

# Evaluation of Postoperative Pain after Pulpectomy using Different File Systems in Primary Teeth: A Systematic Review

## Abstract

**Objective:** The purpose of this systematic review was to compare the incidence and intensity of postoperative pain after pulpectomy using different instrumentations in primary teeth. **Materials and Methods:** An extensive literature search in PubMed, Cochrane Library, Science Direct, LILAC, SIGLE, and Google Scholar was performed to identify English language articles with human subjects that evaluated the effects of different instruments on postoperative pain after pulpectomy. **Results:** The search retrieved 187 references. After screening of the abstracts and articles, based on the inclusion and exclusion criteria, a total of three articles were included in the systematic review. Of the three included studies, two of them had a moderate risk of bias and one showed a high risk of bias. **Conclusion:** The use of rotary instruments contributed to a lower incidence and intensity of postoperative pain than did the hand instruments in all the three studies. More high-quality randomized clinical trials are needed in this field in future studies to support the evidence.

**Keywords:** Instrumentation, postoperative pain, pulpectomy, randomized clinical trials, systematic review

## Introduction

Pulpectomy is the treatment of choice for the primary tooth where there is evidence of chronic inflammation involving radicular pulp or pulp necrosis with or without periapical involvement.<sup>[1]</sup> Endodontic treatment in the primary teeth is more challenging due to the complex anatomy and tortuous course of root canals.<sup>[2]</sup> The success of pulpectomy is determined by the aseptic root canal preparation and hermetic seal of the root canals.<sup>[3]</sup> The biomechanical preparation (BMP) is the paramount step that determines the success of the pulpectomy.<sup>[4]</sup>

In the field of pediatric endodontics, there has been improvement not only with the materials used but also with the techniques used for instrumentation. Hand files were used for canal preparation of the primary teeth traditionally but have also been reported to be more time-consuming and resulted in iatrogenic errors. The BMP in the primary teeth using nickel-titanium rotary files reduced the instrumentation time and resulted in more conical-shaped

canals by considerable dentin removal ensuring adequate root canal cleaning and shaping.<sup>[4,5]</sup>

The reciprocating files work in a reverse “balanced force” cutting motion instead of a rotary motion and are driven by a preprogrammed motor that directs the files in a back and forth “reciprocating motion.” The reciprocating motion improved the flexibility of files that adapts better to the tortuous root canals, thereby providing better cleaning efficacy and improved safety of the shaping procedure.<sup>[6,7]</sup>

A brief complication is the postoperative pain that embarks within few hours or days after endodontic therapy. Several factors have been associated with the incidence of postendodontic pain including age, sex, pulpal and periradicular status, type of tooth, sinus tract, preoperative pain, and technical factors. The significant factor is the instrumentation procedure that can provoke an acute periapical inflammatory response, secondary to chemical, mechanical, and/or microbial damage to the periradicular tissues.<sup>[8,9]</sup> During chemomechanical preparation, the extrusion of dentinal debris, microorganisms, pulp

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tissue, and irrigants into the periapical tissues results in inflammation.<sup>[8]</sup> Postendodontic pain is considered as a poor indicator in terms of success of a case.<sup>[10,11]</sup>

Investigators have evaluated various root canal systems and compared the postoperative pain in the primary teeth following manual, rotary, or reciprocating instrumentation. Each study has used different methods for evaluating the effectiveness of the root canal system, thus giving a literature of various methods available. The aim of this study is to systematically and qualitatively review the existing literature, which evaluates the postoperative pain after pulpectomy using different instrumentation systems in primary teeth, and to find out the instrumentation system that can result in lower incidence and intensity of pain following pulpectomy in the primary teeth.

## Materials and Methods

This systematic review was conducted and reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines.<sup>[12]</sup> The scientific approval for the study was obtained from the institutional scientific review board (SDC/Pedo-1803/19/040).

