

ORIGINAL RESEARCH

Comparative Evaluation of Outcome of Single Visit Endodontic Therapy in Primary Mandibular Molars Using Hand and Rotary Instrumentation: An In-Vivo study

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Received: 12-02-2023**Accepted: 27-03-2023****ABSTRACT**

Introduction: Early loss of deciduous teeth leads to deleterious effects on permanent dentition. Hence, pulpectomy is considered a viable option in the treatment of necrotic primary teeth. With the advent of technology, pediatric endodontics has also evolved leading to an evolutionary shift from a traditional hand filing system to a rotary system leading to quicker, economical, and sustainable root canal treatment outcomes.

Aim: To compare root canal preparation and obturation time and to evaluate post-operative signs and symptoms following single sitting pulpectomy in primary mandibular molars using hand and rotary instrumentation in young children aged between 4-7 years.

Materials and Methods: Pulpectomy was performed on 150 primary molars. Hand K files were used for half of them, while Pro AF baby gold rotary files were used for the other half randomly divided. The time utilized for instrumentation, the quality of obturation obtained, and post operative pain were noted.

Results: In comparison to hand filing, it was found that Pro AF baby gold required less time for instrumentation and offered the best possible obturation. The post operative pain observed with ProAF baby gold was significantly less than hand filing at 6 hrs and 12 hrs intervals. However, the follow-up at 24 hrs, 48 hrs, 72 hrs, 1 week, and 3 weeks depicted no significant difference between the two systems.

Keywords: Pulpectomy, Primary Teeth, Hand K-files, Rotary files, Instrumentation, Obturation, Post-Operative Pain.

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Introduction:

The importance of saving deciduous teeth starts with the notion that they are the best space maintainers. Losing them due to caries or infection in the root canal can have a detrimental impact on the development of the dental structures and facial-skeletal complex in totality. The ideal line of treatment for the necrotic pulp of primary dentition is endodontic treatment (pulpectomy) than extraction. The key objective of disinfecting and shaping a root canal is to eliminate bacteria causing pain and necrosis.^[1] The main challenge for pulpectomy in primary teeth is primarily negotiation. Apart from this, the bizarre and tortuous curvature of the roots makes thorough instrumentation quite difficult.^[2] Hence, rotary

systems were introduced to reduce the time taken for endodontic treatment and maximize results.

The literature exemplifies the use of nickel-titanium (Ni-Ti) rotary files for root canal preparation in primary teeth being economical with considerably uniform and predictable fillings.^[3,4,5] However, the dentin of the primary tooth is less dense and more soft than that of the permanent ones which makes the use of rotary difficult.^[6,7] Also, the roots of deciduous teeth are smaller, constricted, and more curved making the resorption at the root tip often unnoticeable.^[8] All of these traits make it difficult to use Ni-Ti rotary devices on primary teeth.

Pro AF Baby Gold file system (Kids-e-dental) is developed exclusively for primary teeth to

enhance the safety and comfort of the patient as well as the dentist. Hence, this study was conducted to compare the root canal preparation and obturation time and to evaluate post-operative signs and symptoms following single sitting pulpectomy in primary mandibular molars using a hand and Pro AF baby gold rotary file system.

Materials and Methods:

A randomized screening of more than 1500 children among the 4-7 years age group was conducted from the outpatient department of Pedodontics and random dental check-up camps from class PreKG to class I of different schools. Children having first and second primary mandibular molars with carious pulpal exposure, and absence of periapical and interradicular radiolucency with sufficient coronal tooth structure and root structure (more than 2/3 root length) radiographically were participants in the study. Patients with internal and pathologic root resorption, non-restorable tooth structure, and tooth with severe mobility, were excluded. A total of 140 children with 150 carious primary mandibular molars fulfilling the inclusion criteria were selected. The parents/guardians of each subject were informed, and consent was obtained. The selected carious teeth were randomly divided into two groups A and B for endodontic treatment with manual technique and rotary technique respectively.

