August 2008

Endodontic

PRACTICE • US

PROMOTING EXCELLENCE IN ENDODONTICS

The only Autoclavable LED Ultrasonic Handpiece with the 1st ever "Air-Active" feature for cleaning dentinal debris!

Proven technology from the Industry Leader...

Autoclavable LED's

NEWTRON LED

ENDO success

Endo Success Kit includes the follow 6 tips:
ET18D - (Diamond-Coated) for cavity access.
ETBD - (Ball Diamond Tip) for locating calcified canals.
ET20- (Stainless Steel) the "Universal" re-treatment tip.
ET25S - (Niobium Titanium) for use in the coronal third.
ET25 (Niobium Titanium) for use in the middle or apical third.
ETPR - (Stainless Steel) for loosening of posts.

AIR-ACTIVE

P MAX NEWTRON XS

- 1st EVER Autoclavable LED Ultrasonic Handpiece!
- 1st EVER "Air-Active" feature for cleaning dentinal debris

  "No air syringe required"
- Two 300ml tanks which are easy to refill, even during a procedure.
- Newtron technology means power, control and reliability.
- Over 70+ tips available.

Purchase a P Max Newtron XS (F58510) and an Endo Success Kit (F00737) and get a 2nd Endo Success Kit (F00737) FREE!
Offer expires 12/31/08.

ACTEON
North America

Free Facts circle (13) on card

124 Gaither Drive, Suite 140 • Mount Laurel, NJ 08054 • Tel - (800) 289 6367 • Fax - (856) 222 4726 • info@us.acteongroup.com • www.acteongroup.com

Use of new ultrasonic tips in conventional endodontics

Bertrand Khayat, DDS, MSD, and Jean-Charles Michonneau, LSD, analyze the use of ultrasonic tips in conventional endodontic treatments

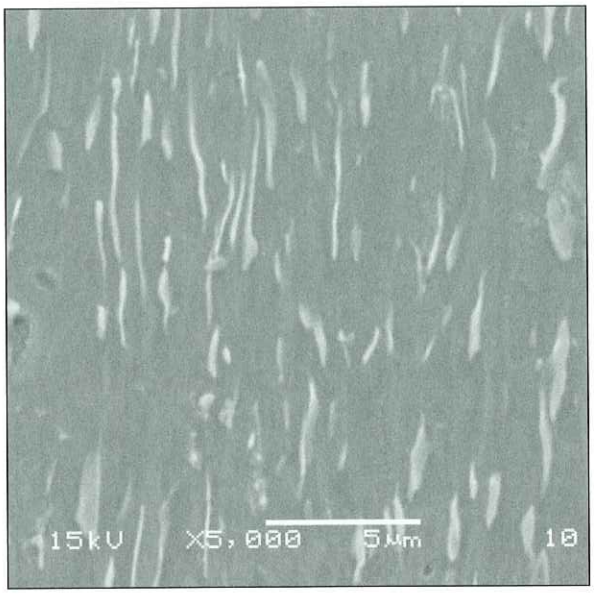


Figure 1: Cristalline structure of TA6V under the SEM

Figure 2: Denser and more regular cristalline structure of TiNb under the SEM

Ultrasonics have been used in endodontics since the sixties (Richman, 1957; Martin and Cunningham, 1985), but ultrasonic instruments dedicated to endodontics did not appear until the use of the operating microscope in the nineties (Carr GB, 1992; Kim and Baek, 2004). These tips became rapidly part of the armamentarium to perform endodontic treatment at the best level. In the access cavity, as well as inside the root canals, they proved useful in managing calcifications, obstacles and removal of broken instruments.

Ultrasonic energy used in endodontics is produced by either piezoelectricity or magnetostriction. Piezoelectric technology produces ultrasonic vibration through a quartz crystal traversed by an electrical current. Magnetostrictive technology uses ferromagnetic material that produces ultrasonic vibrations under an electromagnetic field. The piezoelectric ultrasonic generator will provide a vibration of greater intensity that is more suitable for endodontic use.

The first tips were made of steel and developed by Dr Gary Carr in the late eighties. Thinner and more resistant titanium tips appeared a few years later. Today, a new generation of ultrasonic tips made of titanium niobium by Satelec is available for conventional endodontic treatment.

