Endodontics Residency Program at the University of Texas Health Science Center at San Antonio. He

was recently honoured with the International Association of Dental Research (IADR) Pulp Biology and Regeneration Distinguished Scientist and the Journal of Dental Research Cover of the Year award. He has contributed the development of many endodontic programmes and served as an advisor and mentor to students. He is also a member of the AAE's Editorial Board Committee.

Stephen P. Niemczyk, DMD, will be presented with the Calvin D. Torneck Part-time Educator Award. This award recognises a part-time educator in a predoctoral or advanced specialty programme in endodontics whose valuable contributions have demonstrated dedication to endodontics and instilled in his/her students the desire to pursue excellence in their careers.

Niemczyk is an assistant programme director at Albert Einstein Medical Center with the Department of Dental Medicine and Post Graduate Endodontics. He was also director of endodontic microsurgery and clinical professor at Harvard University School of Dental Medicine. He has presented on hundreds of topics, contributed to or authored six books and 13 reports. He is the recipient of many awards, including consecutively receiving the Earl Banks Hoyt Award for Academic Teaching Excellence.

Anil Kishen, BDS, MDS, PhD, is being honoured with the Louis I. Grossman Award. This award recognises an author for cumulative publication of significant research studies that have made an extraordinary contribution to endodontology.

Kishen is a professor at the University of Toronto Faculty of Dentistry. He has published more than 135 journal publications, 20 book chapters, three books and co-invented eight patents/invention disclosures. He has received several awards including Enterprise Challenge Innovator (Singapore), American Association of Endodontists Foundation-Dentsply-Research Excellence and W.W. Wood Award for Excellence in Dental Education from The Association of Canadian Faculties of Dentistry. He is a prolific researcher whose work is focused on nanobiomaterials and phototherapeutics to fight oral health infections and improve patient outcomes. He specifically studies topics in endodontic infections and analyses interactions between host tissue and harmful bacteria.

Mahmoud Torabinejad, DMD, MSD, PhD, receives the Ralph Sommer Award. This award is given to the principal author(s) of a publication of specific significance to the science and art of endodontology.

Torabinejad was an adjunct professor at Loma Linda University, University of Pacific in San Francisco, University of California in San Francisco. He has presented on over 100 topics, authored 271 articles and has won the following awards: Iranian Gold Medal of Education, Ralph F. Sommer Award of the AAE, Louis I. Grossman Award of the AAE, Philanthropic award of the AAE Foundation, the Edgar D. Coolidge Award of the AAE, Louis I. Grossman Award of the French Association of Endodontists, LLUAHSC Vanguard Award for the Mission of Healing, Distinguished Dental School Research Award, Loma Linda University (LLU) Distinguished Investigator Award.

Alejandro M. Aguirre, MBA, DDS, is being celebrated with the Spirit of Service Lifetime Award. This award acknowledges a member who has demonstrated the true spirit of leadership either recently or over the years.

> "These particular individuals that the association is honoring are among the best within the endodontic field..."

Aguirre is an endodontist with Endodontic Associates Limited in the Minneapolis/St. Paul Metropolitan area of Minnesota. He has his master's in business administration and is a member or past member of local, state and national boards of different dental and volunteer organisations. Aside from being a skilled endodontist, his background also includes entrepreneurship, finance, business analytics, association management and leadership development, parliamentary procedure, diversity and inclusion, and consulting in all aspects of leadership especially on developing emerging leaders from traditionally underrepresented groups. His community service work includes Minnesota Mission of Mercy, where he was the first chair of the committee and raised over $300,000 in cash donations and involved in passing a new state law to allow out-of-state dentists who want to come to Minnesota to treat patients to obtain a temporary license.

Lynda L. Davenport RDA, FAADOM, will receive Honorary Membership, which is granted by the Board of Directors in acknowledgement of their significant contributions that have furthered the advancement of endodontics.

Davenport is the practice manager for Endodontic Associates in Nashville. She has owned and managed a contracting business and was the president of a manufacturing company. She was a professional track organiser for AAE events, served on the AAE's Annual Meeting Planning Committee and was Chair of the Special Committee on Professional Staff Development. She currently serves at The Heimerdinger Foundation—Board of Directors and as chair of the Ambassador Committee, which is a non-profit to support patients undergoing cancer treatment with foods identified to fight the side effects of cancer treatment.

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ROOTS SUMMIT: New dates

By DTI

Given the global nature of the ROOTS community, the event organisers have been closely monitoring developments regarding COVID-19 around the world. For the safety of attendees, it has been decided to postpone the event to 20–23 May 2021. ROOTS SUMMIT 2021 will still be held at the Cubex Centre Prague in the Czech Republic.

