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Outcomes for Selective Root Canal Retreatment

Although endodontic treatment is highly successful, large cross-sectional studies report a prevalence of posttreatment disease as high as 42%. Multirooted teeth risk posttreatment disease, typically due to missed or inadequately cleaned and filled canals and isthmuses. In many cases, root canal retreatment may be preferred to surgical endodontic treatment. Selective root canal retreatment limits retreatment to roots that present with periapical pathosis, leaving untreated other roots in the same tooth with no visible or perceived apical lesions. This method has clear advantages—a more conservative access cavity directed to the retreated root only, a reduced chance for iatrogenic errors, lower cost for the patient—but no studies have analyzed the potential for new periapical lesions in the untreated roots.

Brochado Martins et al from the University of Amsterdam and Vrije Universiteit Amsterdam, the Netherlands, conducted a retrospective study to evaluate the clinical and radiographic outcomes of selective root canal retreatment after ≥ 12 -months follow-up, and to assess the periapical status of the untreated roots in the same tooth and

tooth survival. They reviewed the records of nonsurgical endodontic retreatments of multirooted teeth performed over a 40-month period at 3 private and 1 university clinics. To be included in the study, retreated teeth had to be multirooted with a clinical diagnosis of apical periodontitis, have ≥ 1 lesion-free root that was not retreated, healthy periodontal status and a set of either periapical radiographs or cone-beam computed tomographs taken pretreatment, posttreatment and ≥ 12 months after treatment.

A total of 75 teeth with 195 roots in 75 patients were included in the study. Radiographic evidence was categorized as belonging to 1 of 6 outcomes, ranging from 1 (new peri-

apical radiolucency) to 6 (unchanged healthy periapical status, with no radiolucency before and after retreatment); outcomes for roots graded 4 through 6 were classified as favorable, while outcomes for roots graded 1 through 3 were classified as unfavorable. Tooth survival was defined as the presence of the retreated tooth at the time of follow-up.

Maxillary first molars were most frequently retreated; the mesiobuccal (MB) root of the maxillary first molar was the

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most frequently retreated root, primarily due to a missed MB2 canal. At follow-up, nearly 93% of retreated roots had a favorable outcome. Only 4 of the 113 unretreated roots developed new periapical pathosis (Table 1). No treatment-related parameters studied (quality of root canal filling, sealer extrusion, iatrogenic mishaps, type of coronal restoration) directly influenced the outcome of the retreated roots. At the final follow-up, 92% of the teeth survived; the remaining teeth were extracted due to vertical root fracture and were considered nonendodontic failures. In 6 of the 10 cases whose outcomes were classified as unfavorable, patients remained asymptomatic, a result that these patients found satisfactory.

Conclusion

Based on these results, selective root canal retreatment appears to be a reliable treatment for teeth presenting with posttreatment disease. It is hoped that larger clinical trials with longer follow-ups can be conducted to confirm these findings.

Brochado Martins JF, Viegas OG, Cristescu R, et al. Outcome of selective root canal retreatment—a retrospective study. *Int Endod J* 2022; doi:10.1111/iej.13871.

Root Canal Treatment in Young Patients with Cardiovascular Risk

Apical periodontitis is widespread; it has been estimated that, worldwide, half the population has ≥ 1 tooth with apical periodontitis, with a prevalence of 6.3% of all teeth. Along with it being one of the main causes of tooth loss, apical periodontitis is an independent risk factor for cardiovascular disease. Recent research has identified higher levels of proinflammatory mediators, such as serum C-reactive protein (CRP), interleukin (IL)-6 and soluble E-selectin, in patients diagnosed with apical periodontitis.

According to the American Heart Association, individuals with levels of high-sensitivity CRP < 1 mg/L have low risk of developing a future cardiovascular event; those with levels between 1 and 3 mg/L have a moderate risk; and those with levels > 3 mg/L have a high risk. Previous studies have established an association between apical periodontitis and moderate to severe cardiovascular

risk based on serum high-sensitivity CRP.

To further study this potential association, Garrido et al from Universidad de Chile undertook a study of otherwise healthy young persons (aged 16 to 40 years) with primary apical periodontitis associated with apical lesions of endodontic origin without any acute or chronic systemic diseases. Patients diagnosed with any noncommunicable disease and with moderate to severe periodontitis or obesity were excluded.