Single visit pulpectomies were performed in both groups. The treatment was carried out under local anesthesia. Rubber dam isolation was done for all the pulpectomy procedures. Initially, caries were removed which was followed by an access opening with a round bur. The access bleed analysis confirmed the complete necrosis of the pulp. The length of the canal was estimated by using no. 15 K file and designated when it was radiographically 1 mm short of the apex. Teeth in Group A were prepared using stainless steel K files and the conventional technique. In Group B, hand instrumentation up to No 20 K file before initiation of rotary instrumentation was done. Then the canals were disinfected and shaped using Pro AF Baby Gold rotary files in the "crown down" technique. This was done precisely under the manufacturer's recommendation. Irrigants used for biomechanical preparation were 1 ml of 3 percent NaOCL and

normal saline. After the canals were irrigated, and dried using paper points, they were incrementally filled with Endoflas using a reamer. After removing any extra coronal filling material, glass ionomer cement was applied to seal the coronal space. The complete time duration for instrumentation and obturation was recorded using a stopwatch and two blinded examiners radiographically assessed the quality of the root canal filling and documented whether it was at the optimal level, underfilled, or overfilled, based on criteria given by Coll and Sadrian.^[9] The ideal obturation was defined as being at or less than 1 mm from the radiographic apex.

The postoperative pain intensity was evaluated at 6 hrs followed by 12, 24, 48, 72 hrs, and then 1 week and 3 weeks by recording on a specially prepared questionnaire for the parents and using a four-point pain intensity scale as given by Topcuoglu et al. (2017).^[10] The pain is measured on a four-point scale as follows: zero - no pain, one - slight pain, two - moderate pain, and three - severe pain.

Results:

Results on continuous measurements were presented as Mean \pm SD and significance was assessed at three different levels of significance (5%, 1%, and 0.1%). Normality in the data set was examined through Shapiro-Wilk's test. After testing the normality, the significance of difference between mean values of quantifiable variables was tested through the independent Mann-Whitney test. The association between attributes in the contingency tables was tested through a chi-square test.

To maintain a significant sample size for statistical analysis and overcome sample size attrition owing to dropouts, the final sample of 150 teeth from 140 participants aged 4 to 7 years was collected. Carious primary teeth fulfilling the inclusion criteria in each subject were assessed clinically and through random division and were divided into two groups. Group A included 75 teeth to be prepared endodontically with manual technique. Group B It included 75 teeth to be prepared endodontically with the rotary technique. Table 1 displays the distribution of subjects by age.

Table 1: Distribution of subjects according to age

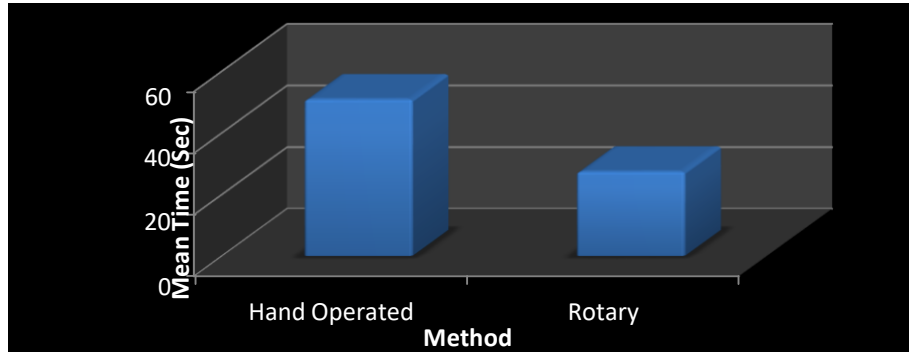
Method	Age (in Years)				Mean \pm SD	MW U-Statistic	p-Value
	4	5	6	7			
Hand Operated	9	19	24	23	5.81 \pm 1.01	2712 ^{NS}	0.6948
Rotary	7	22	19	27	5.88 \pm 1.01		

With a standard deviation of 2.41, the average time of instrumentation for hand files was 50.88 minutes. With a standard deviation of 1.29, the average time of instrumentation for rotary files was 27.44 minutes. The Mann-Whitney U test results suggest that rotary files require less instrumentation time than hand files, which is statistically significant. (Table 2), (graph 1)

Table 2: Mean instrumentation time between hand operated and rotary system

Method	Mean± SD	MW U-Statistic	p-Value
Hand Operated	50.88± 2.41	5625***	< 0.0001
Rotary	27.44± 1.29		

