



Revolutionizing Pediatric Dentistry: The Role of Rotary Files – A Review

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ABSTRACT:

Primary tooth preservation is crucial until physiological exfoliation occurs. Pulpectomy, which has various benefits over extraction, is one of the therapy choices for pulpally damaged primary molars. Performing endodontic treatment in primary teeth can pose significant challenges, especially when it comes to canal preparation, a procedure considered crucial in root canal therapy and often requiring substantial time and effort. The manual approach is considered the standard method of biomechanical preparation, although it has some limitations that have led to the advent of rotary instrumentation, which is more practical and less time demanding. Recently, nickel-titanium (Ni-Ti) rotary files have been introduced for application in pediatric endodontics. The use of these files allowed for more efficient instrumentation and more consistent obturations at a lower cost.

1. Introduction

In order to maintain the integrity of the arch, the main objective of paediatric dentistry is to keep the primary teeth in the mouth until their physiological exfoliation [1]. Preserving primary teeth is of utmost importance due to their roles in supporting effective chewing, speech articulation, maintaining aesthetics, and preventing the development of detrimental habits that can lead to misaligned teeth. Additionally, primary teeth serve as guides for the eruption of permanent successors. Neglecting treatment for these primary teeth can result in damage to the incoming permanent successors, such as enamel issues like hypo-mineralization or hypoplasia. This can hinder a child's overall oral health, causing discomfort, impacting food choices, and affecting their daily functioning [2].

Dental caries is considered the most persistent and irreversible ailment that affects the undamaged areas of a tooth, significantly influencing a child's regular functioning. When tooth decay invades both the enamel and the dentin, it is often treated using a variety of restorative materials [2]. Nevertheless, when primary teeth exhibit pulpal involvement due to caries, it is imperative to undergo pulpal treatment to alleviate discomfort and ensure the functional integrity of the teeth until they naturally shed. The recommended treatment approach for primary teeth with pulpal infections is pulpectomy, a procedure that entails the thorough elimination of pulpal tissue, debridement, and canal

preparation, culminating in obturation using an appropriate resorbable material. The effectiveness of pulpectomy treatment is significantly impacted by the complex root canal system found in primary teeth. The primary objective of root canal instrumentation is to eliminate infection, and this plays a crucial role in determining the success of the procedure [13].

Despite the fact that manual preparation methods are still the norm in biomechanical preparation, they have some drawbacks, including a number of iatrogenic mistakes such as canal transportation, ledging, zipping, and apical blockage. Nickel-titanium (NiTi) rotary instruments were created in the field of endodontics in order to overcome these problems with the conventional manual file method. These instruments have produced the desired results by effectively cleaning the root canals while preserving the original canal space during BMP procedures. Compared to primary teeth, permanent teeth are more frequently treated with nickel-titanium (NiTi) instruments. The development of NiTi rotary instrumentation has sped up and simplified permanent tooth treatment compared to manual instrumentation, resulting in consistently better root canal shape. [2][4][5]

The dentin of primary teeth is softer and less dense than that of permanent teeth, and the roots are shorter, thinner, and more curled, frequently with barely perceptible root tip resorption. Ribbon-shaped roots are a distinctive feature of the primary root canal system. The use of Ni-



Ti rotary instruments is hampered by all of the aforementioned qualities.

According to Kuo et al. (2016), the following characteristics should be included in a practical pulpectomy technique for the primary dentition:

- (1) Fast and simple procedures, with short treatment times and a minimal number of appointments
- (2) Effective debridement of the root canals without weakening the tooth structure or endangering the underlying permanent teeth
- (3) Few procedural complications
- (4) Maintaining tooth function until it is naturally shed.^[6]

2. Rotary Systems in Pediatric Dentistry:

Need for Pediatric Rotary File System:

- 1) The risk of lateral perforation is increased when primary teeth with thinner, curved roots are treated with rotary equipment designed for permanent teeth.
- 2) Excessive obturation paste can occur as a result of the instrument extending beyond the apex, potentially widening the apical foramen.
- 3) The mouth opening is constrained in children. Use of adult rotary files on primary teeth is challenging due to their larger length ^[7].
- 4) The risk of lateral perforation is increased when primary teeth with thinner, curved roots are treated with rotary equipment designed for permanent teeth.
- 5) Excessive obturation paste can occur as a result of the instrument extending beyond the apex, potentially widening the apical foramen.
- 6) The mouth opening is constrained in children. Use of adult rotary files on primary teeth is challenging due to their larger length ^[7].

