

ADVANCEMENTS AND INSIGHTS INTO PEDIATRIC ROTARY ENDODONTICS: A
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ABSTRACT

The retention of primary teeth is of paramount importance until the natural process of exfoliation occurs. The most eminent ways of preserving is by performing endodontic treatment which is essential for addressing complications of the pulp, which may necessitate procedures such as pulp capping, pulpotomy, or pulp extirpation, followed by root canal therapy. The biomechanical preparation of the canal is fundamental to the success of the pulpectomy procedure. Although the manual method has long been regarded as the standard, it presents significant drawbacks that can hinder efficiency and outcomes. Embracing rotary instrumentation not only addresses these challenges but also enhances the overall effectiveness and speed of the procedure, making it a superior choice for dental professionals.

KEYWORDS: Pulpectomy, Rotary files, Primary teeth.

INTRODUCTION

Dental caries is a largely predominant multifactorial disease and has been a major public health problem.^[1] When caries is limited to enamel and dentin, it is restored normally by means of various restorative materials. But if there is pulpal involvement of caries associated with the primary teeth, it requires to be pulpally treated in order to resolve the pain and functionally preserve the teeth until it exfoliates physiologically.^[2] This process of root canal treatment in deciduous teeth is termed as pulpectomy. The outcome of pulpectomy is significantly influenced by the instrumentation of root canals, which is performed with the primary goal of removing the infection.^[3,4]

Yang et al in 1996 stated that success of pulpectomy depends on elimination of irrigation pathway by cleaning and shaping the root canals. The established technique for preparing the canals of primary teeth involves manual instrumentation using a hand file, like reamer, broaches, files etc.^[5] Though manual preparation remains the conventional approach for biomechanical preparation but it has its limitations, including various iatrogenic errors like ledging, canal transportation, zipping and apical blockage.^[6] Barr *et al.* in 2000 introduced rotary instruments to pediatric endodontics and concluded that the use of Ni-Ti rotary files for root canal preparation in primary teeth was cost-effective and rapid, resulting in consistently predictable and uniform obturation.^[7]

Use of the rotary instrumentation technique transforms the root canal to a more conical shape and thus enhances the quality of obturation.^[8] The design and flexibility of NiTi alloy instruments allow the files to preserve the original anatomy of curved canals especially in primary teeth and reduce procedural errors. Some benefits of the NiTi rotary file system include quicker instrumentation times, more consistent and affordable obturations, and increased patient compliance. However, there are a number of drawbacks to using adult rotary files on youngsters due to the longer file length and taper, which can lead to over-instrumentation and lateral perforations. NiTi rotary files were therefore created with kids in mind.^[9] The first file system to be introduced was Kedo-S rotary system, which came into existence from Nov, 2016. Since then, a lot of rotary files have been developed especially for kids. After that various other rotary file system were introduced like Pro AF Baby GoldTM, Prime PedoTM, DXL-Pro PedoTM, NeolixTM (France), Denco Kids files and Sani Kid rotary files.^[10]

The introduction of these pediatric rotary files had brought a great advantage for both the dentist and the children as it increases the ease of operation, decreases the chair time which in turn increases co-operation of the child, efficient debris removal, decreased post-operative pain as compared to hand files, etc.

DISCUSSION

In pediatric endodontics, rotary instruments has been in

use since 1993. In 2000, Barr *et al.* reported the first case of using NiTi rotary files in root canal therapy for primary teeth. Since then, pediatric dentistry has introduced the use of several NiTi rotary instruments that utilise a modified approach.^[11] The use of rotary tools for pulpectomy in primary molars holds a great promise since Ni-Ti files possess elastic memory that enables for quick root canal preparation without the requirement for pre-curvature. The radial land and inactive tips of Ni-Ti files helps maintain them balanced within the root canal, and their elastic memory minimises the chance of root canal deformation.^[12] Due to their ease of use, rotary files could be particularly beneficial for children with behavior management issues.^[13]

Advantages of Rotary Systems for Canal Instrumentation in Primary Teeth^[14]

- Decreases the chair side time
- Results in preparation of funnel-shaped canals which in turn produces uniform fill of the obturation paste
- Quick removal of the tissue and debris
- Better cleaning ability of the canals when compared to the manual technique
- Increases the patient cooperation.

Some of the rotary files designed for children are-

Kedo file system

In 2016, Ganesh Jeevardhan introduced this system for primary root canal treatment. They are available in different generation due to manufacturing modifications.