Graph 1: Mean instrumentation time between hand operated and rotary system



As reported by the examiner 1, 28% of the teeth with hand files instrumentation exhibited over obturation, 20% of the teeth showed under obturation, and 52% of the teeth showed optimal obturation. For rotary file instrumentation, 76% of the teeth had ideal obturation, whereas 9.3% of the teeth displayed under obturation and 14.7% over obturation. Since the percentage of optimal fillings in the rotary method (76 %) was much larger than those in the hand operated method (52%), it was inferred that the rotary method was highly significantly (at 1% probability level) superior to the hand method. (Table 3), (Graph 2)

Table 3: Comparison of optimum obturation attainment using hand and rotary instrumentation by examiner 1

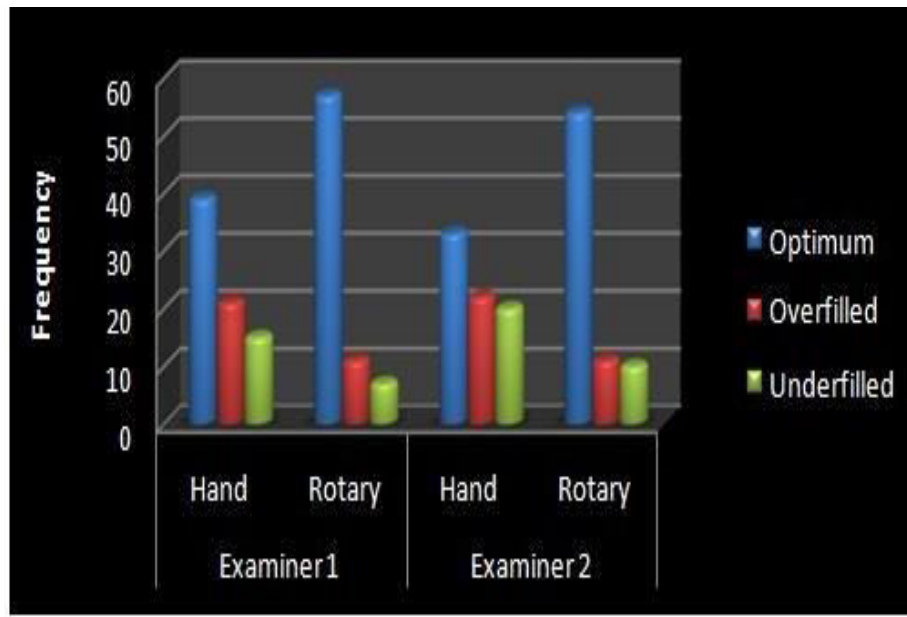
Method	Optimum		Overfilled		Underfilled		Row Total	
	Number	% age	Number	% age	Number	% age	Number	% age
Hand	39	52.0	21	28.0	15	20.0	75	100.0
Rotary	57	76.0	11	14.7	7	9.3	75	100.0
Column Total	96	64.0	32	21.3	22	14.7	150	100.0

As graded by examiner 2, 44% of teeth with hand files instrumentation showed optimal obturation, 29.3% of the teeth showed over obturation and 26.7% of the teeth showed under obturation. For rotary instrumentation, 72% of the teeth had optimal obturation, whereas 13.3% of the teeth were displayed under obturation and 14.7% over obturation. Since the percentage of optimal fillings in the rotary method (72 %) was much larger than those in the hand operated method (44 %), it was inferred that the rotary method was highly significantly (at 1% probability level) superior to the hand method. (Table 4), (Graph 2)

Table 4: Comparison of optimum obturation attainment using hand and rotary instrumentation by examiner 2

Method	Optimum		Overfilled		Underfilled		Row Total	
	Number	% age	Number	% age	Number	% age	Number	% age
Hand	33	44.0	22	29.3	20	26.7	75	100.0
Rotary	54	72.0	11	14.7	10	13.3	75	100.0
Column Total	87	58.0	33	22.0	30	20.0	150	100.0

Graph 2: Inter- group comparison of obturation quality as assessed by two examiners in both methods



