

## Original Research

### Comparative assessment of the efficacy of rotary versus manual instrumentation in pulpectomies of primary teeth: a clinical study

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#### ABSTRACT:

**Background:** Use of hand files in primary teeth is time-consuming, can lead to the formation of unwanted curvatures, and can cause iatrogenic errors. To overcome these difficulties, rotary instrumentation using nickel-titanium files was done. **Aims:** The present study was conducted to clinically evaluate and assess the difference in manual versus rotary instrumentation in root canals of primary teeth concerning instrumentation duration, obturation duration, quality of fills, and complications encountered. Also, the success of pulpectomy using hand files versus rotary files was assessed. **Materials and Methods:** 40 primary mandibular molars were randomly allocated to two groups namely control group subjects (n=20) that were treated using manual instrumentation and intervention group (n=20) using rotary instrumentation. The success was established in absence of excessive tooth mobility, sinus tract presence, gingival abscess/swelling, tenderness on percussion, and/or pain history. The collected data were subjected to statistical evaluation for results formulation. **Results:** The mean time for instrumentation was  $25.69 \pm 3.82$  minutes for the manual instrumentation group, whereas, for the rotary group it was significantly lesser ( $19.35 \pm 4.92$ ) with  $p < 0.0001$ . Mean obturation time for the manual group was  $5.21 \pm 0.89$  minutes and was lesser for the rotary group with  $4.71 \pm 0.97$  minutes ( $p = 0.09$ ). At 3 and 6 months, 97.36% (n=37) cases were considered successful in the manual instrumentation group, whereas 92.10% (n=35) cases in the rotary group were successful. At 18 months, 91.66% (n=33) pulpectomies were considered clinically successful in the manual group and 86.11% (n=31) cases in the rotary group were successful clinically. **Conclusion:** The present study concludes that less instrumentation time is needed with rotary instruments than manual instruments. Obturation quality and clinical success were similar in both manual and rotary instrumentation.

**Keywords:** K-file, primary teeth, pulpectomy, rotary files, root canal preparation.

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#### INTRODUCTION

Damage to the dental is seen despite prevention strategies, owing to the progression of traumatic injuries, restorative procedures, and dental caries. This can lead to the premature and untimely loss of the primary teeth which can affect the forming permanent dentition. Retaining the primary teeth with pulpal damage and pathology acts as a space maintenance measure with added advantages of esthetics maintenance, normal succedaneous permanent teeth eruption, and prevention habits like tongue thrusting.<sup>1</sup>

One of the most common and effective treatments of pulpal affected primary teeth, especially molars is pulpectomy. The various advantages of pulpectomy over-extraction are space maintenance, permanent dentition normalcy in eruption, esthetics, and others. A pulpectomy is a procedure where infected/inflamed/necrotic pulp tissue is removed from coronal and radicular areas followed by cleaning and shaping of root canals, and their filling. The success of pulpectomy is governed by various factors including the technique used, instrumentation quality, disinfection, irrigation, and root canal obturation.<sup>2</sup>

Instrumentation in the pulpectomy procedure is done to remove the existing pulpal infection. However, this is challenging owing to curved and narrow canals with pulpal tissue webbing and the presence of accessory canals. Also, continuous physiologic resorption is seen in the roots of primary molars. The conventional root canal cleaning and shaping in permanent teeth is done using stainless steel hand files. Using these files in primary teeth can lead to the formation of curvatures in the root canals of primary teeth. This can lead to time-consuming, improper, and inefficient cleaning and shaping of the canals in primary teeth. Also, the use of these files is associated with iatrogenic errors.<sup>3</sup>

To overcome these difficulties, rotary instrumentation using nickel-titanium files was introduced. Various literature data has reported the supremacy of these rotary files over hand instrumentation in permanent teeth. However, data concerning the efficacy of the use of rotary files in primary teeth is scarce.

Some in-vitro studies have demonstrated the superiority of nickel-titanium rotary instruments over the manual one concerning time efficiency and cleaning capacity for instrumentation of root canals in primary teeth.<sup>4</sup> Very few studies evaluated long-term results of comparing these two file systems in primary molars. Hence, the present study was conducted to clinically evaluate and assess the difference in manual versus rotary instrumentation in root canals of primary teeth concerning instrumentation duration, obturation duration, quality of fills, and complications encountered. Also, the success of pulpectomy using hand files versus rotary files was assessed.

