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Association Between Apical Periodontitis and Systemic Inflammation

Many studies over the past several decades have found a correlation between periodontal disease and a host of systemic morbidities, including atherosclerotic cardiovascular disease, diabetes, pneumonia, adverse pregnancy outcomes and chronic obstructive pulmonary diseases; one study found a possible link between marginal periodontitis and Parkinson disease. The connection appears to be inflammatory mediators in the bloodstream.

Although apical periodontitis may present with such clinical signs as inflammation, pain, swelling, redness and loss of function, it can also be asymptomatic for years, undiscovered unless spotted by the practitioner on a radiograph. But even asymptomatic apical periodontitis can affect the level of systemic inflammatory mediators and thereby have a negative impact on overall health. To better understand this relationship, Georgiou et al from the University of Amsterdam and Vrije Universiteit, the Netherlands, undertook a systematic review of the available evidence and conducted a meta-analysis of the results.

After a thorough search of the relevant published research, the authors found 20 studies (with a total of >800 patients) that matched the inclusion criteria for their systematic review, including 9 studies that had not been included in the only previous systematic review, conducted in 2013, on this topic. Of the qualifying studies, 12 were case-control studies. The remaining 8 were interventional studies, which assessed inflammatory markers before and after treatment that included pus drainage, antibiotic administration, endodontic treatment, extraction or a combination of these. Some studies were limited to patients with either asymptomatic or symptomatic apical periodontitis; others included both.

The studies tested for a wide range of inflammatory markers in the bloodstream; sufficient data were collected from the case-control studies to conduct 6 meta-analyses. In the largest comparisons, the authors found a significant relationship between elevated levels of C-reactive protein, an inflammatory marker directly linked to atheroscle-

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Table 1. Systemic inflammatory markers: impact on patients with apical periodontitis vs controls.

Significantly higher levels in patients:

C-reactive protein (patients with either severe PAI or moderate PAI)
Asymmetrical dimethylarginine
Interleukin-6

No significantly different levels in patients:

Circulating immune complex
Reactive oxygen species

rotic vascular disease and increased risk of acute cardiovascular events, and patients with apical periodontitis accompanied by either a severe or moderate periapical index (PAI). They also found a significant relationship between elevated levels of asymmetrical dimethylarginine and interleukin-6 (Table 1).

A further meta-analysis showed that treatment for apical periodontitis significantly reduced the levels of C3 complement, a protein network associated with metabolic syndrome, diabetes and cardiovascular risk. A further meta-analysis failed to prove that treatment reduced C-reactive protein levels. However, both meta-analyses were based on small, older studies, which calls into question their reliability.

Conclusion

The sum of our current knowledge indicates that untreated apical periodontitis contributes to systemic inflammation, known to negatively affect human health. Because of the wide variation among the published data in inclusion criteria, sample size, follow-up times and controlling for confounding factors such as smoking and depression, further study is warranted to find the pathway through which apical periodontitis has an impact on systemic inflammation

and how this can be most effectively treated.

Georgiou AC, Crielaard W, Armenis I, et al. Apical periodontitis is associated with elevated concentrations of inflammatory mediators in peripheral blood: a systematic review and meta-analysis. J Endod 2019;1279-1295.

Impact of Endodontic Treatment on Quality of Life

Study after study has shown excellent clinical success or survival rates of teeth after endodontic treatment. But evaluating outcomes based only on clinical parameters overlooks current trends that emphasize patient-centered outcomes, especially quality of life (QoL). Oral health-related quality of life (OHRQoL) indices allow us to expand outcome measures beyond the mere absence of disease to include physical, psychosocial and social well-being. Unfortunately, only 1 systematic review that addresses OHRQoL after endodontic treatment has been published.

Leong and Yap from Ng Teng Fong General Hospital, Singapore, attempted to remedy this lack of knowledge by conducting a systematic review of articles published through July 2018 that reported studies of QoL in patients who received endodontic treatment. Included in the review were clinical studies that measured QoL in patients

- ≥18 years of age
- who received any endodontic treatment
- with a functional coronal restoration of ≥6 months

The authors found 6 (3 cross-sectional, 1 case-control and 2 cohort) studies that met their criteria. All the published papers involved nonsurgical root canal therapy; no studies evaluating QoL after endodontic surgery required ≥6 months of occlusal function.

Four of the 6 studies concluded that nonsurgical root canal treatment improved patients' OHRQoL. The remaining 2 studies, which focused on patients with persistent pain after endodontic treatment, found that persistent pain had a negative impact on those patients' QoL but had minimal impact on daily activities. Five studies that looked at patient satisfaction stratified by who had performed the root canal treatment (endodontist, general dentist, postgraduate student) arrived at inconsistent results, although the authors suggested that the results could have been influenced by the fact that endodontists tend to treat more complex cases.

Conclusion

Although the evidence remains scanty, the existing studies show that nonsurgical endodontic treatment improves patients' QoL. Further research in

this area could help practitioners understand how patients' perceptions and preferences should be considered when planning treatment.

Leong DJX, Yap AUJ. Quality of life of patients with endodontically treated teeth: a systematic review. Aust Endod J 2019;doi:10.1111/aej.12372.

Comparing Anesthetic Efficacy In Treatment of Irreversible Pulpitis

For many years, lidocaine has been the local anesthetic most commonly employed by dentists. When combined with adrenaline, lidocaine, with its rapid onset and typical duration of 60 minutes for pulpal anesthesia and 3 to 5 hours for soft tissue anesthesia, has proven effective in maintaining adequate pain management, an essential tool for patient comfort and reducing fear and anxiety in typical patients. However, lidocaine has proven less effective in inducing profound anesthesia in patients in need of endodontic treatment, especially in teeth with symptomatic irreversible pulpitis.