For the pain scores at 6 hours, there was a highly significant difference (at 1% probability level) between the two groups which means after 6 hours, the rotary group was associated with a highly significantly lower incidence of pain compared to the hand group. Also at 12 hours, a significant difference (at a 5% probability level) was again detected between the two groups which means again after 12 hours rotary group was associated with a significantly lower incidence of pain compared to the hand group. At 24 hrs, 48 hrs, 72 hrs, 1 week, and 3 weeks, no significant difference could be detected between the two groups. (Table 5)

Graph 3: Comparative intensity of pain at different time intervals in both groups

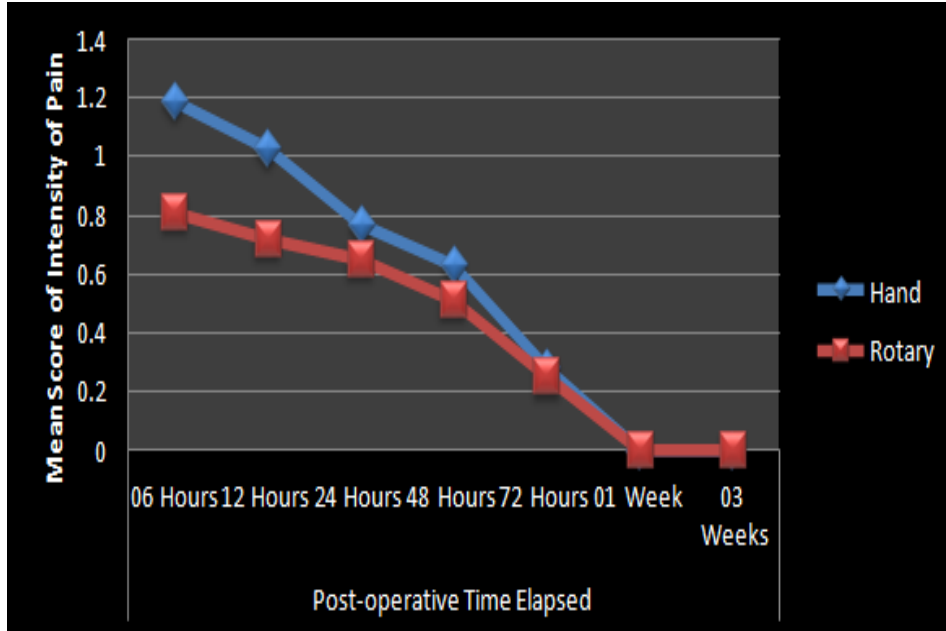


Table 5: Comparison of pain scores using hand and rotary instrumentation

Post-Operative Time Elapsed	Pain Score	Hand Operated Method (N = 75)		Rotary Method (N = 75)		χ^2 -statistic (at 2 d.f.)	p-Value
		Frequency	% age	Frequency	% age		
06 Hours	0	15	20.0	33	44	10.019**	0.0067
	1	31	41.3	23	30.7		
	2	29	38.7	19	25.3		
	3	0	0.0	0	0.0		
12 Hours	0	22	29.3	38	50.7	7.115*	0.0285
	1	29	38.7	20	26.7		
	2	24	32.0	17	22.7		
	3	0	0.0	0	0.0		
24 Hours	0	35	46.7	42	56	1.395 ^{NS}	0.4978
	1	22	29.3	17	22.7		
	2	18	24	16	21.3		
	3	0	0.0	0	0.0		
48 Hours	0	42	56.0	49	65.3	1.450 ^{NS}	0.4844
	1	19	25.3	14	18.7		
	2	14	18.7	12	16		
	3	0	0.0	0	0.0		
72 Hours	0	54	72	56	74.7	0.136 ^{NS}	0.9341
	1	21	28	19	25.3		
	2	0	0	0	0		
	3	0	0.0	0	0.0		
01 Week	0	75	100	75	100	0.000 ^{NS}	1.0000
	1	0	0	0	0		
	2	0	0	0	0		
	3	0	0.0	0	0.0		
03 Weeks	0	75	100	75	100	0.000 ^{NS}	1.0000
	1	0	0	0	0		
	2	0	0	0	0		
	3	0	0.0	0	0.0		

Discussion:

The smaller size of primary teeth causes early necrosis with chronic inflammation reaching beyond pulp.^[11] The primary teeth are not only smaller in size, but their anatomy varies greatly when compared to permanent teeth as the roots are short, thin, and curved and the root resorptions are undetectable^[8]. Traditionally, stainless steel hand instruments have been used to clean and shape canals. The ribbon-shaped pattern of the primary root canals makes it necessary to clean and shape them with a special rotary file.^[12] The superiority of rotary instrumentation over manual in permanent teeth has led to an evolutionary move from hand files to exclusive pediatric rotary systems.^[13-17] However, there are no studies that evaluate the efficiency of the Pro AF Baby Gold rotary file system in primary teeth. Therefore, the current in-vivo study aimed to compare the root canal preparation and obturation time and evaluate post-operative signs and symptoms following single sitting pulpectomy in primary mandibular molars.

In pediatric dentistry, treatment of shorter time not only decreases anxiety but also makes the

treatment easy for the child. This enhances the cooperation of the pediatric patient in the procedure.^[18] This study shows that using Pro AF Baby gold files to prepare the canals in primary teeth results in a significantly shorter instrumentation time (P 0.05). Results are comparable with studies performed with adult rotary systems.^[3,12,19,21] (Table 2 and Graph 1). Decreased instrumentation time helps in reducing the fatigue of the patient and the clinician as well.^[19,21].

In the present study, two examiners who were blind to the groups evaluated the quality of obturation using the criteria outlined by Coll and Sadrian (1996)^[9] as underfilled, ideal, or overfilled. In Group B, 76% of the cases graded by examiner one and 72% of cases graded by examiner two showed optimal filling while in Group A, only 52% of the molars as graded by examiner one and 44% as graded by examiner two showed optimal filling. Since the percentage of optimal fillings in the rotary method (76% and 72 %) were much larger than those in the hand method (52% and 44 %) it was thus inferred that the rotary method was highly significant (at 1%

probability level) superior to the hand method (Table 3,4). The obturation quality observed with Pro- AF- Baby Gold rotary files was superior which is in accordance to previous studies reported in literature (Graph 2). Ni-Ti rotary instruments when compared to stainless steel hand files have better flexibility and increased fracture resistance. The memory capacity feature makes shaping curved canals with rotary files much easier with minimal canal transportation. This offers the dentist more confidence while using the rotary files in a primary canal that is curved. The wider canal preparation allows for easy and precise obturation as well, yielding better results than preparation with hand files.^[22]

For the post operative pain, the intergroup comparison at different time intervals showed that at 6 hours, there was highly significant difference (at 1% probability level) between the two groups. Rotary group was associated with highly significantly lower incidence of pain compared to hand group. Also at 12 hours, significant difference (at 5% probability level) was again detected between the two groups which means again after 12 hours, rotary group was associated with significantly lower incidence of pain compared to hand group. Post 12 hours, for a period of 24 hrs, 48 hrs, 72 hrs, 1 week and 3 weeks no significant difference in pain was observed between the two groups. Moreover, mean score of post operative pain at 6 hours in hand instrumentation group was 1.19 while in rotary instrumentation group was 0.81. Similarly at 12 hours, mean score of post operative pain in hand instrumentation group was 1.03 while in rotary instrumentation group was 0.72 (Graph 3). This implies that intensity of pain in rotary instrumentation group was less as compared to hand instrumentation group at 6 hours and 12 hours^[23]. The post-operative pain in both groups was at maximum levels at six hours and then gradually reduced over the following 24 hours. As compared to hand instrumentation, which pushes the debris apically and increases post-operative pain, engine- driven rotary instruments shift the debris coronally.^[24,25] The result of our study corresponds to the notion that the post-operative pain reported with rotary instruments is manifold decreased as compared to hand instruments^[26,27].

Conclusion:

The outcome of present study showed that pulpectomy procedure with rotary method shows better biomechanical preparation which leads to better obturation quality. The time taken to complete the pulpectomy is less using the rotary instrumentation as compared to hand instrumentation which is very much favorable in pediatric dentistry. Moreover, the post operative pain is less in rotary method which alleviates the anxiety of the child in future. Hence, the advancements in the endodontic instruments are

valuable and favorable in the pediatric dentistry.

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