

# Evaluation of Quality of Obturation Using Two Different Rotary Files and Hand Files in Primary Teeth: A Randomized Controlled Trial

Neethu Ann Preethy<sup>1</sup>, Ganesh Jeevanandan<sup>2</sup>, Mebin George Mathew<sup>3</sup>, Erulappan M Subramanian<sup>4</sup>

## ABSTRACT

**Aim and objective:** To estimate the obturation quality and instrumentation time on comparing traditional hand files and two rotary file types during root canal instrumentation in deciduous molars.

**Materials and methods:** Forty-five deciduous mandibular molars were taken and randomly allotted to three groups ( $n = 15$ ). Group I: K-hand files, group II: ProTaper Gold rotary file, and group III: Kedo-SG Blue rotary files. Before and after root canal instrumentation, standardized digital radiography was taken and the instrumentation time was also noted. The recorded data were then subjected to statistical analysis utilizing SPSS Software version 22.0. To compare the instrumentation time and quality of obturation between the groups, a Chi-square test and ANOVA with the level of significance at 0.05 were employed.

**Results:** There was no significant difference recorded with reference to the quality of obturation ( $p > 0.05$ ). However, the difference was noticed to be statistically significant when the instrumentation time between the two rotary groups and the manual instrumentation groups was taken into account ( $p < 0.05$ ). The rotary systems ProTaper Gold and Kedo-SG Blue exhibited a significantly less instrumentation time on comparing with that of the hand files.

**Conclusion:** Concerning the quality of obturation, all three file groups demonstrated almost a similar performance. However, there was a significant difference noticed in the instrumentation time with the use of manual instrumentation in comparison to rotary instrumentation in deciduous teeth.

**Keywords:** Deciduous teeth, Hand K files, Obturation quality, Pediatric rotary files.

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## INTRODUCTION

The evolution in dentistry has led to several developments in recent years. This had led to improvisation not just in the material aspect but also in the instrumentation and technique aspects leading to better work quality particularly in fields like pulp therapy.<sup>1</sup>

Pulpectomy involves the removal of infected tissue in symptomatic deciduous teeth which is considered a taxing procedure in the domain of pediatric dentistry.<sup>2</sup> The success of a pulpectomy relies on the obturation of the root canal system in the same way as the apt method of instrumentation and chemo-mechanical preparation.<sup>3</sup>

It is said that the length of the treatment procedure strongly influences the child's behavior and the conventional manual instrumentation method used for cleaning as well as shaping proves to be long and cumbersome.<sup>4,5</sup> There have been several studies documented on the usage of hand files in primary root canals for instrumentation.<sup>6</sup> Despite their wide usage, these hand files have few undeniable limitations which include lengthy canal preparation time as well as unequal preparation of root canals.<sup>4</sup>

At the start of the year 2000, NiTi files were introduced into the field of Pediatric Endodontics by Barr et al.<sup>6</sup> Rotary instrumentation using NiTi files thus has gained popularity in recent years to overcome the disadvantages of manual instrumentation. Rotary files are preferred for their ability to reduce the instrumentation time, conserve the sinuous root canal path of deciduous teeth, and also provide conical-shaped canals enhancing the quality of obturation.<sup>4,7,8</sup>

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<sup>1-4</sup>Department of Pediatric and Preventive Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

**Corresponding Author:** Ganesh Jeevanandan, Department of Pediatric and Preventive Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India, Phone: +91 9884293869, e-mail: helloganz@gmail.com

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Very few studies have been done comparing the different rotary file systems in primary teeth.<sup>1,5,7-14</sup> Systematic clinical trials need to be conducted with rotary files in primary teeth to validate the results and to arrive at definitive conclusions. There are no *in vivo* studies done comparing the quality of obturation and time taken for instrumentation of Kedo-SG blue and ProTaper Gold Rotary Files in deciduous teeth. Therefore, this particular study was conducted to compare and evaluate instrumentation time and quality of obturation of ProTaper gold and Kedo-SG rotary files with hand files in primary molars. The hypothesis is the presence of a significant difference in the instrumentation time and obturation

quality using rotary instrumentation when compared with manual instrumentation in deciduous molars.

## MATERIALS AND METHODS

The randomized controlled trial was conducted in the Department of Pediatric and Preventive Dentistry in dental college from the month of July to November of 2018. Approval for trial design was obtained from the Institutional Review Board and got informed consent from both the parents of the children who took part in the study.

Forty-five children in total aging 4–8 years who required pulpectomy in any of the deciduous mandibular molars were allocated to one of the three groups: Group I: manual hand K files, group II: ProTaper Gold rotary files, and group III: Kedo-SG blue rotary files. An individual not involved in this study prepared the computer-generated randomization sequence. We arrived at a sample size of 45 utilizing G power analysis from a previous *in vivo* study with 95% power.<sup>8</sup> Children were selected for this study if they met the following criteria: (a) vital or non-vital lower deciduous molars without sinus tract, (b) without external or internal pathologic root resorption in teeth, (c) existence of adequate coronal tooth structure to support stainless steel crown. Those children exhibiting a lack of cooperative ability, children having underlying systemic diseases, and children requiring special healthcare needs were excluded from the study.

