Pain Prevalence and Severity before, during, and after Root Canal Treatment: A Systematic Review

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Abstract

Introduction: Anticipation and experience of root canal associated pain is a major source of fear for patients and a very important concern of dentists. Pretreatment, treatment, and posttreatment pain is anticipated, experienced, remembered, and shared by patients. The purpose was to determine the influence of root canal treatment on pain prevalence and severity and estimate the prevalence and severity of pretreatment, treatment, and posttreatment pain in patients receiving root canal treatment. **Methods:** Defined searching of MEDLINE, Embase, Cochrane, and PsycINFO databases identified 5,517 articles. Systematic review, including title scanning, abstract scanning, full-text review, and quality rating, provided 72 studies for meta-analysis. L'Abbe plots were used to evaluate the influence of root canal treatment on pain prevalence and severity. Pretreatment, treatment, and posttreatment pain prevalence and severity data were analyzed. **Results:** L'Abbe plots revealed that pain prevalence and severity decreased substantially after treatment. Mean pretreatment, 24-hour posttreatment, and 1-week posttreatment pain prevalences with associated standard deviations were 81 (28%), 40 (24%), and 11 (14%), respectively. Pretreatment, 24-hour posttreatment, and 1-week posttreatment pain severities, on a 100-point scale, were 54 (24%), 24 (12%), and 5 (5%), respectively. Supplemental injections were frequently required (60 [24%]). **Conclusions:** Pretreatment root canal–associated pain prevalence was high but dropped moderately within 1 day and substantially to minimal levels in 7 days. Pretreatment root canal–associated pain severity was moderate, dropped substantially within 1 day of treatment, and continued to drop to minimal levels in 7 days. Supplemental anesthesia was often required. *(J Endod 2011;37:429–438)*

Key Words

Endodontic, L'Abbe plot, meta-analysis, pain, prevalence, root canal, severity

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Pain of endodontic origin is widely feared by the public (1–3). Root canal procedures are commonly believed to be the most painful dental treatment, but only 17% of subjects experiencing root canal treatment described it as their most painful dental experience (4). Indeed, the provision of over 15 million elective root canal treatments annually in the United States suggests that the public values root canal treatment (5). Rigorous systematic reviews have shown that root canal treatment facilitates the long-term retention of teeth with pulpal or periradicular disease that would otherwise likely be extracted (6, 7). Root canal treatment obviously alleviates pain of endodontic origin, but this important benefit has not yet been subjected to systematic review or meta-analysis.

Accurate knowledge of pain prevalence and severity associated with pulpal or periradicular disease and its diminution by root canal treatment has the potential to change the attitudes of the public, dentists, and other health care professionals, thus allowing more natural teeth to be retained. Dentists could be better guided by the best evidence in making anesthesia and pain management treatment decisions. In addition, more accurate evidence-based advice could be given to individual patients by individual dentists. This would improve the basis upon which individual patients make their own informed treatment decisions. Furthermore, data on expected pain could be used to reassure patients during treatment and healing or to identify those who fall beyond the norms, so that additional care could be appropriately provided. However, the extant literature containing data on endodontic pain is rather disparate and primarily includes articles focusing on other topics, typically prognostic variables, treatment variables, or medications (8, 9). Direct comparisons of pretreatment, treatment, and posttreatment pain are extremely rare (10–12). Thus, it is difficult for the dentist to identify, assimilate, or synthesize data on root canal treatment–associated pain in a clinically applicable manner.

Systematic review uses defined methods to search, critically appraise, and synthesize the available literature pertaining to a clinical question. Systematic review is a fundamental scientific activity that methodically digests large quantities of information to find an answer to a research question. It is an efficient and reproducible scientific technique that produces generalizable findings. It also allows the researcher to assess consistency of relationships and to explain inconsistencies and conflicts in data. Furthermore, it increases power and precision of estimations. Hence, systematic review and meta-analysis are widely regarded as providing the highest level of clinical evidence (8, 13–16). The purpose of this study was to determine the influence of nonsurgical root canal treatment on pain prevalence and severity in adult patients and to estimate the prevalences and severities of pain experienced before, during, and after root canal treatment through systematic review and meta-analysis.