Titanium Niobium

1. Composition:

Titanium niobium was developed in order to replace TA6V, a titanium alloy widely used in dentistry, to improve the mechanical properties of ultrasonic tips. The TA6V includes rank 4 titanium, aluminum (6%)

Dr Bertrand Khayat graduated from the University of Paris in 1982 and obtained his certificate in Endodontics and his master of science in dentistry from the university of Washington in 1987. He maintains a private practice limited to endodontics. Dr Khayat has lectured internationally, he is also widely published and an active member of many international endodontic societies and associations.
Dr Jean-Charles Michonneau qualified in 1999 and obtained his certificated in Endodontics in 2001 from the University of Brussels. He is currently in private practice limited to endodontics in Paris, France.

Figure 3: Rotopro bur by Ellman on a high speed dedicated for post removal

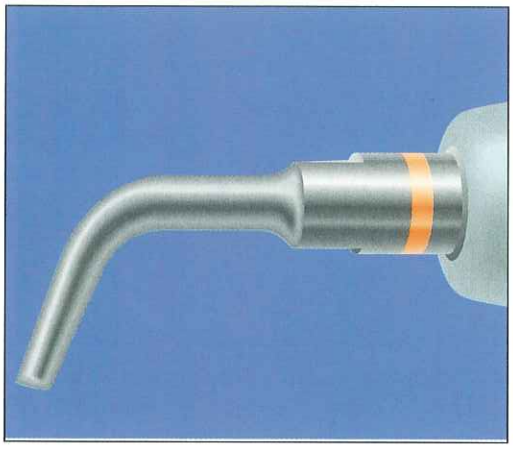


Figure 4: ETPR ultrasonic tip dedicated for post removal

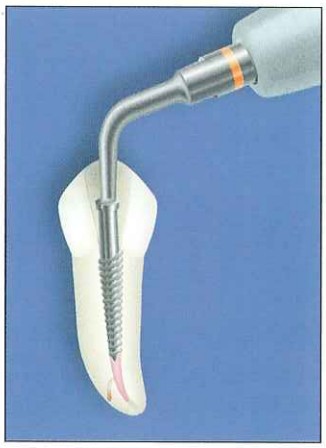


Figure 5: ETPR ultrasonic tip is applied on the head of the post in its long axis to transmit the ultrasonic vibration

Figure 6: The post has to be removed to complete the retreatment of this first lower premolar

Figure 7: Radiograph after post removal showing no damage of the tooth structure

Figure 8: Final obturation displaying the complexity of the root canal anatomy

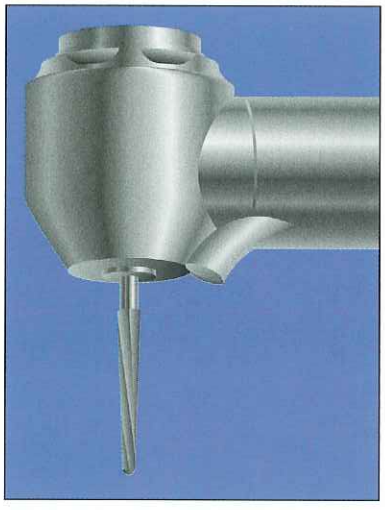


Figure 9: Zekrya Endo bur mounted on a high-speed handpiece designed for access cavity

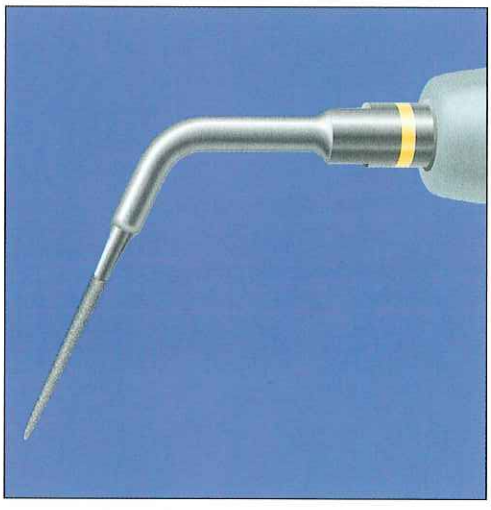


Figure 10: ET18D ultrasonic tip coated with diamond to refine the access cavity

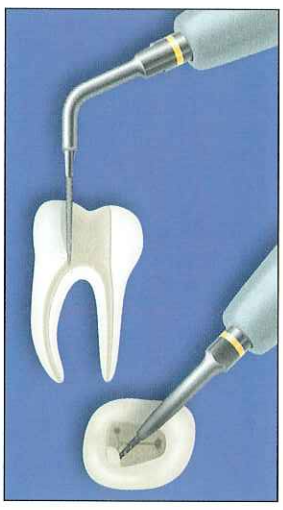


Figure 11: Elimination of overhangs with ET18D ultrasonic tip on the mesiobuccal canal of a lower molar

