



Original Research

Comparative evaluation of cleaning efficacy of Kedo-SH manual and Kedo-S rotary endodontic files in deciduous molars: an in-vitro study.

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ABSTRACT

Introduction: Preparation of root canals in deciduous molars can be challenging due to their inherent anatomy. Endodontic files were introduced recently for exclusive use in deciduous dentition. Hence, the aim of the present comparative study was to assess the cleaning efficacy of manual and rotary endodontic files in deciduous molars.

Methods and materials: Sixty canals of recently extracted deciduous molars were selected which did not have more than one-third of their root length resorbed. Following working length determination, India ink dye was injected into all the canals. They were arbitrarily allocated into two groups; Group I: Kedo-SH manual files (n=30) and Group II: Kedo-S rotary files (n=30), for the purpose of instrumentation. The root canals were cleared of debris and sections prepared. The sections were examined under a stereomicroscope under 40X magnification for removal of India ink at different thirds and given scores. Data was statistically analyzed using Student t test and ANOVA with level of significance at 5%.

Results: Both file systems resulted in superior cleaning of the coronal and apical section of the root canals. The average scores for coronal and middle sections of the root canals with Kedo-SH manual files (9.5 ± 8.062 ; 10.75 ± 10.31 , respectively) were significantly higher than that of Kedo-S rotary files (5 ± 6.63 ; 6.05 ± 7.5 , respectively) ($p < 0.05$).

Conclusion: Root canals prepared with Kedo-S rotary files showed significant superiorly clean root canals than those prepared using Kedo-SH manual files.

Keywords: Kedo-S, Kedo-SH files, deciduous molars, pulpectomy, root canal instrumentation.

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INTRODUCTION

Dental caries continues to be the main oral disease in children across the globe. The foremost objective of pediatric dentistry is to preserve optimum health of deciduous teeth until their normal shedding so as to maintain the arch integrity.¹ Symptomatic deciduous teeth with chronic inflammation and/or radicular pulp necrosis are treated with pulpectomy. It involves pulp extirpation, thorough cleaning and obturation with an appropriate resorbable material.³ However, endodontic treatment is more challenging in primary teeth because of complex root canal configurations, dynamic variation of root apex and difficulties in management of children. A thorough biomechanical preparation is essential for the success of pulpectomy as it helps in adequate elimination of infected tissue from the root canal.⁴

Hand instrumentation is the conventional and commonly used method for root canal preparation in the primary teeth, but it is time consuming.⁵ The use of rotary files in deciduous teeth was first reported by Barr et al⁶, where-in Profile 0.04 taper rotary files were used. There is an increasing use of rotary Ni-Ti systems in the preparation of root canals in deciduous teeth and has become more popular among pediatric dentists since then.

An exclusive root canal file system, Kedo-files (Reeganz Dental Care Pvt. Ltd. India) has been introduced to be used in deciduous teeth.⁷ Kedo-SH file system consists of six hand files: 3 stainless steel files (P1, P2, P3) for pulp extirpation and 3 Ni-Ti files. The Kedo-S file scheme consists of three Ni-Ti rotary files (D1, E1, U1). The NiTi manual and rotary files are used to shape narrow canals in primary molars (D1), wider canals in primary molars (E1) and anterior canals (U1). These files are 16 mm in length, with a working length of 12 mm and a variable taper designed according to root canal diameter. These files are special because they have varied taper (4-8%) and different tip diameters (D1-0.25, E1-0.30, and U1-0.40) that correspond with their use in primary teeth.⁸ These files are beneficial for biomechanical preparation of shorter root lengths, curved and ribbon-shaped canals in primary molars, without risk of over instrumentation.

However, there is a dearth of studies about cleaning ability of these rotary files designed for use in deciduous teeth. Therefore, the current comparative study was carried out to assess the cleaning effectiveness of Kedo-SH manual files and Kedo-S rotary files in deciduous molars.

MATERIALS & METHODS

The present study was carried out in the Department of Pediatric and Preventive Dentistry. The institutional ethical review board gave its approval to the study protocol (**Ref. No.120/2019-20**).

