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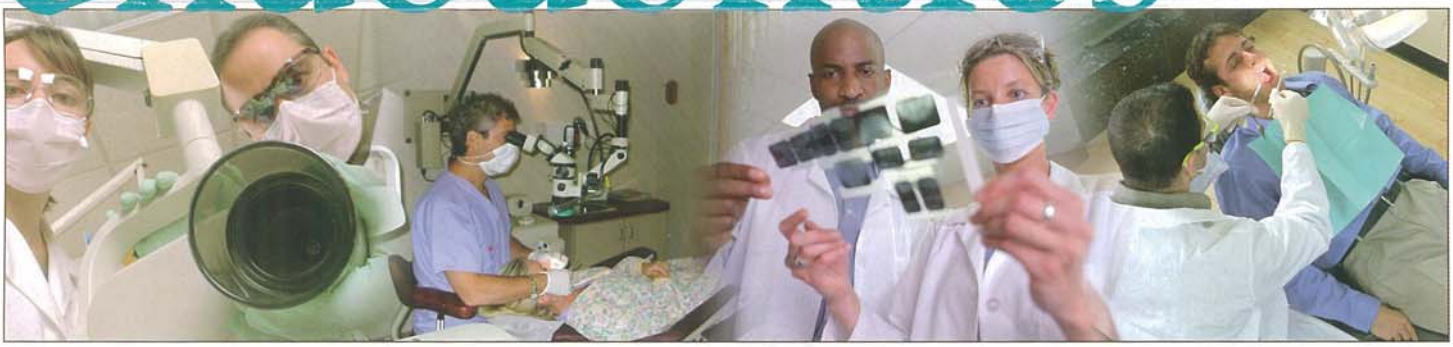

RealSeal 1 or Thermafil: Which Provides a Superior Seal in Vivo?

Preserving apical health and permitting healing of preexisting apical pathosis are 2 of the aims of endodontic therapy. After optimal microbial control in the first phase of root-canal treatment, the root-filling material seals the canal to maintain an environment conducive to the prevention or elimination of apical periodontitis over time. Success can be anticipated when a root-canal filling material can consistently resist coronal microleakage in teeth that have been rendered free of cultivable bacteria.

A resin-based polymer, Thermafil Plus (Tulsa Dental, Tulsa, Okla.) is a root-filling product that consists of a plastic carrier coated with gutta-percha. The product is heated in a ThermaPrep Plus Oven (Dentsply, Melbourne, Australia) and is used in conjunction with an epoxy-resin sealer (Thermaseal Plus; Tulsa Dental). Resilon (Pentron Clinical Technologies, Wallingford, Conn.) is a synthetic polymer-based root-filling material designed to be used with a dual-cured polymer-based composite sealer containing a mixture of dimethacrylate, urethane dimethacrylate, ethoxylated dimethacrylate, hydrophilic difunctional dimethacrylates and several fillers to establish bonded interfaces between the Resilon core, the sealer and the prepared root-canal wall.

A recently developed carrier-based filling material, the RealSeal 1 (RS-1) Bonded Obturation System (SybronEndo Corp., Orange, Calif.), is a polysulfone-containing polymer with radiopaque filler, and the surrounding Resilon-based filling contains polycaprolactone and polyolefin polymers loaded with fillers. RS-1 combines adhesive-bonding technology with a carrier product, with the goal of providing an efficient obturation technique, combined with optimal leakage resistance.

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Duggan et al from the University of North Carolina at Chapel Hill subjected 2 carrier-based root-filling products to a 4-month microbial challenge in 8 beagle dogs (8 premolars per beagle), using histologic markers to assess periapical inflammation and bacterial penetration of the 2 filling materials. Teeth were aseptically prepared and filled with RS-1 ($n = 25$) or Thermafil ($n = 25$). The study included 2 control groups of teeth. The first group received a coronal seal over either RS-1 or Thermafil root fillings ($n = 8$), and the second group was instrumented and left completely empty ($n = 8$). After 4 months, the dogs were euthanized using an intravenous barbiturate.

Histologic evidence of periapical inflammation was observed in 29% of the Thermafil group and in 9% of the RS-1 group (Figure 1). This difference was only significant when controlling for a possible tooth position effect on inflammation presence ($p < .05$). Histologic evidence of bacterial penetration was present in 9% of the RS-1 group and in 70% of the Thermafil group. The difference in penetration rates between RS-1 and Thermafil was statistically significant when controlling for any dog or tooth position effects on bacterial penetration ($p < .01$). Histologic evidence of inflammation and histologic evidence of infection showed a statistically significant correlation ($p = .002$).

