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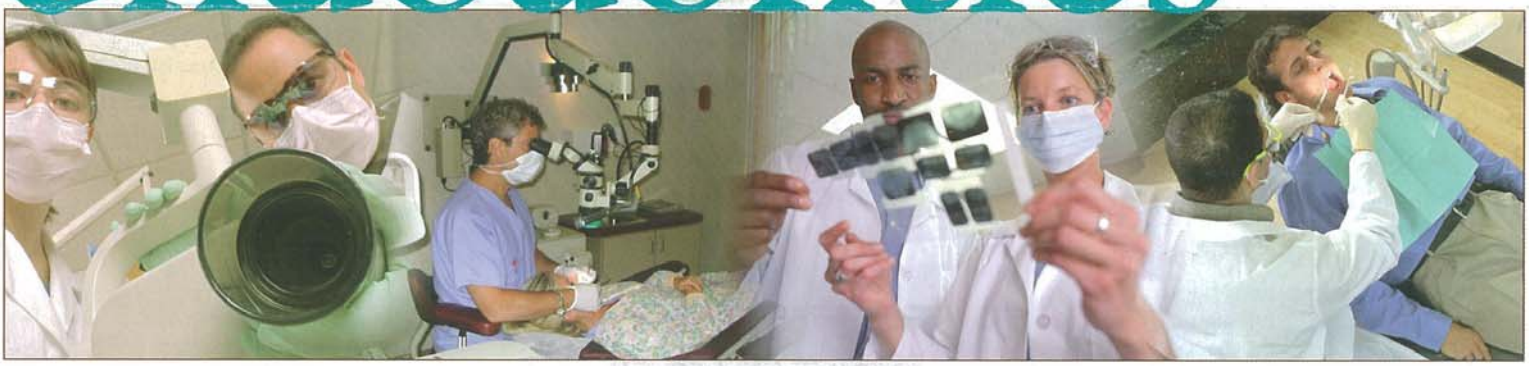

Are Root-end Fillings Required for Endodontic Success?

Periapical surgery with root-end resection is indicated on endodontically treated teeth with apical lesions, in which re-treatment is not likely to resolve the pathology. The surgery involves a root-end resection and the placement of a root-end filling to seal any remaining bacteria in the root-canal system.

Some studies have found that healing occurs even in the absence of root-end filling, that is, an apical curettage procedure only. However, ex vivo studies have suggested that a root-end filling is necessary to prevent leakage from the root canal. The results from previous studies are thus inconclusive. Two randomized clinical trials (RCTs) comparing mineral trioxide aggregate (MTA) and intermediate restorative material (IRM) reported success rates of 84–92% for MTA and 76–86% for IRM after 1 year, and 92% for MTA and 87% for IRM after 2 years.

Christiansen et al from the University of Aarhus, Denmark, compared periapical healing after root-end resection followed by a root-end filling with MTA or smoothing of the gutta-percha (GP) root filling only. The study was conducted according to the guidelines for an RCT. The null hypothesis was that no significant differences in healing existed between the 2 treatment methods 12 months postoperatively.

A total of 44 patients (52 teeth with periapical infection) with an average age of 54.6 years (range, 30–77 years) participated in the study comparing the MTA and GP treatment methods. Radiographs produced 1 week and 12 months postoperatively were compared after blinding for treatment method, and healing was assessed as complete, incomplete, uncertain or unsatisfactory.

Six teeth were not available for the 12-month follow-up: 3 teeth (GP) had been reoperated because of pain, and 2 teeth (1 GP, 1 MTA) had been extracted because of

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root fracture (these 5 teeth were classified as failures). One patient's tooth (GP) was not available for recall.

In the GP/curettage group,

- 7 teeth (28%) showed complete healing,
- 6 teeth (24%) incomplete healing,
- 6 teeth (24%) uncertain healing and
- 2 teeth (8%) unsatisfactory healing after 1 year.

In the MTA retrofilling group,

- 22 teeth (85%) showed complete healing,
- 3 teeth (12%) incomplete healing and
- none were scored as uncertain or unsatisfactory healing after 1 year (Table 1).

The difference in healing between the GP and the MTA groups was significant ($p < .001$).

Several factors may have influenced the difference in healing rates between the curettage and the retrofilling groups. The ultrasonic instrumentation in the MTA retrofilling groups included preparation of isthmuses and removal of discolored areas that might harbor bacteria and by-products of bacteria. In the curettage group, the root tip with the apical delta was resected; however, no cleaning of isthmuses and discolored areas was performed. In the MTA retrofilling group, the prepared cavity was thoroughly packed with MTA in an attempt to completely seal the canal system. For the curettage treatment, it is questionable whether the smoothing of GP with a hot instrument improved the apical seal. In several cases, the 1.5-mm diameter of the droplet-shaped instrument was larger than the GP-filled canal lumen after root-end resection; thus, the instrumentation did not always reach the GP inside the canal lumen. Furthermore, the GP material was often fragile and tended to break into pieces in the attempt to improve the apical seal.

