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Original Research Article

A study on comparison of cleaning efficiency of rotary and manually operated endodontic files

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ABSTRACT

Objective: The purpose of this study is comparison of cleaning efficiency of rotary and manual endo files during cleaning and shaping of primary and permanent tooth.

Materials and Methods: A total of 100 articles were searched in pubmed on cleaning efficiency of rotary and manual files. Articles which had protocol on cleaning efficacy rather than cyclic fatigue and torsional effects were included. A total of 15 articles were assessed out of which 7 were included.

Result: Rotary files were found to have significantly better cleaning efficiency and less time consumption on primary and permanent tooth. However manual endodontic files were also found to serve equivalent cleaning efficiency.

Conclusion: In this study we obtain several articles which stated variable results and conclusion. However, particularly on cleaning efficiency, rotary and manual endodontic files were found to have significantly no differences in primary as well as permanent tooth.

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1. Introduction

There has been several studies and various protocols followed in the past regarding cleaning efficiency of endodontic files. Whether it be rotary or manual, several file system have found to serve its performances rather equivalently. When discussed about cleaning efficiency of rotary endodontic files over manual files, both did not prove to be one better than the other rather show equal performances. With the introduction of new techniques, better endo work and outcome with less time has been observed.¹ Outcome of a successful endodontic therapy is related to correct diagnosis and effective cleaning, shaping and disinfection of the root canals.² Among innovations in root canal instruments, nickel titanium file has two to three

times more elastic flexibility than and appear to be more fracture resistant compared to stainless steel files.³

Ni-Ti instruments for manual root canal preparation as well as for rotary endodontic hand pieces have been developed for easy root canal preparation.⁴ Therefore the purpose of this study is to compare cleaning efficiency of various rotary and manual files by assessing several other similar articles published earlier.

2. Materials and Methods

A group of comprehensive literature were searched upto December 2023 to identify available literature through PubMed/Medline database. List of reviews and studies were searched to obtain a particular strategy.

Study based on manual and rotary endo files on primary and permanent were included however studies which had

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no protocol without mentioning effectiveness on cleaning efficiency and time consumption were not included.

Selection and assessment of studies: Authors independently searched several articles reviewed their abstracts. The studies were selected in accordance with inclusion criteria. The full text and abstract were screened and evaluated however some studies were excluded which did not meet the strategic requirement. Risk of biasness were rated as low and if disagreement was to be found it was finalised by remaining author. Data were collected for each study: authors name, publication year, sample characteristics, number of included samples in each group, evaluated outcome, and final conclusion. Later, the studies which were analysed were included for comparative evaluation.

3. Result

A brief flowchart is being prepared for better analysis (Figure 1). A total of hundred articles were searched in pubmed. Among which twenty were searched in google scholar. Those which did not fulfilled criteria were not included. After which remaining articles were assessed and the descriptive parameters were recorded and presented in Table 1.

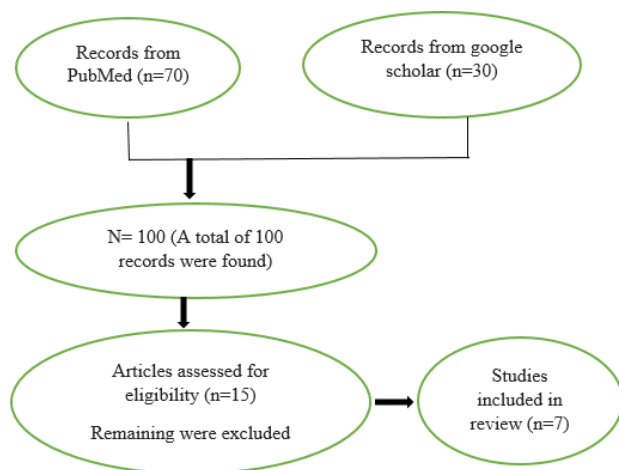


Figure 1: Flow diagram on selection of eligible studies

4. Discussion

Although there has been many theories and protocols on cleaning efficiency of root canals, several investigators have proven that one serves better than another. There is still ongoing debate over whether rotary files does more cleaning efficiently than manual files. Several factors play important role in clinical success of root canal treatment such as biomechanical preparation, type of materials, number of visits, type of restorations etc.^{5,6}

Study have been performed on invitro and invivo to evaluate efficacy of root canal instrumentation. Reddy JM et al⁷ has stated that manual NiTi files produced significantly less smear layer and debris compared to Rotary ProTaper NiTi instruments. Both systems of Rotary ProTaperNiTi and manual NiTi files used did not produce completely clean root canals. Manual NiTi files produced significantly less smear layer and debris compared to Rotary protaper instruments. This finding was found similar with Mohammad Reza Azar et al⁸ that Mtwo rotary system show acceptable cleaning ability in both primary and permanent teeth, and achieved results similar to those of K-files. With regard to the cleaning ability of root canals, there were no significant differences between K-file and Mtwo rotary system in the apical, middle or coronal third of the canals.

