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Effect of Occlusal Reduction on Postoperative Pain in Symptomatic Irreversible Pulpitis and Apical Periodontitis: A Systematic Review of Randomized Clinical Trials

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Abstract

Objectives: Acute dental pain due to symptomatic irreversible pulpitis associated with symptomatic apical periodontitis represents one of the most challenging emergencies in endodontics. Occlusal reduction has traditionally been proposed as an adjunctive procedure to relieve postoperative pain following root canal treatment. This systematic review aimed to evaluate the effectiveness of occlusal reduction in reducing postoperative pain intensity in patients with symptomatic irreversible pulpitis and apical periodontitis. **Materials and Methods:** A comprehensive electronic search was conducted in PubMed, ScienceDirect, and Google Scholar for studies published between 2012 and 2022, using the keywords occlusal reduction, symptomatic irreversible pulpitis, and symptomatic apical periodontitis. Boolean operators were applied. Inclusion criteria were randomized or prospective clinical trials published in English or French that evaluated the effect of occlusal reduction in endodontically treated teeth diagnosed with symptomatic irreversible pulpitis, with or without apical periodontitis. Five studies met the eligibility criteria and were included in the review. **Statistical Analysis:** Postoperative pain intensity, assessed using Visual Analog Scale (VAS) or Numeric Rating Scale (NRS) at different time intervals, and analgesic or placebo consumption were recorded. Due to heterogeneity in study designs and outcome measures, a qualitative synthesis was performed. **Results:** Five clinical trials published between 2013 and 2021, involving a total of 499 patients, were analyzed. Two studies reported a significant reduction in postoperative pain during the first 12 - 24 hours following occlusal reduction compared with control groups, whereas three studies found no statistically significant difference between groups. Analgesic consumption did not differ sig-

nificantly across the included studies. Variability in methodology, tooth type, instrumentation techniques, and evaluation intervals may account for the conflicting results. **Conclusions:** Current evidence suggests that occlusal reduction may provide limited short-term benefits in reducing postoperative pain in endodontically treated teeth with symptomatic irreversible pulpitis and apical periodontitis, particularly within the first 12 - 24 hours. However, its overall effectiveness remains inconsistent, and occlusal reduction should not be recommended as a routine adjunctive procedure. Further well-designed randomized controlled trials are required to clarify its clinical relevance.

Subject Areas

Dentistry

Keywords

Occlusal Reduction, Symptomatic Irreversible Pulpitis, Symptomatic Apical Periodontitis, Postoperative Pain, Endodontics

1. Introduction

Symptomatic irreversible pulpitis, often referred to as "toothache", is a frequent dental emergency characterized by severe spontaneous pain, sensitivity to percussion, and difficulty in pain control with conventional analgesics. When associated with symptomatic apical periodontitis, the inflammatory process extends beyond the pulp to periapical tissues, further intensifying the pain experience [1].

Endodontic therapy remains the treatment of choice in such situations, with reported success rates between 74% and 97% depending on the presence of preoperative periapical lesions [2]. In addition to root canal treatment, occlusal reduction has historically been proposed as an adjunctive measure to decrease mechanical stimulation of sensitized nociceptors, thereby potentially reducing postoperative pain [3].

However, the irreversible nature of occlusal reduction and the increasing emphasis on minimally invasive dentistry necessitate a critical evaluation of its real clinical benefit. This systematic review aimed to investigate whether occlusal reduction provides a significant reduction in postoperative pain in patients with symptomatic irreversible pulpitis and apical periodontitis undergoing endodontic treatment.

2. Materials and Methods

2.1. Study Design

A systematic review of the literature was conducted following a structured research strategy.

2.2. Search Strategy

Electronic searches were performed in PubMed, ScienceDirect, and Google Scholar

from January 2012 to December 2022. Keywords included *occlusal reduction*, *symptomatic irreversible pulpitis*, and *symptomatic apical periodontitis*. Boolean operators were applied:

- "Occlusal reduction AND symptomatic irreversible pulpitis".
- "Occlusal reduction AND symptomatic apical periodontitis".
- "Symptomatic irreversible pulpitis AND symptomatic apical periodontitis".
- Combined equation with all three terms.

2.3. Eligibility Criteria

Inclusion criteria:

- Randomized or prospective clinical trials.
- Published in English or French between 2012 and 2022.
- Studies evaluating occlusal reduction in teeth with symptomatic irreversible pulpitis ± apical periodontitis.
- Outcomes measured: postoperative pain (VAS or NRS), analgesic consumption.

Exclusion criteria:

- Case reports, in vitro studies, reviews, animal studies, or non-controlled trials.

2.4. Data Extraction and Analysis

Two reviewers independently screened titles, abstracts, and full texts. Duplicates were removed. Data extracted included author, year, country, study design, sample size, tooth type, intervention (occlusal reduction protocol), control, and outcomes. Due to heterogeneity in methodology, a qualitative synthesis was performed without meta-analysis.