In 2000, Barr et al. were the first to describe the utilization of NiTi rotary files in root canals of primary teeth. **Since then, different NiTi rotary devices using a modified methodology have found utility in paediatric dentistry.**

3. Kedo File System

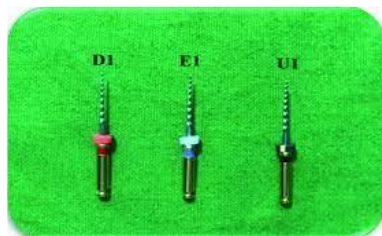
The Kedo file system, introduced by Dr. Ganesh Jeevanandan of Reeganz Dental Care Pvt. Ltd., India, in 2016, stands as the world's inaugural set of files specifically crafted for root canal preparation in primary teeth. Kedo files are available in Hand type (Kedo-SH) and Rotary type (Kedo-S, Kedo-SG, Kedo-SG Blue, Kedo-S Square) The variable taper designs found in Kedo rotary files provide you the adaptability and efficiency to accomplish effective cleaning and shaping. These files effectively and significantly prepare the middle and apical portions of the primary root, with particular emphasis on readying the coronal third. This preparation facilitates the smooth flow of obturating material and helps prevent lateral perforation at the apical region ^{[8] [9]}.

Kedo-S Rotary Files [First Generation Kedo-S Files]

The Kedo-S files consist of a three-file system, which are designated as D1, E1, and U1, respectively. All files have a varying taper to correspond with their use on primary teeth. Following are the three file system:

- D1: The tip diameter of the D1 is 0.25 millimetres. Utilized for primary molars featuring narrow canals, such as the mesial canals in mandibular molars and the distobuccal canal in maxillary molars, indicated by a red color code.
- E1: The tip diameter of the E1 is 0.30 millimetres. Utilized for primary molars featuring wider canals, such as the distal canals in mandibular molars and the palatal canal in maxillary molars, indicated by a blue color code.
- U1: The tip diameter of the U1 is 0.40 millimetres. Used in primary incisor teeth, indicated by a black color code

The kedo-S paediatrics rotary files have a gradual taper that makes coronal expansion and straight line access simple. This gradual taper aids in effective canal preparation and prevents excessive instrumentation of the inner wall of the root surface. To ensure the canal walls are clean before obturation and to remove any loose pulp tissue, a large amount of irrigating solution must be used. Use of the Kedo-S paediatrics rotary file system requires a hand piece with low speed and steady torque. ^{[8] [9]}



Kedo-SG Rotary Files [Second Generation Kedo-S Files]

Almost identical to Kedo-S, Kedo-SG is the second generation of Kedo file systems. It has the following new and improved features over Kedo-S, however: The use of M wire technology; NiTi heat treatment; and increased resistance to cycle fatigue.



Kedo-SG Blue Rotary Files [Third Generation Kedo-S Files]

- Kedo-SG Blue represents the third generation of the Kedo-S file systems. While it maintains comparability with its predecessors, it offers enhanced features such as:
- NiTi (Nickel Titanium) subjected to heat treatment with precisely controlled memory wiring.

The addition of a blue titanium oxide layer coating (which extends cutting durability, enhances flexibility, and boosts resistance to cyclic fatigue) ^[10].



Kedo-S² Rotary Files - Fourth Generation Kedo-S Files

The fourth generation of Kedo file systems is the Kedo-S2 system. It's a two-file system with characteristics found in earlier generations. The inclusion of two cross-sections in a single file is the trait that most separates this generation from previous ones, though.

The file's significant features comprise:

Apical 5 mm – It possesses a triangular cross-section, engages in three-point contact with the canal wall, features a 4-5% taper, and shares similarities with Kedo-S files.