The sample size was estimated using GPower software v. 3.1.9.2. The power of the study was considered at 80%, with a Confidence Interval of 95% and 5% error. The estimated sample size was 52.

Deciduous molars with carious pulp exposure, and diagnosed with irreversible pulpitis were included. These teeth showed radiographic signs of pulpal and interradicular or furcal involvement and had at least one half to two third root length. Primary molars indicated for extraction for orthodontic purpose were also included.

Roots with internal or external resorption and root canal calcification were excluded. A total of 60 root canals from freshly extracted human deciduous molars formed the study group.

The deciduous molars were cleaned of any calculus, debris and then washed with distilled water and stored in 0.5% sodium hypochlorite for one week. Access cavities were prepared with No. 330 bur (Mani, Tochigi, Japan) with a high-speed arotor handpiece (NSK, Pana Air, Japan) under water spray. The root canals were irrigated using normal saline. A #15 K-file (Dentsply y-Maillefer, Ballaigues, Switzerland) was introduced into each canal and the working length was estimated at 1-2 mm short of the apex. India ink was injected into the root canal of these molars using an insulin syringe and the canals were randomly divided into 2 groups of 30 canals each.

In group I, root canals were instrumented using Kedo-SH manual files and the sequence of instrumentation was followed according to manufacturer's instruction, where the stainless-steel file (P2) was used to extirpate pulp tissue and Ni-Ti files (D1 and E1) were used to shape narrow canals and wider canals, respectively.

In group II, Kedo-S rotary files was used 1-2 mm short of working length using an X-Smart motor to instrument the canals following manufacturer's instructions. The file D1 with a diameter of 0.25 mm was used in deciduous molars with narrow canals (mesial canal in lower molars and distobuccal canal in upper molars). The file E1 with a tip diameter of 0.30 mm was used in wider molar canals (distal canal in mandibular molars and palatal canal in maxillary molars). The files were used in a low-speed constant- torque handpiece at a speed of 150-300 rpm (rotation per minute) along with intermittent saline irrigation.

The root canals were cleared in order to visualize their internal lumen. The teeth were then stored in sealed jars containing 10% chloridric acid for 3 days, following which they were washed under running cold water for 8 hours and dehydrated in 70% alcohol (for 16 hours), 90% alcohol (for 3 hours), and 96% alcohol (for 3 hours) during which alcohol was changed every hour⁵ Following dehydration, the teeth were placed in methyl salicylate. The teeth were then decoronated at the cemento-enamel junction. A cut was made at 1-2 mm short of the apex using a #11 surgical scalpel blade. Then the remaining length of each root was sectioned at two levels to obtain approximate equal lengths of coronal, middle, and apical sections for each canal. Every section was placed on a 1.5×2-inch modelling wax sheet and analyzed under a stereoscopic under 40X magnification, for removal of India ink from the canals. Each section was then evaluated using a scoring system given by Silva et al⁵ as follows:

Score 0: whole ink removal (the canal was completely clean and no ink remained in any part of the root canal)

Score 1: almost complete ink removal (traces of ink found in some areas)

Score 2: fractional ink removal (ink found on some walls in some areas larger than pinpoints or as interrupted short lines of ink less than 0.5 mm on the walls)

Score 3: no ink removal (appreciable amount of ink, larger than 1 mm, were present on some areas of the canal walls) (Figure 1).

Higher scores indicate poor cleaning efficacy.

Data obtained was analyzed using Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp. Student t test and Analysis of variance (ANOVA) was used to compare the mean scores. Level of significance was measured as $p < 0.05$.

RESULTS

Table 1 shows that with both file systems, clearing of India ink dye was comparatively better in the coronal and apical sections of the canals. A significant variance was seen in the mean scores obtained for coronal section of the root canals between Kedo-SH manual files (9.5 ± 8.062) and Kedo-S rotary files (5.0 ± 6.63) ($p < 0.02$)

Groups	Coronal third (mean \pm SD)	Middle third (mean \pm SD)	Apical third (mean \pm SD)	p value
Group I (Manual files)	9.5 \pm 8.06	10.75 \pm 10.31	9.75 \pm 9.11	0.86
Group II (Rotary files)	5.0 \pm 6.63	6.05 \pm 7.5	6.0 \pm 7.53	0.78

Table 1: Comparison of scores between coronal, middle and apical thirds of root canals in each group.