Conclusion

MTA was shown to be a successful root-end filling material, with a healing rate of 96% when evaluated 12 months postoperatively. Teeth treated with MTA retrofilling had significantly better healing than teeth treated by smoothing of the orthograde GP root filling only (healing rate 52%).

Christiansen R, Kirkevang L-L, Hørsted-Bindslev P, Wenzel A. Randomized clinical trial of root-end resection followed by root-end filling with mineral trioxide aggregate or smoothing of the orthograde gutta-percha root filling:1-year follow-up. Int Endod J *2009; 42:105-114.*

Identifying Apical Periodontitis Using a New Periapical Index

Because radiographs are 2-dimensional representations of 3-dimensional structures, certain clinical and biologic features might not be visualized on routine radiographic images. However, the images are essential because they offer evidence of the progression, regression and persistence of apical periodontitis (AP).

New imaging modalities, such as cone-beam computed tomography (CBCT), have become available as diagnostic tools. Endodontic applications of CBCT are being identified as this technology becomes more prevalent; its potential indications include diagnosis of pathologic lesions from endodontic and nonendodontic origins, assessment of root-canal morphology, determination of root and alveolar bone fractures, analysis of external and internal root resorption and invasive cervical resorption, and presurgical planning in root-end procedures.

Estrela et al from the Federal University of Goiás, Brazil, evaluated a periapical index (PAI) based on CBCT for identification of AP. Radiolucent images suggestive of periapical le-

Table 1. *Radiographic and clinical assessment of healing for the GP and MTA groups*

	Radiographic assessment				Clinical assessment	
	1	2	3	4	5	6
	Complete healing	Incomplete healing	Uncertain healing	Unsatisfactory healing	Reoperation (pain)	Extraction (fracture)
GP	7	6	6	2	3	1
MTA	22	3	0	0	0	1

sions were measured, using Planimp software, on CBCT scans in 3 dimensions: buccopalatal, mesiodistal and diagonal. The cone-beam computed tomography periapical index (CBCTPAI) was determined by the largest lesion extension using a 0–5 scoring system. Three observers using the CBCTPAI criteria evaluated 1014 images (periapical radiographs and CBCT scans) originally taken of 596 patients. AP was identified in 39.5% and 60.9% of cases by radiography and CBCT, respectively ($p < .01$).

Conclusion

The results indicated that AP detection was higher with CBCT than with periapical radiography. The CBCTPAI proposed in this study offers a diagnostic method for use with high-resolution images that can reduce the incidence of false-negative diagnoses, minimize observer ambiguity and increase the reliability of epidemiologic studies, especially those studies referring to AP prevalence and severity.

Estrela C, Bueno MR, Azevedo BC, et al. A new periapical index based on cone beam computed tomography. J Endod *2008;34: 1325-1331.*

Comparison of Three Anesthetic Techniques

The inferior alveolar nerve block (IANB) is the most frequently used injection technique for achieving local anesthesia for mandibular dental procedures. However, the IANB does not always result in successful pulpal anesthesia. Failure rates of 10–39% have been reported in the literature. In 1960 and 1977, Vazirani and Akinosi, respectively, introduced similar techniques for mandibular anesthesia. The injection is a closed-mouth technique, with the landmarks for needle insertion being the mucogingival junction of the maxillary second molar. It is known as the Vazirani–Akinosi technique. In 1973, Gow-Gates introduced a new technique for mandibular anesthesia, using extraoral landmarks and a target site in the neck of the mandibular condyle.

In a prospective, randomized study, Goldberg et al from Ohio State University compared the degree of pulpal anesthesia obtained with the conventional inferior alveolar, the Gow-Gates and the Vazirani–Akinosi techniques in vital, asymptomatic teeth. With a crossover design, 40 patients received all 3 techniques in a random manner with 3.6 mL of 2% lidocaine with 1:100,000 epinephrine given at 3 separate appointments. An electric pulp tester was used to test for anesthesia of the first molars, first premolars and lateral incisors in 3-minute cycles for 60 minutes. Anesthesia was considered successful when 2 consecutive 80-readings were obtained within 15 minutes, and the 80-reading was continuously sustained through the 60th minute.

A total of 18 patients—8 Gow-Gates injections and 10 Vazirani–Akinosi injections—did not have profound lip numbness at 21 minutes (unsuccessful blocks) and were eliminated from the statistical analysis. Because 8 patients were removed from the Gow-Gates technique, 8 corresponding patients were removed from the IANB group, as equal numbers were required for statistical comparison. By the same token, 10 corresponding patients were removed from the IANB group when comparing the Vazirani–Akinosi technique. All of the patients used for data analysis had profound lip anesthesia with all 3 techniques.