Kedo S File

These are the first generation files with gradual taper which aids to prevent over instrumentation of the inner root wall surface and facilitates efficient canal preparation. They are operated with a constant-torque with speed of 150-300 rpm.

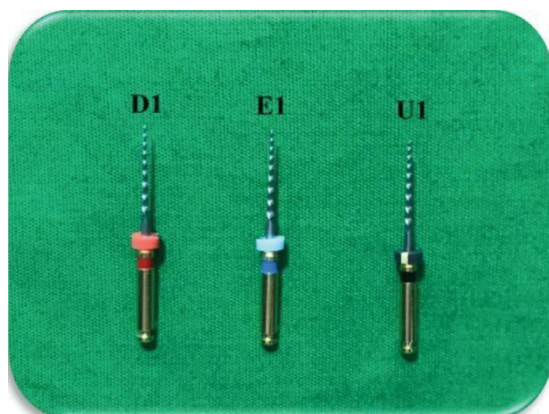


Fig. 1: Kedo-S paediatric Ni-Ti rotary files – Red colour coded- 0.25 tips diameter, Blue colour coded- 0.30 tip diameter and Black colour coded- 0.40 tip diameter used for root canal.

Though the length of these files are 16mm but the working length is 12mm. This system consists of 3 Ni-Ti

rotary files (fig.1) designed with varying diameter for different primary teeth. D1 file with 0.25 mm diameter is used in narrow canals (disto-buccal canal in maxillary molars and mesial canals in mandibular molars), E1 file is available in 0.30 mm tip diameter, designed for wide canals (palatal canal of maxillary molar and distal canal of primary mandibular molar) and U1 with 0.40mm diameter is used in anterior teeth because of its larger tip.^[15]

Kedo SG

These are the second generation files which are heat treated and they provide good quality of obturation.^[14]



Fig. 2: Kedo-SG rotary files.

Kedo SG Blue

These are the third generation files which operate at an ideal rotational speed of 250 - 300 RPM and the torque required is 2.2 - 2.4 Ncm. These files have a controlled memory with super flexibility. They are also made by heat treatment. Due to presence of titanium oxide it provides resistance to cyclic fatigue upto 75%. Priyadarshini *et al* reported better quality of obturation and reduced instrumentation time in lower primary molars using Kedo-SG blue files.^[16]

Kedo S Square

These are the fourth generation files with low fracture rate.^[17] As compared to the previous generation file system, Kedo S Square has 2 file system, P1 for molars and A1 with 6 to 8% at first 5 mm of the file taper is 6% followed by increase in taper by 7 and 8% by anterior teeth. This prevents the extrusion of the obturating material and allows easy flow.^[18]



Fig 3: Kedo S square

Kedo S Plus

These are the fifth generation files with dual core material and uniform cross section, which is heat treated

along with titanium oxide coating at middle and apical region. 14 molars can be prepared using 1 file.^[19] These files resulted in reduced post operative pain comparison compared to hand instruments.^[20]

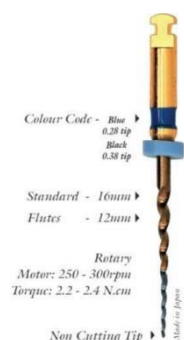


Fig 4: Kedo-S Plus.

Pro AF Baby Gold Files

With 4 and 6 % taper and high flexibility, Pro AF is a five-file system utilizing NiTi CM wire technology. For preparing narrow canals, B1 file (#20–04%) and B2 file (#25–04%), for wide canals, B3 file (#25–06%) and B4 file (#30–04%), and B5 file (#40–04%). These instruments are also suitable for permanent tooth where the patient has opening their mouths fully but require root canal treatment, especially in cases involving third molars.^[16,21]

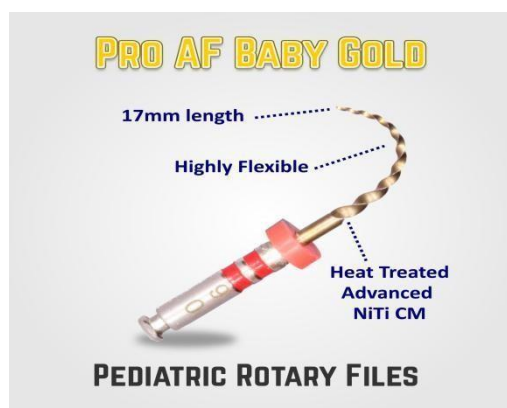


Fig. 5: Pro AF Baby Gold Files.

