

A Review on Pediatric Rotary Endodontic Systems

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How to cite this article:

Boddupalli Tejasree Kameswari, Vijay A Trasad, Shruthi B Patil, Anand K Tavargeri/A Review on Pediatric Rotary Endodontic Systems/Indian J Dent Educ. 2021;14(4):101-106

Abstract

It is very important to preserve the primary teeth in the dental arch till its normal anticipated exfoliation occurs for a range of esthetic, functional, physiological, and psychological reasons. Therefore it is important to treat pulpally involved teeth due to various carious and/or non-carious reasons. Pulp therapies range from indirect pulp capping to pulpectomy. The conventional way of performing biomechanical preparation in pulpectomy is by use of hand files. However, advances are not uncommon in Pediatric practice to make the treatment more efficient, less time-consuming. The rotary systems in Pediatric endodontic practice are now gaining popularity because of their efficiency and this article aims at understanding various rotary systems exclusively available for use in Pediatric endodontics.

Keywords: Rotary; Pediatric; Endodontic.

Key Messages: Rotary systems have been introduced to the Pediatric practice in recent times. It started with the use of rotary file systems of permanent teeth with primary teeth. Later rotary files exclusive for Pediatric files are designed. The article provides an insight on rotary file systems exclusive for Pediatric practice.

Introduction

According to AAPD guidelines, pulpectomy is indicated in primary teeth with carious pulp exposures in which, coronal and radicular pulp exhibits clinical signs of hyperaemia, or evidence of pulp necrosis with or without caries involvement.¹ The mechanical preparation can be done using hand filing or through rotary systems.

The use of NiTi rotary files in primary teeth root canals was first described by Barr et al. in 2000.² Recently, an exclusive Pediatric endodontic file systems have been introduced for primary root canals.³ This article aims to review various rotary systems available exclusively for Pediatric practice.

Need for rotary systems in Pediatric dentistry

Usually, biomechanical preparation was done with endodontic broaches and hand files.² in spite of the widespread use of manual instrumentation for pulpectomy in primary teeth, there are certain potential limitations associated with its use like time-consuming, inadequate cleaning of the canals, possibility of ledge formation, risk of lateral perforations, dentine compaction and fracture of the instrument.⁴

To minimize the shortcomings of conventional system, the rotary technique of instrumentation is introduced to minimize the debris extrusion and also facilitates obturation. It also favors a patient's

cooperation by shortening the treatment time for shaping the canals that is one of the greatest challenges in Pediatric endodontics.⁵

Emergence of various rotary systems in Pediatric dentistry

The introduction of rotary instrumentation started with NiTi systems introduced as early as 1960 by Buelher,⁶ which at that time became popular for orthodontic wires and dental burs. The K-type root canal files were made and tested extensively by Serene and his colleagues,⁷ and the first NiTi rotary appeared on the market around 1993. These early rotary files introduced did not have cutting edges but rather had broad radial lands.

Those files retained the 16 mm long cutting blade but had a greater taper than typical 0.02 for K files.⁸ A newer form of the rotary system was introduced as the modification of the traditional rotary system. Barr et al. was the first to use rotary NiTi files for primary root canal preparation.² They reported that use of NiTi files for root canal preparation in primary teeth was cost-effective, faster, and resulted in uniform and predictable fillings.⁹

Various rotary file systems were used in Pediatric practice. However, the rotary file systems exclusive for Pediatric practice were first introduced in the year 2016 by Dr. Ganesh Jeevanandan.⁵ The pediatric patients have a limited mouth opening. Hence the longer length of adult rotary files makes it difficult to use in Pediatric patients. Pediatric rotary files are designed with a shorter length. This provides ease of operation when working with pediatric patients. Kuo C et al. suggested that a rotary file with modified length, taper, and tip size would be more effective for pulpectomy in primary teeth.¹⁰

Various studies have shown that Ni-Ti instruments are efficient and effective for root canal preparation in permanent teeth. Barr ES et al used Ni-Ti ProFile 0.04 taper rotary files for pulpectomy procedures and concluded that the use of Ni-Ti files resulted in uniform and predictable root canal fillings. Although these files are frequently used for permanent teeth, a major concern in applying them for primary teeth is the possibility of lateral perforation on the inner surface of primary teeth. These lateral perforations can be due to the pre-designed greater taper of the rotary files.¹¹ Some of the commercially available Pediatric rotary files are Prime Pedo(India), DXL-Pro Pedo (India), KEDO S (India), Pro AF Baby Gold (India), Neolix (France), Denco Kids files (China), and Sani Kid rotary files (China).¹²

KEDO S

Kedo file system consists of KEDO S (kidsEndodonticShaper), an engine drive NickelTitanium (NiTi) rotary file system. The KEDO S rotary file system consists of three files namely D1, E1 and U1(Fig 1).¹¹ All the files are made up of nickeltitanium alloy with a triangular crosssection and a non-cutting tip. The files also have a negative rake angle with variably variable taper (VV). The KEDO S files are 16 mm in length with 12 mm cutting blades (working area of the files). D1 of the KEDO S rotary file system consists of 0.25 ISO tip diameter with a VV taper of 4–8%.