There were no significant differences ($p > .05$) between the IANB and Gow-Gates techniques, or IANB and Vazirani–Akinosi techniques with respect to injection discomfort. There were no significant differences ($p > .05$) between IANB and Gow-Gates techniques and IANB and Vazirani–Akinosi techniques with regard to soft-tissue anesthesia (Table 2).

Table 2. *Percentages and number of patients who experienced anesthetic success*

	Anesthetic technique		
	Inferior alveolar	Gow-Gates	Vazirani–Akinosi
Anesthetic success*†			
First molar	53% (17/32)	38% (12/32)	27% (8/30)
First premolar	62% (20/32)	44% (14/32)	50% (15/30)
Lateral incisor	25% (8/32)	16% (5/32)	13% (4/30)

*For the inferior alveolar and Gow-Gates techniques, n = 32; for the Vazirani–Akinosi technique, n = 30. *There were no significant differences (p > .05) between the inferior alveolar and Gow-Gates techniques. †There were no significant differences (p > .05) between the inferior alveolar and Vazirani–Akinosi techniques.*

Conclusion

The authors concluded that, for the patients who achieved lip numbness, the conventional IANB provided anesthesia similar to that provided by the Gow-Gates and Vazirani–Akinosi techniques in vital, asymptomatic teeth. Both the Gow-Gates and Vazirani–Akinosi techniques will result in a slower onset of pulpal anesthesia than the conventional IANB.

Goldberg S, Reader A, Drum M, et al. Comparison of the anesthetic efficacy of the conventional inferior alveolar, Gow-Gates, and Vazirani-Akinosi techniques. J Endod *2008;34:1306-1311.*

Success of Implants vs Endodontically Treated Teeth

Implant and endodontic treatments are both highly predictable procedures. Arguments are often made that one treatment is more predictable than the other, but it is difficult to make an objective comparison. Many of the classic endodontic studies show artificially low success rates because of strict definitions of success, whereas survival may be a better measure of success. Most implant outcome studies use survival as the sole criterion, but some use more stringent criteria to evaluate success.

Many factors contribute to the predictability of implants and endodontically treated teeth. Factors that have been linked to implant success are location in the mouth and type of restoration. Other factors, such as systemic disease, smoking and bone quality, contribute to lowered success rates. In addition, the type of restoration, occlusion and esthetics play roles in the success of the treatment.

Another factor that complicates comparison of the 2 treatments is the fact that the 2 treatments have different biologic factors related to their outcome. Endodontic failure is generally the result of persisting intraradicular infection. It is widely accepted that some portion of the root-canal system provides a niche for infection that evades the body's defenses. This niche might be a missed canal, infected dentinal tubules or a portion of the canal that was not totally obturated. Implant failures, on the other hand, are usually a result of the body's inability to tolerate the implant material, although infection plays a major role in peri-implantitis.

Hannahan and Eleazer from the University of Alabama at Birmingham compared, with minimal subjective grading, the success of each treatment. Outcome was determined by clinical chart notes and radiographs. Failure was defined as removal of the implant or tooth. Uncertain findings for implants were defined as mobility class I or greater, radiographic signs of bone loss or an additional surgical procedure. Mobility class I or greater, periapical index score of ≥3 or the need for apical surgery was classified as uncertain for endodontically treated teeth. Success was recorded if the implant or tooth was in place and functional.

Implants were placed by periodontists in a group practice; the endodontic treatments were performed by endodontists also in group practice. Charts of patients with 129 implants meeting inclusion criteria showed average follow-up of 36 months (range, 15–57 months), with a success rate of 98.4%. Patients with 143 endodontically treated teeth were followed for an average of 22 months (range, 18–59 months), with a success rate of 99.3%. No statistically significant difference was found ($p = .56$).

When uncertain findings were added to the failures, implant success dropped to 87.6% and endodontic success dropped to 90.2%. This difference also was not statistically significant ($p = .61$). The authors found that 12.4% of implants required interventions, whereas only 1.3% of endodontically treated teeth required interventions, and this was statistically significant ($p = .0003$).

Conclusion

The authors found little difference in the success of implant and endodontically treated teeth. They did find, however, that implants required significantly more postoperative treatments to maintain them.

Hannahan JP, Eleazer PD. Comparison of success of implants versus endodontically treated teeth. J Endod *2008;34:1302-1305.*

In the next issue:

- Periapical microsurgery
- Articaine for supplemental buccal mandibular infiltration anesthesia
- Nickel-titanium rotary PathFile to create glide path

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