On 11 March 2020, the World Health Organization declared the COVID-19 outbreak a pandemic, and many countries have implemented travel restrictions of unknown duration. While it was hoped that the situation would calm down in a few weeks, government reactions globally are in fact escalating. Therefore, the decision has been made to push ROOTS SUMMIT to next year; however, the organisers have come up with an interim solution to avoid disappointing registrants—while keeping them safe.

"We know that is a long time to wait to get together, so we would like all of the participants to join us for an online ROOTS SUMMIT this 22 and 23 May. The online programme is being finalised, and multiple continuing education credits for this online programme will only be available to registered participants," said co-chairman Stephen Jones in a statement. Regarding the delayed event, he explained: "All currently registered participants remain registered, and we look forward to seeing you in person on 20–23 May 2021. In addition to the extra continuing education credits that only currently registered participants will receive, we will include two tickets to our Saturday night party at no charge. Please refer to our FAQs (on ROOTS SUMMIT website) if you have any additional questions or concerns."

"It is our wish that you, your loved ones and your friends pass through this time well and, above all, stay healthy! Trust us; we will check on that when we see you at ROOTS SUMMIT 2021!" he concluded.

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AAE provides considerations for dental and endodontic care during COVID-19 crisis

The American Association of Endodontists (AAE) announced several recommended considerations to its 8,000-plus endodontist and dentist members amid the COVID-19 outbreak. The announcement came at a time when other dental organisations revealed similar recommendations regarding dental care and emergency vs. non-emergency treatment.

"Given the rapid and global spread of the COVID-19 pandemic, it is the responsibility of everyone—health care providers and fellow citizens—to do everything possible to reduce the spread of this infection," said AAE President Dr Keith V. Krell. "While there is no simple solution to balancing delivery of oral health care and minimising the spread of the coronavirus, there is much we as endodontists and dentists can do to help reduce its spread."

Along with these recommendations, the AAE also published on its website, ahead of its publication in the May issue of the *Journal of Endodontics*, a review co-authored by Dr Ken M. Hargreaves providing an overview of the epidemiology, symptoms and routes of transmission of COVID-19. In addition, specific recommendations for dental practice are suggested.

"Advance publishing of this very important guidance has been critical in getting our members up to speed on the situation we're facing," Krell said. "In the coming days, we'll continue to respond accordingly as the situation changes."

The AAE's recommendations are as follows:

- We agree with the CDC as well as professional organisations such as the ADA in recommending postponement of non-urgent oral health care for up to three weeks.
- Examples of urgent conditions requiring oral health care may include severe dental pain, abscess with lymphadenopathy, or a dental infection-related fever.
- Some urgent conditions may be treated with appropriate analgesics or antibiotics. A recent report from the *British Medical Journal* recommends acetaminophen over ibuprofen. While providing pharmacological treatment, practitioners can continue to monitor patient responses by telephone contact.
- If pharmacotherapy is insufficient, the recent review co-authored by Dr Ken M. Hargreaves summarises considerations for appropriate dental care.
- As of now, the impact of the epidemic varies across the country. Accordingly, the recommendations of our members' local and state dental societies should be reviewed.

As this pandemic evolves, new recommendations will likely emerge. We advise to follow updates on AAE website.

Source: American Association of Endodontists

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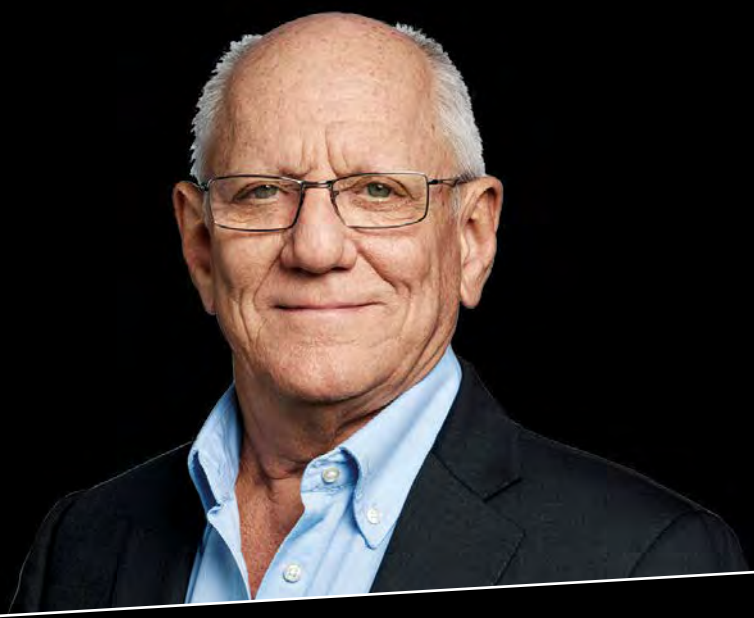

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