Coronal 7 mm – It exhibits a tear-drop cross-section, establishes two-point contact with the canal wall, showcases a 6-8% taper, and bears resemblance to H files.

The dual cross-section feature enhances tapering toward the canal's apex. This results in reduced apical preparation, minimizing the risk of lateral strip perforation in the canals. Simultaneously, it increases coronal preparation of the root canals, enabling the smooth flow of obturating material into the primary teeth's canals.

The following two files are present in this system:

- **A1** - This replaces the U1 file found in earlier generations. It features a tip diameter of 0.038 mm, a cutting edge length of 13 mm, an overall file length of 17 mm, and is identifiable by its blue color code, along with red and blue bands on the handle for easy recognition.
- **P1** - This replaces the E1 and D1 file found in earlier generations. It features a tip diameter of 0.028 mm, a cutting edge length of 12 mm, an overall file length of 16 mm, and is identifiable by its black color code, along with green and black bands on the handle for easy recognition ^[10].





Various Generations of Kedo File System

FEATURES	KEDO-S	KEDO-SG	KEDO-SG BLUE	KEDO-S SQUARE
TOTAL LENGTH	16mm	16mm	16mm	P1:16mm A1:17mm
WORKING LENGTH	12mm	12mm	12mm	P1:12mm A1:12mm
TAPER	4-8% variable taper	4-8% variable taper	4-8% variable taper	4-8% variable taper
METALLURGY	Ni-Ti rigid	Heat treated Ni-Ti	Heat treated Ni-Ti with Titanium oxide layer	Heat treated Ni-Ti with Titanium oxide layer
FILE SIZE	D1, E1, U1	D1, E1, U1	D1, E1, U1	P1, A1
COLOUR CODE	D1: Red E1: Blue U1: Black	D1: Red E1: Blue U1: Black	D1: Red E1: Blue U1: Black	P1: Red and blue bands on handle A1: Green and black bands on handle
TIP DIAMETER	DI:0.25 EI:0.30 U1:0.40	DI:0.25 EI:0.30 U1:0.40	DI:0.25 EI:0.30 U1:0.40	P1:0.028 A1:0.038
CLINICAL USE	D1: Narrow molar canal E1: Wide molar canal U1: Anterior canal	D1: Narrow molar canal E1: Wide molar canal U1: Anterior canal	D1: Narrow molar canal E1: Wide molar canal U1: Anterior canal	P1: Molar A1: Anterior

IDEAL ROTATIONAL SPEED: 250-300 rpm

TORQUE REQUIRED: 2.2-2.4 N.cm

Pro AF Baby Gold Files

The Pro AF Baby Gold pediatric rotary file offered by Dentobizz consists of five flexible NiTi CM (controlled memory) wire files, each with a uniform taper ranging from 4% to 6%.

Features:

- File is 17 mm in length, created specifically for primary teeth
- There is a distinctive short orifice enlarger designed to prevent the occurrence of cervical ledging.
- With a sequential combination of 4% and 6% taper files, canal shape is improved

- Almost no separation is produced by heat treatment
- Improved canal centricity with advanced NiTi CM wire
- High flexibility

The various files of Pro AF Baby gold system:

FILES	TIP DIAMETER	TAPER
B0 (short orifice enlarger)	0.015mm	10%
B1(yellow band)	0.020mm	4%



B2(red band)	0.025mm	4%
B3(red band) The handle features two red bands to aid in identification.	0.025mm	6%
B4(blue band)	0.030mm	4%
B5(black band)	0.040mm	4%

IDEAL ROTATIONAL SPEED: 300rpm

TORQUE REQUIRED: 2N.cm

Following is the order in which files are used:

- For anteriors: Begin with B4, then proceed to B5.
- For posteriors:

When dealing with palatal and distal canals, use B2 first, followed by B4.

For narrow apex:

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

When #20 K file loose at the apex-Use B2 followed by B3.^[10]



Prime Pedo Files

These files have been heat-treated, have a triangle cross section, and are memory-controlled. Compared to manual instrumentation, they have increased cleaning effectiveness and produce superior obturation.

