A Professional Courtesy of:

WESTSIDE ENDODONTICS
b.503.693.6163 • f.503.693.6073

The offices of Dr. Steven Singh

HILLSBORO OFFICE
434 S. First Avenue
Hillsboro, OR 97123
(503) 693-6163

WASHINGTON SQUARE
9735 SW Shady Lane, Suite 308
Portland, OR 97223
(503) 693-6163

www.westsideendo.com

update on endodontics™

Winter 2025

Root Canal Treatment and Control of Diabetes

Diabetes mellitus affects more than half a billion people worldwide, with type 2 diabetes mellitus constituting >90% of the total. Davidović et al from the University of East Sarajevo, Bosnia and Herzegovina, conducted a prospective cohort study to examine the outcome of root canal treatment in type 2 diabetes patients, including the impact of glycated hemoglobin (HbA1c) levels, and the effect that root canal treatment may have on HbA1c levels. They enrolled patients with type 2 diabetes and controls, seeking nonemergency root canal treatment at a university dental center over a 20-month period. All enrolled patients were >18 years old and had 1 single-rooted and single-canalled tooth with nonvital pulp and asymptomatic apical periodontitis without preoperative pain or swelling. Three groups were created:

- 25 patients with type 2 diabetes and an achieved targeted HbA1c level <7
- 25 patients with type 2 diabetes and an unachieved targeted HbA1c level ≥7
- 25 patients without diabetes, as confirmed by an internist at the university

The clinically relevant targeted HbA1c level of <7 matched the standard set by the American Diabetes Association Standards of Medical Care.

All patients underwent endodontic treatment by a single operator following a standardized protocol. After 12 months, the outcome of endodontic treatment was evaluated through a combination of clinical and radiographic findings. Clinical success criteria were the absence of pain, sensitivity, soft tissue inflammation, tooth mobility and alteration of marginal bone level; radiographic outcomes were based on change in periapical index (PAI) from baseline. Healed teeth presented with no clinical signs or symptoms and a PAI ≤2; unhealed teeth presented with clinical signs or symptoms and/or a PAI ≥3.

Inside this issue:

At recall, root canal treatment reduced PAI scores in all groups. However, the group with HbA1c levels ≥7 had significantly worse PAI scores than did the other groups. Treatment success occurred in 79% of control teeth, 65% of teeth in patients with HbA1c levels <7 and 41% of teeth in patients with HbA1c levels ≥7 (Table 1). The patients in the group with unachieved target HbA1c levels on

Table 1. ***Changes in PAI and treatment success at 12-month follow-up.***

	Total	Control	Achieved targeted HbA1c level	Unachieved targeted HbA1c level
PAI before treatment	4.04 ± 0.55	4.04 ± 0.55	3.96 ± 0.56	4.14 ± 0.56
PAI at 12-month follow-up	2.07 ± 0.90	1.71 ± 0.80	1.96 ± 0.88	2.59 ± 0.80
Changes in PAI	1.97	2.33	2.00	1.55
PAI ≤2	62.3%	79.2%	65.2%	40.9%
PAI ≥3	37.7%	20.8%	34.8%	59.1%

PAI, periapical index.

had on average a decreased HbA1c value, although this tendency did not quite reach statistical significance. A multivariate regression analysis demonstrated that patients with HbA1c levels ≥7 were nearly 5× as likely to have persistent apical periodontitis after root canal treatment.

Conclusion

The study showed that type 2 diabetes and apical periodontitis create a 2-way relationship in which diabetes enhances the osteolysis in apical periodontitis while, at the same time, apical periodontitis increases the cumulative inflammatory burden in diabetes. Root canal treatment may improve glycemic control in patients who have not achieved target HbA1c levels.

Davidović B, Krunić J, Mladenović I, et al. Effects of apical periodontitis treatment on hyperglycaemia in diabetes: a prospective cohort study. Int Endod J *2024;57:1099-1109.*

Forms of Tooth Resorption

Tooth resorption refers to the loss of tooth structure caused by clastic cells that can lead to tooth loss, infection of the root canal system and periodontal consequences. Blum from the University of Melbourne, Australia, classified tooth resorption into 3 categories and reviewed their causes and appropriate treatment.

