

**Comparative evaluation of instrumentation time and quality of obturation between Kedo-S and Protaper rotary file in root canal preparation of primary lower molars: a non-randomised clinical trial**

<sup>1</sup>Aswani Anil, Senior Resident, Department of Pediatric & Preventive Dentistry, Government dental college, Thrissur, Kerala, India.

<sup>2</sup>T V Anupam Kumar, Professor & Head, Department of Pediatric & Preventive Dentistry, Government dental college, Kottayam, Kerala, India.

<sup>3</sup>Rita Zarina A, Professor & Head, Department of Pediatric & Preventive Dentistry, Government dental college, Trivandrum, Kerala, India.

<sup>4</sup>Gibi Syriac, Assistant Professor, Department of Pediatric & Preventive Dentistry, Government dental college, Kottayam, Kerala, India.

<sup>5</sup>Raseena K T, Senior Resident, Department of Pediatric & Preventive Dentistry, Government dental college, Kottayam, Kerala, India.

<sup>6</sup>Resmi Ramesh, Senior Resident, Department of Pediatric & Preventive Dentistry, Government dental college, Alappuzha, Kerala, India.

**Corresponding Author:** Aswani Anil, Senior Resident, Department of Pediatric & Preventive Dentistry, Government dental college, Thrissur, Kerala, India.

**Citation of this Article:** Aswani Anil, T V Anupam Kumar, Rita Zarina A, Gibi Syriac, Raseena K T, Resmi Ramesh, “Comparative evaluation of instrumentation time and quality of obturation between Kedo-S and Protaper rotary file in root canal preparation of primary lower molars: a non-randomised clinical trial”, IJDSIR- June - 2021, Vol. – 4, Issue - 3, P. No. 572 – 578.

**Copyright:** © 2021, Aswani Anil, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

---

**Introduction**

Preservation of dental arch space is one of the primary objectives of Pediatric Dentistry. Premature loss of primary teeth may cause aberration of the arch length, resulting in drifting of permanent teeth and consequent malocclusion. Whenever possible, the pulpally involved tooth should be maintained in the dental arch, provided that it can be restored to function, free of disease. [1]

Pulpectomy refers to the removal of all pulpal tissue from the tooth, including both coronal and radicular portions. The anatomy of the roots of primary teeth in some cases may complicate these procedures. There has always been an interest in successfully negotiating the complex anatomy of roots of primary teeth and retaining them. [2] One of the limitations of pulpectomy in primary teeth is the long chair time during which child’s behaviour

management could be problematic. [3] Traditionally, stainless steel files have been used for cleaning and shaping the primary tooth root canals manually. Recently, Nickel-Titanium rotary files have been developed for use in endodontics. Rotary biomechanical preparation of primary teeth was first described by Barr et al. (2000) with profile 0.04 taper instrument which was cost effective and efficient resulting in a consistently uniform and predictable obturation. [4] Silva et al. reported decreased duration of time for root canal preparation with a rotary in primary teeth. [5] Protaper is a NiTi file, that combines multiple progressive tapers within the shaft; shaping files (S) have an increasing taper in the coronal direction, whereas finishing files (F) have decreasing taper. [6] Although these files are frequently used for permanent teeth, a major concern in applying them for primary teeth is the possibility of lateral perforations on the inner surface of roots of primary teeth. These perforations can be due to the predesigned greater taper of protaper rotary files. [7] Kedo-S file, world's first rotary file for primary teeth; have a gradual taper aiding in easy coronal enlargement and straight line access. This gradual taper also helps in efficient canal preparation and avoids over instrumentation of the inner wall of the root surface. [8] Root canal preparation with Kedo-S rotary files are considered to be effective in debriding the uneven walls of primary teeth, resulting in a consistent instrumentation time and predictable quality of obturation. Studies have been done comparing protaper rotary files and conventional hand instrumentation methods in primary teeth. But very few studies have been done regarding the Kedo-S rotary files and its comparison with the existing rotary file systems. For this reason, it will be of interest to conduct a study to compare the effectiveness of Kedo-S rotary file with that of Protaper rotary file.

