

---

## **Outcome of primary root canal treatment: systematic review of the literature. Part 1: effects of study characteristics on probability of success**

*Ng Y L, Mann V, Rahbaran S, Lewsey J, Gulabivala K*

---

### **CRD summary**

The review aimed to determine the influence of study characteristics on the estimated pooled success rates for primary root canal treatment. The authors concluded that success rates for strict radiographic criteria ranged from 68% to 85%, and that the evidence for treatment factors affecting primary root canal outcome is insufficient. This is a reasonable interpretation of the evidence presented.

### **Authors' objectives**

To determine the influence of study characteristics on the estimated pooled success rates for primary root canal treatment.

### **Searching**

MEDLINE and the Cochrane Library were searched up to December 2002. Search terms were reported. In addition, four key journals (International Endodontic Journal; Journal of Endodontics; Oral Surgery Oral Medicine Oral Pathology Endodontics Radiology; Dental Traumatology and Endodontics), abstracts and conference proceedings were also searched. Personal contacts and the references of all relevant papers and review articles were checked in order to identify any additional papers. Only papers published in English, German, Chinese and Japanese were included.

### **Study selection**

Clinical studies investigating primary root canal treatment with at least six months post-operative follow-up, reporting overall success (based on clinical and/or radiographic criteria), were included in the review. Where studies had included root canal re-treatment cases, results were included only if stratified analysis of primary root canal treatment were available. Sample size was required to be reported.

Randomised controlled trials (RCTs), prospective cohort studies and retrospective observational studies were included in the review. Treatment outcome was determined by radiographic examination alone (R) or in combination with clinical findings (R&C). Radiographic criteria of success were reported as 'strict' in the majority of included studies, and operator qualification was classified as undergraduate, general dental practitioner, postgraduate student or specialist. Approximately a third of the included studies used undergraduate operators and a third of included studies used specialist operators. Fifteen studies reported follow-up of at least four years. Unit of measure was tooth or root (single-rooted teeth). Most of the included studies were conducted in the USA/Canada. Other countries included: Scandinavia, UK, Israel, Holland, Saudi Arabia, Italy, Japan, Switzerland, South Africa, India, Australia, Germany, Turkey and Hong Kong.

Three reviewers independently selected papers for inclusion in the review and any disagreements were resolved through discussion.

### **Assessment of study quality**

The authors did not state that the validity of the included studies was assessed.

### **Data extraction**

Overall success rates (percentage) were extracted or calculated from raw data for each study. Radiographic criteria of success were categorised into 'strict' (complete resolution of peri-apical lesion at recall) and 'loose' (reduction in size of existing peri-apical lesion at recall). Data were extracted onto a pre-designed and piloted form.

Three reviewers independently extracted data from the included studies and any disagreements were resolved through discussion. Initial agreements among the reviewers were moderate (K=0.57 to 0.61).

## Methods of synthesis

Studies were pooled in a meta-analysis using a random-effects model, in order to calculate weighted pooled success rates, grouped by factor (decade of publication), study specific criteria for success (radiographic or combined radiographic and clinical), unit of outcome measure (tooth or root), duration after treatment (at least four years versus less than four years), geographical location (USA, Scandinavian or other), and qualification of the operator (specialist, postgraduate, undergraduate, general dental practitioner or mixed group). Un-weighted pooled success rates were also calculated. Summary estimates were reported as success rates (percentage) with their 95% confidence intervals. Statistical heterogeneity was assessed using the Cochran's Q test, and meta-regression was used to investigate potential sources of heterogeneity as well as investigate the impact of factors specific factors on success rate.

## Results of the review

Sixty-three studies were included in the review (number of patients not reported): six randomised controlled trials, eight prospective cohort studies, and 49 retrospective observational studies.

Recall rates were reported in thirty-nine studies (median 52.7%, range 11 to 100%), and sample sizes ranged from 22 to 2,921 teeth or 38 to 2,921 roots. Fewer than a third of the studies using radiographic assessment of outcome employed at least two observers to carry out the assessment, and observers were calibrated prior to evaluation of radiographs in eight studies and intra/inter observer reliability tests were carried out in nine studies.