## MATERIALS AND METHODS

The present study was conducted at S. B. Patil Dental College and Hospital, Bidar, Karnataka from January 2017 to January 2018, after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects visiting the Outpatient Department of Paediatric and Preventive Dentistry of the Institute. A total of 40 subjects were included from both genders within the age range of 4 years to 7 years. The inclusion criteria for the study were subjects having irreversible pulpitis, sinus tract, periapical radiolucency, necrotic pulp, at least 2/3<sup>rd</sup> remaining root, and/or radiolucency in the furcation area of the mandibular second primary molar. The exclusion criteria were subjects having swelling (intraoral/extraoral), perforated pulpal floor, excessive mobility, systemic disease, mental disabilities, subjects needing sedation/general anesthesia, and subjects with inadequate remaining tooth structure for restoration.

After final inclusion, parents of all subjects were informed about detailed study design, and consent was also taken. The subjects were randomly allocated to two groups using the flip of the coin. The control

group subjects (n=20) were treated using manual instrumentation and the intervention group (n=20) using rotary instrumentation. All pulpectomies were performed conventionally in a single visit by single operator expertise in the field under local anesthesia using 2% Lignocaine. The manual instrumentation was started with k-files and prepared till 15-30 No. 2% pro taper sequentially till working length. For the rotary group, nickel-titanium rotary files were used having 4% taper and utilized crown-down technique. Root canal preparation was done sequentially with 04/20, 04/25, 04/30 files till working length. Copious irrigation was done using normal saline and 2.5% sodium hypochlorite.

Following preparation, the canals were dried using absorbent paper points and were obturated with calcium hydroxide pate mixture with zinc oxide powder in normal saline to get the consistency as desired. The obturation was done 2mm short of radiographic apex. After obturation, the teeth were restored with Glass Ionomer cement. The time for obturation and instrumentation was calculated with a stopwatch. The instrumentation time was the time from canal negotiation to the final canal shaping, whereas, obturation time was time from instrumentation completion to obturation of all canals. After completion of the root canal therapy, stainless steel crown was placed in all teeth after 1 week of obturation.

All teeth were evaluated at 3, 6, and 18 months postoperatively using modified Coll and Sadrian criteria.<sup>5</sup> The success was established in absence of excessive tooth mobility, sinus tract presence, gingival abscess/swelling, tenderness on percussion, and/or pain history. The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) for results formulation. The data were expressed in percentage and number. The level of significance was kept at  $p < 0.05$ .

## RESULTS

The present study was conducted to clinically evaluate and assess the difference in manual versus rotary instrumentation in root canals of primary teeth concerning instrumentation duration, obturation duration, quality of fills, and complications encountered. Also, the success of pulpectomy using hand files versus rotary files was assessed. A total of 40 subjects were included from both genders within the age range of 4 years to 7 years and the mean age of  $5.52 \pm 0.742$  years for the control group and  $5.52 \pm 0.674$ . There were 10 males and 10 females in the manual instrumentation group, whereas, there were 12 males and 8 females in the rotary group. The mean time for instrumentation was  $25.69 \pm 3.82$  minutes for the manual instrumentation group, whereas, for the rotary group it was significantly

lesser ( $19.35 \pm 4.92$ ) with  $p < 0.0001$ . Mean obturation time for the manual group was  $5.21 \pm 0.89$  minutes and was lesser for the rotary group with  $4.71 \pm 0.97$  minutes ( $p = 0.09$ ) (Table 1).

On assessing the obturation quality in the two groups of the study subjects, it was seen that underfilled obturation was seen in 15% ( $n = 3$ ) of study subjects of the manual group and 10% ( $n = 2$ ) subjects from the rotary group. Over-filled obturation was seen in 20% ( $n = 4$ ) of study subjects of the manual group and 25% ( $n = 5$ ) subjects from the rotary group. The optimum filled obturation was seen in 65% ( $n = 13$ ) of subjects from both groups (Table 2).