## Materials and methods

The present study is a non randomised clinical trial. The ethical approval for the study was obtained from our Institutional Review Board with ethical committee number IEC/M/14/2017/DCK. Children belonging to the age group of 4-7 years reporting to our department were included in the study. Informed consent of individual parent concerning the participation in the study was obtained. Inclusion criteria includes primary mandibular molars with signs of irreversible pulpitis with adequate bone support (at least 2/3rd of intact root length) without gingival swelling, sinus tract or purulent exudates expressed from the gingival margin. Patients who did not provide informed consent, children with underlying systemic diseases, with special health care needs, those lacking co-operative behaviour and grossly decayed teeth with external or internal resorption were excluded from the study. Children were divided into 2 different groups (Group A & B) with 32 in each group. Each child in both groups had two dental visits. Screening, radiographic investigation, explaining about the procedure and obtaining the required consent from the parent were done in first visit and pulpectomy using rotary files in second visit. A detailed medical and dental history was obtained from each patient. In Group A, Pulpectomy was carried out with protaper rotary instrumentation technique and in Group B using Kedo S Pediatric rotary file system. Under appropriate Local Anaesthesia using 2% lignocaine with 1:200000 adrenaline (Ciron Drugs & Pharmaceuticals Pvt Ltd, India) and Rubber dam isolation (GDC Marketing, India), access cavity was prepared. Using No 4 round carbide bur in a high speed handpiece, the superficial caries and roof of the pulp chamber was removed. Tapered carbide bur was used to extend and favourably orient the axial walls of pulp chamber. Coronal pulp amputation was done with spoon excavator

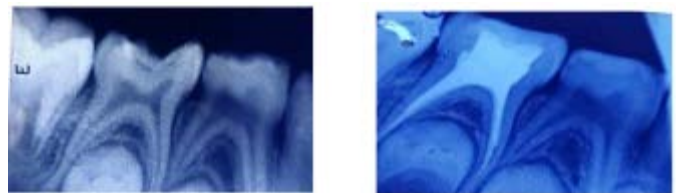
(API). After completing amputation, hemostasis was evaluated. The canal orifices were located and extirpation of the pulp was done with #10 Barbed Broach. No.10 and No.15 size K-files were used to determine the patency of the canals. In both Rotary groups canal length was determined by digital radiograph. The file was kept 2mm short of the apex. Care was taken not to go beyond the apex. In Group A, 21mm length Protaper Rotary file (Koden) was used. Only S2 Protaper Rotary file (250rpm & torque 1.8Ncm) was used till the working length using Waldent Endo Pro Cordless Endo Motor. In Group B, Biomechanical preparation was done using Kedo S Rotary file (Reeganz Dental Care Pvt. Ltd. India) (250rpm & torque 1.8Ncm). Only D1 file of diameter 0.25mm with a variable taper was used till the working length using Waldent Endo Pro Cordless Endo Motor. Copious irrigation with 3% Sodium hypochlorite solution and Saline was performed after each file systems. The instrumentation time was noted in minutes from the start of instrumentation till the completion of cleaning and shaping of the canals using a stop watch by an assistant. After biomechanical preparation, canals were irrigated well and dried with paper points. Obturation was done with Zinc-oxide Eugenol cement. The prepared canals were obturated with creamy paste of Zinc Oxide Eugenol using hand pluggers in plugging action with wet cotton pellets (King et al). [9] Final restoration was done with a Glass Ionomer Cement. Post-operative intraoral Digital radiographs were taken after the obturation to assess the quality of obturation. The pulpectomy treated teeth were restored with Stainless steel crowns on the same appointment. Quality of obturation was assessed by apical seal evaluated in millimeters from the apical end of the canal filling material to the radiographic apex, Presence or absence of voids & extrusion of obturated material (defined as any extruded material vertically beyond the

radiographic apex). The comparison among two groups was determined radiographically (digital radiograph) based on the following criteria by Coll and Sadrian. [10] All canals filled 1mm or more short of radiographic apex was considered as short fill. Obturation of one or more of canals having ZOE ending at radiographic apex was considered as complete fill. The obturation was considered as long fill in case of any canals showing ZOE outside the radiographic apex. Apical seal was measured from digital radiograph to categories the length of fill. Obturated canals were assessed for the presence or absence of voids and extrusion of obturated material by digital radiography [Figure1 & Figure 2].

