

## Rotary Files in Pediatric Dentistry: Review article

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### ABSTRACT

Pulp therapy is considered a main choice for treating primary teeth with pulp involvement, and pulpectomy is the best choice for root canal therapy in teeth with irreversible pulpitis or necrosis. The main objective of root canal treatment is the elimination of microorganisms, and this can be achieved through chemo-mechanical removal of inflamed vital pulpal tissues, residual necrotic tissues, infected dentine, and debris. Therefore, cleaning and shaping is an important step to eliminate organic debris and leading to a successful pulpectomy procedure.

Rotary Nickel- Titanium (Ni-Ti) was introduced into dentistry to overcome the disadvantages of the manual files. In pediatric patients, they have limited mouth opening and the longer length of adult rotary files makes it more difficult to use. That's why some rotary Ni-Ti files were specially designed and manufactured for primary teeth.

*Keywords: Kedo-S files, Rotary Files, Primary teeth, Pulpectomy.*

## **1-Introduction**

Challenging problems may be present when performing pulpectomy in primary molars like difficulty in instrumentation of canals with complexities, lengthy endodontic preparation time and some behavior management require advances to up to date techniques.<sup>1</sup>

Rotary Nickel- Titanium (Ni-Ti) was introduced into dentistry to overcome the disadvantages of the manual files. In permanent teeth, the use of rotary files has proven to be effective with decreased instrumentation time in curved molar root canals. They provide greater flexibility and raise the possibility of automated instrumentation.<sup>2</sup>

In pediatric patients, they have limited mouth opening and the longer length of adult rotary files makes it more difficult to use. That's why some rotary Ni-Ti files were specially designed and manufactured for primary teeth.

### **Review:**

Several authors have reported clinical success using rotary systems manufactured for permanent dentition with modified protocol in pediatric endodontics such as ProFile, ProTaper, Hero 642, Mtwo, K3, FlexMaster, WaveOne, Protaper Next, OneShape. Recent rotary files have been manufactured for primary teeth such as, Kedo-S rotary files (the first rotary Pedodontic files), Prime Pedo™ (Sky International Enterprises, India), DXL-Pro Pedo™ (Kraft Marketing, India), Pro AF Baby Gold (Kids-e-dental, India), Denco Kids files (DENCO, China) and Kid Files (SANI, China).<sup>2,3</sup>

### **First Generation Files:**

#### **Systems:**

##### *1. Profile0.04:*

These files have a triple U-shaped cross-section and a non-cutting tip, with flat radial lands, constant pitch and taper with a 20° helical angle.<sup>4</sup>

2. *Flex-Master (VDW, Munich, Germany):*

These Ni-Ti rotary files are characterized by convex triangular cross-section, sharp cutting edges, fixed taper and individual helical angles to prevent “screwing in” effect.<sup>5</sup>

**Second Generation Files:**

These systems have a smaller number of instruments. They provide less instrumentation time and preserve the original shape of the canals.<sup>6</sup> Some studies reported clinical success in primary molars using these rotary files with a modified protocol.<sup>7</sup>

**Systems:**

1. *Protaper Files (Dentsply Maillefer, Ballaigues, Switzerland):*

The ProTaper system includes six instruments, three shaping files and three finishing files.<sup>8,9</sup> SX file which is considered an orifice opener, S1, S2 and F series files.

2. *The K3 rotary system (SybronEndo, Orange, California):*

The K3 rotary nickel-titanium file system has an asymmetrical design with a slightly positive rake angle for optimum cutting efficiency, fixed taper, and a noncutting tip.<sup>10</sup>

3. *Mtwo (VDW, Munich, Germany):*

Mtwo has a two-fluted S-shaped cross section. Its specific design and flexibility helps to maintain the original root canal curvature, so they are safe and effective.<sup>11</sup>

**Third Generation Files:**

These brand files offer heat treatment technology.<sup>11</sup> However, there are no literature reviews of these files system in deciduous teeth.

**Systems:**

1. *Twisted file:*

Recently, new manufacturing processes (metal twisting, surface conditioning and R-phase heat treatment) introduced the third generation of Ni-Ti rotary instruments: the twisted file (TF). These processes surface (deoxidation) have shown to maintain the flutes' sharpness, increase the resistance of the instrument and provide significant flexibility.<sup>12</sup>

## 2. Hyflex (Coltene Whaledent):

HyFlex Controlled Memory (CM) Ni-Ti Files have been produced by applying a unique process that controls the memory of the material and makes the alloy more flexible, as it doesn't rebound to its original shape like the conventional Ni-Ti alloy.<sup>13</sup> This allows the file to follow the anatomy of the canal, reduces ledging, transportation or perforation and the files can be pre-bent to help in avoiding the creation of steps.

## **Fourth Generation Files:**

The reciprocal movement idea inspired the manufacturers to introduce the 4th generation of rotary systems. Reciprocating motion is a back and forth motion, in clockwise and anti-clockwise direction, it helps to reduce the risk of instrument separation, as it avoids the over engagement of the dentin.

