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CADTH RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL

Endodontic Therapy Interventions for Root Canal Failure in Permanent Dentition: A Review of Clinical Effectiveness, Cost-Effectiveness, and Guidelines

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Context and Policy Issues

Root canal, or endodontic treatment, is a procedure in which an inflamed or infected pulp is removed, and the inside of the tooth is cleaned, disinfected, then filled and sealed with a restorative material. The procedure has a high success rate, although persistence of symptoms or infection recurrence can occur in 10% to 15% of cases.[1]Tooth survival over two to 10 years following initial root canal treatment was shown in a systematic review to range between 86% and 93%.[2] In many cases of infection or symptom recurrence, a second root canal treatment (root canal re-treatment) is considered. Apicoectomy is usually needed when root canal re-treatment is not successful, and is a procedure in which the root tip, or apex, is removed along with the infected tissue, then a root end filling (retrofilling) is placed to seal the area.[3] Factors associated with a better chance of success of apicoectomy include patients ≤ 45 years old, upper anterior or premolar teeth, cases without preoperative pain, lesions without periodontal involvement, absence of perforating lesions, and teeth with only one periapical surgery.[4-6] In the case of apicoectomy failure, the tooth may need to be extracted.

This Rapid Response report aims to review the clinical and cost-effectiveness of endodontic interventions (root canal re-treatment, apicoectomy and retrofilling) after failed root canal treatment, compared to initial root canal treatment alone (no treatment) or tooth extraction. Guidelines associated with the use of root canal re-treatment, apicoectomy with or without apical curettage, and retrofilling in permanent teeth will also be examined.

Research Question

1. What is the clinical effectiveness of root-canal re-treatment in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

2. What is the clinical effectiveness of apicoectomy with or without apical curettage in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

3. What is the clinical effectiveness of retrofilling in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

4. What is the cost-effectiveness of root-canal re-treatment in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

5. What is the cost-effectiveness of apicoectomy with or without apical curettage in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

6. What is the cost-effectiveness of retrofilling in permanent teeth after failed root canal treatment compared to initial root canal treatment alone (i.e. no treatment) or tooth extraction?

7. What are the evidence-based guidelines regarding the use of root canal re-treatment, apicoectomy with or without apical curettage, and retrofilling in permanent teeth?

Methods

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, economic studies, randomized controlled trials, non-randomized studies, and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2007 and February 7, 2017.

Rapid Response reports are organized so that the evidence for each research question is presented separately.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Children and adults (all ages) with permanent teeth, presenting with root canal treatment failure Subgroups of interest: Indigenous populations
Intervention	Root canal re-treatment Apicoectomy with or without apical curettage Retrofilling
Comparator	Initial root canal treatment alone; tooth extraction (No comparator required for guidelines)
Outcomes	Treatment success rate, clinical benefits and harms (e.g., pain, infection, root fracture, root perforation) Cost-effectiveness outcomes (e.g., cost per health benefit/QALY) Evidence-based guidelines, including indications for use
Study Designs	Health technology assessments (HTA), systematic reviews (SR), meta-analyses (MA), randomized controlled trials (RCTs), non-RCTs, economic evaluations, guidelines.

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2007.

Quantity of Research Available

A total of 656 citations were identified in the literature search. Following screening of titles and abstracts, 639citations were excluded and 17 potentially relevant reports from the electronic search were retrieved for full-text review. Two potentially relevant publications were retrieved from the grey literature search. Of these potentially relevant articles, 19 publications were excluded for various reasons, and no publications met the inclusion criteria and were included in this report. Appendix 1 describes the PRISMA flowchart of the study selection. Additional references of potential interest that did not meet the selection criteria are provided in Appendix 2.

Summary of Findings

No evidence was identified regarding the clinical and cost effectiveness of endodontic interventions following a failed root canal treatment. No evidence-based guidelines for endodontic re-treatment were identified.

Conclusions and Implications for Decision or Policy Making

There was no evidence found on the clinical and cost-effectiveness of endodontic interventions (root canal re-treatment, apicoectomy and retrofilling) after failed root canal treatment, compared to initial root canal treatment alone (no treatment) or tooth extraction. There were no guidelines found associated with the use of root canal re-treatment, apicoectomy with or without apical curettage, and retrofilling in permanent teeth.

The literature search identified some studies with potential interest which reported the clinical effectiveness of root canal re-treatment and apicoectomy with no comparator, or with a comparator which was not initial root canal treatment alone or tooth extraction. A list of these studies is provided in Appendix 2. A 2008 systematic review of longitudinal studies with a minimum of 6-month follow-up which investigated the success rates of root canal re-treatment found the rate of complete healing of the permanent tooth was 76.7%.[7] A systematic review of RCTs up to February 2016 compared the clinical effectiveness of the surgical (apicoectomy) or non-surgical (root canal re-treatment) approach for tooth healing, and found no evidence of superiority of either approach at one- year, four-year and 10-year follow-up.[8] This non-superiority was also reported by a 2015 systematic review of randomized and non-randomized studies that found no statistically significant difference in the long-term follow-up (more than four years) between the surgical and non-surgical approaches to re-treatment.[9] A retrospective analysis based on German insurance claims data of 93,797 apicoectomies showed tooth cumulative survival rates of 91.4%, 85.7% and 81.6% at one year, two years and three years, respectively.[10] For comparison, retrospective data analysis based on German insurance claims data of 556,067 initial root canal treatments found the cumulative survival rate of 93.0%, 88.2% and 84.3% at one year, two years and three years, respectively.[11] A Canadian prospective study on the outcomes of apicoectomy on 134 teeth after a minimum of four years and up to 10 years after treatment showed 74% were healed and 94% were functional (without signs or symptoms).[12] The 5-year prognosis after apicoectomy was 8% poorer (75.9%