This file is specifically designed for the narrower canals in primary teeth, namely mesiobuccal and mesiolingual in mandibular molars and mesiobuccal and distobuccal in maxillary molars. The E1 file consists of 0.30 ISO tip diameter with a VV taper of 4–8%. This file is specifically designed for the wider canals in primary teeth, namely distal canal(s) in mandibular molars and palatal canal(s) in maxillary molars.

The U1 file consists of 0.40 ISO tip diameter with a VV taper of 4–8%. This file is specifically designed to prepare maxillary and mandibular anterior primary teeth.¹³



Fig. 1: Image showing KEDO S pediatric rotary files D1-red coded, E1-blue coded and U1-black coded.¹³

The taper of the instruments is designed according to the diameter of primary teeth with narrow and wide root canals. The KEDO S pediatric rotary file system must be used in a low speed constant-torque handpiece. The ideal rotation speed is 150–300 rpm.¹¹ The KEDO S pediatric rotary files have a gradual taper aiding in easy coronal enlargement and straight-line access. This gradual taper also helps in efficient canal preparation and avoids the instrumentation of the inner wall of the root surface.

Generations of KEDO S files:

- 2016- KEDO S
- 2017- KEDO SG
- 2018- KEDO SG Blue
- 2019- KEDO S Square
- 2021- KEDO S Plus

The advantages of KEDO S rotary system include that they preserve the original anatomy of the curved canals in primary teeth during canal preparation. The clockwise motion of the KEDO S rotary file pulls pulpal tissue and dentin out of the canal resulting in ineffective cleaning of primary molar canals. The duration of canal preparation is reduced using the KEDO S rotary file system in primary teeth by approximately 2-3 minutes. This would help to reduce fatigue of the patient and operator resulting in a better quality of treatment. Uniform canal preparation is obtained using rotary files resulting in a better quality of obturation.¹¹ The disadvantages of KEDO S rotary system includes the cost of constant torque hand-piece and the use of Ni-Ti instruments are technique sensitive and proper training is required for the operator.¹¹

Pro AF Baby Gold

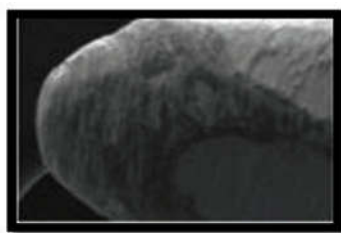
This system includes NiTi rotary files. They have a short Length of 17 mm files (fig 2). They are packed in specially designed autoclavable box. These are Heat-treated NiTi files, they are available in 5 files of 4% taper #20 size; 4% taper, #25 size; 4% taper,

#30 size; 4% taper, #40 size; 6% taper, #25 size. As they are heat-treated they have controlled Memory and aids in conservative canal preparation. It has to be set at 300 RPM, 2N torque, and in autoreverse mode.

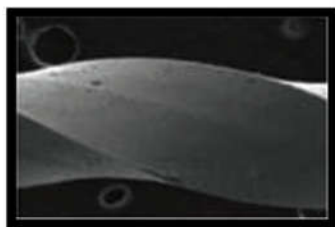


Fig. 2: Pro A F Baby Gold rotary file systems.

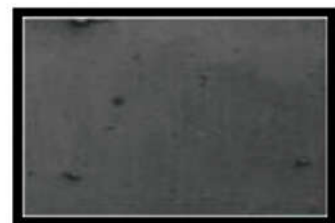
It is indicated for Pediatric Rotary Endodontics as well adult Rotary endodontics in the condition where there is limited accessibility eg. Third molar root canal treatment, Oral Submucous Fibrosis. The salient features of this system include Short 17mm file length improving safety with comfort to both dentist and the patient. It has advanced NiTi CM wire for better canal centricity, unlike NiTi file. Heat-treatment resulting in nearly no separation. It is a versatile rotary file system suitable for conservative preparation of all types of canals. It has improved Shaping of canals with a sequential combination of 4% and 6% taper files. Images of the cross section of the root under CBCT (fig 3).