Each patient was evaluated for cardiovascular risk factors. Blood samples were obtained at baseline and analyzed for high-sensitivity CRP along with tumor necrosis factor alpha (TNF- α), IL-6, IL-10, IL-1 α and soluble E-selectin; patients determined to be at high risk for cardiovascular disease based on high-sensitivity CRP levels were also analyzed for monomeric CRP. Following root canal treatment, patients were recalled at 1 month and 6 months for clinical and radiographic examinations, at which times blood samples were again obtained.

Mean diameter of apical lesions was significantly reduced at 1- and 6-month follow-ups. TNF- α , IL-6, IL-10, IL-1 α and soluble E-selectin levels failed to show any significant differences from baseline. A borderline significant decrease in high-sensitivity CRP levels was seen at 1 month, but the decrease did not remain significant at 6 months. However, in the subset of patients diagnosed at baseline to be at risk for cardiovascular disease, both high-sensitivity CRP and monomeric CRP decreased significantly at both 1 month and 6 months after endodontic treatment.

Table 1. Outcomes per tooth and per retreated and unretreated root (n = 75 teeth, 195 roots).

	Unfavorable	Favorable
Outcome per tooth	10 (13.3%)	65 (86.7%)
Outcome per retreated root		
Mesial root	6 (9.1%)	60 (90.9%)
Distal root	0	12 (100.0%)
Palatal root	0	3 (100.0%)
Buccal root	0	1 (100.0%)
Outcome per unretreated root		
Mesial root	0	8 (100.0%)
Distal root	1 (1.6%)	61 (98.4%)
Palatal root	3 (7.0%)	40 (93.0%)

Conclusion

This study was conducted with a relatively small population over a 6-month period; larger, longer studies are needed to confirm the results. Nevertheless, the data from this study strongly suggest that root canal treatment may reduce CRP levels in young patients with apical periodontitis, thereby reducing their cardiovascular risk.

Garrido M, Bordagaray MJ, Schweitzer C, et al. Reduced C-reactive protein levels after root canal treatment in clinically healthy young apical periodontitis individuals at cardiovascular risk: a prospective study. *Int Endod J* 2024;doi:10.1111/iej.14029.

Biomarkers in Smokers with Chronic Apical Periodontitis

Despite decades of evidence showing its deleterious effect on health, smoking continues to be one of the largest public health problems worldwide and has an impact on the pathophysiological pathways affecting the health of the dental pulp and the surrounding bone tissues. Smokers may have a higher prevalence of apical periodontitis and need for endodontic treatment. Several immunologic biomarkers have shown an association of periapical lesion development in apical periodontitis, including receptor activator of nuclear factor kappa B ligand (RANKL) and tumor necrosis factor alpha (TNF- α); in contrast, osteoprotegerin promotes bone remodeling regulation, and osteopontin is essential to bone matrix mineralization and resorption.

de Paula et al from Fluminense Federal University, Brazil, compared the levels of RANKL, TNF- α , osteoprotegerin and osteopontin between smokers and nonsmokers, hypothesizing that any differences would create increased bone resorption in smokers with chronic apical periodontitis. They enrolled 24 systemically healthy patients scheduled for tooth extraction due to a clinical diagnosis of pulp necrosis and a radiographic diagnosis of primary chronic apical periodontitis; 12 patients were smokers, 12 nonsmokers. Periapical lesions were removed from the extracted teeth and processed for histologic analysis. Levels of immunoexpression were divided into 3 categories:

- negative to focal
- weak to moderate
- strong

Variables such as age, sex, tooth location (mandible vs maxilla) and tooth position in the dental arch were similar between the 2 groups. RANKL expression was weak to moderate in two-thirds of the smoker group and strong in the remaining patients, compared with 100% weak to moderate in the nonsmoking patients, a significant difference. All patients in the smoker group showed negative to focal expression of both osteoprotegerin and osteopontin, while levels in one-half the nonsmoking group were judged weak to moderate, also a significant difference. TNF- α levels did not differ between the 2 groups.

RANKL acts as a ligand of receptor activator of nuclear factor kappa B (RANK). The binding of the 2 activates the osteoclastogenesis process, resulting in higher bone resorption, a finding corroborated in animal studies. Osteoprotegerin inhibits the binding

of RANKL and RANK; the combination of higher RANKL expression and lower osteoprotegerin expression has been confirmed in patients with apical periodontitis. Because of their lower levels of osteopontin, an important mediator of bone remodeling, smokers may be less prone to bone matrix mineralization. While recent studies have suggested that TNF- α may be an important modifying factor in chronic apical periodontitis, no difference in TNF- α levels was seen in periapical lesions between smokers and nonsmokers. However, previous studies included only nonsmokers, which may explain the differing results.

