The Prognosis of Altered Sensation after Extrusion of Root Canal Filling Materials: A Systematic Review of the Literature

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Abstract

Introduction: The aim of this study was to systematically review and evaluate the literature regarding the prognosis of altered sensation after extrusion of root canal filling materials and the possible factors influencing it. **Methods:** A systematic search of the literature was performed to identify studies that reported on altered sensation after extrusion of root canal filling materials during endodontic treatments. The articles were evaluated for their relevance based on strict inclusion criteria, and the identified suitable articles were subject to data extraction and analysis. **Results:** Initially, 109 possibly relevant articles were identified. After screening and full-text evaluations, 28 articles that met the inclusion criteria were analyzed, reporting on a total of 84 patients with altered sensation after extrusion of root canal filling materials. All the included studies, except 1 case series, were case reports. Under the limited available data, the extracted data showed that 91% of the patients had fully or partially recovered over time. Most of the cases in the lower molars as well as most of the cases in which the obturation was performed using paraformaldehyde-containing sealer or cases in which an immediate treatment was not performed did not fully recover. **Conclusions:** The current scientific knowledge regarding the prognosis of nerve injuries caused by overextruded endodontic materials relies primarily on case reports. Within the limitations of the published data, it seems that the tooth locations, types of extruded materials and the obturation technique, and treatment after the injury may affect the nerve injury prognosis. *(J Endod 2016;42:873–879)*

Key Words

Altered sensation, nerve injury, root canal filling materials, root canal treatment

Nerve injury and an ensuing altered sensation represent a serious complication of endodontic treatments (1–9). Endodontic treatment–related nerve injuries result from mechanical, chemical, or thermal trauma to nerve bundles. These injuries may occur either by direct trauma during the treatment or after the treatment when secondary intra-alveolar edema develops with subsequent increased pressure inside the mandibular canal (5, 8, 10–14).

Three-dimensional obturation of the root canal system constitutes 1 of the goals of endodontic treatment. Ideally, the filling material should be confined to the root canal space without extending to periapical tissues or other neighboring structures (15, 16). However, if filling materials are accidentally extruded to neighboring neurovascular structures, nerve injury with an ensuing altered sensation may occur (3, 6–8, 15, 17, 18).

Numerous reports were published on the management of nerve injuries related to overextended filling materials, but they significantly vary in the cases' characteristics and treatment protocols and present inconsistent and confusing results (2, 3, 5, 7, 17, 19–23). Evidence-based dentistry is an approach to oral health care that integrates the best available clinical evidence to support the practitioner's clinical expertise for each patient's treatment needs and preferences (24–26). Thus, an evidence-based review of the available literature regarding the prognosis of altered sensation after extrusion of endodontic materials and its possible influencing factors is important.

The aim of this study was to systematically review and evaluate the literature regarding the prognosis of altered sensation after extrusion of root canal filling materials and the possible factors influencing it.

Materials and Methods

Criteria for Considering Studies for the Systematic Review

The inclusion criteria for the systematic review were as follows:

1. Clinical studies reporting the extrusion of endodontic root canal filling materials during an endodontic treatment (*root canal filling materials* defined as "any material or combination of materials placed inside a root canal for the purpose of obturating and sealing the canal space" [27])
2. Altered sensation diagnosed after the endodontic procedure

Reviews, animal studies, *in vitro* studies, and studies not relevant to the topic of this study were excluded.

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Search Methods for the Identification of Studies

The search covered all articles published in dental journals from 1976 to July 2015. The following electronic databases were searched: MEDLINE using the PubMed search engine (http://www.ncbi.nlm.nih.gov/sites/pubmed) and Scopus (http://www.scopus.com). The following gray literature databases were also searched: HealthInfonet (http://www.healthinfonet.ecu.edu.au), Closing the Gap Clearinghouse (http://www.aihw.gov.au/closingthegap), and OpenGrey (http://www.opengrey.eu).

The following key words were used for an initial search through MEDLINE: (((root canal filling) OR endodontic)) AND ((nerve injury) OR altered sensation). The Medical Subject Headings (MeSH) received were as follows: ((("root canal obturation"[MeSH Terms] OR ("root"[All Fields] AND "canal"[All Fields] AND "obturation"[All Fields]) OR "root canal obturation"[All Fields] OR ("root"[All Fields] AND "canal"[All Fields] AND "filling"[All Fields]) OR "root canal filling"[All Fields]) OR endodontic[All Fields]) AND (((("nerve tissue"[MeSH Terms] OR ("nerve"[All Fields] AND "tissue"[All Fields]) OR "nerve tissue"[All Fields] OR "nerve"[All Fields]) AND ("wounds and injuries"[MeSH Terms] OR ("wounds"[All Fields] AND "injuries"[All Fields]) OR "wounds and injuries"[All Fields] OR "injury"[All Fields])) OR (altered[All Fields] AND ("sensation"[MeSH Terms] OR "sensation"[All Fields]))) AND "humans"[MeSH Terms].