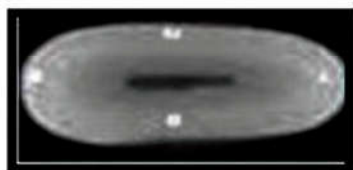
Accurate tip grinding,
Non cut tip Sharp Edge,



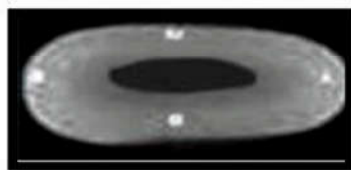
Super high cutting
efficiency



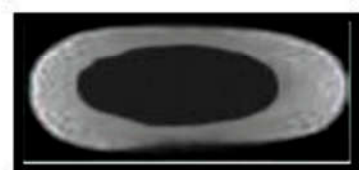
Well Polished surface by
advanced patented technology



Unprepared Flattened canal



Conservative Preparation
(4% taper file)



Aggressive Preparation
(6% taper file)

Fig. 3: Cross section of root under CBCT.

Pro AF Baby Gold (fig 4)

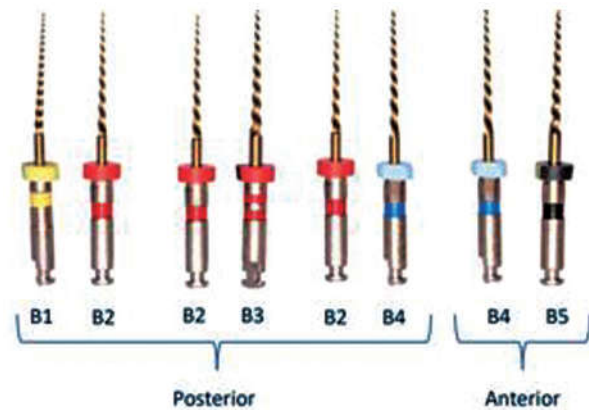


Fig 4: B1 (#20-4%) Yellow B2 (#25-4%) Red

B2 (#25-4%) Red B3 (#25-6%) Red

B2 (#25-4%) Red B4 (#30-4%) Blue

B4 (#30-4%) Blue B5 (#40-4%) Black

Instrumentation Protocol

Once access cavity is prepared, canal location with #10k file has to be done. Then negotiate canal to working length upto #20 K file. Orifice enlarger (if orifice enlargement needed)(BO- #15-10%) has to be used. If Apex is narrow and #20 K file engages at Apex - B1 (#20-4%) Yellow, B2 (#25-4%) Red files are used for biomechanical preparation. If Apex is wide and #20 K file is loose at Apex - B2 (#25-4%) Red, B3 (#25-6%) Red files are used. If Apex is very wide (eg. Palatal and Distal canals) - B2 (#25-4%) Red, B4 (#30-4%) Blue files are used. For anteriors (Maxillary)- B4 (#30-4%) Blue, B5 (#40-4%) Black files has to be used.

Prime Pedo

These are the new pediatric rotary files developed for use in primary teeth. Prime Pedo file system consists of four files (Starter, P1, P2, Endosonic file). Endosonic file with 2% taper in Prime Pedo kit allows for conservative apical preparation of primary molars. Prime-Pedo files are gold treated. The file used for apical preparation has a 6% taper. These files possess controlled memory. This controlled memory allows them to be centered in the curved canals of primary molars.⁵ Prime Pedo files used have a triangular cross-section, are heat-treated, and have controlled memory. Heat-treated files are less prone to deformation and follow the original anatomy of the root canals. The better cleaning efficacy of rotary files can be attributed to the triangular cross-section and positive rake angle of Prime Pedo. This triangular cross-section also

reduces the contact areas between the file and the dentin and reduces the stresses on the files. Prime Pedo rotary files possess controlled memory which allows these files to be centered and follow original canal anatomy in primary molars. They have higher flexibility and potential fatigue resistance. Increased fatigue resistance might reduce fracture of rotary files in curved root canals of primary molars.¹²

DXL-PRO

DXL-Pro file system has three files (#30, #20, and #25). The DXL-Pro file used for apical preparation has a 6% taper. They possess controlled memory which allows them to be centered in curved canals of primary molars.⁵ DXL-Pro files have a convex triangular cross-section, guiding non-cutting tip, and controlled memory. The orifice enlarging file has a length of 16 mm. In this study, the better cleaning efficacy of rotary files can be attributed to the triangular cross-section and positive rake angle of Prime Pedo and DXL-Pro rotary files. The better cleaning efficacy of rotary files can be attributed to the triangular cross-section and positive rake angle of DXL-Pro rotary files. DXL-Pro rotary files possess controlled memory which allows these files to be centered and follow original canal anatomy in primary molars. They have higher flexibility and potential fatigue resistance. Increased fatigue resistance might reduce fracture of rotary files in curved root canals of primary molars.¹²