Materials and Methods

A systematic review was developed following established guidelines (9). Methodology included the following: formulating review questions using a PICO (patient population, intervention, comparison, and outcome) framework, constructing a search strategy, defining inclusion and exclusion criteria, locating studies, selecting studies, assessing study quality, extracting data, and interpretation.

The following review questions were formulated to determine the influence of nonsurgical root canal treatment in adult patients on pain prevalence and severity estimations and allow the comparison of pretreatment, treatment, and posttreatment pain in patients requiring and receiving root canal treatment: (1) In adult patients receiving

TABLE 1. Search Strategy for Root Canal Treatment–associated Pain

I	((exp Endodontics/or exp Dental Pulp Diseases/or exp Periapical Diseases/or exp "Root Canal Filling Materials"/or Dental Pulp Test/or Dental Pulp/or Dental Pulp Cavity/) or (("root canal".mp. or apicectom:.mp. or apicoectom:.mp. or (dead adj3 (teeth or tooth)).mp. or (dental adj3 pulp:).mp. or endodont:.mp. or endont:.mp. or endosonic.mp. or ((lateral or vertical) adj condensation).mp. or ((non-vital or nonvital) adj3 (teeth or tooth)).mp. or obtura.mp. or obturation.mp. or obturate.mp. or (pulp adj3 (capping or therap: or extirpation:)).mp. or (pulp adj (canal$1 or chamber$1)).mp. or pulpectomy.mp. or pulpotomy.mp. or replantation.mp. or ("root" adj end adj5 fill:).mp. or ((silver or gutta) adj3 (percha or balata)).mp. or (silver adj (cone$1 or point$1)).mp. or thermafil.mp. or trans-polyisoprene.mp. or transpolyisoprene.mp. or ultrafil.mp.) or ((periradicular or radicular or periapical or apical).mp. and (exp tooth/or exp tooth components/))) not (*Apicoectomy/or *Dental Implantation, Endosseous, Endodontic/or *Retrograde Obturation/or *Tooth Replantation/)) and (Clinical Protocols/or exp Clinical trials/or exp Patient Care Management/or Patient Selection/or Practice Guidelines/or clinic:.mp. or (recall adj3 appointment$1).mp. or ((patient or research) adj3 (recruitment or selection)).mp. or (selection adj3 (criteria or treatment or subject$1)).mp. or (treatment adj protocol$1).mp. or ra.fs. or radiograph:.mp. or ah.fs. or histolog:.mp. or (nonsurg: or non-surg:).mp.) and (exp Disease progression/ or exp Morbidity/ or exp Mortality/ or exp "Outcome assessment (health care)"/ or exp Patient satisfaction/ or exp Prognosis/ or exp Survival analysis/ or exp Time factors/ or exp Treatment outcome/ or ((beneficial or harmful) adj3 effect$).mp. or co.fs. or course.mp. or (inception adj cohort$1).mp. or (natural adj history).mp. or outcome$1.mp. or predict$.mp. or prognos$.mp. or surviv$3.mp. or fail$5.mp. or longevity.mp. or durability.mp. or succes:.mp. or random$.ti,ab. or predispos$.ti,ab. or causa$.ti,ab. or exp Case-control studies/ or (case$1 adj control$).ti,ab. or exp Cohort studies/ or exp "Comparative study"/ or exp Epidemiological Studies/ or odds ratio/ or (odds adj ratio$1).ti,ab. or exp Risk/ or risk$.ti,ab. or Meta-analysis/ or Meta-analysis.pt. or practice guideline.pt. or exp Clinical Trials/ or (randomized controlled trial or controlled clinical trial).pt. or random$.ti,ab. or (systematic adj review$1).mp. or Retreatment/ or Recurrence/ or (retreat: or revis:).mp.)
II	(Dental anxiety/ or odontophobia.mp. or ((dental or dentist:) adj5 (pain or anxi: or phob: or fear)).mp. or ((Pain/ or Fear/ or Anxiety/) and (exp Dentistry/ or exp Stomatognathic System/ or exp Stomatognathic diseases/)) or ("Quality of Life"/ or exp Consumer Satisfaction/ or Attitude/ or ((consumer$1 or patient$1) adj5 (satisf: or preference$1 or accept:)).mp.))
III	((Dentition, Primary/ or (immatur: adj3 (teeth or tooth)).mp. or (open adj3 (apex or apices or apexes)).mp. or blunderbuss.mp. or limit to (preschool child <2 to 5 years> or child <6 to 12 years>)) not (Dentition, Mixed/ or Dentition, Permanent/ or Adolescent/ or (mature adj3 (teeth or tooth)).mp. or (closed adj3 (apex or apices or apexes)).mp. or limit to all adult <19 plus years>)) not (Animal/ not Human/)) limit to English language

