

Pain Perception during Intrapulpal Anesthesia: A Systematic Literature Review

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ABSTRACT

Intrapulpal injections are a blessing in disguise to endodontists. Every endodontist would have successfully achieved pain relief in cases by administering intrapulpal injections. The satisfaction of painless pulp extirpation to the dentist and comfortable endodontic treatment experienced by the patient following intrapulpal anesthesia cannot be emphasized more. At the same time, intrapulpal injections are themselves extremely painful. The objective of this systematic review is to determine the pain associated with the administration of intrapulpal injections through a systematic review.

Keywords: Intrapulpal anesthesia, Irreversible pulpitis, PRISMA 2020, Pain perception.

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INTRODUCTION

Pulpitis is one of the few dental conditions that need emergency care. By the rule of thumb, any inflammation causes edema. In a pulpitis scenario, there is no effective drainage of the edema fluid as the pulp chamber is a closed cavity. This increases the intrapulpal pressure. The management of acute pulp inflammation is to relieve the intrapulpal pressure by draining the fluid and extirpate the inflamed pulp. Draining fluid can be achieved by opening the coronal access and with anti-inflammatory medications. Extirpation of the inflamed pulp is important as this prevents further accumulation of edema fluid. In addition to the intrapulpal pressure, the pain in pulpitis is attributed to the nerve terminals in the chamber. A delta and C fibers get stimulated because of the inflammatory process leading to a specific type of pain.¹

RATIONALE

Emergency access opening and pulp extirpation is the one-step pain relieving procedure that helps manage both conditions. Access opening can be an extremely painful procedure by itself if not anesthetized properly. Thus, achieving adequate pulp anesthesia is important for a painless endodontic treatment. In most cases, the common anesthetic techniques of buccal infiltration and inferior alveolar nerve block are adequate to achieve profound anesthesia.

When the primary anesthetic technique fails, supplementary techniques like intraligamentary, intraosseous, and intrapulpal anesthesia are administered.²⁻⁴ Intrapulpal injections are indicated when pulp anesthesia is not achieved even after adequate soft tissue anesthesia and the patient feels pain when the pulp chamber is entered. The effect of the intrapulpal injection is immediate but extremely painful with a shorter duration of effective anesthesia. Thus, it is important to assess pain perception during intrapulpal anesthesia. Extol literature review done in this regard has brought forth the necessity to consolidate the body of knowledge about pain perception during intrapulpal anesthesia. So, a literature review was commissioned to throw much light on the intricacies

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involved in the study concept. Systematic review articles give a detailed evidence-based insight of the topic.⁵⁻⁷

OBJECTIVE

This article consolidates the available literature that helps to determine the pain associated with the administration of intrapulpal injections. The PRISMA 2020⁸ is adopted as a guide for executing the systematic review.

Intrapulpal injections are a blessing in disguise to endodontists. Every endodontist would have successfully achieved pain relief in pulp extirpations by administering intrapulpal injections. The satisfaction of painless pulp extirpation to the dentist and comfortable endodontic treatment experienced by the patient following intrapulpal anesthesia cannot be emphasized more. At the same time, intrapulpal injections are themselves extremely painful.⁹ Various research articles were published related to supplementary anesthetic techniques.^{10,11} Although the literature is scanty in this area, available literature was reviewed to assess the pain during intrapulpal injections. The gathered research is consolidated for steering the research aspirants in the field. Accordingly, the following research questions were framed.

Table 1: Keywords

Keyword 1	Pain perception during intrapulpal anesthesia
Keyword 2	Intrapulpal anesthesia as supplementary anesthetic technique

RESEARCH QUESTIONS

- What was the pain response among patients during the administration of intrapulpal injections?
- What are the procedures which could alter the pain scale during administration of intrapulpal injections?

METHODOLOGY

The methodology of the systematic literature review was executed by identifying the keywords. These keywords were finalized by reviewing the significance of the topic and the allied topics related to the study.

SELECTION OF KEYWORDS

The keywords used to search the database are tabulated in [Table 1](#).

ELIGIBILITY CRITERIA

After deciding the list of keywords to use for collecting the literature, eligibility criteria were decided to proceed for further collection of literature. Decision about the eligibility criteria not only consolidates the relevant literature but also guides for further systematic literature review.

The eligibility criteria for selecting the articles to answer the research questions were decided by the following criteria.

Inclusion Criteria

- English language published articles
- Published between 2001 and 2023
- Studies on human, adult patients
- Clinical studies/published clinical trials related to pain in irreversible pulpitis and intrapulpal injections

Exclusion Criteria

- Articles in languages other than English
- Clinical trials that are not yet published
- Articles with clinical studies on children, nonhuman subjects
- Articles published related to pain management for other dental treatments
- Repeated content

By adhering to these norms of eligibility following data repositories were verified.

DATA REPOSITORIES

The following databases were reviewed between April 1 and May 3, 2023 to identify the relevant studies using the specified keywords.