and vanadium (4%). The titanium niobium includes also rank 4 titanium, aluminum (6%) and niobium (7%), which replaces vanadium. The introduction of this new element improves the quality of ultrasonic transmission and increases the mechanical resistance of the tips.

2. Microstructure:
The titanium niobium alloy has a crystalline structure with two phases: alpha and beta. In titanium niobium there is 50% of alpha phase and 50% of beta phase. In TA6V, there is 60% of alpha phase and only 40% of beta phase. The increase of the beta phase allows a greater stability of the alloy, resulting in a smoother vibration pattern. The crystalline structure of the titanium niobium is denser and more regular than the one of the TA6V. This is shown in the SEM pictures (Figures 1 and 2).

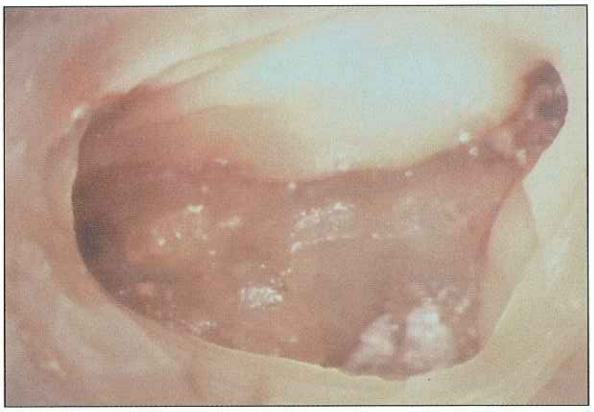


Figure 12: Initial step of the access cavity on an upper first molar with remaining portion of the roof

Figure 13: The roof of the chamber is totally removed

Figure 14: After removal of the last overhangs, MB2 is revealed and the access cavity is complete

3. Mechanical properties:
An ultrasonic tip should be able to transmit a powerful ultrasonic vibration without fracturing itself.

The tensile strength of titanium niobium is slightly higher than that of TA6V and with this the possibility of manufacturing a longer and thinner tip. An ultrasonic tip should be able to transmit a powerful ultrasonic vibration without fracturing. Due to their increased resistance, these tips can be used in the apical area in a sure and efficient way. The greater elasticity of the alloy offers the possibility of pre-bending the tip in particular clinical situations.

Clinical use of ultrasonic tips

Post removal

Removing a post can be a difficult task in endodontic retreatment (Smith, 2001). The goal is to retrieve the post while preserving the maximum tooth structure. The Rotopro bur from Ellman can be used (Figure 3). It is mounted on a high-speed handpiece and the rotation in contact with the post generates a vibration that is nearly ultrasonic.

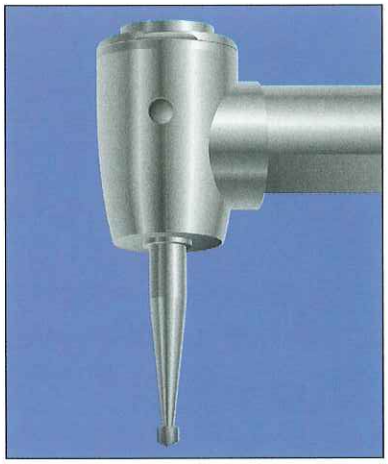
The ultrasonic tip, ETPR (Figure 4), dedicated to post removal can be applied on the head of a post in its long axis (Figure 5). Operated at full power with maximum irrigation to avoid any increase in temperature (Budd, Gekelman and White, 2005), it will transmit a powerful ultrasonic wave that will break up the cement to facilitate the post removal (Figures 6, 7 and 8).

The two techniques can be combined.