I lists MeSH keywords and search terms for non-surgical root canal treatment. II lists the MeSH keywords and search terms for psychosocial data. III lists the MeSH keywords and search term limits.

nonsurgical root canal treatment, does root canal treatment decrease pain prevalence? (2) In adult patients requiring nonsurgical root canal treatment, what is the prevalence of pretreatment pain? (3) In adult patients receiving nonsurgical root canal treatment, what is the prevalence of treatment pain? (4) In adult patients receiving nonsurgical root canal treatment, what is the prevalence of posttreatment pain? (5) In adult patients receiving nonsurgical root canal treatment, does root canal treatment decrease pain severity? (6) In adult patients requiring nonsurgical root canal treatment, what is the severity of pretreatment pain? (7) In adult patients receiving nonsurgical root canal treatment, what is the severity of treatment pain? and (8) In adult patients receiving nonsurgical root canal treatment, what is the severity of posttreatment pain?

Inclusion and Exclusion Criteria

Inclusion criteria further refined the review questions; these included comparative or noncomparative, prospective or retrospective, longitudinal data including prevalence and severity of pretreatment and posttreatment pain; incidence of treatment pain; anesthetic efficacy; and incidence of flare-ups, swelling, and emergencies. Inclusion criteria for article included the following: articles published in English from January 1966 to December 2009, adult subjects, secondary teeth, and a quality rating of 19 or more in the Wong Scale–Revised. (17) Exclusion criteria consisted of literature that failed to meet these inclusion criteria; root canal treatment caused by trauma; treatment modalities not currently being used, such as the blanket prescription of antibiotics without specific indication, the use of paraformaldehyde containing sealers, and so on; gray literature (literature not listed in MEDLINE, Cochrane, PsycINFO, or EMBASE databases); and studies without pain measurement outcomes.

Search Methodology

Electronic searches were performed in MEDLINE, Cochrane, EMBASE, and PsycINFO databases. The search strategies for MEDLINE, Cochrane, and EMBASE databases were as follows: "endodontic studies" and for "psychosocial outcomes" in a prior investigation but with the addition of the term "pain" (Table 1) (6). The search strategy for PsycINFO was simply keyword (periapical disease OR endodontics OR root canal). The results were supplemented by hand searches, citation mining, and expert recommendation. Hand searching involved reviewing the table of contents of every issue of the most recent 2 years of the following journal titles: *American Journal of Dentistry*, *International Endodontic Journal*, *Journal of Dentistry*, *Journal of Endodontics*, *Journal of Oral Rehabilitation*, *Oral Surgery Oral Medicine Oral Pathology and Oral Radiology*, and *Endodontics, Pain, and Quintessence International*. The citation mining and expert recommendation processes incorporated relevant materials that did not appear in database searches, such as book chapters or review articles. Experts were consulted to recommend additional articles or books for review. Two investigators screened the titles and abstracts of all articles identified in the electronic and hand searches. Articles that did not meet the search criteria were excluded. All remaining articles were full-text reviewed in the second stage of the process.

Study Quality Rating

The quality of study methodology, design, and data analysis was assessed using the Wong Scale–Revised. Studies were assessed by reviewer responses to nine questions; a score of 1 (inappropriate), 2 (mediocre), or 3 (appropriate) was assigned to each question. Out of a comprehensive total score of 9 to 27, a score under 19 indicated that the methodology, design, and analysis of the study failed to support the reliability of the authors' conclusions, necessitating exclusion from the meta-analysis (17).

Data Analysis

L'Abbe plots were used to depict the effect of root canal treatment intervention on the prevalence and severity of pain. Studies that reported