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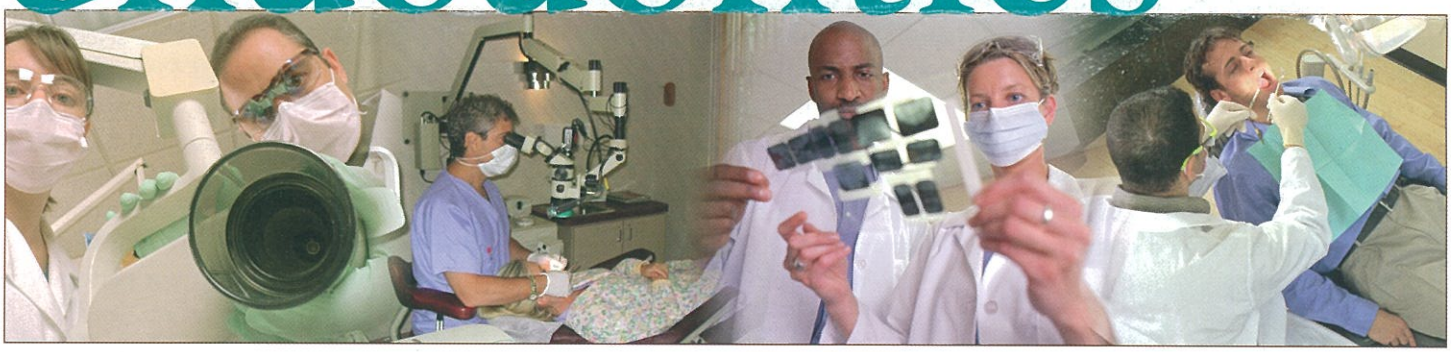

Mineral Trioxide Aggregate for Partial Pulpotomies in Cariously Exposed Teeth

Several studies have shown a very high success rate for partial pulpotomies in traumatically injured crowns and young permanent molars with carious exposure. Partial pulpotomy is the surgical amputation of 2–3 mm of exposed and inflamed coronal pulp tissue followed by a dressing agent to promote healing and maintain vitality of the remaining pulp tissue. The dressing most commonly used has been calcium hydroxide; however, in vitro and animal studies have suggested that mineral trioxide aggregate (MTA) maintains the integrity of the pulp and even induces proliferation of these cells, while demonstrating hard-tissue formation (Figure 1). Barrieshi-Nusair and Qudeimat from Kuwait University evaluated clinical and radiographic results using gray MTA for partial pulpotomy in young permanent teeth with pulps exposed by caries.

The study included 31 first permanent molars with carious exposure in 23 patients aged 7–13 years (average age, 10 years). Clinical and radiographic examination revealed a pulpal response within normal limits and normal appearance of the periradicular area. Each patient received a diagnosis of reversible pulpitis and normal periapex. After caries removal, the exposed pulp tissue was removed with a diamond bur to a depth of 2–4 mm. After hemostasis, 2–4 mm of gray MTA paste was placed against the fresh wound. The floor of each cavity was covered with a base of glass ionomer, and the teeth were restored with amalgam or stainless-steel crowns.

Teeth were reviewed radiographically and clinically at 3-, 6-, 12- and 24-month intervals. At 2 years, the treatment was considered a failure if pain, swelling, sinus tract, tenderness to percussion, evidence of periradicular or furcal pathosis, or root resorption was present. In addition,

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immature teeth whose root development failed to continue were also considered failures.

Of the 28 teeth available for evaluation, 22 (79%) were responsive to vitality testing and showed no signs of clinical or radiographic failures. Six teeth did not respond to vitality testing; however, the patients were asymptomatic. Radiographically, no signs of periradicular bone or root resorption were noted in any of the teeth, with no evidence of internal root resorption or calcification. A hard-tissue bridge was observed on radiographic examination in 18 cases (64%). All 7 teeth that had open apices at the beginning of the treatment showed continued root maturation.

Conclusion

Significantly, this study maintained pulp vitality in the radicular portion of immature teeth. Endondontic therapy on first molars in children can be negatively affected by the child's inability to cooperate and tolerate a long treatment. Partial pulpotomy using MTA appears to be a viable alternative.

Barrieshi-Nusair KM, Qudeimat MA. A prospective clinical study of mineral trioxide aggregate for partial pulpotomy in cariously exposed permanent teeth. J Endod *2006;32: 731-735.*

Extended Apical Enlargement with Hand Files vs Rotary NiTi Files

Optimal root-canal treatment calls for maintenance of the original root canal's path by cutting the dentin on the root-canal wall circumferentially so that the outline of the prepared root-canal wall reflects the original outline. Bartha et al from the University of Szeged, Hungary, compared the use of rotary nickel–titanium (NiTi) Lightspeed instruments (LS) with NiTi hand instruments (HA) for shaping the apical portion.

