



PEDIATRIC ROTARY FILE SYSTEMS: A REVIEW

**Poulam Guha, Sunita Agarwalla, Taniya Thakur, Biswaroop Chandra and
Gautam Kumar Kundu**

Department of Pediatric and Preventive Dentistry Guru Nanak Institute of Dental Sciences and Research 157/F,
Nilgunj Road, Sahid Colony, Panihati, Kolkata-700114

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ABSTRACT

The field of dentistry has witnessed great developments and innovations in the past few decades and many major paradigm changes are yet to arrive in the near future. Similarly, in the field of pediatric endodontics, not only have the materials been improved but also the techniques and instrumentation, rendering a better and improved quality of work. Treatment procedures, involving primary teeth with pulpal pathosis, using hand instrumentation was tiresome and complicated which often led to untoward situations. Use of rotary files were advocated to counter the problem. Advent of rotary files in pediatric endodontics marked the emergence of rotary pediatric rotary files. Hence, this article reviews various pediatric rotary file systems being used for instrumentation in recent times.

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INTRODUCTION

In Pediatric dentistry, pulpectomy is the preferred approach for the treatment of primary teeth with pulpal pathosis. Before placement of obturating material, the root canals of primary teeth are shaped and cleaned. Manual instrumentation remains the conventional method for root canal preparation in primary teeth. The time taken for root canal preparation with the conventional method is quite lengthy resulting in patients and clinicians' fatigue. Striking alterations and complexities in root canal morphology of primary teeth also calls for improvement in the instrument's design to prevent undesirable complications like ledges, perforations, transportation to name a few.

Nickel-Titanium (NiTi) instrumentation is more popularly used for root canal preparation in permanent teeth compared to primary teeth. The introduction of NiTi rotary instrumentation has made treatment in permanent teeth easier and faster than manual instrumentation ensuing in consistently superior root canal shaping. Similar principles of canal debridement and dentin shaping using NiTi instruments was introduced to the pediatric set-up by Barr *et al.*¹ in 2000.

In the bygone years, various rotary NiTi file systems were reportedly used to improve the shaping procedure in primary teeth.

Crespo *et al.*² in 2008 and Musale, Mujawar³ in 2014, found in their studies that rotary files prepared more conical canals in primary teeth than manual instruments. However, few complications seem to arise.

Firstly, Primary dentin is softer and less dense than that of the permanent teeth and the roots are shorter, thinner and more curved. Root tip resorption is often undetectable. This often leads to

- Increased risk for perforation
- Overfill of the obturation paste occurs as the apical overextension of the instrument may enlarge the apical foramen.¹
- Secondly, pediatric patients have a limited mouth opening. The longer length of adult rotary files makes it difficult for use in primary teeth.⁴

Kuo *et al.*⁵ in 2006 had clearly stated that newer NiTi rotary instruments with more appropriate length, taper and tip size exclusively for the primary dentition would be advantageous and necessary. In recent years, a number of pediatric rotary systems have been introduced.

Table 1

Year	Important Events
1988	Nickel Titanium alloys found its way into Endodontics when Walia <i>et al.</i> ⁶ introduced NiTi root canal hand files.
2000	Rotary instruments were introduced to pediatric endodontics by Barr <i>et al.</i> ProFile system was used in his studies.
2004	Silva <i>et al.</i> ⁷ proposed the use of ProFile 0.04 instruments for primary teeth.