Prime Pedo

These files are gold coated, features a triangular cross-section, and possess controlled memory properties, which help to improve the accuracy of canal shaping. It consists of 5 system. Firstly the Starter File (8% taper, 16 mm) used for orifice enlargement, P1 file (#15, 6% taper, 18 mm) for narrow canals, P2 file (#25, 6% taper, 18 mm) for wide canals and Endosonic file (2% taper, 18 mm) for apical preparation.^[22]

DXL Pro Pedo Rotary files system

Three files system (#30, #25 and #20) with convex triangular cross section, non cutting guiding tip and controlled memory. They are used sequentially, #30 with 8% taper is for orifice enlargement followed by 20 and then 25 with 6% taper is for apical preparation.^[19] Katge

et al in his study concluded that two pediatric rotary files ie Prime PedoTM, DXL-ProTM) provide significantly better cleaning efficacy at the coronal and apical third of the root canals in primary molars than H files. However, at the middle third all the three file systems had similar cleaning efficacy.



Fig. 6: Pedoflex system.

Pedo Flex files

Three file system (20, 25 and 30) with a length of 16mm and 4% taper, recommended to used at 1.5N torque and 350RPM. They are super flexible with triangular cross section with non cutting tip and sharp cutting edge, thus avoiding apical transportation.^[23]

Denco Kedo files

With the length of 17mm and 19mm, these are heat activated blue NiTi files. It consists of four file system #25 (.04 mm tip dia), #25 (.06 mm tip dia), #30 (.04 mm tip dia), #40 (.04 mm tip dia). They used at a speed of 300 RPM with torque of 2 Ncm.^[24]

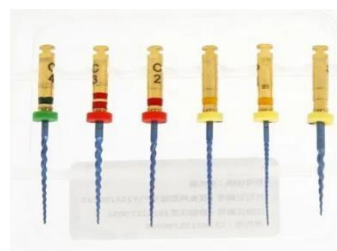


Fig. 7: Denco kedo files.

Endogal Kids Rotary System

These files are made up of heat treated NiTi alloy and have a triangular cross section. Both rotary and reciprocating motions are compatible with this system. However, in pediatric cases, reciprocating motion is preferred due to its shorter working time. It consists of

EK1 file (0.25 tip diameter, taper 4%) for narrow canals;

EK2 file (0.25 tip dia, taper 6%) for medium canal;

EK3 file (0.30 tip dia, taper 4%) for wide canals;

EK4 file (0.40 tip dia, taper 4%) for very wide canal of anterior teeth The length of these files are 17 mm except EK4 file which have 19mm length.^[25]



Fig 8: Endogal Kids Rotary System.

Reciproc Blue NiTi files

These files are made by heat treatment with CM-Blue Wire NiTi alloy. With the apical diameter of 300µm in double-S cross-section, these files have a length of 17 mm. Studies reveal that the both the Endogal and Reciproc Blue NiTi endodontic reciprocating systems yield similar outcomes in canal preparation. On the other hand, the coronal third of the Reciproc Blue NiTi system often shows a greater degree of preparation.^[25]



Fig. 9: Reciproc blue NiTi files.

Sani kids rotary files

This file system was introduced in 2019 and has three files (1S, 2S and 3S) with super flexibility and was smartly designed. This file system is easier to use in children or patients with limited mouth opening because of its pre-bendable property. Because of its unique design it reduces the risk of perforation and ledge formation. It is used in curved canals due to its high anti-bending strength.

1S Sani kids rotary files

4% taper with 21mm, 25mm, 28mm and 31mm working length, comes in yellow in color. Because of its unique technique it reduces root canal transportation and makes the biomechanical preparation more natural.

2S Sani Kids Rotary Files

6% taper with 25mm working length, comes in red color. It has a huge advantage while working with curved canals.

3S Sani Kids Rotary Files

4% taper with 28mm working length, comes in green color. Over cutting of dentin is avoided. As the main working area is at the 1/3 of the root tip.^[26]



Fig 10: Sani Kid Rotary files.

CONCLUSION

From the beginning, we've applied the principles of endodontics, originally developed for permanent teeth, to address issues in primary molars. We used every tool available to treat primary teeth like permanent teeth whether they be rotary files, manual files, or instruments. The pediatric rotary files system help the pediatric dentist in performing the pulpectomy procedure easier and faster. It results in predictable quality and uniform obturation in lesser time. Given the significance of preparation time in managing pediatric patients, it is advised to utilize rotary instruments for pulpectomies. Paediatric rotary files aren't restricted solely to primary teeth, they can also be employed in adult patients with restricted mouth opening for third molar root canal treatment.

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