- SpringerLink
- Science Direct
- Taylor and Francis
- PubMed
- Cochrane and Embase database

Table 2: Details about the databases selected, articles extracted

Database	Searched articles	Reviewed after exclusions	Relevant articles to the research questions
ScienceDirect Keyword 1	15	13	0
ScienceDirect Keyword 2	22	14	0
SpringerLink Keyword 1	8	6	0
SpringerLink Keyword 2	3	3	0
Taylor and Francis Keyword 1	5	3	0
Taylor and Francis Keyword 2	4	3	0
PubMed Keyword 1	3	2	2 (Research question 2)
PubMed Keyword 2	3	1	0
Cochrane and Embase	2	2	2 (Duplicated articles)
Total	65	47	2

Cochrane and Embase searches resulted in documents repeated in PubMed. So, they were excluded. The results were supplemented with hand search and citation mining.

SEARCH STRATEGY

The above-mentioned databases were searched for with two different keywords for each database. Year of publication (2001–2023) and only original research papers were added in the filter to make the search specific. As there was not much work done in the area related to pain perception during intrapulpal anesthesia, a long span of studies was considered (2001–2023). The details about the database, initial set of articles, and final set of selected articles are listed in [Table 2](#).

ANALYSIS

A total of 65 articles were collected using the two keywords from the five databases. All the articles went through the process of critical review for the selection of a final list of articles and data collection. Data items were listed and a synthesis of the information from the selected articles was made. The results were listed as follows.

A detailed review of the relevant 27 articles that were considered out of 37 originally selected articles from the ScienceDirect library was done. About 13 articles with keyword 1 search^{10–22} and 14 articles with keyword 2 search^{11,13–16,18,23–30} were extracted. Following the suit, a detailed review of the relevant 8 articles out of 11 articles from keyword 1^{31–36} and keyword 2 search^{31,37,38} from the SpringerLink database was done. Also, a review of the five relevant articles out of nine articles from Taylor and Francis searches was done, and three articles^{39–41} meeting keyword 1 search as well as three articles satisfying keyword 2^{39,42,43} search were extracted. Finally, three relevant articles^{44–46} were retrieved from PubMed.

Table 3: Description of the selected articles for review

Year	Author	Aim	Methodology	Outcome
2020 ⁴⁴	Suresh Nandini et al.	To assess the pain perception during intrapulpal anesthesia using thinner gauge needles and syringes with or without topical anesthesia as an adjunct	Clinical study; randomized trial; assessed pain with visual analog scale	Thinner the needle gauge, less painful was the intrapulpal injection
2015 ⁴⁵	Sooraparaju et al.	To determine whether the topical application of benzocaine gel along with hyaluronidase to the pulp chamber could reduce the pain felt with the intrapulpal injection technique	Clinical study; assessed pain with visual analog scale	Topical application of 20% benzocaine gel with hyaluronidase to exposed pulp reduces the pain during intrapulpal injection

Articles from Cochrane and Embase search engines were duplicated in PubMed, thus they were excluded.

RESULTS

Extracted articles were finally reviewed with research questions 1 and 2. As mentioned initially, there was a dearth of literature related to the study topic. Only two articles were finally selected depending on their suitability to the research questions.

It was found that most of the articles from Science Direct were on irreversible pulpitis and they either have tested various chemical agents or techniques for achieving local anesthesia other than intrapulpal anesthesia. None of them answered our research questions. It was found that from the SpringerLink articles, one article studied the effect of endoic on anesthetizing the tooth, while the other article discussed the effect of cooling before administering the buccal infiltration anesthesia in maxillary molars. As in the previous database review, none of the two addressed the research questions. Also, it was found that none of the articles from Taylor and Francis search provided sufficient information to answer the research questions. Finally, three relevant articles from PubMed^{44–46} searches were analyzed and among them, two articles were found to answer the research question. Except for the two articles, there is no study documented from 2001 to 2023 on the identification of pain response during the administration of intrapulpal pressure from the searches done within the limitations of this review.

It is surprising to observe that there is no article found to be relevant to research question 1 and only two articles could answer research question 2.^{44,45} First article identified the effect of the thickness of the needle gauge on pain perception during intrapulpal pressure. The results of the clinical trial showed that a 31 gauge needle provided adequate anesthesia with less pain during injection. The second article explained the reduction of pain following the use of topical benzocaine gel before intrapulpal anesthesia.⁴⁵ Results are tabulated in Table 3.

CONCLUSION

The systematic literature review could demonstrate that there is no article published that identified the pain scale on administration of intrapulpal anesthesia (research question 1) under the limitations of this systematic review. However, there were two articles published that suggested methods to reduce pain during administration of intrapulpal anesthesia (research question 2). Further clinical studies are needed to analyze the pain response in such situations.

The detailed analysis of the available literature through this systematic review reaffirms the need to encourage more research in the area of intrapulpal anesthesia, particularly the pain perception during administration. This systematic literature review brought forth the gray areas to work in these dental procedures. The risk of bias could not be avoided due to the smaller number of articles satisfying the research question. This highlights the gap in the literature that can be addressed by prospective researchers.

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