### Focused Participants, Interventions, Control, and Outcomes question

The research question formulated was based on the Participants, Interventions, Control, and Outcomes (PICO) principle: “Which file system result in lower incidence and intensity of postoperative pain following pulpectomy in the primary teeth?” [Table 1].

### Eligibility criteria

Studies were considered eligible if they met the following criteria:

- Studies published in English language
- Studies reporting the incidence of pain after pulpectomy in primary teeth using hand, rotary, or reciprocating instrumentation
- Studies reporting the intensity of postoperative pain after pulpectomy in the primary teeth using hand, rotary, or reciprocating instrumentation
- Randomized clinical trials (RCTs) comparing two or more root canal instruments.

Studies such as *in vitro* studies, animal studies, case reports, non-RCTs, or RCTs focusing on permanent teeth and those lacking any of the “PICO” components were excluded.

**Table 1: Research question in Participants, Interventions, Control, and Outcome format**

Population - Primary teeth undergoing pulpectomy
Intervention - Rotary instrumentation, reciprocating instrumentation
Comparison - Hand instrumentation
Outcome - Incidence and intensity of postoperative pain

## Search strategy

A comprehensive literature search with “English” language restriction was conducted to identify the available literature up to October 2019 using MEDLINE/PubMed, the Cochrane library (CENTRAL), Science Direct, LILAC, SIGLE, and Google Scholar database. In addition, the reference list of reviews and selected studies was also hand searched to reclaim the papers that might be undetected during the database search.

The following search strategy was adapted for each database search: (Primary teeth OR deciduous tooth) AND (pulpectomy OR pulp therapy OR root canal therapy OR root canal preparation OR endodontic treatment) AND (rotary instrumentation OR reciprocating instrumentation OR manual instrumentation) AND (post-operative pain OR post-endodontic pain OR post-treatment pain).

## Data collection

Two reviewers independently screened all titles and abstracts. If the abstracts did not provide adequate information to make decision, full articles were further reviewed. Any discrepancy was resolved by discussion between the reviewers. For each study, the following data were systematically reported: publication details, study design, sample size according to instrumentation technique used, methodology used for comparison, and comparative analysis.

## Risk of bias within the studies

Risk of bias in the included studies was independently assessed by the two reviewers referring to the guidelines described in the Cochrane Handbook for Systematic Reviews of Interventions.<sup>[13]</sup> The methodological quality of the included studies was assessed by evaluating the following parameters: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias. The final risk of bias of each individual study was determined accordingly:

- Low risk of bias: If all the parameters were evaluated to be of “low risk”
- Moderate risk of bias: If one or more parameters were evaluated to be “unclear”
- High risk of bias: If any of the parameters were evaluated as “high risk.”

## Results

### Study selection

A total of 187 articles were retrieved from the databases during the search process. After screening titles, abstracts of six articles were assessed by two independent investigators (inter-reviewer agreement,  $\kappa = 0.91$ ). Finally,

three studies were included in the review, based on the inclusion and exclusion criteria. The study selection process is presented as a flow diagram in Figure 1. The excluded studies and reason for their exclusion are mentioned in Table 2.

**Study characteristics**

The detailed characteristics of the included studies are listed in Table 3. All the three clinical trials compared the postoperative pain after pulpectomy using hand files and different systems of rotary files.<sup>[14-16]</sup> The various rotary instrumentation included are Kedo-S, Revo-S, and MTwo files. None of the studies compared the pain after preparation using reciprocating system in primary teeth.

**Risk of bias of the studies**

Figures 2 and 3 show the results of the risk of bias assessment in the included studies, which we performed

according to the Cochrane Handbook for Systematic Reviews of Interventions.<sup>[13]</sup> All the three studies reported the means of randomization generation clearly, and two trials adopted suitable methods of allocation concealment. Although outcome assessments were masked in the trials, the masking of operators was not clearly indicated. Based on these criteria, two studies showed moderate risk of bias and one showed a high risk of bias.