Discussion

Endodontic treatment is considered as a conservative approach in primary teeth as it aids in the maintenance of teeth till physiological exfoliation occurs that helps in preventing space loss, physiological growth and development, speech development, maintenance of eruption and shedding pattern, and so on. Several factors contribute to the success of pulpectomy starting from proper case selection to establishing a void-free coronal seal. One of the important factors that play a key role in biomechanical preparation aims at microbial elimination using mechanical preparation and through irrigation. The application or use of rotary instrumentation in Pediatric Endodontic dates back to 1993.²

The objectives of cleaning and shaping is to create space for subsequent instruments, Provide path for irrigating solutions, disinfect the canal.¹⁷ Ideal pulpectomy technique is being a fast procedure, aiding in effective debridement, no weakening the tooth structure, endangering the underlining per-

manent teeth, having minimal procedural complications, and maintaining tooth function until it is naturally exfoliated.¹⁰

The biomechanical preparation in primary teeth is performed using the adult endodontic files. There are various disadvantages during use of adult endodontic files in primary teeth namely the length and taper of the files. Certain morphological characteristics like shorter curved roots, root resorption, thin dentinal walls have to be considered and careful mechanical preparation has to be done maintaining original canal shape, uniform removal of dentin, and aiding through chemical preparation.³ Success of pulpectomy lies in elimination of bacteria, creating path for irrigating solutions and through cleaning and shaping.¹⁸ Use of rotary practice includes removal of tissue and debris are quickly.¹⁹ Advantages of rotary systems for canal instrumentation in primary teeth include that there is decreases the chairside time.¹⁵ It results in preparation of funnel-shaped canals which in turn produces uniform fill of the obturation paste. They aid in quick removal of the tissue and debris. They have better cleaning ability of the canals when compared to the manual technique and also helps in increasing the patient cooperation.^{2,4,16}

Disadvantages of rotary systems for canal instrumentation in primary teeth include that there is increased risk for perforation which is attributed due to the anatomy of the primary teeth- thin dentinal walls.¹⁵ The Chances for separation of the instrument within the canal when instrumented aggressively and in dry field possibility of overfill of the obturation paste occurs as the apical overextension of the instrument enlarges the apical foramen, these systems are expensive and there is a need for training to learn the technique.²

The influence of rotary instrumentation for pulpectomy on the children's behavior include long chairside time during pulpectomy procedure can cause difficulty in managing the children.^{15,20} Pulpectomy procedure is considered to be the most stressful and heavier treatment for the child, and the complication is further attributed by the anatomical complexities that are not found in the permanent teeth.²¹

Application of rotary files may be more appropriate in children with behavior management problems. Various studies have stated that using rotary files for canal instrumentation in primary teeth significantly reduces the chairside time which plays a prime role in treating children who are less cooperative, thus causing a positive impact on the child's cooperation.^{22,16} An article by Farhin Katgel,

et al. revealed that Pediatric rotary files had a better cleaning efficacy as compared to H files at coronal and apical third of root canals. However, at middle third, no difference in cleaning efficacy was found between two pediatric rotary files (Prime Pedo, DXL-Pro) and H files. Pediatric rotary files can be used as an alternative to conventional H files in routine pediatric endodontics for better instrumentation of root canals.¹²

KEDO S Pediatric Rotary Files for Root Canal Pulpectomy was performed by Dr. Ganesh Jeevanandan using KEDO S rotary files among four and four and half year old kids revealed that the KEDO S pediatric rotary file system will help the dentist in performing the pulpectomy procedure faster. These instrumentation techniques are considered to be an effective method to debride the uneven walls of primary teeth.

The root canal preparation with the pediatric rotary file system has consistently resulted in uniform and predictable quality of obturation. However, considering better root canal preparation and quality of obturation, the use of KEDO S pediatric rotary files is recommended for pulpectomy procedure in primary teeth.¹¹

An in vitro study by Farhin Katgel et al., concluded that Pediatric rotary files had a better cleaning efficacy as compared to H files at coronal and apical third of root canals. However, at middle third, no difference in cleaning efficacy was found between two pediatric rotary files (Prime Pedo, DXL-Pro) and H files. Pediatric rotary files can be used as an alternative to conventional H files in routine Pediatric endodontics for better instrumentation of root canals.

Conclusion

Rotary endodontics in Pediatric practice has evolved from the era of using adult rotary file systems in Pediatric practice to exclusive Pediatric rotary file systems. Various rotary file systems are available in Pediatric practice and most of them concluded that Pediatric rotary files can be used in routine endodontic practice in primary teeth for faster and better instrumentation. There are also studies assessing behavior management in pediatric practice while using rotary systems. However, the direct relations of the use of rotary instrumentation on the child's behavior and the anxiety levels have not been assessed.⁵¹ there is sufficient literature present only on few rotary systems, no sufficient literature is available on rotary systems exclusive for Pediatric practice. Hence more studies are

required on estimating the efficacy of Pediatric rotary file systems in terms on clinical efficiency, child management.

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