3. Results

3.1. Search Results

A total of 1,670 articles were identified through electronic database searching and manual searching. After removal of 1,195 duplicate records, 475 articles remained for initial screening. Following title screening, 370 articles were excluded, leaving 105 articles for abstract assessment. After abstract screening, 55 articles were excluded, and 50 articles were retained for full-text evaluation. Finally, 5 clinical trials met all eligibility criteria and were included in the review [4]-[8] (**Figure 1**).

3.2. Study Characteristics

The five included studies were published between 2013 and 2021, conducted in Iran, Nepal, and Egypt, with sample sizes ranging from 44 to 308 participants [4]-[8]. All studies involved patients diagnosed with symptomatic irreversible pulpitis and tenderness to percussion, with or without symptomatic apical periodontitis (**Table 1**).

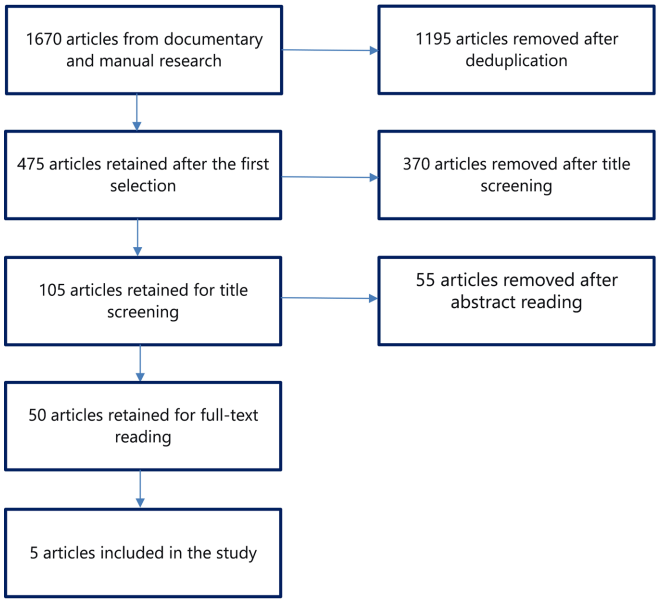

Figure 1. Flowchart of study selection (PRISMA diagram).

Table 1. Characteristics of included studies between occlusal reduction and control groups.

Author (Year)	Country	Study Design	Sample Size	Diagnosis	Tooth Type	Journal
Parirokh M. *et al.* (2013)	Iran	Randomized Clinical Trial	54 teeth	Symptomatic irreversible pulpitis + percussion sensitivity	Posterior teeth (maxillary & mandibular)	*Journal of Endodontics*
Ghimire S. *et al.* (2020)	Nepal	Non-randomized Clinical Trial	48 patients	Symptomatic irreversible pulpitis + mild percussion sensitivity	Posterior teeth (maxillary & mandibular)	*Journal of College of Medical Sciences*
Emara R. S. *et al.* (2018)	Egypt	Prospective Double-blind Randomized Clinical Trial	44 patients	Symptomatic irreversible pulpitis + apical periodontitis	Mandibular posterior teeth	*International Endodontic Journal*
Fathy M. S. *et al.* (2021)	Egypt	Randomized Clinical Trial	44 patients	Symptomatic irreversible pulpitis + apical periodontitis	Maxillary & mandibular premolars, molars	*Acta Scientific Dental Sciences*
Ahmed Y. E. *et al.* (2020)	Egypt	Prospective Randomized Controlled Clinical Trial	308 patients	Symptomatic irreversible pulpitis + perpercussion sensitivity	Mandibular premolars and molars	*International Endodontic Journal*

Pain Outcomes (Table 2):

- **Parirokh *et al.* (2013)** [4]: No significant difference in postoperative pain reduction.
- **Ghimire *et al.* (2020)** [5]: Similar results, with no significant differences overall; some subgroups (>45 years) reported higher pain with occlusal reduction.
- **Emara *et al.* (2018)** [6]: Reported significant pain reduction at 12 hours post-instrumentation in the occlusal reduction group, but no long-term benefit.
- **Fathy *et al.* (2021)** [7]: No significant differences in pain scores or analgesic intake between groups.

Table 2. Pain outcomes and analgesic intake across included studies.