**Synthesis of results**

A meta-analysis was infeasible. The included studies were heterogeneous in terms of their methodology, and the comparisons between interventions could not be performed.

**Discussion**

Postoperative pain is a prime criterion that determines the clinical success of endodontic therapy in both primary

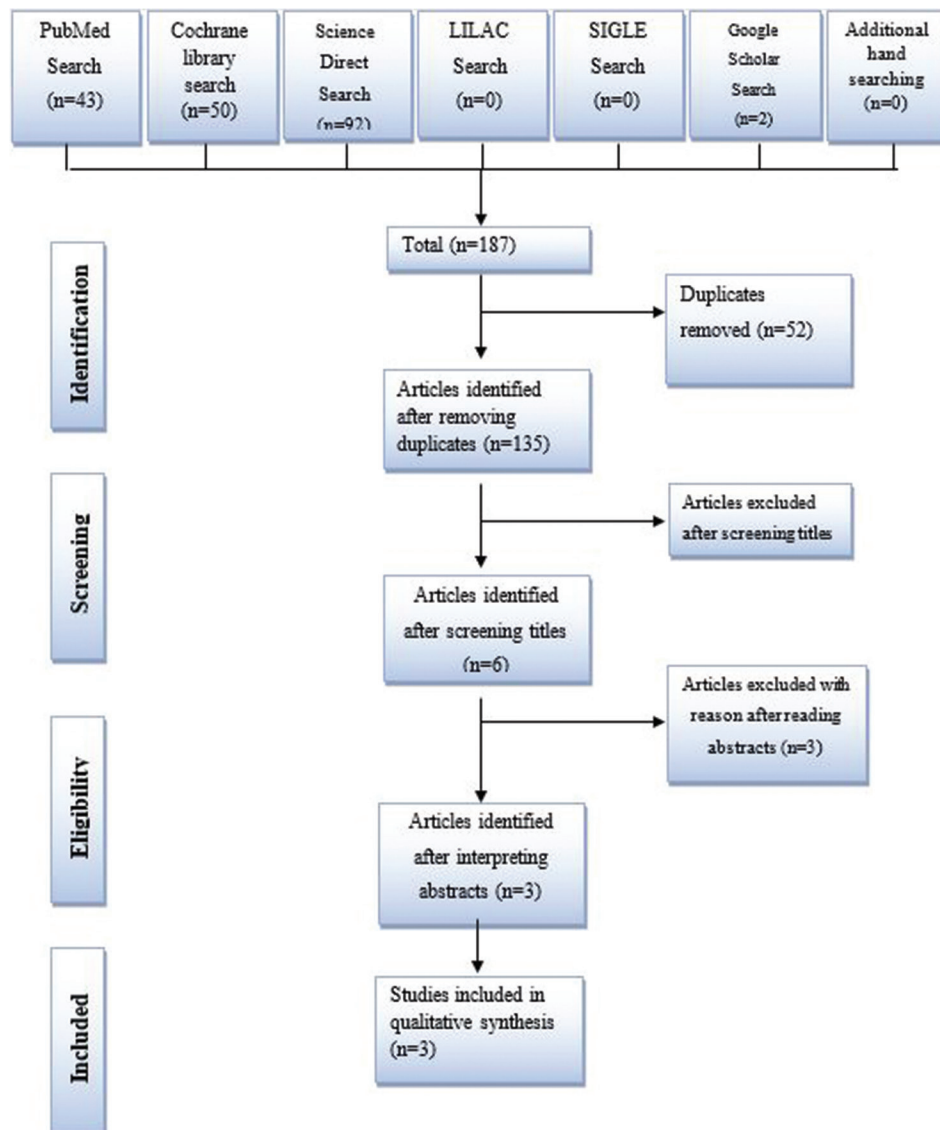


Figure 1: Flow diagram of study selection

**Table 2: Studies excluded after screening and reason for exclusion**

Authors	Year	Publication journal	Study title	Country	Study population	Reason for exclusion
Sevekar SA, Gowda SHN	2017	J Clin Diagn Res	Postoperative pain and flare-ups: Comparison of incidence between single and multiple visit pulpectomy in primary molars	India	80 primary molars Group 1: Single visit pulpectomy Group 2: Multiple visit pulpectomy	Compared the postoperative pain between different sessions of pulpectomy procedure and not based on instrumentation
Govindaraju L, Jeevanandan G, Emg S, Vishawanathaiah S	2018	Int J Clin Pediatr Dent	Assessment of quality of obturation, instrumentation time and intensity of pain with pediatric rotary file (Kedo-S) in primary anterior teeth: A randomized controlled clinical trial	India	45 primary anterior teeth Group 1: Hand K-files; Group 2: Rotary ProTaper files Group 3: Rotary Kedo-S files	Evaluated the intensity of pain during canal preparation and not postoperatively
Farokh-Gisour E, Parirokh M, Kheirmand Parizi M, Nakhaee N, Aminizadeh M	2018	Iran Endod J	Comparison of postoperative pain following one-visit and two-visit vital pulpectomy in primary teeth: A single-blind randomized clinical trial	Iran	100 primary molar teeth Group 1: Single visit pulpectomy Group 2: Multiple visit pulpectomy	Compared the intensity of postoperative pain between single and multiple visit pulpectomy and not based on instrumentation

**Table 3: Characteristics of included studies**

Author and year	Study population	Type of teeth	Sample size according to instrumentation technique	Pain outcome measure	Intensity of postoperative pain