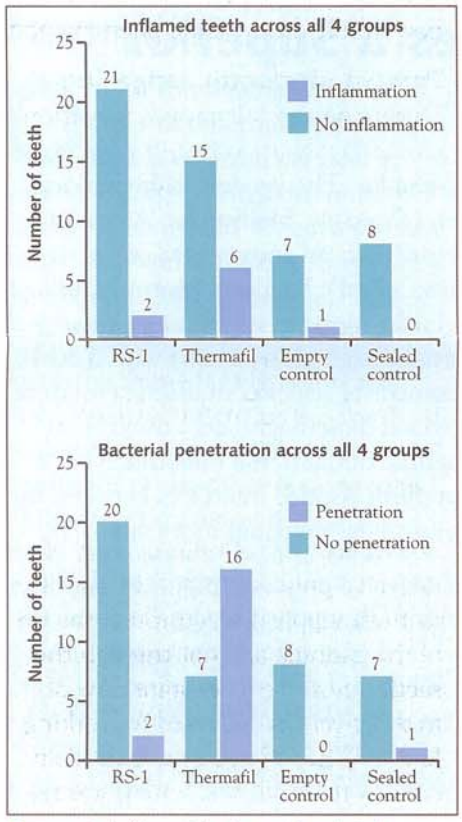

Figure 1. Inflamed teeth and bacterial penetration across the 4 groups.

Conclusion

RS-1 appeared to resist bacterial penetration more effectively than Thermafil. Human outcome studies will determine whether adhesive technology offers a benefit over alternative root-filling products.

Duggan D, Arnold RR, Teixeira FB, et al. Periapical inflammation and bacterial penetration after coronal inoculation of dog roots filled with RealSeal 1 or Thermafil. J Endod *2009;35:852-857.*

Diagnosing Barodontalgia

Barodontalgia is an oral pain caused by a change in barometric pressure. In U.S. Army Air Force altitude-chamber simulations conducted in the 1940s, barodontalgia ranked fifth among the physiological complaints of the trainees and third as a causative factor of premature cessation of the simulation. In a retrospective study undertaken after World War II, 9.5% of U.S. Air Force aircrews reported ≥1 episodes of barodontalgia during their flights.

At present, reports of in-flight dental manifestations of pressure changes are relatively few because of pressurized airplane cabins, high-quality dental care and the improvement of oral health in the second half of the 20th century. Barodontalgia has also been experienced by self-contained underwater breathing apparatus divers.

Zadik from the Israel Defense Forces reviewed the diagnostic process for barodontalgia, which can be classified into 4 groups relating to pulp and periapical conditions (Table 1). Previous studies have shown that identifying the offending tooth can be difficult because practitioners cannot reproduce the barometric pressure change with ordinary dental facilities.

Differential Diagnosis

Barotitis media is the most common reaction to altitude-related pressure changes, when the negative pressure developed in the middle ear is usually not resolved spontaneously by the auditory tube. Symptoms range from ear discomfort to intense pain, tinnitus, vertigo with nausea, and deafness.

External otitic barotrauma is caused by the misuse of earplugs. During descent, the relative pressure in the closed cell is negative. Thus, the external layer of the tympanic membrane epithelium or of the external canal epithelium may be sucked away from the underlying tissue.

Barosinusitis may occur when the normal sinus outflow is compromised and a pressure gradient is created, resulting in a vacuum effect. Pain can be felt in the oral region.

Pulp necrosis occurs in necrotic pulp with an open decayed crown

Table 1. *Classification of dental-induced barodontalgia*

Class	Cause	Symptoms
I	Nonreversible pulpitis	Sharp momentary pain on ascent
II	Reversible pulpitis	Dull throbbing pain on ascent
III	Necrotic pulp	Dull throbbing pain on descent
IV	Periapical pathosis	Severe persistent pain on ascent and descent

when changes in barometric pressure permit air to enter the pulp chamber. The infected/inflamed root-canal content can then be forced into the jawbone and lead to facial emphysema.

Prevention

Good oral health is key to preventing barodontalgia. Routine radiographs and pulpal sensitivity tests should be performed in teeth with preexisting extensive restorations to rule out occult pulp necrosis and periapical pathosis.

Conclusion

Dentists should employ the described preventive measures when treating pilot and diver patients. Also, available data should be used to diagnose the causes of barodontalgia.

Zadik Y. Barodontalgia. J Endod *2009;35: 481-485.*

Effective Devices And Techniques for Irrigant Agitation

Removal of pulp tissue remnants, microorganisms and microbial toxins from the root-canal system is essential for endodontic success, but the intricate root-canal anatomy can harbor tissue debris, microbes and their by-products, prevent close adaptation of the obturation material and result in persistent periradicular inflammation. Gu et al from Sun Yat-sen University, China, reviewed the following contemporary endodontic irrigant agitation methods and their debridement efficacy.

Syringe irrigation with needles/cannulas

Dispensing an irrigant into a canal through needles of various gauges, either passively or by moving the needle up and down the canal space, is still widely accepted by both general practitioners and endodontists. Some needles dispense an irrigant through their most distal ends; others deliver it laterally through closed-ended, side-vented ports. The latter may improve the hydrodynamic activation of an irrigant and reduce the chance of apical extrusion.

The mechanical flushing action created by conventional hand-held syringe needle irrigation is relatively weak, because inaccessible canal extensions and irregularities may harbor debris and bacteria, making thorough canal debridement difficult. A previous study showed that when conventional syringe needle irrigation was used, the irrigating solution was delivered only 1 mm deeper than the tip of the needle.