Figure 1: Quality of obturation using protaper rotary file



Figure 2: Quality of obturation using Kedo-S rotary file



Data were entered in MS EXCEL sheet and was transferred to SPSS version 16.0 for statistical analysis. Statistical significance was set at p value less than 0.05. Independent's' test was used to compare the mean instrumentation time and Chi-square test was used to compare the quality of obturation between two groups.

#### Results

Among 64 children studied, 27 were boys (42.2%) and 37 were girls (57.8%). The mean age of subjects in group A was  $4.9 \pm 0.91$  years and that of group B was  $5.19 \pm 0.94$  years [Table 1]. The mean instrumentation time observed for instrumentation with Protaper rotary file is

4.99±0.46minutes and that of Kedo-S file is 6.19±0.52minutes. While comparing the results of independent ‘t’ test, the mean instrumentation time between the two groups shows a statistically significant result of Protaper rotary files showing less instrumentation time as compared to Kedo-S file (p<0.05) [Table 2] [Figure 3].

Table 1: Distribution of demographic variables in each group

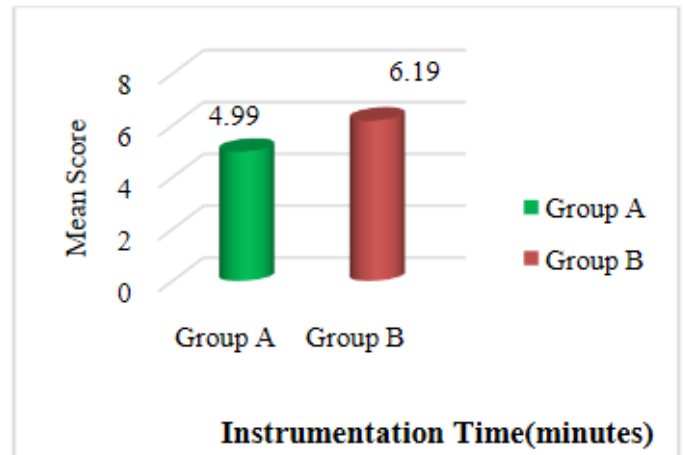
Variables		Group A (Protaper)	Group B (Kedo-S)
Age (years)	Mean age	4.906	5.188
	SD	0.9197	0.9483
Gender	Boy	12	15
	Girl	20	17
	Total	32	32

SD = standard deviation

Table 2: Comparison of instrumentation time between the groups

Instrumentation Time (minutes)		
Group	Group A	Group B
Number of subjects	32	32
Mean	4.99	6.19
Standard deviation	0.47566	0.52078
p value	0.000	0.000

Figure 3: Comparison of mean instrumentation time between two groups



In quality of obturation, both groups were completely filled in 24 cases; indicative of 75% of the total mesial canal obturation. Distal canals were completely filled in 25 and 26 cases in group A and group B respectively, which indicates more than 75% of the total distal canal obturation. Hence, no statistical significance were found between group A and group B with regard to the apical seal in mesial and distal canals of lower primary molars at p>0.05. Considering both groups, no statistical significance were found between group A and group B with regard to the voids and extrusion of obturated material in mesial and distal canal obturation with zinc oxide eugenol of lower primary molars at p value> 0.05.

### Discussion

A practical pulpectomy technique for the primary teeth should include fast procedure with short treatment time, minimal number of appointments, effective debridement without weakening the tooth structure or endangering the underlining permanent teeth and maintaining tooth function until it's natural exfoliation.[6] The principal roadblock to pulpectomy success is the multiple tortuous root canals in primary teeth and the apparent connection between coronal pulpal floor with the intraradicular area. [11, 12] Because of this, mechanical debridement and