Some studies have reported that articaine, which is metabolized differently from lidocaine more effectively achieves profound pulpal anesthesia in these patients. But other studies have found little difference in outcomes. Although several systematic reviews and meta-analyses of multiple studies have been undertaken, the results have been inconclusive, in part, perhaps, because the individual

studies differ widely in types of teeth treated and method of administration.

Nagendrababu et al from International Medical University, Malaysia, conducted an umbrella review—a relatively new methodology that analyzes the results from a group of systematic reviews—to determine whether 4% articaine should be preferred to 2% lidocaine combined with a vasoconstrictor when treating teeth with irreversible pulpitis. The authors hoped to resolve 4 questions about the 2 anesthetic solutions:

- which one was the most effective local anesthetic solution
- which one was associated with the least pain during injection
- which one had the most rapid onset of pulpal anesthesia
- which one had the fewest adverse events

Five systematic reviews with 35 individual meta-analyses published between 2011 and 2019 met their criteria for inclusion.

All 5 reviews concluded that articaine was significantly more successful than lidocaine (Table 2). In the 3 reviews

that performed a separate analysis for maxillary teeth using the infiltration technique, 2 found articaine outperformed lidocaine; all 4 of the reviews that performed a separate analysis for mandibular teeth found articaine had a better success rate, regardless of delivery method.

Only 1 review analyzed the time to onset of anesthesia; articaine had a more rapid onset. The same review, the only one to analyze pain during injection and adverse effects, associated articaine with a lower pain score and fewer adverse effects.

Conclusion

The authors concluded that sufficient evidence shows that articaine outperforms lidocaine following inferior alveolar nerve blocks, infiltrations and supplemental injections during endodontic treatment of teeth with irreversible pulpitis. Limited available evidence suggests that articaine injections are less painful, have a more rapid onset of anesthesia and fewer adverse effects.

Nagendrababu V, Duncan HF, Whitworth J, et al. Is articaine more effective than lidocaine in patients with irreversible pulpitis? An umbrella review. Int Endod J 2019; doi:10.1111/iej.13215.

Table 2. Successful pulpal anesthesia rate for articaine vs lidocaine.

Study	Odds ratio favoring articaine
Brandt et al (2011)	2.44
Kung et al (2015)	2.21
Su et al (2016)	
per patient	1.15
per tooth	1.10
St. George et al (2018)	1.60
Nagendrababu et al (2019)	1.42

Postoperative Pain After Occlusal Reduction

The reported prevalence of postoperative pain after root canal treatment varies widely. Most postoperative pain dissipates fairly rapidly, with severity falling by 50% after the first day and to <10% by day 7. Given the multifactorial causes and varying perceptions by individual patients, it is not surprising that many treatment modalities have been proposed to relieve postoperative pain after root canal treatment, including

- preoperative medication
- postoperative medication
- long-acting anesthetics
- intracanal medicament
- laser therapy
- glide path preparation
- rotary instrumentation
- machine-assisted irrigant agitation
- occlusal reduction

The theory behind occlusal reduction—the selective removal of dental hard tissue resulting in the loss of some of the anatomical features of the occlusal surface—holds that removing occlusal contacts reduces mechanical stimulation, thus decreasing pressure on a tooth with inflamed periapical tissues. While studies have touted the benefits of occlusal reduction on postoperative pain following endodontic treatment, the evidence remains scant and inconsistent.

Nguyen et al from the University of Melbourne, Australia, conducted the

first systematic review and meta-analysis of published studies employing occlusal reduction to manage postoperative pain after root canal treatment. The 7 studies that qualified for their systematic review were randomized clinical trials that measured postoperative pain with a visual analog scale (VAS) after ≥ 6 hours.

The studies showed inconsistent results, perhaps due in part to differing inclusion criteria, methodology, follow-up and outcome assessment. Of the 7 studies, which included just under 1000 patients, 3 found that occlusal reduction effectively reduced or prevented postoperative pain after root canal treatment, while 4 found no significant effect. Only 1 study found significant pain reduction in the first 24 hours.

The results suggested that occlusal reduction was an effective treatment to reduce postoperative pain in teeth with irreversible pulpitis that were tender to percussion, as well as in teeth with symptomatic apical periodontitis without remarkable radiographic changes. A meta-analysis of the 3 studies that measured postoperative pain at day 6, which included more than three-quarters of all patients in the systematic review, determined that occlusal reduction decreased postoperative pain at the 6-day follow-up.

Several confounding factors could have influenced the results. Use of either preoperative analgesia or low-dose corticosteroids, both recognized treatments to reduce postoperative pain, were included in most of the studies. Instrumentation (manual or rotary) varied among the studies, as did irrigation solutions and the use of intracanal medications.

Conclusion

Because occlusal reduction requires the permanent removal of enamel or dentin, the practitioner must weigh any possible negative sequelae of the procedure. Nevertheless, the results of this study suggest that occlusal reduction decreases postoperative pain after root canal treatment in teeth diagnosed with irreversible pulpitis and symptomatic apical periodontitis.

Nguyen D, Nagendrababu V, Pulikkotil SJ, Rossi-Fedele G. Effect of occlusal reduction on postendodontic pain: a systematic review and meta-analysis of randomised clinical trials. *Aust Endod J* 2019;doi:10.1111/aej.12380.

In the next issue:

- Periodontitis and chronic disease medication on nonsurgical root canal treatment
- Influence of missed canals on periapical lesions
- Association between dental anxiety and intraoperative pain

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