Access cavity

The quality of the access cavity will influence the outcome of the entire root canal treatment. An ideal access cavity should not only permit the localization of all canals but also minimize the stress of all instruments upon insertion (Levin, 1967). After entering the pulp chamber, the Zekrya endo bur can be used to effectively eliminate the roof of the pulp chamber without damaging the floor (Figure 9).

An ultrasonic tip, ET18D, (Figure 10) coated with



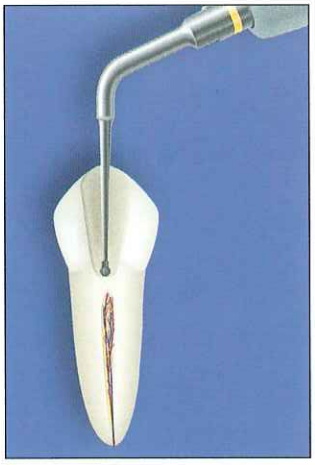


Figure 15: Surgical length round bur on a low-speed handpiece to locate canal orifices

Figure 16: The ETBD ultrasonic tip allows much better visibility to locate canal orifices

Figure 17: Canal location with the help of the ETBD ultrasonic tip on a calcified lower premolar

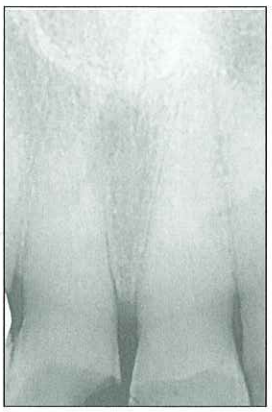


Figure 18: Calcified upper central incisors

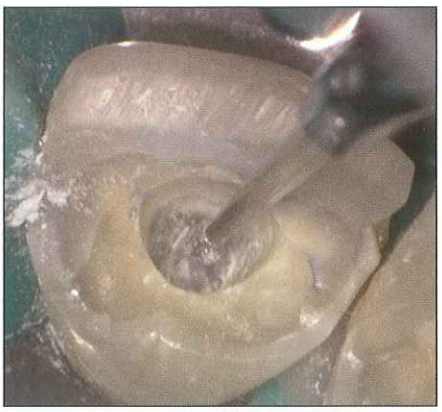


Figure 19: Use of the ETBD ultrasonic tip for root canal location. The increased visibility allows deep penetration of the tip

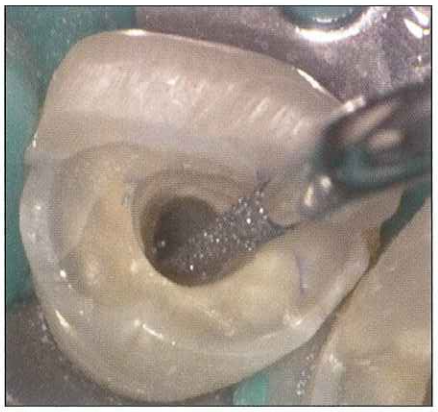


Figure 20: Elimination of overhangs with ET18D ultrasonic tip

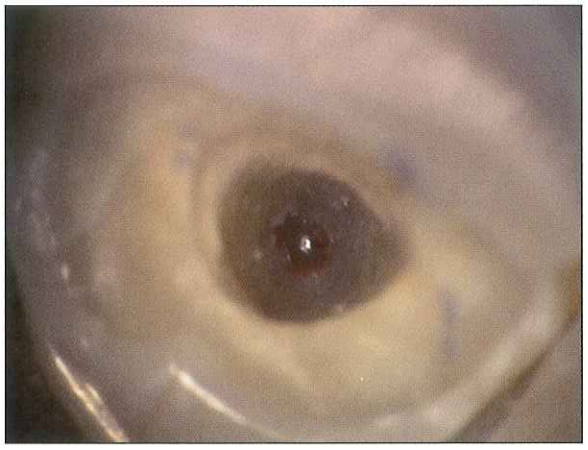


Figure 21: The canal can be seen

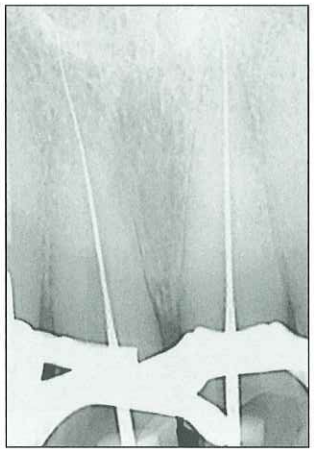


Figure 22: Radiographs with files at working length

diamond can also be used to perform this task more precisely (Figures 11, 12, 13 and 14). Due to the absence of a handpiece head, the use of the ET18D ultrasonic tip will improve visibility, especially in those hard to reach areas (second molars or patients with small mouths).

