



## Pediatric Rotary Endodontics: A Review

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**Abstract**

*The preservation of primary teeth is crucial until the onset of physiological exfoliation. Pulpotomy are one of the most effective procedures to save a main tooth that has become necrotic. A significant part of the pulpotomy technique is the biomechanical canal preparation. The accepted technique for primate tooth canal preparation is manual instrumentation with a hand file. The preparation was done using reamers, files, and ultrasonic equipment. Even though manual preparation methods are still the norm for biomechanical preparation, they have several drawbacks, such as a number of iatrogenic mistakes such ledging, zipping, canal transit, and apical blockage. To address these issues with the traditional manual file system, nickel-titanium (NiTi) rotary instruments were developed in the field of endodontics. These instruments have produced the desired results by effectively cleaning the root canals while preserving the original canal space during BMP procedures. The numerous rotary file systems utilised in paediatric dentistry are the topic of the current review.*

**Keywords:** *Pulpotomy, Rotary files, Rotary Endodontics.*

**Introduction**

The main objective of paediatric dentistry is to maintain the integrity of the arch by keeping the primary teeth in place until they naturally exfoliate.[1,2] Pulpotomy, which has a number of benefits over extraction, is one of the treatment options for pulpally harmed primary molars.[3] A significant factor in the outcome of the procedure, which will have an impact on the efficacy of root canal therapy, is the intricate root canal system of primary teeth. The outcome of pulpotomy is significantly influenced by the instrumentation of root canals, which is performed with the primary goal of removing the infection.[4,5]

The preparation of the canal is essential to the success of the pulpotomy procedure because proper shaping of the canal system removes all contaminated pulpal tissue and provides an adequate path for irrigation in the radical third portion, resulting in successful obturation of the prepared root canals. The standardised method for prepping the canals of the primary teeth is manual instrumentation with a hand file.[6]

Even though manual preparation methods are still the norm for biomechanical preparation, they have several drawbacks, such as a number of iatrogenic mistakes such ledging, zipping, canal transit, and apical blockage.[7]

The use of rotary instruments in endodontic treatment has been made possible by the invention of nickel-titanium alloys. The shorter root canal length in deciduous teeth allows for speedier rotational instrumentation when compared to the permanent dentition. The rotating approach of instrumentation is known to reduce the amount of debris extrusion and to make obturation easier. By reducing the amount of time needed to shape the canals, one of the most difficult tasks in paediatric endodontics, it also encourages a patient's cooperation. [8,9] The numerous rotary file systems utilised in paediatric dentistry are the topic of the current review.

**Rotary Endodontics in Pediatric Dentistry:** Since 1993, rotary instrumentation has been used in paediatric endodontics. Barr et al. published the first description of the use of NiTi rotary files in primary teeth root canals in 2000. Since that time, different NiTi rotary systems using a modified method have been used in paediatric dentistry.[10] Because Ni-Ti files are motor-activated, they can prepare the root canal quickly and do not require pre-curvature due to their elastic memory. The elastic memory of the Ni-Ti file lowers the likelihood of root canal deformation, and the radial land of the Ni-Ti file, along with inactive tips, holds it in the centre of the root canal.[11] Rotary files also improve patient cooperation by shortening treatment time for cleaning canals. This factor is clinically relevant in pediatric dentistry because it allows faster procedures with maintenance of quality and security as well as reducing patient's and professional's fatigue. Considering that rotary files are more convenient to use, their application may be more appropriate in children with behavior management problems.[12]

### **Rotary file used in Pediatric Endodontics**

**Pro Taper System:** Dr. Cliff Ruddle, Dr. John West, and Dr. Pierre Machtou created these instruments. A new generation of root canal shaping equipment is available from Dentsply Maillefer in Ballaigues, Switzerland. They are called ProTaper NiTi instruments. The ProTaper system is based on a unique concept and comprises just six instruments, three shaping files and three finishing files.[13,14]

**Advantages:** Reduces friction, increases the cutting efficiency, lowers the risk of instrument separation, replaces Gates-Glidden drills, selective removal of dentin.[15]

**Disadvantages:** Cannot be used twice in same root and unexpected lateral perforation.[16]

**The K3 rotary system:** Presented by John McSpadden, M.D. (Lookout Mountain, Georgia). Three radial lands, a continuous taper, a non-cutting tip, and an asymmetrical shape with a positive rake angle all contribute to effective preparation. [17,18] This technology offers benefits including excellent cutting qualities, increased flexibility, canal tracking, avoids the screwing-in effect, shorter procedure times, minimises canal transportation, resists torsional and cyclic fatigue, lessens patient fatigue, and tactile control. The disadvantages include high cost, the need to operate at a specific speed (between 300 and 350 rpm), and the need for sensitive handling.[19]

**Kedo file system:** Jeevanandan G et al. introduced the Kedo file system, a unique paediatric rotational file system, in 2016. The innovative Kedo nickel-titanium rotary files are only used for root canals of primary teeth preparation. Kedo rotary files offer variable taper designs that provide them the flexibility and effectiveness to clean and shape consistently well. These files result in extensive preparation of the primary root's coronal third and enough preparation of the middle and apical thirds, allowing for easy flow of the obturating material and preventing lateral perforation at the apical region.[20,21]