Outcome measure used: Pooled success rates (combining the two examination methods: radiographic examination alone and radiographic examination in combination with clinical findings) were 74.7% (95% confidence interval (CI): 69.8 to 79.5; 40 studies) using strict radiographic criteria, and 85.2% (95% CI: 82.2 to 88.3; 36 studies) using loose radiographic criteria. Meta-regression analysis indicated that success rates based on strict radiographic criteria were significantly lower than success rates based on loose radiographic criteria (10.5%, 95 CI: 4.4 to 16.7;  $p=0.001$ ). Radiographic criteria were found to be a substantial source of statistical heterogeneity.

Duration after treatment: Pooled success rates increased with longer follow with strict radiographic criteria, ranging from 29.6% (95% CI: 14.2 to 73.3; two studies) at six months, to 67.7% (95% CI: 39.0 to 96.4) at 12 months, to 85.4% (95% CI: 80.3 to 90.6; eight studies) at greater than 48 months. No obvious trend in success rate was found by duration of follow-up when loose radiographic criteria were used.

Year of publication: No obvious trend in success rate was found by decade of publication.

Geographic location: North American countries more frequently reported success rates based on loose radiographic criteria and Scandinavian countries more frequently reported success rates based on strict radiographic criteria. Pooled success rates using loose criteria were 70.3% for Scandinavian countries, 88.1% for North America and 84.5% for 'other' countries. Pooled estimate using strict criteria for Scandinavian countries was 80.5%.

Qualification of operators: One study directly compared outcome of treatment by qualification of operators. This study found no statistically significant difference in success rates for operator based on qualification. Weighted pooled estimates for success (strict/loose) were: 74.8% (95% CI: 67.0 to 82.7; 14 studies) and 83.3% (95% CI: 75.8 to 90.9; 11 studies) for undergraduates; 65.7% (95% CI: 56.3 to 75.1; six studies) and 86.2% (95% CI: 82.9 to 89.5; five studies) for general dental practitioners; 77.2% (95% CI: 64.5 to 89.8; four studies) and 93.1% (95% CI: 91.5 to 94.7; two studies) for postgraduate students; and 84.8% (95% CI: 80.1 to 89.4; 11 studies) and 87.6% (95% CI: 83.9 to 91.3; 17 studies) for specialists.

Meta-regression indicated that none of the study characteristics investigated were found to have a significant effect on the success rates reported (separately on loose or strict radiographic criteria) or account for any of the statistical heterogeneity found.

## Authors' conclusions

Estimated weighted pooled success rates of treatments completed at least one year previously ranged between 68% and 85% when strict radiographic criteria were used. These reported success rates did not appear to have changed over the last four/five decades. The quality of the evidence for treatment factors affecting primary root canal treatment was sub-optimal.

### CRD commentary

The review question was supported by clear inclusion criteria. Two databases were searched for relevant studies and the authors made attempts to locate unpublished studies. However, some studies could have missed as inclusion was restricted by language (English, German, Chinese and Japanese). Methods used to select papers and extract data were likely to have minimised the possibility of reviewer error and bias. The authors did not appear to have systematically assessed the validity of the included studies, but some aspects of quality were reported. Appropriate meta-analytic methods were used. Overall, the authors' conclusion is a reasonable interpretation of the evidence presented, although the range of success rates would appear to include data derived using both strict and loose criteria.

### Implications of the review for practice and research

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that greater standardisation in aspects of study design, data recording and outcome data is needed in future studies.

### Funding

Not reported.

### Bibliographic details

Ng Y L, Mann V, Rahbaran S, Lewsey J, Gulabivala K. Outcome of primary root canal treatment: systematic review of the literature. Part 1: effects of study characteristics on probability of success. *International Endodontic Journal* 2007; 40(12): 921-939

### PubMedID

17931389

### DOI

10.1111/j.1365-2591.2007.01322.x

### Original Paper URL

<http://onlinelibrary.wiley.com/journal/118494119/abstract>

### Indexing Status

Subject indexing assigned by NLM

### MeSH

Humans; Probability; Research Design; Root Canal Therapy; Treatment Outcome

### AccessionNumber

12008005035

### Date bibliographic record published

30/09/2008

### Date abstract record published

12/08/2009

### Record Status

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.