Author (Year)	Pain Evaluation Method	Follow-up Intervals	Main Findings on Pain	Analgesic/Placebo Intake
Parirokh M. *et al.* (2013)	VAS	6 h, 12 h, 18 h, 24 h, 2 - 6 days	Both groups showed significant pain reduction over time; **no significant difference** between occlusal reduction and control	No significant difference between groups
Ghimire S. *et al.* (2020)	VAS	24 h, 2 - 6 days	**No significant difference** overall; in patients > 45 years, occlusal reduction group reported **higher pain on days 5 - 6**	Not specified
Emara R. S. *et al.* (2018)	VAS	6 h, 12 h, 24 h, 48 h (post-instrumentation and post-obturation)	Pain significantly reduced at **12 h** in occlusal reduction group; no long-term difference	Placebo/analgesic use slightly higher in control group, but not significant
Fathy M. S. *et al.* (2021)	VAS	6 h, 12 h, 24 h, 48 h (post-instrumentation and post-obturation)	**No significant difference** in pain intensity between groups	No significant difference between groups
Ahmed Y. E. *et al.* (2020)	NRS	6 h, 12 h, 24 h, 48 h (post-instrumentation and post-obturation)	**Significant pain reduction** at 12 h and 24 h in occlusal reduction group; effect not maintained after obturation	No significant difference between groups

- **Ahmed *et al.* (2020)** [8]: Found significant short-term reduction in pain intensity at 12 - 24 hours in the occlusal reduction group, but no effect on medication use.

4. Discussion

This systematic review evaluated the effect of occlusal reduction on postoperative pain in patients with symptomatic irreversible pulpitis associated with apical periodontitis. Overall, the findings indicate that occlusal reduction may provide limited short-term pain relief within the first 12 - 24 hours following root canal treatment; however, its overall effectiveness remains inconsistent across studies [6] [8].

Two randomized controlled trials [6] [8] demonstrated a statistically significant reduction in early postoperative pain, supporting the hypothesis that eliminating occlusal contacts may reduce mechanical loading and stimulation of inflamed periapical tissues [3]. In contrast, three other studies [4] [5] [7] failed to show a significant benefit, suggesting that postoperative endodontic pain is more strongly influenced by inflammatory mediators and neurogenic mechanisms than by occlusal forces alone [9]. These conflicting results indicate that occlusal reduction is not a universally effective strategy for pain control.

A notable and counterintuitive finding was reported by Ghimire *et al.* [7], who observed higher pain levels at days 5 - 6 postoperatively in patients over 45 years of age who underwent occlusal reduction. This challenges the traditional rationale of occlusal adjustment as a pain-relieving adjunct. Possible explanations include age-related changes in periodontal ligament mechanoreception, delayed inflammatory resolution, or altered pain perception in older patients. In addition, occlu-

sal reduction may disrupt established occlusal balance, potentially leading to transient instability or compensatory functional adaptations that could exacerbate discomfort rather than relieve it. This finding highlights the importance of patient-related factors, particularly age and occlusal dynamics, in modulating the clinical response to occlusal modification.

Interpretation of the results is further limited by significant heterogeneity among the included studies [4]-[8]. Differences in study design, occlusal reduction protocols, sample sizes, and pain evaluation intervals complicate direct comparison. Moreover, variations in endodontic treatment strategies, such as single-visit versus multiple-visit procedures, may have influenced postoperative pain outcomes, as interappointment flare-ups are more frequently associated with multi-visit treatments. Differences in instrumentation techniques (manual, rotary, or reciprocating systems) may also affect apical debris extrusion and periapical tissue irritation, thereby confounding the isolated effect of occlusal reduction.

Importantly, the irreversible removal of tooth structure inherent to occlusal reduction must be considered in light of the principles of minimally invasive dentistry, as emphasized in the Introduction. In the absence of consistent and sustained clinical benefit, unnecessary removal of sound tooth structure cannot be justified and may contradict current conservative treatment philosophies.

Analgesic consumption, assessed in all included studies [4]-[8], did not differ significantly between occlusal reduction and control groups. This suggests that occlusal reduction does not reduce the need for pharmacological pain management and should not be viewed as an alternative to established analgesic protocols.

Clinical Implications: Based on the available evidence, routine occlusal reduction cannot be recommended for all cases of symptomatic irreversible pulpitis or apical periodontitis. Its use should be limited to carefully selected situations in which clear clinical indicators of occlusal overload are present, such as visible wear facets, fremitus, marked tenderness related to hyperocclusion, or a patient's clear sensation of a "high bite" on the affected tooth. Even in such cases, occlusal reduction should be performed conservatively and within a well-defined diagnostic framework.

Limitations: This review included only five clinical trials with heterogeneous methodologies, limiting the strength and generalizability of the conclusions. In addition, the literature search was restricted to studies published up to December 2022; therefore, results from major trials published thereafter may further clarify the clinical value of occlusal reduction. Future well-designed randomized controlled trials with standardized endodontic protocols, consistent pain assessment methods, and predefined subgroup analyses are required.

5. Conclusion

Occlusal reduction may reduce short-term postoperative pain in patients with symptomatic irreversible pulpitis and apical periodontitis, particularly within the first 24 hours [6] [8], but evidence remains inconsistent [4] [5] [7]. It should be

reserved for selected cases rather than applied as a routine adjunctive procedure.

Conflicts of Interest

The authors declare no conflicts of interest.

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