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ORIGINAL ARTICLE

Comparison of Conventional and Rotary Files in Root Canal Preparation of Primary Molar Teeth

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ABSTRACT

Introduction: Pulpectomy is a very common pulp therapy provided to the primary molars with necrosis and irreversible pulpitis. Conventional (hand) files have been used as a standard meth- od of root canal instrumentation in primary teeth. But, being a time-consuming technique, it has led to an increase in the chairside time henceforth, can result in a decrease of co- operative behaviour in paediatric patients.

Objective: The aim of the study was to compare chairside time in root canal preparation of primary teeth clinically using rotary and hand files and quality of obturation radiographically.

Methodology: The study was designed as non- probability consecutive sampling performed at a single centre on 108 primary molars with necrosis or irreversible pulpitis in children aged 4-9 years. Subject selection for our study was in accordance with the inclusion and exclusion criteria and were placed randomly in the two groups i.e. (HF) conventional (hand) files and (RF) rotary (ProTaper NEXT®) file groups respectively.

Results: A total 108 primary molars were included in the study. There was a significant difference (p=0.003) between Group RF and Group HF for root canal preparation time (mins). On the other hand, there was no difference in the quality of obturation among the two groups HF & RF (94.4% vs 96.3%) (p=0.31).

Conclusion: The study concluded that mean root canal preparation time (mins) was significantly reduced in rotary file group as compared to the hand file group. But the results in quality of obturation was similar for both techniques.

Keywords: Hand files, Primary molars, Pulpectomy, Rotary (protaper).

INTRODUCTION

Dental caries still remains one of the most predominant diseases affecting children globally and commonly leads to pulpal contribution in primary teeth.[1] When pulpal inflammation becomes irreversible or necrosis occurs, pulpectomy is measured the treatment of superior to maintain the tooth until its natural exfoliation.[2] Pulpectomy involves complete elimination of infected pulp tissue followed by cleaning, shaping, and obturation of the root canal system using resorbable materials such as zinc oxide eugenol or calcium hydroxide based pastes.[3] The achievement of this procedure largely rely on efficient canal debridement and obturation.[4]

Traditionally, root canal preparation in primary teeth has been accomplished with the use of stainless-steel hand files. Although this method has been proven to be effective, it has been found to be time-consuming, which may result in fatigue for the dentist, along with reduced cooperation from the paediatric patient.[5] The complex and tortuous root canal anatomy of primary molar teeth makes root canal preparation difficult.[6] The invention of nickel-titanium (NiTi) rotary endodontic instruments revolutionized endodontic procedures.[7] These instruments are flexible, cut efficiently, and are capable of preserving the original canal curvature, reducing the time required for endodontic procedures. Various studies have proven the efficacy of using rotary endodontic instruments in permanent teeth, but their use in primary teeth is still in its nascent stage.[8]

In Pakistan, pulpectomy procedures are still commonly performed using hand instrumentation, and limited local research has compared rotary and conventional techniques in primary teeth. Therefore, this study aimed to evaluate the clinical efficiency of rotary instrumentation compared with conventional hand files in paediatric pulpectomy procedures.

METHODOLOGY

This clinical comparative study was conducted in the Department of Pediatric Dentistry at the Children Hospital, Pakistan Institute of Medical Sciences (PIMS), Islamabad for the duration one year from January 2020 to December 2020. The study aimed to compare the efficiency of conventional hand files and rotary nickel–titanium files during root canal preparation in primary molars. A total of 108 primary molars requiring pulpectomy were included in the study. The participants consisted of children aged between 4 and 9 years who presented with primary molars diagnosed with irreversible pulpitis or pulpal necrosis and were suitable candidates for pulpectomy treatment. Teeth showing advanced root resorption, extensive periapical pathology involving the permanent successor, or those deemed non-restorable were excluded from the study. Ethical approval for this study was obtained from the Ethical Review Committee of Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU), Pakistan Institute of Medical Sciences (PIMS), Islamabad (F.1-1/2015ERB/SZAMBU). Written informed consent was obtained from the parents or guardians of all participating children prior to the clinical procedures.

The selected teeth were randomly allocated into two equal groups consisting of 54 teeth each In the first group, root canal preparation was performed using conventional stainless steel hand. files, whereas in the second group instrumentation was carried out using the ProTaper Next rotary file system with an endodontic motor. All clinical procedures were performed under local anaesthesia with proper isolation. After administration of local anaesthesia, an access cavity was prepared and working length was determined radiographically.

Root canal preparation was then carried out according to the assigned instrumentation technique. In the hand file group, canals were instrumented sequentially using stainless steel K-files following standard step-back technique. In the rotary file group, canals were prepared using ProTaper Next rotary instruments according to the manufacturer's recommended protocol. During instrumentation, canals were irrigated with appropriate irrigating solution and recapitulation was performed to maintain canal patency. The total time mandatory for root canal preparation was documented in minutes using a stopwatch.

After the completion of canal preparation, the canals were dried out with paper points, and obturation was done with zinc oxide eugenol paste. Post-operative radiographs were taken to

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evaluate the obturation. Radiographic evaluation classified the obturation as optimal fill, underfill, or overfill. All the recorded data were processed with statistical software. Statistical analysis included calculating the mean values and standard deviations for the continuous data. Comparisons between the two groups were carried out. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 108 primary molars from children aged 4–9 years were involved in this study. The mean age of the subjects was 6.10 ± 1.17 years (Table 1). The sample involved 64 males (59.3%) while 44 females (40.7%). The teeth were randomly assigned into two equal groups: Hand File (HF) group (n=54) and Rotary File (RF) group (n=54) (Table 2).