Topçuoğlu <i>et al.</i> , 2017 <sup>[14]</sup>	110 children (6-8 years)	Primary maxillary first molars	Manual: K-files (55 teeth)	Modified Wong Baker facial scale	K-files > Revo-S
Nair <i>et al.</i> , 2018 <sup>[15]</sup>	75 children (4-6 years)	Primary maxillary and mandibular molars	Rotary: Revo-S files (55 teeth) Manual: K-files (25 teeth) Rotary: Kedo-S files (25 teeth) Rotary: MTwo files (25 teeth)	Modified Wong Baker facial scale	K-files > Kedo-S > MTwo
Panchal <i>et al.</i> , 2019 <sup>[16]</sup>	69 children (4-6 years)	Primary maxillary and mandibular molars	Manual: K-files (25 teeth) Manual: H-files (25 teeth) Rotary: Kedo-S files (25 teeth)	Modified Wong Baker facial scale	H-files > K-files > Kedo-S

and permanent dentition.<sup>[17]</sup> In case of young children, postoperative pain is often escalated with increased anxiety.<sup>[18]</sup> Postendodontic pain has multifactorial etiology and depends on the association of host immunological response, infection, and physical damage.<sup>[19]</sup> During BMP, dentinal residue, pulp tissue, necrotic debris, irrigation solution, and microorganisms are incontrovertibly pushed into periapical tissues. The apical extrusion of debris could occur more readily in the primary teeth due to physiological root resorption. Purging of these rudiments into periapical tissues may cause undesired consequences, such as induction of inflammation, delay in healing, and postoperative pain.<sup>[20]</sup> A positive correlation between preoperative and postendodontic pain has been explained by the presence of pretreatment infection, leading to secondary infection during treatment.<sup>[21]</sup> The foremost goal is to render optimal treatment with merest postoperative pain by proper cleaning and shaping of the canals in such a way that all the debris and bacteria containing tissues are eliminated.