Trauma-induced Resorption— Trauma-induced resorption includes 3 subtypes: surface resorption, pressure and orthodontic resorption, and replacement resorption. Surface resorption describes shallow areas of cementum or dentin resorption typically resulting from minor trauma. Because it is shallow and frequently clinically asymptomatic, it may be difficult to detect. In the absence of infection, surface resorption is typically transitory and self-limiting, and requires no intervention.

Pressure and orthodontic resorption results from physical forces applied to a tooth, including impacted teeth and tumors or cysts that generate a physical force on the tooth. Management involves removal of the impacted tooth or the pathosis. Orthodontic resorption describes resorption of the apical portion of the root following orthodontic tooth movement. Because it presents without signs or symptoms, orthodontic resorption is diagnosed through radiographs. Treatment involves temporary cessation of orthodontic treatment; resorption stops when the treatment stops.

Replacement resorption includes external replacement resorption, featuring the progressive replacement of surface root structure (dentin and cementum) by alveolar bone from extensive necrosis of the periodontal ligament. Most commonly caused by severe luxation injuries and delayed reimplantation of avulsed teeth, this often results in tooth loss in the absence of timely intervention. Internal replacement resorption, a rare condition, involves the replacement of tooth structure with bone beginning within the root canal system. Diagnosed only through radiographs, internal replacement resorption does not require treatment.

Infection-induced Resorption— Infection-induced resorption may be either internal or external. Internal inflammatory resorption occurs within the root canal system due to infection, rendering the coronal pulp necrotic. A cavity forms, progressively resorbing the canal walls. Diagnosis through periapical radiographs will show a relatively round, symmetrical and centrally located radiolucency of the root canal space. Treatment involves removal of the infective agent. Because of the cavity, rotary endodontic instruments will likely prove insufficient; various adjunctive measures must be taken.

External inflammatory resorption results from damage to root cementum that exposes the root surface. It occurs anywhere along the length of the root and adjacent structures, rendering the tooth nonvital. Endodontic treatment stops the infection, whereupon resorption ceases.

Hyperplastic Invasive Resorption— Invasive resorption may be cervical or coronal. Although the cause of cervical invasive resorption is unknown, persistent infection, as well as inflammation or mechanical stresses in the periodontal ligament, may contribute to progression. Teeth are often asymptomatic, but pulpal symptoms may develop. Treatment involves removal or inactivation of resorptive tissue, followed by restoration of the defect. If the defect is large and extends beyond the coronal third of the root canal, the tooth should be extracted or left untreated.

Coronal invasive resorption develops in erupting teeth in a localized coronal enamel defect. Treatment involves removal of the resorptive tissue and inactivation of the resorptive cells.

Conclusion

Tooth resorption is a complex and multifaceted condition that can lead to tooth loss. The practitioner needs to recognize when resorption exists and understand when endodontic intervention is required.

Blum JS. The various forms of tooth resorption. Aust Endod J *2024;doi:10.1111/aej.12857.*

Outcomes of Nonsurgical Endodontic Retreatment

Despite primary endodontic treatment's excellent reported success rates, failures do occur. The practitioner is then faced with 3 main treatment options: nonsurgical retreatment, surgical endodontics and tooth extraction. Sabeti et al from the University of California, San Francisco School of Dentistry, conducted a systematic review of randomized controlled trials and cohort studies to determine the outcomes and prognostic factors associated with contemporary nonsurgical retreatment.

Eligible studies from the relevant literature included randomized controlled clinical trials and cohort studies with a sample size of ≥30 patients and a follow-up of ≥2 years that reported periapical healing assessed by radiographic evaluation and defined success as the simultaneous achievement of clinical normalcy and periapical healing. They identified 29 articles for inclusion, all of which had been published no earlier than 2002, with the majority published no earlier than 2016.

All but 1 study employed strict criteria to evaluate radiographs; the majority also evaluated radiographs using loose criteria. Based on strict criteria, periapical healing rates ranged from 64.1% to 93.7%; a pooled analysis showed a healing rate of 78.8%. Periapical healing rates ranged from 68.8% to 96.4%, with a pooled rate of 87.5% using loose criteria. Success rates ranged from 64.1% to 90.1% using strict criteria and 68.8% to 95.5% using loose criteria; pooled rates were 78.0% and 86.4%, respectively.