healed) than at one year (83.8% healed) in a prospective study on 191 subjects.[13] In summary, these studies showed, for re-treatment following an initial root call, that the success rate for the non-surgical approach (root canal re-treatment) was over 76% at a minimum of 6 months follow-up, while the success rate for the surgical approach (apicoectomy) was over 81% after three-year follow-up. Comparisons between the re-treatment with surgical and non-surgical approaches to re-treatment do not show superiority of either approach in long-term follow-up.

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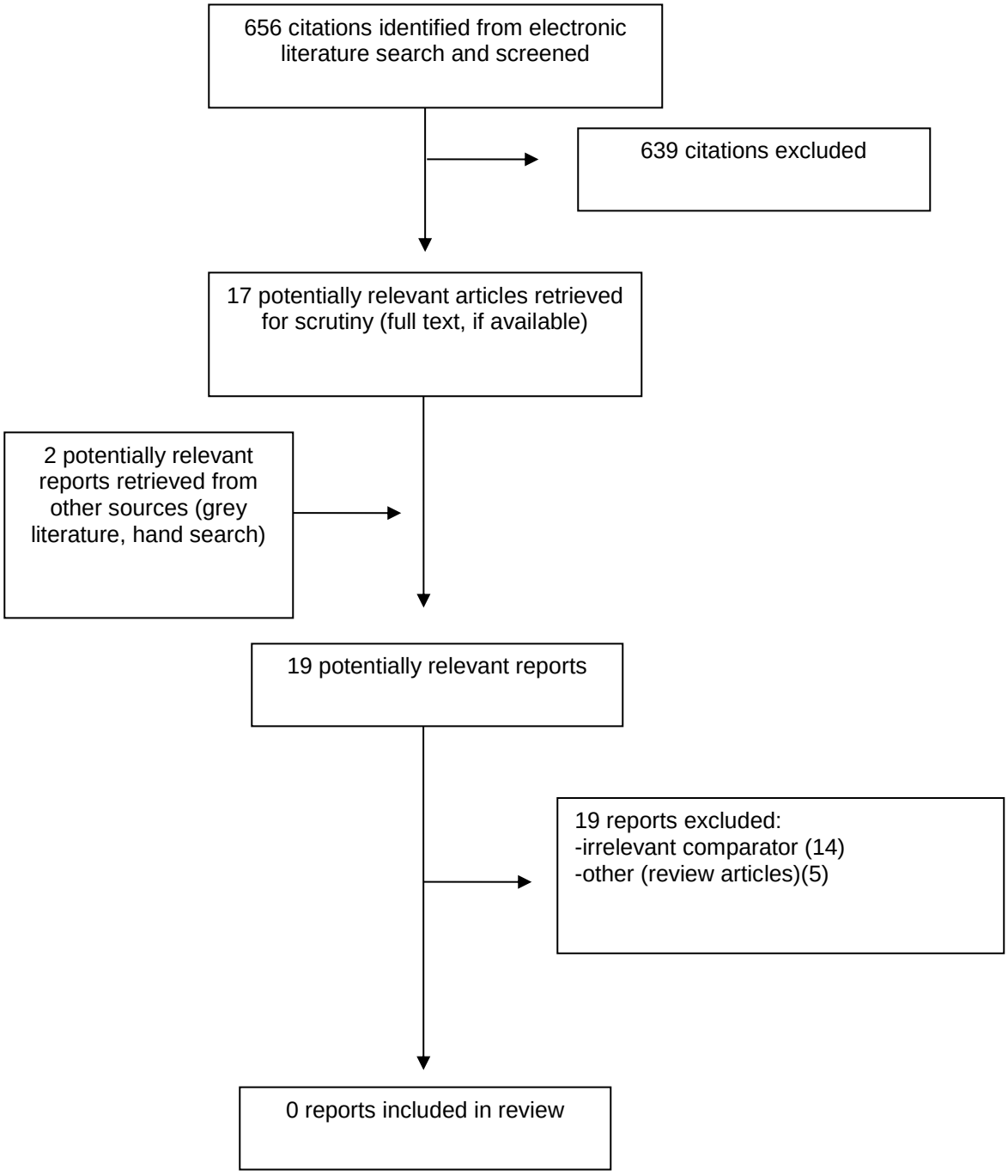
Appendix 1: Selection of Included Studies



Appendix 2: Additional References of Potential Interest (studies that compared different retreatment approaches)

Systematic reviews

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