An additional search was then performed through Scopus databases using the same key words. Related articles and the reference lists of the literature reviews that were retrieved by the MEDLINE search engine were manually checked for possible further eligible articles. No language restriction was applied.

Data Collection and Analysis

Selection of Studies. The articles were initially evaluated for relevance based on their titles and abstracts by 2 reviewers independently (E.R. and I.T.). Possibly eligible studies were subject to a full-text evaluation. The full text of the relevant studies was obtained and reviewed for suitability based on the inclusion criteria described previously. Cases of disagreement were discussed together until agreement was reached. The identified suitable articles were subject to data extraction and analysis and were also assessed for their methodological quality and their suitability to inclusion in a meta-analysis.

Data Extraction. Data were extracted by 2 reviewers independently (E.R. and T.G.). Cases of disagreement were subject to joint evaluation by the reviewers until agreement was reached. The following variables were recorded:

1. *Preoperative variables:* The patients' demographics (age and sex) and the involved tooth location
2. *Intraoperative variables:* The type of sealer (16, 28, 29) and the obturation technique (16) (lateral condensation, vertical condensation, or sealer only technique)
3. *Postoperative variables:* The type of nerve injury (8, 30) (*anesthesia,* defined as insensitivity to all forms of stimulation; *paresthesia,* defined as a sensation such as burning, prickling, or partial numbness; and *hyperesthesia,* defined as increased sensitivity to all forms of stimulation [8]); the time of treatment (7, 8) (*immediate treatment,* defined as treatment within 48 hours of injury, and *delayed treatment,* defined as treatment performed later than 48 hours after the injury); the preformed treatment (surgical treatment, nonsurgical treatment, or no treatment); the follow-up time (in months); and the reported outcome (full recovery, partial recovery, or no recovery) (7, 8)

Assessment of the Studies' Methodological Quality and Suitability for a Meta-analysis of the Results. The studies were evaluated for the possibility of a meta-analysis of their results based on the assessment of their methodological quality (31) and heterogeneity.

Results

The search in the MEDLINE database using the PubMed search engine identified 77 articles. Through the other sources, 93 articles were identified, and after the removal of duplicates, the additional articles not previously identified in MEDLINE included 21 articles identified using Scopus databases and 11 possibly relevant articles identified by the manual search. No additional studies were found in the gray literature database search. Eventually, 109 studies were initially evaluated for relevance based on their titles and abstracts. Possibly eligible studies were then subject to a full-text evaluation as previously described. The diagram of the article selection process is presented in Figure 1 (32).

All the included studies (3, 12, 15, 19, 33–55), except 1 case series (7), were case reports. As a result, a meta-analysis could not be performed. The included articles were subject to data extraction and descriptive statistics. Table 1 presents data retrieved from the included studies.

The details regarding the evaluated variables were not fully reported in all included studies; thus, the results are presented as a percentage from the number of cases in which the particular variable was reported. There were 28 included articles that reported on a total of 84 cases of patients who presented with altered sensation after extrusion of root canal filling materials, including 26 (84%) female patients and 5 (16%) male patients, with an average age of 39 years (range, 16–70 years).

There was 1 (3%) case reported in the first lower premolar, 6 (19%) in the second lower premolar, 11 (36%) in the first lower molar, 11 (36%) in the second lower molar, and 2 (6%) in the third lower molar. There were no cases reported in other tooth locations.

In 3 (11%) cases, zinc oxide eugenol–based sealer was used; in 1 (4%) case, a calcium hydroxide–based sealer was used; in 8 (29%) cases, a resin-based sealer was used; in 11 (39%) cases, a paraformaldehyde-containing sealer was used; in 4 (13%) cases, core materials only were used; and in 1 (4%) case, another sealer type was used.

In 6 (33%) cases, lateral condensation was used as the obturation technique; in 3 (17%) cases, vertical condensation was used; and in 9 (50%) cases, a sealer-only technique was used.

In 11 (33%) cases, anesthesia alone was diagnosed; in 7 (21%) cases, paresthesia alone was diagnosed; in none of the cases, hyperesthesia alone was diagnosed; in 2 (6%) cases, other types of nerve injury were reported; and in 13 (40%) cases, a combination of more than 1 type of altered sensation was reported.

In 7 (8%) cases, immediate treatment was performed; in 27 (32%) cases, delayed treatment was performed; and in 50 (60%) cases, no treatment was performed. From the treated cases, a surgical treatment was performed in 23 (68%) cases, and in 8 (24%) cases a nonsurgical treatment was performed. In 3 (9%) cases, both surgical and nonsurgical treatments were performed.

The average follow-up time was 10 months (range, 0–42 months). In 18 (53%) cases, a full recovery was reported; in 13 (38%) cases, a partial recovery was reported; and in 3 (9%) cases, no recovery was reported.

The distribution of the evaluated pre-/intra-/postoperative variables according to the type of outcome reported, with "full