subsequent filling are difficult. Advancement in the field of endodontics for primary teeth from the use of hand Headstrom files and Kerr-files to the current rotary systems was a boon for these difficulties. [13] Farther challenging aspects of Pediatric Dentistry is managing the behaviour or understanding the anxious, fearful and uncooperative child. The cooperation of the child during of deciduous teeth is related to several factors, among which the important being the visit duration. To overcome some of these issues, nickel-titanium alloy was introduced in endodontics which fulfilled the objectives of simplicity, speed, safety, and stress reduction for both the clinician and the patient. [14] Mechanical preparation of primary teeth utilizing Ni-Ti rotary files was first done by Barr et al. and they concluded that the use of Ni-Ti rotary files for root canal preparation in primary teeth was cost effective, faster, and resulted in consistently uniform and predictable fillings. [4] There are various file systems which are recently developed and are specially designed for Pediatric patients. Kedo file systems are the world's first files designed for root canal preparation in primary teeth which was first reported in Jeevanadan et al (2017). Kedo files are available in Hand type (Kedo-SH) and rotary type (Kedo-S, Kedo-SG). The Kedo-S Paediatric rotary files have a gradual variably variable taper aiding in easy coronal enlargement and straight line access. [7] The Kedo-S file system (Reeganz dental care Pvt. Ltd. India) consists of three Ni-Ti rotary files namely D1, E1 and U1 [Figure 4]. The total length of the file is 16 mm and working length is 12 mm. Kedo-S D1 file has a tip diameter of 0.25 mm with a variable taper. It can be used in primary molars with narrow canals (mesial canals in mandibular molars and distobuccal canal in maxillary molars). E1 file has a tip diameter of 0.30 mm and can be used in wider molar canals (distal canal in mandibular molars and palatal canal in maxillary molars). U1 has a tip

diameter of 0.40 mm and used in primary incisor teeth. The taper of the instruments are designed according to the diameter of primary teeth with narrow and wide root canals. Kedo-S files must be used in a low speed constant-torque handpiece with a lateral brushing motion. The ideal rotation speed is 150 - 300 rpm and 2.2 N cm torques. [7] Figure 4: Kedo-S Pediatric rotary file.



Previous study by Govindaraju et al reported that Kedo-S files were very effective during root canal preparation of primary teeth with reduction in instrumentation time and better quality of obturation. [15] The present study utilizes Protaper file system in canal preparation of group A by inserting only S2 file under passive pressure which was in accordance with the study of Kuo et al who modified the protocol used in permanent teeth by encouraging the usage of only Sx and S2 in primary teeth. The S1 file was not used, because it was too small to efficiently prepare the root canals of primary molars, and the F series files were not used either, because the increased taper (7%~9 %) and tip size resulted in excessive apical dentin removal. [6] The mean instrumentation time in the present study with Protaper rotary file ( $4.99 \pm 0.46$  minutes) was shorter compared to Kedo-S rotary file ( $6.19 \pm 0.52$  minutes) and the difference was statistically significant ( $p < 0.05$ ). A study conducted by Panchal et al comparing the instrumentation time and



obturation quality between Hand held K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth concluded that Pediatric rotary files Kedo-S rotary file has better obturation quality in minimum instrumentation time. [16, 17] In the present study, no statistically significant difference was noticed in both groups with respect to quality of obturation. But in Makarem et al and Ochoa Romero et al a statistically significant difference was noted in the quality of obturation while comparing rotary and manual instrumentation in primary molars. [18,19,20] As there is limited literature in regard to the quality of obturation with rotary instruments in primary teeth, more studies are needed to analyze the volumetric change during pre- and post-canal preparation and after root canal filling using different rotary system. Due to reduced length of Kedo-S files, they can be easily used in children since they have a limited mouth opening. Fracture resistance of Kedo-S files was high compared to Protaper files. Former was used for canal preparation in more than eight teeth without fracture, but latter fractured with a limit of four teeth. Above said are some of the advantages of Kedo-S files which were experienced during the course study. An increase in instrumentation time was noticed in root canals prepared by Kedo-S rotary file which might be due the reduced torque (1.8Ncm) used in the present study (manufacturer's recommendation was 2.2-2.4Ncm). The morphology of root canals of first and second primary mandibular molars are entirely different and therefore the instrumentation time might vary in both primary first and second lower molars. This may affect the quality of obturation which is not mentioned separately in this study. Quality of obturation was assessed in both canals (mesial or distal canals) of primary molars; but it was not mentioned specifically whether it was in mesiobuccal, mesiolingual or distobuccal, distolingual root canals. Presence or absence of voids in

obtured canals prepared by two rotary systems were assessed by postoperative digital radiographs which is a two dimensional image of a three dimensionally object. The study would have gained much significance if quality of obturation was assessed three dimensionally. Previously stated are the few limitations of the study.