*Corresponding author: Poulam Guha

Department of Pediatric and Preventive Dentistry Guru Nanak
Institute of Dental Sciences and Research 157/F, Nilgunj Road,
Sahid Colony, Panihati, Kolkata-700114

	Kuo <i>et al.</i> used ProTaper rotary files, SX (19 mm) and S2 (21 mm) with an 18:1 Axxess Spring-Head handpiece in his studies. Canoglu <i>et al.</i> ⁸ proposed a crown down technique with Profile .04 instruments up to .04 /30 file in deciduous teeth. They activated the files by a Nouvag TCM Endo motor at 250 rpm.
2006	Nagaratna <i>et al.</i> ⁹ proposed a technique in which teeth were instrumented with profile 0.04 taper 29 series rotary files starting from size 2 to 7. Files were advanced slowly towards the apex and withdrawn as soon as working length was reached.
2007	Elmsallati <i>et al.</i> ¹⁰ demonstrated in his study that K3 system produced minimum wear of root canal walls, which provides an interesting angle in the endodontic preparation of primary teeth. Bahrololoomi <i>et al.</i> ¹¹ used 25-mm long Flexmaster NiTi rotary files in pulpectomy of primary tooth and followed modified crown-down technique with 35/0.06, 35/0.04, 30/0.06 and 40/0.02 tapers. Final shaping was achieved with a gentle “advance and withdraw” motion.
2008	Kummer <i>et al.</i> ¹² used HERO 642 system in his studies for comparison between manual and rotary instrumentation.
2011	Pinheiro <i>et al.</i> ¹³ compared the cleaning effectiveness of manual, hybrid and rotary instrumentation techniques in primary molar teeth. Hybrid instrumentation was done with the ProTaper system and K-files, while in rotary instrumentation, root canals were prepared using ProTaper files in the following sequence: S1 and S2 followed by F1 and F2.
2012	Azar <i>et al.</i> ¹⁴ compared the cleaning capacity of Mtwo & ProTaper rotary files with that of manual files in primary teeth.
2016	Kedo-S files introduced by Dr. Ganesh Jeevanandan ¹⁵ . 1 st generation of files used exclusively for pediatric endodontics.
2017	The 2 nd generation of Kedo file systems, Kedo-SG ¹⁶ files introduced. They were heat treated files which exhibited greater resistance to cyclic fatigue along with M wire technology.
2017	Pro AF Baby Gold ¹⁷ file system introduced by Dentobizz. A two-file system with controlled memory NiTi wire for better canal centricity.
2018	The 3 rd generation of Kedo file systems, Kedo-SG Blue ¹⁸ introduced. The files demonstrated blue titanium oxide layer coating (prolongs usability of cutting, greater flexibility & increased resistance to cyclic fatigue).
2019	The 4 th generation of Kedo file systems, Kedo-S ² system ¹⁹ was introduced. The biggest highlight of this generation was the presence of dual cross-sections in a single file

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Kedo File system: World’s first files designed for root canal preparation in primary teeth developed by Dr. Ganesh Jeevanandan (Reeganz Dental Care Pvt. Ltd. India).

Kedo-S system: Kedo-S was the 1st generation of the Kedo files to be developed. Kedo-S files are a three-file system consisting of:

- D1 - features a tip diameter of 0.25 mm. Used in primary molars with narrow canals (mesial canals in mandibular molars and distobuccal canal in maxillary molars). Colour code – red.
- E1 - features 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). Colour code – blue.
- U1- features a tip diameter of 0.40 mm and used in primary incisor teeth. Colour code – black.

The total length of the files is 16 mm and working length is 12 mm. The ideal rotational speed is 250 - 300 rpm. The torque required is 2.2 - 2.4 N.cm. Important characteristics include:

- Non-cutting tip
- Radial land
- Negative rake angle
- Pecking motion (to prevent taper lock)
- Patented Variably variable taper (VVT) [prevents screw-in effect, torsional loading]

- Scraping motion
- Core diameters similar to K3 file system.
- Shape memory



Fig 1 Kedo-S files



Fig 2 Kedo-SG files

Kedo-SG system: Kedo-SG is the 2nd generation of Kedo file systems, almost similar to Kedo-S except for newer & improved characteristics which are:

- NiTi heat treatment done
- M wire technology
- Greater resistance to cyclic fatigue

Kedo-SG Blue system: Kedo-SG Blue is the 3rd generation of Kedo file systems, similar to previous generations but with improved characteristics which included:

- Heat treated NiTi with controlled memory wiring
- Blue titanium oxide layer coating (prolongs usability of cutting, greater flexibility & increased resistance to cyclic fatigue)

Kedo-S² system: Kedo-S² system is the 4th generation of Kedo file systems. It is a two-file system with properties similar to previous generations. However, the biggest highlight of this generation is the presence of dual cross-sections in a single file. Important characteristics of the file include:

- Apical 5 mm – triangular cross-section, three-point contact with canal wall, 4-5% taper, similar to Kedo-S files.
- Coronal 7 mm – tear-drop cross-section, 2-point contact with canal wall, 6-8% taper, similar to H files.

Two files in this system are as follows:

A1 – Replaces U1 file from previous generations. Tip diameter - 0.038 mm, cutting edge length 13 mm & 17 mm file length. Colour code – black. Green & black bands on handle for identification.

P1-Replaces E1 & D1 files from previous generations. Tip diameter - 0.028 mm, cutting edge length 12 mm & 16 mm file length. Colour code-black. Green & black bands on handle for identification.



Fig 3 Kedo-SG Blue files



Fig 4 Kedo-S² files

Pro AF Baby Gold system: Pro AF Baby Gold system

(Dentobizz) consists of 5 files made up of NiTi CM (controlled memory) wire - flexible with constant taper of 4% & 6%. Important characteristics include:

- Features 17 mm length specially designed for primary teeth
- Heat treatment resulting in nearly no separation
- Advanced NiTi CM wire for better canal centricity
- Unique short orifice enlarger for prevention of cervical ledging
- Improved shaping of canals with sequential combination of 4% & 6% taper files
- Highly flexible

The various files include:

- B0 - short Orifice enlarger. Tip diameter-0.015 mm. 10% taper.
- B1 (yellow band) - Tip diameter-0.020 mm. 4% taper.
- B2 (red band) - Tip diameter-0.025 mm. 4% taper.
- B3 (red band) - Tip diameter-0.025 mm. 6% taper.

Two red bands present on handle for identification.

- B4 (blue band) - Tip diameter-0.030 mm. 4% taper.
- B5 (black band) - Tip diameter-0.040 mm. 4% taper.

Files should be instrumented at 2N.cm, 300 rpm. Sequence of file usage are as follows:

- For anteriors – B4 followed by B5.
- For posteriors -
 - For palatal & distal canals - B2 followed by B4.
 - For narrow apex-

When #20 K file engages at the apex-B1 followed by B2.

When #20 K file loose at the apex-B2 followed by B3.



Fig 5 Pro AF Baby Gold files



Fig 6 Prime Pado files

Prime Pado system: Prime Pado⁴ system consists of four files. Important characteristics include:

- Heat treated, 2 file system
- Conservative preparation
- Controlled memory wire system
- Constant taper

Files include

- Starter - orifice opener. 16 mm length. 8% taper.
- P1-18 mm length. 6% taper; tip diameter - 0.015 mm. Used for narrow canals of primary molars.
- P2-18 mm length. 6% taper; tip diameter - 0.025 mm. Used for wide canals of primary molars & primary anteriors.
- Endosonic file-18 mm length, 2% taper (used for apical 3rd preparation, to be used with ultrasonic scaler).

DXL Pro system: DXL Pro⁴ (Dentomart) rotary system has three files. Important characteristics include:

- Controlled memory wire
- Constant taper
- Triangular cross section

Files include

- #30 – 16 mm length. Taper 8%. Orifice enlargement.
- #20 – Taper 6%. 16 mm length.
- #25 – Taper 6%. 16 mm length.

CONCLUSION

Rotary instrumentation is a feasible and important tool to be used in the endodontic preparation of primary teeth since it requires a shorter clinical time from the pediatric patient. The use of rotary instrumentation has increased the comfort for the patient and along with improving the working condition for all professionals. However, being a recent technique, studies are necessary to demonstrate its efficacy in pediatric dentistry.

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