### **Generation of Kedo File System**

**Kedo-S Rotary Files (First Generation):** Kedo-S rotary file is a single NiTi rotary file system that consists of U1 files for upper and lower anterior primary teeth, D1 files for mesiobuccal and mesiolingual canals, and E1 files for other canals. E1 for the palatal and distal canals of the first permanent molars. They are 16 mm in length overall, with a working length of 12 mm. These files are distinctive due to their variable taper (4%–8%) and variable tip diameter.[22] To facilitate efficient canal preparation and prevent over-instrumentation, the instrument is tapered in accordance with the diameter of the primary root canal.[7] The original anatomy of the primary root canal can be preserved when the Kedo-S instrument is used in curved canals, mostly due of the file's flexibility and design. Because of this, it may easily acclimatise to the erratic and twisted canals of primary teeth.[23]

Jeevanandan and Govindaraju in 2018 compared and evaluated the instrumentation time and quality of obturation between pediatric rotary file (Kedo-S) and manual instrumentation techniques in primary molars with Kedo-S and hand K-files, respectively. They found that Kedo-S to be efficient in preparing canals of deciduous teeth and had better quality of obturation.[24]

**Kedo-SG Rotary (Second-Generation):** Kedo-S Files Kedo-SG rotary files are heat-treated NiTi rotary files utilizing the M-Wire technology. These files result in better obturation quality due to its efficient preparation of primary root canals.[25]

**Kedo SG blue (Third Generation):** It consists of three files in order. There is the entire 16 mm length. The files are designated as D1, E1, and U1 in that order. It is suitable for use in primary teeth due to the variable taper that heat treatment and regulated memory give. Greater flexibility and a resistance to cycle fatigue of around 75% are among the features. An optimal rotating speed is between 250 and 300 rpm, and the required torque is between 2.2 and 2.4 N.

**Kedo-S Square (Fourth-Generation):** Kedo-S Square file (KEDO Dental, India), a 4th generation file. It is a single-file system designed with a triangular cross-section at the apical region and a teardrop cross-section at the coronal region. The Kedo-S Square rotary file system was launched with the promise of lesser root dentin preparation offering decreased rate of primary root resorption.<sup>26</sup> This file system with variably variable taper abrades the dentin, thereby removing a thin layer of dentin from the entire perimeter of the root canal and maintaining dentin integrity for successful three-dimensional obturation, unlike other rotary files with large taper removing excessive dentin, resulting in weakening of roots.[27]

**Pro AF Baby Gold file:** With NiTi CM-Wire technology, the Pro AF Baby Gold file, a paediatric-specific rotary file, is flexible and has a consistent taper of 4% and 6%. They consist of five 17mm long files, and preparation usually only necessitates two files.[28]

**Prime Pedo Files:** These heat-treated, memory-controlled files have a triangular cross shape. In comparison to manual instrumentation, they generate superior obturation and have greater cleaning performance.[29]

#### **Advantage of Rotary files [30,31]**

- The original morphology of curved canals can be preserved because to the design and flexibility of Ni-Ti alloy tools, which can help prevent procedural errors, especially in primary teeth. In addition, a more consistent, predictable paste filling can be achieved in primary teeth thanks to the funnel-shaped canal preparation.
- Rotary files also improve patient cooperation by shortening treatment time for cleaning canals. This factor is clinically relevant in Pediatric dentistry because it allows faster

procedures with maintenance of quality and security as well as reducing patient's and professional's fatigue

- Since rotary files are easier to use, their application may be more suitable for kids who struggle with behaviour management.
- Because the rotary files draw pulpal tissue and dentin out of the canal as they are engaged, the uneven canal walls of primary molars can be cleaned with Ni-Ti successfully.
- Less overfilling happens as a result of the preparation's conical channel and the obturatory paste's simple entrance.
- Because of their elastic memory, Ni-Ti files can prepare the root canal quickly and without the need for pre-curvature.
- Due to its elastic memory and radial aspect, which holds the files in the core of the root canal via wall support and inactive tips, the likelihood of root canal deformation is lessened.

#### **Disadvantage of Rotary files [30,31]**

- The roots of primary teeth are shorter, thinner, and more curved, and the primary dentin is softer and less thick than that of permanent teeth. Resorption of the root tip is frequently invisible. The four ribbon-shaped root morphology that defines the root canal system. All of these traits make it difficult to use Ni-Ti rotary devices on primary teeth.
- The fundamental problem is that all rotary devices rotate with their centre of rotation centred in the root canals, leaving unclean areas and potentially infected tissue in the root canal and isthmuses of primary teeth. To remove any loose pulp tissue with a brushing motion and to make sure that all the root canals are cleansed and prepared for filling, it is required to apply an additional H-file (No. 25 or 30) in ribbon-shaped canals along with sufficient sodium hypochlorite irrigation.
- The high cost of Ni-Ti rotary systems and need for training to learn the technique are their disadvantages.

#### **Conclusion**

The study of rotary endodontics is an area that is constantly being researched. Newer systems with higher efficiency are introduced every day. The NiTi rotary system in paediatric dentistry has two edges. NiTi rotary devices' flexibility and design preserve the original anatomy of curved canals while also lowering procedural mistakes. It enables quicker operations, which improves patient

cooperation—which is crucial in paediatric dentistry. To limit the working duration, the operator's prior training is crucial, though, as tactile sensitivity is declining. Other restrictions with NiTi rotary systems include the expensive cost of the arsenal and the requirement for technical training.

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