A single operator carried out all the procedures. A full-mouth examination with intraoral periapical radiographs of all the teeth indicated for pulpectomy were taken before the start of the clinical procedure. After diagnosis was confirmed, local anesthesia 2% lignocaine with 1:200,000 adrenaline (LOX\*2% adrenaline, Neon Laboratories Limited, India) was administered. The tooth was isolated with the help of a rubber dam (GDC Marketing, India).

A round carbide bur in a high-speed handpiece was used to remove superficial caries and also derooft the pulp chamber. Coronal pulp amputation was carried out using a spoon excavator and a no. 10 size K-file was utilized to determine the canals' patency. Working length determination was by Ingle's radiographic method using the preoperative radiograph. The canal was prepared using:

Group I: Hand K-files (Mani, Tochigi, Japan) from #15 to #30 employing a quarter pull turn method.

Group II: Hand K file #15, #20 followed by ProTaper Gold file-S2 (Dentsply India Pvt. Ltd., Delhi, India) up till the working length with help of X-Smart endodontic motor.

Group III: Hand k file #15 followed by Kedo-SG Blue-D1, E1 was used till the working length with help of X-Smart motor (Reeganz dental care Pvt. Ltd. India).

The canals' instrumentation time was recorded in seconds by an assistant using a stopwatch. Saline irrigation was done and then dried using sterile paper points. Calcium hydroxide and iodoform paste were used for obturation by gently pushing with help of cotton pellets (Metapex, Meta Biomed Co., Ltd., Korea). A post-obturation radiograph was taken to evaluate the obturation quality. It was then analyzed by another pediatric dentist who was blinded to the type of instrumentation employed.

Based on this, the obturation quality was graded as optimal fill, overfill, and underfill (modification by Coll JA and Sadrian R):<sup>15</sup>

Under-filling: ZOE was >2 mm short of the apex in all the canals.

Optimal filling: ZOE ends at the radiographic apex or up to 2 mm short of the apex in one or more of the root canals.

Over-filling: ZOE outside the root in any canal.

Glass ionomer cement (Shofu, Shofu Inc., Japan) was provided as the entrance filling and SS crowns were used for restoration either on the same day or on the next day of the appointment.

SPSS software version 17.0 (Chicago, SPSS Inc.) was used for statistical analysis. Pearson's Chi-square test was utilized for comparison of obturation quality of between the groups. In this study,  $p < 0.05$  was considered to be the level of significance. To compare the instrumentation time between the groups, the ANOVA test was used while *the post hoc* Turkey test was used to identify significant groups with a 5% significance level.

## RESULTS

Out of the 45 children being treated, 28 were girls and 17 were boys belonging to the age group of 4–6 years with the mean age being 5.20 years (Table 1).

With reference to obturation quality among the three groups, 33.3% of teeth instrumented using hand files; 53.3% of teeth instrumented using ProTaper Gold, and 53.3% of teeth instrumented using Kedo-SG Blue rotary files displayed optimal fill (Table 1). No statistically significant difference was observed between the three groups ( $p < 0.05$ ) (Table 2 and Fig. 1).

Similarly, instrumentation time was recorded and intra-group comparison between the three groups was performed with ANOVA test which showed a statistically significant difference between the three groups ( $p < 0.05$ ) (Table 3).

Turkey *post hoc* analysis was done which showed a statistically significant difference ( $p < 0.05$ ) favoring rotary files when compared with hand files. Nevertheless, no significant difference was observed between the two rotary files in relation to instrumentation time (Table 4).

## DISCUSSION

When a primary tooth gets exfoliated early, it turns out to be a crucial concern in the field of pediatric dentistry as preservation of primary teeth is essential for maintaining the proper integrity of the dental arch and facial tissues. It also serves as a guide for the eruption of succedaneous permanent teeth.<sup>16</sup>

**Table 1:** Demographic data and clinical features of the patient receiving treatment with K-file, Kedo-SG blue files, and ProTaper Gold

	K-File	Kedo-SG Blue	ProTaper Gold
Gender			
Girls (n)	10	7	11
Boys (n)	5	8	4
Age (mean, years)	5.33	5.13	5.13
Total mean = 5.20 years			

**Table 2:** Comparison of quality of obturation among the different groups expressed in percentage. Intergroup comparison between the three groups revealed no significant differences

Assessment of quality of obturation	Hand K files	Kedo-SG Blue rotary files	ProTaper Gold rotary files	Overall p value
Under-fill	40	26.6	13.3	0.500*
Optimal-fill	33.3	53.3	53.3	
Over-fill	26.6	20	33.3	