Conclusion

The findings of this small study must be viewed with caution, and additional studies of chronic apical periodontitis biomarkers that include smokers may help define factors that influence endodontic therapy success in this patient group. This study does suggest that smokers may be more vulnerable to chronic apical periodontitis.

de Paula KM, Gomes CC, Valente MIB, et al. Evaluation of receptor activator of nuclear factor kappa B ligand, osteoprotegerin, osteopontin and tumor necrosis factor alpha on chronic apical periodontitis in smokers. *J Endod* 2022; doi:10.1016/j.joen.2022.11.012.

Screening Endodontic Patients For TMD Pain

Temporomandibular disorder (TMD) pain can mimic or coexist with endodontic pain, which can make an accurate diagnosis difficult. A 2023 study found that more than half of patients seeking endodon-

TMD Pain Screener score	Numeric rating of current pain intensity of the chief complaint										
	0*	1	2	3	4	5	6	7	8	9	10
0											
1											
2											
3											
4											
5											
6											
7											

Figure 1. TMD prediction by combinations of thresholds for the 6-question TMD Pain Screener and the current pain intensity of the chief complaint. Teal boxes are predicted non-TMD cases and yellow boxes are predicted TMD cases. *Some patients were not experiencing pain at the moment of the visit, even though they have had pain in the preceding 30 days, and therefore “0” current pain rating is included in the grid..

tic evaluation and treatment for tooth pain suffered from TMD pain. TMD pain was a contributing factor in 20% of these patients and the sole contributing factor in 8%. Persistent “tooth pain” after root canal treatment may be at least in part attributable to TMD. Thus, TMD screening in endodontic patients can be crucial for an accurate diagnosis. Unfortunately, performing a full TMD examination using the validated Diagnostic Criteria for TMD (DC/TMD) is time-consuming and not always practical.

An alternative, the TMD Pain Screener, has shown promise in patients tested in health care centers, but has only been studied in patients without tooth pain or in settings that did not allow for comparison with screening responses from DC/TMD examinations in endodontic patients.

Daline et al from the University of North Carolina at Chapel Hill tested the sensitivity, specificity, predictive values and area under the receiver operating characteristic curve (AUROC) of both the 6-question and the 3-question TMD Pain Screener in patients seeking endodontic evaluation and nonsurgical root canal treatment or retreatment who had suffered tooth pain in the preceding month. They aimed to arrive at a simple screening tool effective for use in an endodontic

office. Over a 14-month period, they recruited 100 patients from 3 university endodontic clinics.

At the first visit, patients completed the full 6-question version of the TMD Pain Screener, which has a scoring range from 0 to 7; scores ≥ 3 were considered positive for TMD. Patients also completed several other screening tests, including the Chief Pain Complaint Questionnaire, the Graded Chronic Pain Scale Revised (GCPS-R) and the Patient Health Questionnaire (PHQ-4), a test for anxiety and depression. These patients underwent clinical examination to determine the presence or absence of TMD myalgia or arthralgia, diagnosis of which was established if all 3 of the following criteria were met:

- a history of jaw/face pain in the previous 30 days
- a worsening or resolving of pain by jaw function/parafunction
- reproduction of familiar pain by maximum mandibular opening or by muscle and/or temporomandibular joint (TMJ) palpation

A standardized and thorough endodontic examination followed.

The full, 6-question TMD Pain Screener resulted in an AUROC

score of 0.71, which indicates “useful accuracy.” To improve the accuracy of the screening test, the researchers evaluated 6 characteristics previously identified as positive association with the prevalence of TMD in endodontic patients. Adding current pain intensity to the TMD Pain Screener resulted in an AUROC score increase to 0.81, creating a useful TMD prediction tool (Figure 1). Adding any other TMD pain predictors did not result in greater screening accuracy.

Conclusion

Due to the high prevalence of TMD pain in endodontic patients, a simple diagnostic aid could greatly help the practitioner when making a differential diagnosis. The combination of the 6-question TMD Pain Screener with the patient’s rating of current pain intensity created a useful and accurate tool to detect TMD pain in patients seeking endodontic treatment.

Daline IH, Slade GD, Fouad AF, et al. Diagnostic accuracy of temporomandibular disorder pain screener in patients seeking endodontic treatment for tooth pain. J Endod 2024;50:55-63.

In the next issue:

- Bone growth around autotransplanted teeth
- Effects of cigarette smoke inhalation on apical periodontitis

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