This instrument is active on its tip to uncover canal orifices and is also efficient on its overall length to suppress any remaining overhangs.

This tip can operate with or without water. Spray cools the instrument and eliminate debris but cutting dry allows maximum visibility and precision.

Root canal localization

Root canal localization is one of the most delicate procedures in both conventional and retreatment endodontics.

Pulp calcification is a result of secondary dentin apposition due to decay, occlusal forces and aging. Clinically, a difference in dentin color and texture will guide the operator towards the canal orifice.

Usually, long-shank small round burs (Figure 15) are used under the operating microscope to track dentin changes in coloration. Frequently the head of handpiece will obstruct the field of vision. Ultrasonic tips with their angulations will allow constant visual control of the working area. The ETBD is a long ultrasonic tip with a small diamond ball on its end (Figure 16). It is primarily dedicated to root canal localization (Figure 17). Its design will permit deep penetration to locate very calcified canals (Figures 18, 19, 20, 21 and 22).

Root canal obstacles

A number of different root canal obstacles can be found during endodontic retreatment. Only ultrasonic tips will be efficient to eliminate carbon posts, resin paste and some types of sealer. All these procedures must be performed under high magnification to prevent mishaps. The extremely high energy of these tips if not correctly used can easily create a root perforation.

The ET20 is a long (20mm), smooth ultrasonic tip (Figure 23). It can be used without irrigation to increase visual control or with water for better elimination of debris. Use of this tip is limited to the pulp chamber and coronal third of the root. Due to its great effectiveness and resistance, this tip can be used in a great number of clinical situations (Figure 24).

Broken instruments

Excessive torsional forces cause the separation of an endodontic instrument during root canal preparation. The higher incidence of breakage will usually follow threading of the instrument into the root canal. The more complex the anatomy (constriction and curvature), the more likely that separation will occur.

A broken instrument is only a problem if it prevents completion of root canal treatment. If the instrument can be by-passed and the preparation and obturation carried out to the desired working length, the prognosis will remain favorable (Crump and Natkin, 1970). If the instrument cannot be by-passed, its elimination should be attempted to achieve success

Figure 23: ET20 ultrasonic tip design for the removal of root canal obstacles

Figure 24: Elimination of the remaining cement after post removal with ET20 ultrasonic tip

Figure 25: ET25 ultrasonic tip design for the removal of broken instruments

(Ruddle, 2004; Carr, 1998; Ward, Parashos and Messer, 2003). This can be accomplished with specific ultrasonic tips.

The ET25 is a long, thin and resistant ultrasonic tip (Figure 25). It must be used without irrigation at moderate power. It is designed to work in the middle and apical third of the root canal. If the broken instrument is located in the coronal third, ET20 would be preferred (Figure 26).

The first step is to create straight-line access to the broken instrument. Then a groove is gently cut around the fragment to free the upper portion of the instrument. ET25 is the most suitable instrument to avoid excessive removal of tooth structure (Figures 27, 28, 29, 30, 31 and 32). The procedure is accomplished under the operating microscope at high magnification and without water.

The final step is to contact the broken instrument in order to transmit ultrasonic vibration. This will hopefully loosen and eliminate the instrument (Ruddle, 2004; Carr, 1998; Ward, Parashos and Messer, 2003).

In some rare instances, where the instrument is broken beyond a curvature, the ET25 can be slightly bent to work around the curvature. This can be done with orthodontic pliers and the instrument should be discarded after its use.

Conclusion

The design and structure of the new ultrasonic tips make them more resistant and efficient. The new titanium niobium alloy allows better transmission of ultrasonic energy and vibration. These safe and reliable instruments can be valuable tools in managing complex endodontics cases.