Consists of four files:

- Starter – These instruments serve as orifice openers, characterized by their 16mm length and an 8% taper.

- P1 – With an 18mm length, 6% taper, and a tip diameter of 0.015mm, this file is employed for treating the narrow canals in primary molars.
- P2 – With an 18mm length, 6% taper, and a tip diameter of 0.025mm, this file is employed for treating the wider canals in primary molars. And primary anteriors



- Endosonic files –With a length of 18mm and a 2% taper, this file is intended for preparing the apical third and should be used in conjunction with an ultrasonic scaler^[11].

DXL Pro TM Files

The DXL-Pro-TM files feature a convex triangular cross-section with controlled memory and a guiding non-cutting tip. In comparison to Prime Pedo files, they offer enhanced cleaning effectiveness and produce superior obturation results.

DXL Pro rotary system has three files

Files include:

- #30 - 8% taper, 16 mm length (Orifice enlargement)
- #20 - 6% taper, 16mm length
- #25 - 6% taper, 16mm length ^[11]

Pedoflex (Neoendo) Rotary File

Pedoflex pediatric rotary files are introduced by Neoendo with length 16mm and taper 4%. It has simple file organisation for a rapid and simple treatment process. Their unique design combines efficient cutting capabilities with flexibility, allowing them to be used effectively in canals of all types in primary teeth ^[12].



Total Length	16mm
Taper	4%
Colour coding	Yellow, Red, Blue
Tip size	Yellow:0.20mm, Red:0.25mm, Blue:0.30mm
Ideal rotational speed	350rpm
Torque	1.5N.cm

Waldent Pedo-Flex File System ^[14]

Pedo-Flex is a nickel–titanium (Ni–Ti) rotary file system specifically developed for use in primary (deciduous) teeth, particularly in procedures such as pulpectomy and root canal preparation in children. It is manufactured by Waldent Innovation Pvt. Ltd., India.

Key Features

Feature	Description
Length & Taper	Files are typically 16 mm long, with taper options of 4% or 6%, suitable for the shorter roots of primary teeth.
Construction & Material	Made of nickel–titanium alloy, treated with gold thermal technology to enhance memory, flexibility, and cutting efficiency.
Flexibility & Fatigue Resistance	Designed to negotiate curved and thin primary canals; the manufacturer claims improved resistance to cyclic fatigue.
Tip & Cross-section	Equipped with a non-cutting safety tip to reduce apical transportation, and a triangular cross-section for sharp and efficient cutting.
Rust & Sterilization Resistance	Autoclavable and resistant to rust and corrosion, ensuring safe reuse in pediatric dental practice.

Features:

Cyclic Resistance

- 350% more resistant to cyclic fatigue.
- Improved Resistant, cyclic fatigue resistance time.

- Triangular cross-section: Sharp cutting edges.

Gold Treated

- Advanced memory alloy tech with elegant dark gold color.
- Controlled memory files.
- Gold thermal treatment: Enhances cutting efficiency.

High Flexibility

- Extreme Flexibility: To negotiate any canal.
- Super – flexible gold alloy.

TIP

- Advanced Tip Process, Avoid Forming Steps.

Advantages

- Reduced treatment time – Shorter instrumentation and obturation times, beneficial in managing pediatric patients.
- Effective root canal cleaning – Enhanced debridement compared with manual instrumentation.
- Improved obturation quality – Better canal filling results in clinical trials.
- Reduced postoperative pain – Patients report less discomfort following treatment.
- Flexibility – Ability to navigate curved canals while preserving canal anatomy.