Similarly, Kedo-S rotary files (6.05 ± 7.5) showed significantly improved cleaning in the middle section of the root canals than Kedo-SH (10.75 ± 10.31) ($p=0.04$) (Table 2)

Groups	Coronal third	Middle third	Apical third
Group I	0.02*	0.04*	0.08
Group II			

* $p < 0.05$ is significant

Table 2: Inter-group comparison of cleaning efficacy in each third of the root canals.

DISCUSSION

Endodontic instruments and procedures have endured abundant developments to obtain optimum effectiveness in cleaning and shaping of the canals in deciduous teeth. With Nickel-Titanium rotary files, root canal treatment has improved by reducing chair-side time, and preparation time.^{5,8}

Deciduous molars differ morphologically and histologically from that of permanent molars. Their roots are shorter and undergo physiologic resorption, with continuous changes in configuration of the internal anatomy of the canals. There are various reports on the use of rotary files in deciduous teeth.^{5,9,10}

However, the thin ribbon shaped and tortuous canals of deciduous molars are difficult to negotiate and can result in perforation of the canal walls and fracture of the instruments.¹¹ Hence, the use of a pediatric rotary file system would be beneficial. The rotary files used in this study are Ni-Ti manual files (Kedo-SH) and Ni-Ti rotary files (Kedo-S) files that are exclusively indicated for root canal preparation of deciduous teeth. These files are shorter in length and therefore, enlargement of the apical orifice with the possibility of overfilling can be avoided.^{7,8}

Rotary instruments made for permanent teeth have been used on deciduous teeth in previous studies. This leads to over instrumentation and lateral perforation of the canal walls of deciduous teeth.^{5,6,9,11} The use of rotary files in deciduous teeth was found to be more effective in preparation time and root canal shaping, enabling better root canal obturation.¹² The Kedo file system has an advantage of using individual files for narrow and wide canals and can result in better cleaning of the root canals. Therefore, we conducted this research to compare the manual Kedo SH files with that of the Kedo S rotary files.

Various aspects of endodontic treatment including cleaning ability of instrumentation technique and quality of canal obturation have been investigated following the dye penetration and clearing method.^{9,13} The clearing technique used in this study was simple and rapid results can be obtained within a few days. This approach makes the teeth transparent; and therefore, the pulp space and canal walls are discernable and the canal can be assessed three-dimensionally.^{13,14,15}

Chemo-mechanical preparation of root canals comprises both mechanical instrumentation and canal irrigation for complete debridement and removal of microbes from the root canal system. Kedo-S rotary files must be used in conjunction with good irrigation. In this study, only saline was used to irrigate the canals in order to eliminate any possible effect of chemical irrigation on the elimination of India ink.

Significantly better cleaning was achieved in the coronal and middle sections of the root canals with rotary files. This can be attributed to the modified length, taper and tip size of the Kedo files. The varying taper design gives flexibility and efficacy to the file system. The varying tip diameter results in significant preparation at the coronal-section and adequate preparation at the middle-section.¹⁶ This is in contrast to the finding of Silva et al⁵ who reported of no significant differences in each canal section between manual and rotary instrumentation technique. The clockwise motion of Kedo-S rotary file pulls pulpal tissue and dentin out of the canal that results in efficient cleaning of tortuous and irregular canal

walls.¹⁶ The Kedo-S rotary files have a unique gradual taper that facilitates coronal enlargement, straight line access and efficient canal preparation.⁷

However, clearing of ink from the root canal walls in the apical section was comparable to manual technique. The rotary files used in our study are designed to maintain the internal morphology of the curved root canals of deciduous molars.¹⁷ In comparison to manual Kedo-SH files, the use of rotary Kedo -S files were found to be more effective in cleaning the root canals of deciduous molars.

CONCLUSION

Both Kedo-SH manual and Kedo-S rotary files were effective in cleaning the root canals of deciduous molars. Cleaning with Kedo-S rotary files was significantly better in the coronal and middle section of the root canals.

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