The comparison of mean root canal preparation time between the two groups showed a statistically significant difference. The hand file group required more time for canal preparation compared with the rotary file group. The mean instrumentation time was 18.1 ± 0.44 minutes for the hand file group and 9.62 ± 0.35 minutes for the rotary file group. The difference was statistically significant (p = 0.003) (Table 3).

Radiographic evaluation of the obturated canals demonstrated comparable results between the two groups. In the hand file group, 51 cases (94.4%) showed optimal obturation, 2 cases (3.7%) were underfilled, and 1 case (1.8%) was overfilled. In the rotary file group, 52 cases (96.3%) showed optimal obturation, while 2 cases (3.7%) were overfilled, and no underfilled canals were observed. Statistical analysis revealed no significant difference among the two groups (p = 0.31) (Table 4).

Table 1: Age Distribution of Patients

Variable	Mean ± SD
All patients	6.10 ± 1.17
Hand File group	5.99 ± 1.13
Rotary File group	6.20 ± 1.22
Min age	4 years
Max age	9 years

Table 2: Gender Distribution of Patients

Gender	Hand File (n=54)	Rotary File (n=54)	Total (n=108)
Male	31 (57.4%)	33 (61.1%)	64 (59.3%)

Table 3: Comparison of Root Canal Preparation Time

Instrumentation Method	Sample Size (n)	Mean Time (minutes)	Standard Deviation	p-value
Hand Files	54	18.1	0.44	
Rotary Files	54	9.62	0.35	0.003

Table 4: Comparison of Quality of Obturation

Quality of Obturation	Hand File (n=54)	Rotary File (n=54)
Underfilled	2 (3.7%)	0 (0%)
Optimal	51 (94.4%)	52 (96.3%)
Overfilled	1 (1.8%)	2 (3.7%)
p-value		0.31

DISCUSSION

The most prevalent chronic disease of the primary dentition is dental caries.[9] Inadequate oral hygiene in infants and children, and dietary practices make them highly susceptible to dental caries that eventually leads to involvement of the pulp.[10] Proper case selection, use of appropriate pulpectomy technique, and appropriate obturating materials are pivotal for the success of such treatment.[11]

The current study included 108 primary molar teeth selected in patients irrespective of gender and both maxillary and mandibular, first and second primary molars were included. The age of the patients in this clinical trial between 4 to 9 years with a mean age distribution in both HF and RF group is 6.10+ 1.17 which was like a study done by Ochoa- Romero in (2011)[12]. At this age, primary molars usually exhibit minimal or no resorption of their roots. Generally, initial root resorption initiates among one and three years after apical closure of the apices of the primary teeth, and exfoliation shadows by approximately three years.[13] Thus, at this mean age primary molars can be selected for root canal treatment if needed. The patients were selected irrespective of their gender and both first & second primary molars were included. Gender distribution in current study turned out to be 64 (59.3%) males and 44 (40.7%) female patients of total 108 sample size. Gender imbalance has no effect on the results of the trial in terms of root canal preparation time and quality of obturation. Lack of chairside co-operation shown by the children less than 4 years of age was the major reason for not including them in the study.

The upper age limit was kept at 9 years with any tooth in this age showing any signs of physiologic of pathologic root resorption on radiograph were excluded. In vitro study done by Bugra ozen et al ()[13] yielded similar results to our current study in terms of time of instrumentation i-e manual around 16.2+ 5.7 mins (maxillary molars) and 16.4 + 6.1 mins (mandibular molars) and ProTaper files having 7.9 + 4.2 mins (maxillary molars) and 8.1+ 5.2 mins (mandibular molars). Another in - vitro study done by Francinne M. Rosa in (2014)[14] with root canals of 144 extracted first and second primary maxillary molars compared the conventional and rotary files for root canal preparation also concluded that a minimum number of minutes for instrumentation was achieved with rotary files. In another study by Pinheiro (2012)[15] it was also concluded shorter instrumentation time with rotary files. Similarly, Ahlquist et al (2001)[16] in another in vitro comparison of manual and rotary techniques didn't record the time but subjectively favoured the rotary instrumentation over the conventional file system as it was simple and faster to used.

Furthermore, there are studies done by authors Boonchoo et al in (2020)[17], Jeevanandan et al in (2018)[18] and Mokhtari et al in (2017)[19] which not only supported the current study for yielding lesser canal preparation time with rotary files as compared to hand files, but also an exceptionally less time in minutes was i.e., 4 mins approximately which is way less than our study and the studies aforementioned.[20] The clinical implications of the present study are particularly relevant for paediatric dental practice. Efficient instrumentation techniques that reduce chairside time may improve patient cooperation and treatment acceptance. Rotary systems may therefore enhance the overall efficiency of pulpectomy procedures in children.

CONCLUSION

Rotary file systems considerably decrease the time required for root canal preparation in primary molars associated with conventional hand files. However, both techniques provide similar quality of obturation. Rotary instrumentation can therefore be considered a time-efficient and clinically effective alternative to conventional hand filing in paediatric pulpectomy procedures.

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