SPEED : 350rpm | TORQUE : 1.5NCm



Baby Blue Rotary File System (A to Z Kids dental, India)

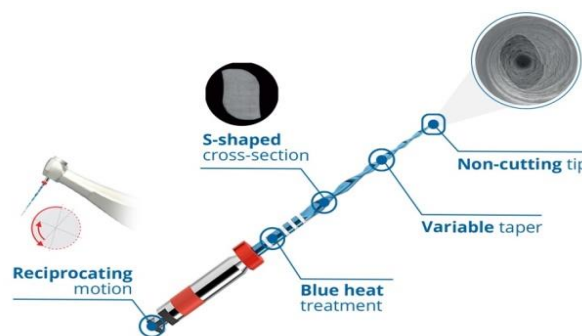
- Three file system
- Consists of foster file (variable taper) which creates a gliding path in the apical part and widens the coronal orifice
- B1(28/.05) file is used for instrumentation of narrow and medium wide canals
- B2(38/.05) file is used for instrumentation of wide canals.
- Taper – 4%
- Ideal rotational speed: 250 – 350rpm
- Torque: 2.2 – 2.6 Ncm
- Super flexibility and greater resistance to cyclic fatigue ^[13]

Reciproc Blue Niti Rotary File System (VDW, Baillagues, Switzerland) ^[13]

- RECIPROC® blue is designed to be used as a single instrument - One instrument only is required to prepare a root canal
- Function in a reciprocating motion and are made by using CM-Blue Wire NiTi alloy with heat treatment.
- Length - 17mm with apical diameter of 300µm in double-S cross-section.
- The physical properties of NiTi files get improved by heat treatment.

File Sizes:

- R25 0.25/.08v (Most cases) 21, 25 & 31mm
- R40 0.40/.06v 21,25 & 31mm
- R50 0.50/.05v 21,25,31 mm



Denco Dental Kids Files (Shenzhen Denco Medical Ltd., China) ^[13]

- Heat activated blue niti files consists of four files
#25 (.04 mm tip dia)
#25 (.06 mm tip dia)
#30 (.04 mm tip dia)
#40 (.04 mm tip dia)
- 17mm and 19mm length
- Speed of 300 RPM
- Torque of 2 Ncm



Sani Kid Rotary Files (Chengdu Sani Medical Equipment Co. Ltd., China) ^[13]

- Consists of three files – blue, red, yellow.
- They have short thread design facilitating chip evacuation.
- These files are available in 17mm and 19mm length with taper of 4% and 6% and are used at 150- 300 rpm and
- 2.0-2.5 N.cm torque.

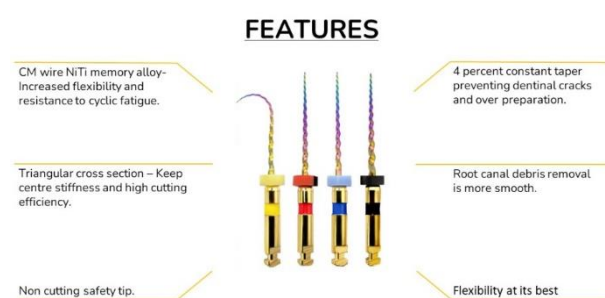


Kids-E Files

Kids-E-Files are advanced, heat-treated rainbow rotary files specially developed for efficient and reliable root canal preparation in **primary teeth**.

The unique **rainbow design** enhances debris removal, cutting performance, and clinical safety.

Manufactured from premium quality **nickel-titanium alloy**, these files undergo specialized **heat treatment and surface modification**, providing exceptional **flexibility** and improved **durability** during pediatric endodontic procedures.



Rainbow Surface Technology involves a **three-stage heat treatment process**. The file is treated in distinct sections: beginning with the **dark blue area** at the highest temperature, followed by the **gold region**, and finally the remaining portions such as **purple, orange, and other shades**.

This method ensures that each part of the file receives targeted thermal processing at different time intervals. The **tip region (approximately the apical 3 mm)** undergoes the **highest level of heat treatment**, as it is the most vulnerable area for instrument separation.

Strengthening this zone enhances **safety and reliability** during clinical use.

As a result, the **Rainbow File System** is engineered to provide an optimal balance between **cutting efficiency** and **operational safety**.

4. Summary and Conclusion

The use of rotary instrumentation is a valuable and efficient technique in the endodontic preparation of primary teeth, as it minimizes the clinical time required for pediatric patients. Research into rotary endodontic instruments is still ongoing. The introduction of newer systems with greater efficiencies. Paediatric dentistry uses the NiTi rotary method, which has both benefits and drawbacks. Consequently, it is crucial that the operator have proper rotary instrumentation training.

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