After 240 root canals in 80 extracted human molars were preflared, the apical portion of the teeth was shaped to optimal apical preparation size (APS) with either LS or HA, using the balanced force technique in a phantom head. The APS ranged from #40 to #55 for most of the "more difficult" canals and from #52.5 to #80 for the distal and palatal canals in molars. The apical area was then sectioned at 1, 2 and 3 mm above the reference length and every cross section analyzed microscopically to determine whether the inner layer of the dentin wall was circumferentially cut by the instrument. The examiners also recorded loss of working length, instrument separation and perforation.

Both groups showed similar results for root-canal curvature and APS. In mesiobuccal, distobuccal and mesiolingual canals, the mean diameter of the master apical file or master apical rotary used to reach APS varied between 0.45 mm and 0.48 mm; in distal and palatal canals, the mean diameter varied between 0.62 mm and 0.67 mm. In the LS group, 4 instruments separated; no instruments separated in the HA group. Neither loss of working length nor perforation was noted in either group. In 70% (LS) and 69% (HA) of the root canals, 2 of 3 levels demonstrated that the root-canal dentin was cut circumferentially.

Regardless of the instrumentation technique, a lower incidence of complete circumferential apical preparation (CAP) occurred at the 1-mm level than at the 2- and 3-mm levels (Table 1), likely due to the noncutting pilot tip of both instrument types. This might be avoided by using LS instruments to the radiographic apex instead of protruding them 1 mm short of it, especially when considering that LS instruments beginning with size #32.5 have a long noncutting tip of 1.25 mm. At the 2- and 3-mm levels, CAP was achieved in 70–78% of the canals in both groups as a result of the wide APS and the step-back technique.

Conclusion

The apical preparation technique used has little effect in achieving

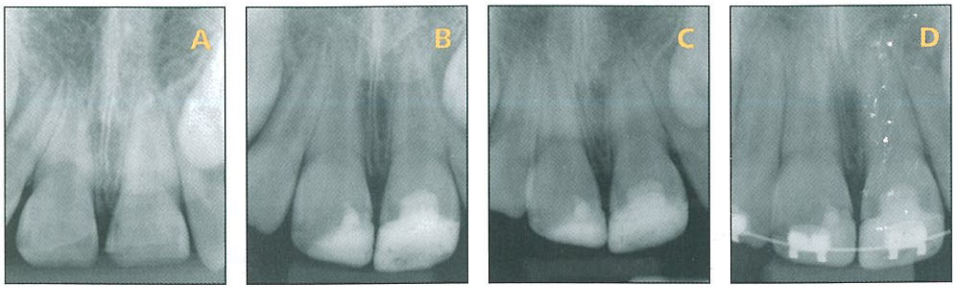

Figure 1. (A) Preoperative periapical radiograph of teeth #8 and #9 with pulp exposures. (B) Postoperative radiograph taken after the partial pulpotomy procedures using MTA as pulp capping material. (C) Six-month follow-up periapical radiograph showing continued tooth development. (D) Eighteen-month follow-up periapical radiograph showing normal tooth development and the absence of periradicular pathosis. Photos courtesy of Dr. R. Schwartz, San Antonio, Texas.

Table 1. *Percentage of root sections demonstrating CAP at different section levels*

CAP	LS group, % (95% CI)	HA group, % (95% CI)
1 mm	45 (36–54)	57 (49–66)
2 mm	70 (61–78)	73 (65–81)
3 mm	78 (70–85)	72 (64–80)

CI, confidence interval.

optimal APS. The risk of procedural errors with a wide apical preparation appears to be slight.

Bartha T, Kalwitzki M, Löst C, Weiger R. Extended apical enlargement with hand files versus rotary NiTi files: part II. Oral Surg Oral Med Oral Pathol Oral Radiol Endod *2006;102:692-697.*

Adhesive Endodontics: Bonding Within the Root-canal System

While pulpitis, apical periodontitis and failed endodontic treatment are all caused by microorganisms, complete elimination of microorganisms cannot be achieved consistently with current treatment methods. Thus, endodontic treatment also involves sealing the root-canal system from the outside environment with an obturating material that prevents leakage of any residual microorganisms. Unfortunately, no currently used dental materials provide a hermetic seal. Schwartz, a private practitioner from San Antonio, Texas, outlined the problems with bonding in the root-canal system, reviewed the progress that has been made and suggested possible strategies for the future.

Traditionally, gutta-percha, in combination with a sealer containing zinc oxide and eugenol, calcium hydroxide or epoxy resin, has been used for endodontic obturating. According to the literature, however, gutta-percha is limited in its ability to properly seal the root-canal system. Newer obturating materials and sealers have been developed based on dentin adhesion technologies borrowed from restorative dentistry. But effective bonding of the root-canal system remains a challenge because of anatomy and limitations in the physical and mechanical properties of the adhesive materials.