Two teeth were exfoliated naturally at 3 and 6 months and were not included in the results. At 18 months, 4

teeth were exfoliated and 36 was the final sample evaluated. The present study also assessed the clinical success of the manual and rotary instrumentation at 3 months, 6 months, and 18 months after pulpectomy (Table 3). It was seen that at 3 and 6 months 97.36% ( $n = 37$ ) cases were considered successful in the manual instrumentation group, whereas 92.10% ( $n = 35$ ) cases in the rotary group were successful. At 18 months, 91.66% ( $n = 33$ ) pulpectomies were considered clinically successful in the manual group and 86.11% ( $n = 31$ ) cases in the rotary group were successful clinically. The difference between the two groups was statistically non-significant at all time intervals with a p-value of 0.54, 0.54, and 0.42 respectively at 3, 6, and 18 months.

Parameter	Technique/Group	Time (Mean±SD)	p-value
Instrumentation time (minutes)	Control (manual)	$25.69 \pm 3.82$	<0.0001
	Rotary	$19.35 \pm 4.92$	
Obturation time (minutes)	Control (manual)	$5.21 \pm 0.89$	0.09
	Rotary	$4.71 \pm 0.97$	

**Table 1: Assessment of Instrumentation time and Obturation time in the Study subjects**

Obturation Quality	Manual Group		Rotary Group		p-value
	%	N	%	n	
Under Filled	15	3	10	2	0.42
Over Filled	20	4	25	5	
Optimum Filled	70	14	65	13	

**Table 2: Assessment of Obturation quality in the two groups of study subjects**

Time Interval	Manual Group		Rotary Group		p-value
	%	N	%	n	
3 months ( $n = 38$ )	97.36	37	92.10	35	0.54
6 months ( $n = 36$ )	97.36	37	92.10	35	0.54
18 months ( $n = 36$ )	91.66	33	86.11	31	0.42

**Table 3: Assessment of Clinical success in the two groups of study subjects**

## DISCUSSION

In the present study, a total of 40 subjects were included from both genders within the age range of 4 years to 7 years and the mean age of  $5.52 \pm 0.742$  years for the control group and  $5.52 \pm 0.674$ . The mean time for instrumentation was  $25.69 \pm 3.82$  minutes for the manual instrumentation group, whereas, for the rotary group it was significantly lesser ( $19.35 \pm 4.92$ ) with  $p < 0.0001$ . Mean obturation time for the manual group was  $5.21 \pm 0.89$  minutes and was lesser for the rotary group with  $4.71 \pm 0.97$  minutes ( $p = 0.09$ ). These findings were comparable to the studies of Makarem A et al<sup>6</sup> in 2014 and Romero TO et al<sup>7</sup> in 2011 where authors reported higher time in manual instrumentation compared to rotary instrumentation.

On assessing the obturation quality in the two groups of the study subjects, it was seen that underfilled obturation was seen in 15% ( $n=3$ ) of study subjects of the manual group and 10% ( $n=2$ ) subjects from the rotary group. Over-filled obturation was seen in 20% ( $n=4$ ) of study subjects of the manual group and 25% ( $n=5$ ) subjects from the rotary group. The optimum filled obturation was seen in 65% ( $n=13$ ) of subjects from both groups. These results were contradictory to the results of the studies of Nagaratna PJ et al<sup>8</sup> in 2006 and Parashos P et al<sup>9</sup> in 2004 where better obturation with rotary instrumentation was reported.

The clinical success at 3 and 6 months were 97.36% ( $n=37$ ) in the manual instrumentation group, whereas 92.10% ( $n=35$ ) cases in the rotary group were successful. At 18 months, 91.66% ( $n=33$ ) pulpectomies were considered clinically successful in the manual group and 86.11% ( $n=31$ ) cases in the rotary group were successful clinically. The difference between the two groups was statistically non-significant at all time intervals with a p-value of 0.54, 0.54, and 0.42 respectively at 3, 6, and 18 months. These findings were consistent with the findings by Chawla HS et al<sup>10</sup> in 2008 and Ozalp N et al<sup>11</sup> in 2005 where similar clinical success was reported by the authors.

## CONCLUSION

Within its limitations, the present study concludes that less instrumentation time is needed with rotary instruments than manual instruments. Obturation quality and clinical success were similar in both manual and rotary instrumentation. Hence, rotary instrumentation is favoured over manual owing to less time. However, the present study had few limitations including smaller sample size, geographical area biases, recall bias, and single-institution nature. Hence, more longitudinal and prospective studies with larger sample sizes, and longer monitoring periods are needed to reach a definitive conclusion.

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