Crown-down technique and use of engine-driven instruments control the preparation in the apical

third of the canal preventing apical extrusion of debris.<sup>[22]</sup> Rotary instrumentation is well known to reduce the preparation time and has also reduced postoperative pain. Increased extrusion of debris associated with hand instrumentation can be ascribed to the piston-like motion of the usage of instrument.<sup>[23]</sup> Studies have reported that the reciprocating system resulted in less apical extrusion than hand instrumentation and comparable to that of rotary instrumentation.<sup>[24,25]</sup>

Postendodontic pain is highly subjective, and the measurement of subjective variables is a huge challenge. The intensity of pain can be measured accurately when more than one scale is used.<sup>[24]</sup> Moreover, determination of exact cause of pain may provide affirmation regarding the hypothesis.

There are various instrumentation techniques available in the literature. However, only few studies evaluated the postoperative pain after pulpectomy in the primary teeth based on instrumentation technique. The goal of this study was to systematically review the available information on postoperative pain after pulpectomy using different

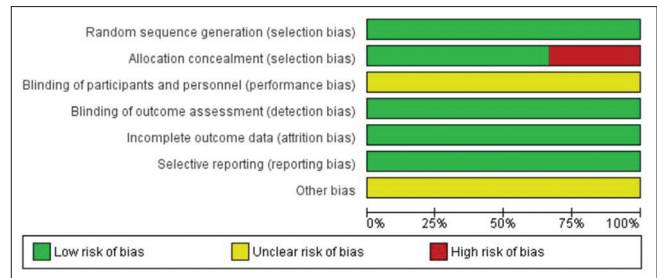
	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Gamze Topçuoğlu <i>et al.</i> , 2017	+	+	?	+	+	+	?
Manisha Nair <i>et al.</i> , 2018	+	+	?	+	+	+	?
Veerale Panchal <i>et al.</i> , 2019	+	-	?	+	+	+	?

**Figure 2: Risk of bias summary: Review authors' judgments about each risk of bias item for each included study. Green, yellow, and red refer, respectively, to low risk of bias, unclear risk of bias, and high risk of bias**

instrumentation techniques in primary teeth, which would help pediatric dentists to make choices based on the scientific evidence available.

The present systematic review includes three studies based on the predetermined inclusion and exclusion criteria, evaluating the incidence and intensity of postoperative pain after pulpectomy in the primary teeth using manual and rotary instrumentation. No studies have evaluated the pain intensity in the primary teeth using reciprocating file system.

According to Topçuoğlu *et al.*,<sup>[14]</sup> canal preparation with hand files causes more intense postoperative pain compared to Revo-S rotary system. The author also stated that the increased extrusion of debris by hand files than rotary Revo-S file as the reason associated with higher pain intensity in hand files group. Nair *et al.*<sup>[15]</sup> compared Kedo-S and Mtwo rotary files with manual K-files and reported less pain frequency in rotary file system without much difference between the two rotary files. This was in accordance to the study conducted by Panchal *et al.*,<sup>[16]</sup> who compared Kedo-S rotary file with manual H- and K-files. The highest postoperative pain scores were noted at 6–12 h interval and decreased over time in all the studies. The studies used a subjective method of evaluation of pain, which is the major limitation creating bias. In addition, the studies did not evaluate the exact cause of the postoperative pain and failed to consider preoperative pain as a variable. Among the three included studies, two showed moderate risk of bias and one showed high risk of bias.



**Figure 3: Risk of bias graph: Review authors' judgments about each risk of bias item presented as percentages across all included studies. Green, yellow, and red refer, respectively, to low risk of bias, unclear risk of bias, and high risk of bias**

The major limitation of this review is the small number of included studies and that the small sample size of all the included studies. More studies with high sample size and standardized operation procedures are required to evaluate the efficacy of these interventions.

## Conclusion

The results of the present review showed that:

1. The use of rotary instrumentation contributed to lower incidence and intensity of postoperative pain than that of hand instrumentation
2. There is a paucity of high-quality randomized trials assessing the effectiveness of different instrumentation for pulpectomy. A strong conclusion cannot be drawn from the available literature due to low evidence. Further studies with high-quality and standardized experimental designs are required to strengthen the evidence.

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## Conflicts of interest

There are no conflicts of interest.

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