A meta-analysis of the data revealed 3 clinical prognostic factors that significantly influenced the periapical healing rate and pooled success rate of nonsurgical retreatment when employing the strict criteria:

Table 2. ***Clinical prognostic factors affecting the success of nonsurgical endodontic retreatment.***

	Healing rate		Success rate	
	Strict criteria	Loose criteria	Strict criteria	Loose criteria
Periapical status				
Periapical lesions present	74.8%	84.0%	75.1%	84.6%
Periapical lesions absent	97.9%	95.7%	97.9%	95.7%
Size of periapical lesions				
≤5 mm on radiographs, ≤65 mm³ on CBCT	87.0%	92.9%	87.0%	92.9%
>5 mm on radiographs, >65 mm³ on CBCT	62.3%	86.7%	62.3%	86.7%
Apical extent of root filling				
Short (>2 mm short of radiographic apex)	51.3%	72.2%	51.3%	72.2%
Adequate (0–2 mm of radiographic apex)	83.8%	89.2%	83.8%	89.2%
Long (extrusion)	78.0%	91.8%	77.2%	94.6%

CBCT, cone-beam computed tomography.

- The rates were significantly greater when no periapical lesions were present.
- The rates were significantly greater when periapical lesions were smaller.
- The rates were significantly reduced when the root filling length was short rather than adequate or long (Table 2).

A follow-up of ≥4 years led to significantly greater healing and success rates under both strict and loose criteria. Studies published before 2010 demonstrated less favorable healing and success rates.

Conclusion

This systematic review and meta-analysis revealed excellent results for nonsurgical endodontic retreatment, with periapical healing and success rates of roughly 78% when measured by strict criteria and 87% when measured by loose criteria. The availability of extended follow-ups should be considered when planning treatment to optimize success.

Sabeti M, Chung YJ, Aghamohammadi N, et al. Outcome of contemporary nonsurgical endodontic treatment: a systematic review of randomized controlled trials and cohort studies. J Endod *2024;50:414-433.*

Treating Irreversible Pulpitis with Pulpotomies

Symptomatic irreversible pulpitis has traditionally received nonsurgical endodontic treatment. More recent research has shown that inflammation of the pulp in these cases is more limited, typically confined to the area near the exposure site, and can be treated by removing only the affected portion of the pulp, leaving the healthy and treatable pulp tissue in place. Pulpotomy techniques can be divided into 2 distinct procedures:

- full pulpotomy, which involves removal of the entire coronal pulp tissue at the level of the root canal orifice
- partial pulpotomy, which involves removal of a small portion of coronal pulp tissue after exposure, followed by the application of a biomaterial directly to the remaining pulp tissue

Kumar et al from the All India Institute of Medical Sciences searched major databases, as well as gray literature, for studies reporting healing outcomes of full and partial pulpectomies to permanent molars with symptoms indicative of irreversible pulpitis. Included were randomized clinical trials comparing the clinical and radiographic success rates with a follow-up of ≥12 months. Studies of teeth with reversible pulpitis or immature roots were excluded.

Only 3 studies qualified for inclusion. Of the 93 full pulpectomies, 9 were failures; of the 98 partial pulpectomies, 17 were failures. All studies showed a higher rate of success for full pulpectomies than for partial pulpectomies, with an odds ratio of 0.51. However, this result was not significant at a 95% confidence interval.

Because of the strict application of inclusion criteria that limited their systematic review to randomized clinical trials, the evidence from all included studies was considered high grade, which suggests that the observed effects were accurate and applicable to the included population. This meant that only 3 studies were included in their systematic review and meta-analysis, with <100 total teeth analyzed for each procedure. The studies used different pulp capping materials and different concentrations of local anesthetic, and varied in their treatment of patients who failed to achieve hemostasis within a certain period, with 1 study classifying patients who experienced uncontrolled bleeding after 6 minutes as failures; the other 2 excluded patients who experienced uncontrolled bleeding after 10 minutes.

Conclusion

Carious permanent teeth with symptomatic irreversible pulpitis should be treated in a sequential manner, beginning with partial pulpectomy and progressing to full pulpectomy if bleeding continues beyond 5 minutes. Larger and longer-term studies are needed to compare the success rates of these 2 treatment options.

Kumar V, Chawla A, Priya H, et al. Comparative evaluation of full and partial pulpotomy in permanent teeth with irreversible pulpitis: a systematic review and meta-analysis. Aust Endod J *2024;doi:10.1111/aej.12844.*

In the next issue:

- Regenerative endodontic procedures in traumatized teeth
- Survival of immature traumatized incisors with pulp necrosis and apical periodontitis

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.