Closer proximity of the irrigation needle to the apex, larger irrigation volume and smaller-gauge needles that achieve deeper and more efficient irrigant replacement improve the efficacy of syringe needle irrigation. Slow irrigant delivery and continuous hand movement will minimize sodium hypochlorite accidents.

Sonic irrigation

The EndoActivator System (Dentsply Tulsa Dental Specialties, Tulsa, Okla.) consists of a portable handpiece and 3 disposable polymer tips of different sizes, which are claimed to be strong and flexible and do not break easily. Reportedly, the EndoActivator System effectively cleaned debris from lateral canals, removed the smear layer and dislodged clumps of simulated biofilm within the curved canals of molar teeth. Vibrating the tip, while moving the tip up and down in short vertical strokes, synergistically produced a powerful hydrodynamic phenomenon.

Passive ultrasonic irrigation

During passive ultrasonic irrigation, energy transmitted by ultrasonic waves from an oscillating file or a smooth wire to the irrigant in the root canal induces acoustic streaming and cavitation of the irrigant. This enhances the cleaning effects of the irrigants.

The EndoVac system

In the EndoVac system (Discus Dental, Culver City, Calif.), a cannula connected by tubing to a syringe of irrigant and the high-speed suction of a dental unit simultaneously exerts negative pressure to pull irrigant from its fresh supply down through the tip of the cannula and out through the suction hose, so a constant flow of fresh irrigant is delivered to working length. The volume of irrigant delivered by the EndoVac system was significantly higher than that delivered

by conventional syringe needle irrigation during the same time period and resulted in significantly more debris removal at 1 mm from the working length than needle irrigation.

Conclusion

Despite the large number of studies of the effectiveness of various endodontic irrigation regimens, no well-controlled clinical studies and no evidence-based studies correlating the clinical efficacy of these devices with improved treatment outcomes are available. Thus, the necessity of using these devices remains unresolved.

Gu L, Kim JR, Ling J, et al. Review of contemporary irrigant agitation techniques and devices. J Endod *2009;35:791-804.*

External Cervical Resorption

One of the least understood types of external root resorption is external cervical resorption (ECR). Its aggressive nature was once described as invasive cervical resorption. Patel et al from King's College London Dental Institute, United Kingdom, reviewed this condition.

Occurring immediately below the epithelial attachment of the tooth at the cervical region, ECR defects can be difficult to diagnose and manage. While the exact cause of ECR is poorly understood, the following etiologic factors might damage the cervical region of the root surface and therefore initiate ECR:

1. Orthodontic treatment: Excessive orthodontic forces at the cervical region of the tooth might result in tissue necrosis adjacent to exposed root dentin. This stimulates mononuclear precursor cells to differentiate into odontoclasts, which are attracted to and resorb the exposed root dentin. Maxillary canines, maxillary incisors and mandibular first molars are commonly affected by ECR. However, ECR usually occurs several years after orthodontic treatment (and therefore the stimulating factor) has ceased. Mandibular incisors and canines are not affected by ECR to the extent that their maxillary counterparts are.

2. Trauma: Previous studies have confirmed that dental trauma was a major potential predisposing factor (15.1% of teeth) to ECR. A study by Heithersay (*Quintessence Int* 1999) found that maxillary central incisors were the most frequently traumatized teeth that subsequently developed ECR. Trauma might be underestimated as a predisposing factor because patients often might not recall trauma to their dentition, especially if the trauma occurred several years before ECR was diagnosed.

3. Intracoronal bleaching: The same Heithersay study reported intracoronal bleaching as a sole and associated predisposing factor for ECR in 3.9% and 13.6% of cases, respectively. It has been suggested that hydrogen peroxide might denature dentin and provoke an immunologic response and that intracoronal placement of a "walking bleach" paste reduces the pH at the root surface of teeth to about 6.5. This slightly acidic environment enhances osteoclastic activity, which might result in ECR.

Treating ECR, which involves complete removal of the resorptive tissue and restoration of the resulting defect with a plastic tooth-colored restoration, depends on several of the following factors:

- severity and location
- whether the defect has perforated the root-canal system
- the restorability of the tooth
- the nature of the ECR lesion

Endodontic treatment might also be required in cases in which the ECR lesion has perforated the root canal.

Conclusion

Early detection is essential for successful management of ECR. Patients with an ECR lesion with no identifiable etiologic factor should have their entire dentition assessed to ensure that no other teeth are affected by ECR. Patients with a history of ≥1 predisposing factors should be monitored for initial signs of ECR. The low risk of developing ECR does not justify taking additional radiographs; however, if the teeth in question have been exposed to ≥1 of the predisposing factors, every radiographic investigation should be checked for ECR lesions.

Patel S, Kanagasingam S, Pitt Ford T. External cervical resorption: a review. J Endod *2009;35:616-625.*

In the next issue

- Relationship between endodontic therapy and heart disease
- Healing effects of chlorhexidine gluconate
- 3-dimensional model for root-canal irrigation

Do you or your staff have any questions or comments about **Update on Endodontics**? *Please call or write our office. We would be happy to hear from you.*