According to K Reddy et al⁹ ProTaper rotary instrumentation have shown maximum cleaning efficacy followed by K3 rotary instrumentation in coronal, middle and apical third of root canal. This study consist of four groups. Group I showed highly statistical significant difference compared to other groups. There was no statistically significant difference considering smear layer at any levels among the groups with no smear layer formation in group IV. This finding correlated with Musale et al¹⁰ that cleaning efficacy of rotary files profile, protaper and hero shaper was significantly better than k files.

In a similar study Panchal V et al have advocated that Rotary instrumentation shows equivalent cleaning efficiency than hand files depending on the system of instrumentation and techniques used.

Although there has been research on rotary and manual files on its cleaning efficiency reciprocating files have proven its equivalent cleaning and shaping efficiency that the reciprocating system exerted an almost similar antibacterial effect when compared with the rotary system.¹¹ Anusha Challagula et al stated that the SAFs had shown superior cleaning efficacy compared with rotary Protaper Universal and manual K files. A statistically highly significant difference was observed with SAF (mean = 1.5), Protaper (mean = 2.5), and Hand K-files (mean = 2.9). However, there was no significant difference in root canal cleaning efficacy with Protaper Universal and Hand K-files.¹²

PK Musale et al have shown that Cleaning efficacy of rotary files was significantly better than manual files.¹⁰ According to Mohammad Reza azar et al there were no significant differences between K-file and Mtwo rotary system in primary and permanent teeth in the apical, middle or coronal third of the canals.¹³ Katge F et al have also suggested no significant difference in cleaning efficacy between H-files and Mtwo files in coronal, middle, and apical thirds of the root canal.¹⁴ However rotary files decrease the instrumentation time and increase the rates of optimally filled canals in primary teeth.¹⁵

Table 1: Records of studies which are being analysed

Authors	Participants	Type of teeth	intervention	Control	Evaluated outcome	result
Reddy JM 2014	Extracted teeth	50 maxillary permanent central incisors	25 teeth manual k files/25 teeth rotary protaper	25 teeth manual k file	Manual NiTi files produced significantly less smear layer and debris compared to Rotary ProTaperNiTi instruments.	Rotary ProTaperNiTi and manual NiTi files used did not produce completely clean root canals.
K Reddy 2013	Extracted teeth	60 single rooted maxillary anterior	4 groups- 15 each group I-ProTaper rotary, group II-K3 rotary, group III-Stainless steel K-file, group IV-root canal irrigation without instrumentation.	15 without instrumentation	Group I showed highly statistical significant difference compared to other groups.	There was no statistically significant difference considering smear layer at any levels among the groups with no smear layer formation in group IV.
Panchal V 2019	Randomised control clinical trials		previously published systematic reviews till december 2016	Hand searched and online searched through pubmed and google	13 articles were included in the systematic review.	Rotary instrumentation shows equivalent cleaning efficiency than hand files depending on the system of instrumentation and techniques used.
Riluwan siddique	Systematic review		Previously published from January 1985 to December 2017.		The results showed that the reciprocating system exerted an almost similar antibacterial effect when compared with the rotary system.	This systematic review does not provide concrete evidence to show increased antibacterial efficacy of reciprocating system as compared to the rotary system.
Anusha challagulla 2023	Extracted teeth	60 primary anterior teeth	Three groups- 20 each. Group I(n=20) SAF. Group II (n=20) protaper universal Group III (n=20) hand k files.	Hand k files (n=20)	The SAFs had shown superior cleaning efficacy compared with rotary Protaper Universal and manual K files.	A statistically highly significant difference was observed with SAF (mean = 1.5), Protaper (mean = 2.5), and Hand K-files (mean = 2.9).
PK Musale 2014	Extracted teeth	60 primary mandibular second molar	Group I K-file, Group II ProFile, Group III ProTaper file and Group IV Hero Shaper file		Rotary files prepared more conical canals in primary teeth than manual instruments.	Cleaning efficacy of rotary files with average scores (Groups II- 0.68, III- 0.48 and IV- 0.58) was significantly better than K-files (Group I- 0.93) (p < 0.05).
Mohammad reza azar 2011	Extracted teeth	70 primary and 70 permanent teeth	two main subgroups(n=20)k files and mtwo and contro; group(n=10)	Three control group k files (n=10)	The Mtwo rotary system showed acceptable cleaning ability in both primary and permanent teeth	there were no significant differences between the K-file and Mtwo rotary system in primary and permanent teeth in the apical, middle or coronal third of the canals

5. Conclusion

In this study we obtain several articles which stated variable results and conclusion. However particularly on cleaning efficiency both rotary and manual endodontic files were found to have significantly no differences in primary as well as permanent tooth. A definitive conclusion cannot be obtain and further research is needed.

6. Source of Funding

None.

7. Conflict of Interest

None.

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