New concepts of engine driven Ni-Ti file systems named Single-Files have made the instrumentation protocol simpler.<sup>14</sup> They decreased working time, cross contamination prevention and improved safety of shaping procedures.<sup>15</sup> Single-file systems have two different motions: reciprocation and continuous rotation.<sup>14</sup>

**WaveOne** (Dentsply Maillefer, Switzerland), **Reciproc** (VDW, Germany), **Self-Adjusting Files** (ReDent-NOVA, Germany) are Fourth generation Files.

## **Fifth Generation Files:**

These file systems have unique offset designs.

## **Systems:**

1. Protaper Next (Dentsply Maillefer, Switzerland):

ProTaper Next was introduced in 2013 as a new version of ProTaper Universal. These files are manufactured from M-Wire alloy which reduces cyclic fatigue by 400 % compared with similar instruments manufactured from conventional Ni-Ti alloys. Consequently, there are less chances of instrument separation.<sup>9</sup> ProTaper Next consists of five files (X1–X5).<sup>16</sup>

2. Revo-S Files (MICRO-MEGA, France):

Revo-S has an asymmetrical cross section, and it initiates a snake like movement inside the canal. The asymmetrical cross section increases the available volume for upward debris removal.<sup>9</sup>

3. OneShape (Micromega, France):

A single file system with variable cross-section that completes canal shaping with one file in complete rotation. It has a micro-mega innovation, which means that the instrument presents with a variable cross-section zone along the blade.<sup>9</sup>

**Newer File Systems used in Pediatric Pulpectomy:**

In 2017, a survey showed that 66% of pediatric dentists needed an exclusive pediatric rotary file for better accessibility and faster instrumentation.<sup>19</sup> Thus, it was recommended by earlier studies to modify these files and to display new Ni-Ti rotary files with different length, taper and tip size specially designed for primary teeth to accommodate their ribbon shaped canals.<sup>18</sup>

This in turn enhances the need of endodontic rotary files specially designed for primary dentition.

➤ **Kedo –S Rotary System (Reeganz Dental Care):**

Kids Endodontic Shaper (Kedo-S) is the world's first rotary file for shaping primary teeth. It is invented by Dr.Ganesh Jeevanandan and came into existence in Nov 2016.

Kedo nickel-titanium rotary files are exclusively used for root canal preparation of primary teeth. These files are characterized by a variably variable (VV) taper designs giving flexibility and efficiency resulting in consistently successful cleaning and shaping, thus allowing an easy flow of the irrigation solution and obturating material and avoiding lateral perforation at the apical region.<sup>19-21</sup>

Kedo-S files are available in hand and rotary type. Kedo-S rotary files are available in four generations:

- First Generation System: Kedo-S Rotary Files:

Kedo-S rotary file is a Ni-Ti rotary file system consisting of D1, E1, and U1 files, where U1 files are for upper and lower anterior primary teeth, D1 for narrow canals, and E1 for wide canals of the primary molar teeth. They have 12mm working length with a total length of 16 mm. The uniqueness of these files is the presence of variable taper (4%–8%) with varying tip diameter. With the use of Kedo-S instrument in curved canals, the original anatomy of primary root canal can be maintained, due to mainly the file design and flexibility. This enables it to closely adapt to the irregular and tortuous canals of primary teeth.<sup>13</sup>

- Second Generation System: Kedo-SG Rotary Files:

Kedo-S-SG rotary files are heat-treated NiTi rotary files applying controlled memory (CM) wire technology. These files result in better obturation quality due to its efficient preparation of primary root canals.<sup>22</sup>

- Third Generation System: Kedo-SG Blue:

Kedo-S-SG Blue files are with super flexibility and have 75% more resistance to cyclic fatigue than its earlier generation.<sup>23</sup>

-Fourth Generation System.

The newer generation Kedo-S- Square consists of P1 file for primary molars and A1 file for primary anterior teeth. They also have variable cross section that ranges from 4-8%, the apical

5 mm has triangular cross section , while the coronal 7 mm has teardrop cross section . This allows reduced apical dentin removal and less aggressive preparation. Kedo-S square files have the advantages of their super flexibility and increased resistance to cyclic fatigue due to its titanium oxide (TiO<sub>2</sub>) coating.<sup>24</sup>

➤ **Prime Pedo Files:**

They are memory-controlled files they are heat treated with triangular cross section. These files improve the cleaning efficacy and produce better obturation compared to manual instrumentation.<sup>3</sup>

➤ **DXL-Pro-TM Files DXL-Pro-TM files:**

The files have a guiding noncutting tip and convex triangular cross section with controlled memory. They provide better cleaning efficacy and result in better obturation than Prime Pedo files.<sup>3</sup>

➤ **Pro-AF Baby Gold Files Pro AF Baby Gold file:**

Specially designed pediatric rotary files with Ni-Ti and controlled memory technology. They comprise of five files of 17mm long and mostly require only two files for preparation.<sup>23</sup>

**Conclusion:**

Considering that preparation time is an important clinical factor in the management of the pediatric patient, thus considering the use of rotary instruments for pulpectomies in primary teeth is recommended. The design and flexibility of Ni-Ti rotary instruments preserves the original anatomy of the curved canals and also reduces the procedural errors Since new modalities of rotary files are rising, more investigations are needed on root canal treatment of primary teeth

**Conflict of Interest**

The authors have no known conflict of interest that could have declared to influence the work reported in this paper.

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