Figure 26: Removal of a broken screw post with ET20 ultrasonic tip in the coronal part of the canal

Figure 27: Use of the ET25 ultrasonic tip to remove the broken instrument in the apical part of the canal

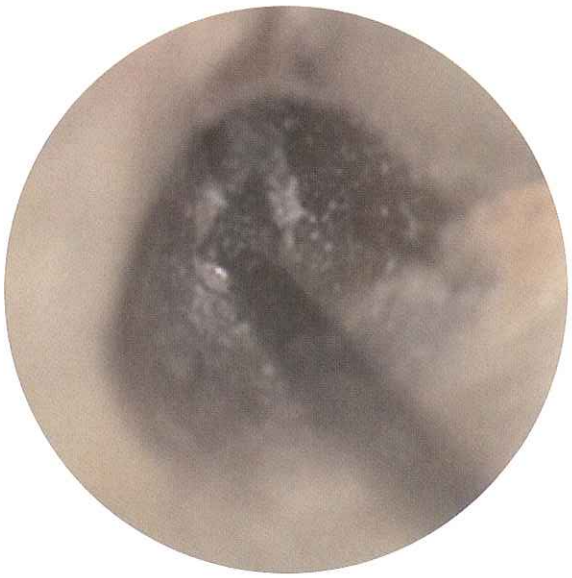
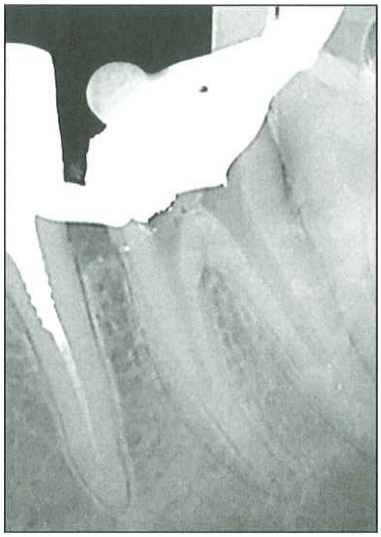


Figure 28: Use of the ET25 ultrasonic tip under the operating microscope to create a groove around the broken instrument

Figure 29: The ET25 tip contact the broken instrument in order to transmit ultrasonic vibration



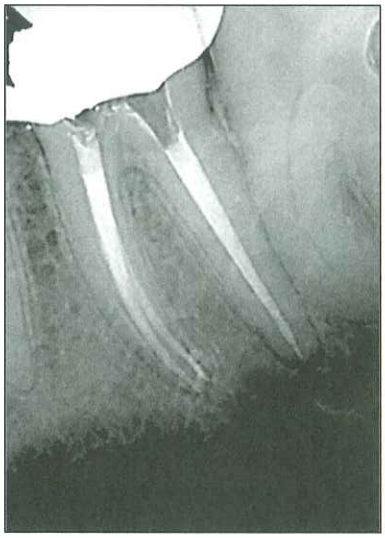


Figure 30: Mandibular molar with a fractured instrument in the mesial root

Figure 31: Radiograph after removal of the fractured instrument

Figure 32: Final obturation

References

Budd J.C, Gekelman D, White J.M (2005) Temperature rise of the post and on the root surface during ultrasonic post removal. *Int Endod J* 38(10): 705-11

Carr GB (1992) Microscopes in endodontics. *J Calif Dent Assoc* 20(11): 55-61

Carr GB (1998) Ch 24: Retreatment. In: Cohen S, Burn RC. *Pathways to the pulp*, 7th ed. St Louis: Mosby 791-834

Crump MC, Natkin E (1970) Relationship of broken root canal instruments to endodontic case prognosis: a clinical investigation. *J Am Dent Assoc* 80:1341-7

Kim S, Baek S (2004) The microscope and endodontics. *Dent Clin N Am* 48:11-18

Levin HJ (1967) Access cavities. *Dent Clin North Am* 701-10

Martin H, Cunningham WT (1985) Endosonics – the ultrasonicsynergistic system of endodontics. *Endod Dent Traumatol* 1: 201-206

Richman MJ (1957) The use of ultrasonics in root canal therapy and root resection. *J Dent Med* 12:12-18

Ruddle CJ (2004) Nonsurgical retreatment. *J Endod* 30(12): 827-45

Smith BJ (2001) Removal of fractured posts using ultrasonic vibration: an in vivo study. *J Endod* 27(10): 632-4

Ward JR, Parashos P, Messer HH (2003) Evaluation of an ultrasonic technique to remove fractured rotary nickel titanium endodontic instruments from root canals. *J Endod* 29(11): 756-767