### **Conclusion**

Instrumentation time and the need to maintain the original path of tortuous and irregular root canal walls are considered to be crucial factors for ensuring the success of pulpectomy. The use of rotary files in root canal preparation of primary teeth is indispensable in the aforementioned role. Reduced length of file and increased fracture resistance are the two supreme qualities of Kedo-S file; a rotary file exclusive for primary teeth. Henceforth Kedo-S files are beneficial for biomechanical preparation in primary teeth.

### **References**

1. Stephen Cohen, Richard C Burns. Pathways of pulp.6th ed. St Louis: Mosby publishers; 2006.p. 631-2.
2. Pinkham, Casamassimo, Fields, Mctique, Nowak. Pediatric dentistry infancy through adolescence.4th ed. Elsevier; 2005.p.403-4.
3. Dean J, Avery DR, McDonald RE. Dentistry for the child and adolescent.7th ed. St Louis: Mosby Elsevier; 2011.p.400-1.
4. Barr ES, Kleier DJ, Barr NV. Use of nickel-titanium rotary files for root canal preparation in primary teeth. *Pediatr Dent* 1999; 21:453-4.
5. Silva LA, Leonardo MR, Nelson-Filho P, Tanomaru JM. Comparison of rotary and manual instrumentation techniques on cleaning capacity and instrumentation time in deciduous molars. *J Dent Child (Chic)* 2004; 71:45-7.

6. Bergmans L, Vann Cleynenbreugel J, Wevers M, Lambrechts P. Mechanical root canal preparation with NiTi rotary instruments: rationale, performance and safety. *Am J Dent* 2001; 14:324-33.
7. Kuo CI, Wang YL, Chang HH, Huang GF. Application of NiTi rotary files for pulpectomy in primary molars. *J Dent Sci* 2006; 1:10-5.
8. Jeevanandan G. Kedo-S Pediatric rotary files for root canal preparation in primary teeth- case report. *Journal of clinical and diagnostic research* 2017; 11:3-5.
9. King NM, Brook AH, Page J: Endodontic therapy for primary teeth: diagnosis and treatment. *Dent Update* 1984; 11:154-6.
10. Coll JA, Sandrian R. Predicting pulpectomy success and its relationship to exfoliation and its succedaneous dentition. *Pediatr Dent* 1996; 18:57-63.
11. Hibbard E D, Ireland R L. Morphology of root canal of primary teeth. *J Dent Child* 1957; 24:250.
12. Moss M J, Addleston R and Goldsmith E D. Histologic study of pulpal floors of deciduous molars. *J Am Dent Assoc*. 1965; 70-72.
13. George S, Anandaraj S, Issac JS, John SA, Harris A. Rotary endodontics in primary teeth – A review. *Saudi Dent J* 2016; 28:12-7.
14. Kummer TR, Calvo MC, Cordeiro MMR, de Sousa Vieira R, de Carvalho Rocha MJ. Ex vivo study of manual and rotary instrumentation techniques in human primary teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontology* 2008; 105:84–92.
15. Govindaraju L, Jeevanandan G, Subramanian EG. Comparison of quality of obturation and instrumentation time using hand files and two rotary file systems in primary molars: A single-blinded randomized controlled trial. *Eur J Dent* 2017; 11:376.
16. Veerale Panchal, Ganesh Jeevanandan, EMG Subramanian. Comparison of instrumentation time and obturation quality between Hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. *J Indian Soc Pedod Prev Dent* 2019; 37: 75-9.
17. Musale PK, Mujawar SA. Evaluation of the efficacy of rotary vs hand files in root canal preparation of primary teeth in vitro using CBCT. *Eur Arch Paediatr Dent* 2014; 15:113-20.
18. Abbas Makarem, Navid Ravandeh, Masoumeh Ebrahimi. Radiographic assessment and chair time of rotary instruments in the pulpectomy of primary second molar teeth: A randomized controlled clinical trial. *J Dent Res Clin Dent Prospect* 2014; 8:84-8.
19. Ochoa-Romero T, Mendez-Gonzalez V, Flores-Reyes H, Pozos- Guillen A. Comparison between Rotary and Manual Techniques on Duration of Instrumentation and Obturation Times in Primary Teeth. *J Clin Pediatr Dent* 2011; 35:359-64.
20. Zameer M. Evaluation of radicular dentin remaining and risk of perforation after manual and rotary instrumentations in root canals of primary teeth: An invitro study. *Pediatr Dent* 2016; 4:57-65.