\* $p > 0.05$ , statistically not significant

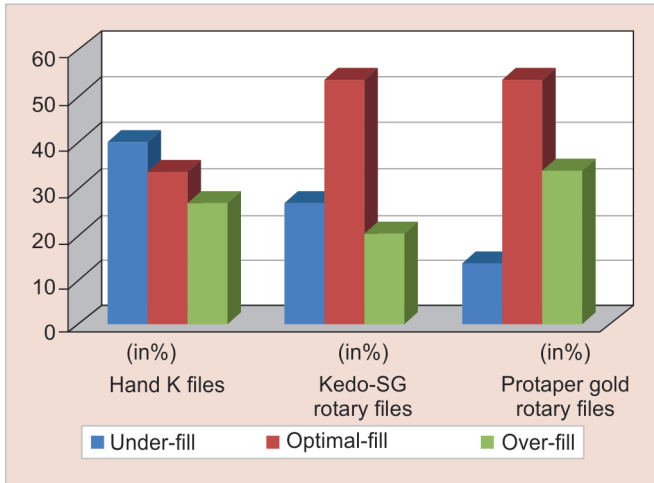


Fig. 1: Obturation quality of the three file groups described in percentage

Table 3: Comparison of instrumentation time among the three groups

Group	N	Instrumentation time, mean ± Std. dev.	Overall p value*
Hand files	15	5.21 ± 14.51	<0.05*
Kedo-SG Blue rotary files	15	1.53 ± 16.37	
ProTaper Gold rotary files	15	2.09 ± 23.35	

\*p < 0.05, statistically significant

Table 4: Intergroup comparison of instrumentation time among the groups

Groups	Groups	Overall p value
K file	ProTaper Gold	<0.05*
	Kedo-SG blue	<0.05*
ProTaper Gold	K file	<0.05*
	Kedo-SG blue	>0.05
Kedo-SG blue	K file	<0.05*
	ProTaper Gold	>0.05

\*p < 0.05, statistically significant; p > 0.05, no statistical significance

Several *in vitro* studies have been done previously comparing the rotary and manual instrumentation.<sup>1,4,6</sup> As of now, there are no *in vivo* studies of particular comparing hand files with ProTaper Gold and Kedo-SG files. And therefore, this trial was done to evaluate the instrumentation time and quality of obturation using hand K-file, ProTaper Gold rotary file, and Kedo-SG rotary files.

ProTaper Gold is a newly introduced rotary file with advanced metallurgy for greater flexibility and resisting cyclic fatigue. It has a progressively tapered design which improves the cutting efficiency and safety. The convex triangular cross-section decreases the rotational friction between the file blades and dentin.<sup>17,18</sup>

The Kedo-SG Blue files system (Reeganz dental care Pvt. Ltd., India) is a newly introduced exclusive pediatric endodontic file system. It consists of three heat-treated and titanium oxide-coated Ni-Ti rotary files. The total length of these files is 16 mm and the working length of these files is 12 mm. D1, E1, and U1 are the terms used to name each file, respectively. The variable taper of these files corresponds to its use in deciduous teeth. D1 file with its tip

diameter of 0.25 mm can be used in deciduous molars with narrow canals. E1 file having a tip diameter of 0.30 mm can be used in wider molar canals. U1 file is mainly indicated for primary incisor teeth and 0.40 is its tip diameter.<sup>12</sup>

In the present study, there is no statistically significant difference in obturation quality between manual K files, ProTaper Gold rotary files, and Kedo-SG blue rotary files. The results of our study in respect to obturation quality are as reported by another study by Govindaraju et al., who reported no significant difference in obturation quality on comparing rotary ProTaper Universal and K3 files with instrumentation using hand K-files.<sup>8</sup>

However, it is contrary to the study done by Crespo et al., who demonstrated better obturation quality using ProFile rotary files when compared with manual instrumentation<sup>1</sup> and also to another study done by Ochoa-Romero et al., who reported superior obturation quality using rotary files; 80% optimal filling using K3 rotary files and 50% with hand files.<sup>11</sup> This disputable result can be ascribed to the use of dissimilar materials and techniques used for obturating root canals.

Instrumentation time noted in this study was noted to be significantly less in the rotary file group when compared with the manual instrumentation group. This is in concordance to another study comparing manual instrumentation with Hero 642 rotary type files which showed lower instrumentation time with rotary files when compared with hand K files in deciduous teeth.<sup>13</sup> This less time taken for instrumentation sequentially influences positive behavior in children, thereby permitting faster completion of the treatment procedure.

**LIMITATION**

A possible limitation in the current study was that only mandibular molars were taken into consideration for the study.

**CONCLUSION**

The obturation quality is more acceptable with rotary files than the manual instrumentation method. The minimization of instrumentation time in the pulpectomy procedure was also noticed with rotary file use in deciduous molars. On that account, Kedo-SG blue or ProTaper Gold rotary file systems can be used as an optional technique for root canal preparation in deciduous teeth.

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