Many of the limitations of dentin bonding are related to polymerization shrinkage. When resin-based materials polymerize, individual monomer molecules join to form chains that contract as the chains grow and intertwine, and the mass shrinks from 2–7% depending on the volume occupied by filler particles and the test method. When the force of polymerization contraction exceeds the bond strength of the adhesive, a gap results along the surfaces with the weakest bonds, often within the hybrid layer (although it can occur in other areas).

Uniform application of a primer or adhesive in the apical one third is difficult at best and requires proper application for effective bonding. Once the primer is applied, the volatile carrier must be evaporated and the area dried, but using paper points for application and drying, as recommended by at least 1 manufacturer, is probably not very effective for either task. Yet without proper evaporation and drying, the bond is adversely affected. In teeth with small, complex anatomy, the entire procedure may prove impossible.

The ideal obturating material would be

- easy to manipulate;
- amenable to different obturating methods;
- stable in the oral environment;
- radiopaque;
- biocompatible;
- antimicrobial;
- nonshrinking or expanding 0.5% during polymerization;
- self-adhesive;
- capable of forming a stable bond to dentin that does not degrade with time and function;
- capable of forming a bond that is not affected by oxidizing agents like sodium hypochlorite;
- capable of strengthening the tooth; and
- easily removable for post placement or retreatment.

Conclusion

Adhesive obturating materials have the potential for achieving greater success in endodontic treatment than the current traditional materials. However, currently available prod-

ucts do not demonstrate clear benefit. Continued research and development may result in improvements and in new, more effective materials to seal the root-canal system.

Schwartz RS. Adhesive dentistry and endodontics. Part 2: bonding in the root canal system—the promise and the problems: a review. J Endod *2006;32:1125-1134.*

One-visit vs Multiple-visit Endodontic Therapy

Patients, referring dentists and endodontists share a growing perception that most endodontic therapy can be accomplished in 1 treatment visit. However, the long-term results of 1-visit endodontics are not clear. Mohammadi et al from Sadoughi University of Medical Sciences, Iran, reviewed the literature to determine when 1-visit therapy represents the best treatment option.

Treatment in 1 visit offers the following advantages:

1 Because it is less time-consuming, 1-visit therapy should result in a lower cost for the patient and potentially a higher profit for the dentist.

2 Numerous studies have shown that postoperative pain is equally low regardless of how many visits the therapy requires. Thus, because of the additional discomfort due to local anesthetic or trauma from a rubber dam application experienced after a second visit, 1-visit endodontic treatment may be less painful than multivisit treatment.

In a tooth with a cariously exposed vital pulp, the infection is normally found only at the wound surface, resulting in localized inflammation. In the most apical portion of the pulp tissue, microorganisms are usually not present. In such a case, pulpectomy is carried out on the presumption that the pulpal condition is irreversible and may lead to tissue breakdown and subsequent root-canal infection.

While it can be assumed that an infection is present in the necrotic pulp, an apical inflammatory lesion is normally present that may or may not be associated with manifestations of acute infection. However, a non-infected pulpal necrosis, which may follow ischemic injury in accidental trauma, is cause for less concern.

Few well-controlled clinical trials have evaluated this issue of 1 vs multiple visits; results of these trials did not show a significant difference between a 1- and 2-visit protocol. However, since the key to healing apical periodontitis is proper root-canal disinfection, the use of an interappointment antimicrobial dressing is not without merit.

In infected cases, mechanical instrumentation should be completed at the first visit with the aid of the antibacterial irrigation solution sodium hypochlorite. Calcium hydroxide paste should be placed in the canal to potentially achieve a bacteria-free root-canal system by the second appointment. Biopure MTAD (Dentsply, Tulsa, Okla.), a very promising new irrigation solution containing a tetracycline isomer, citric acid and a detergent, safely removes the smear layer and effectively eliminates *Enterococcus faecalis*, which is resistant to several medicaments.

Conclusion

In both vital cases and nonvital traumatic cases without signs of apical periodontitis, 1-visit treatment appears to be an effective option. In infected cases, a 2-visit protocol remains the current standard, but 1-visit endodontic treatment seems to be an achievable goal in the near future for infected cases with apical periodontitis.

Mohammadi Z, Farhad A, Tabrizizadeh M. One-visit vs. multiple-visit endodontic therapy: a review. Int Dent J *2006;56:289-293.*

In the next issue:

- Ultrasonics in endodontics
- Effect of smear layer on canal obturation
- Orthodontic root resorption of endodontically treated teeth

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