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Pediatric Rotary files from old to new: A Review

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ABSTRACT: An infected primary teeth leading to space loss is an important concern in pediatric dentistry, where natural tooth is considered as the best space maintainer. Tooth decay continues to be the main causative factor for the high rate of loss. The introduction of nickel titanium rotary instrumentation has made endodontics in permanent teeth easier and faster than manual instrumentation resulting in consistent and predictable root canal shaping. Similar principles of canal debridement and dentin shaping using NiTi instruments can be applied to primary teeth. With new versions rapidly becoming available, the clinician may find it difficult to pick the file and technique most suitable for an individual case. Practitioners must always bear in mind that all file systems have benefits and weaknesses.

Keywords: Primary teeth, Pulpectomy, Root canal preparation, Rotary Endodontics.

I. INTRODUCTION:

The procedure of the pulpectomy involves gaining access into the root canal by a proper access opening followed by the removal of infected pulp from the pulp chamber and roots of the tooth.[1] The most important step in pulpectomy which determines the success of the treatment is the canal debridement followed by obturation with a resorbable material.[1]

Ideal requirements for a successful pulpectomy in the primary dentition must have the following features: The procedure should be fast and simple, the treatment duration should be short, minimal number of appointments, an effective debridement of the root canals without weakening the tooth structure or endangering the underlying permanent teeth, it should have few procedural complications, and should help in restoring the tooth to maintain its function.[2]

Earlier, the cleaning of the primary root canal system was done by the hand instruments like K-files, H-files, reamers, etc. These hand files although were effective in debridement of the root canal but the main drawback was the longer treatment duration. The longer the chair time procedure the more difficult it was for a pediatric dentist to achieve positive behavior in a child patient.[2] Barr et al., 2000 concluded that the use of rotary files in primary teeth resulted in a funnel shaped canal preparation leading to a consistent and uniform root canal filling as compared to hand files.[3] Primary teeth roots have complex anatomy and specific features which are different from the permanent teeth such as the roots are being shorter, thinner, and ribbon-shaped with more curvature, root dentin being softer and the root tip resorption is often undetectable. In addition, pediatric patients have limited mouth opening and the longer length of adult rotary files makes it difficult for use.[4] Therefore, it is important to choose file system that should maintain the original canal shape without producing deviations and provide a uniform removal of dentin from the canal walls.[5]

To overcome these drawbacks, various pediatric rotary files have been introduced for root canal shaping in primary teeth that offer several

advantages over manual instrumentation in primary root canal preparation. These are

1. Kedo-S Pediatric Rotary File System.
2. Kedo SG files
3. Kedo SG blue files
4. Kedo-S square files
5. Pro-AF Baby Gold Files
6. Prime Pedo Files
7. DXL-Pro-TM Files
8. Sani kid
9. Denco kid.[6]

Kedo files system is the world's first files designed for root canal preparation in primary teeth. Kedo files are available in Hand type (Kedo - SH) and rotary type (Kedo –S files system). It was introduced by Ganesh Jeevanandan in the year 2016.[7]

Kedo-S rotary files are exclusively developed pediatric rotary files with modified length, taper, and tip size to perform pulpectomy in an effective and convenient way.[8]

There are four generations of Kedo-S rotary file system available:

Kedo-S:First-Generation, Kedo-SG:
Second-Generation, Kedo-SG Blue:
Third-Generation, and Kedo-S Square:
Fourth-Generation System.

Kedo-S rotary files: Kedo-S is the first generation rotary file system which was introduced in pediatric endodontics, to suit the need towards primary dentition. Kedo-S is a three file system consisting of D1, E1 and U1 files made up of NiTi. The total length of these files is 16 mm and the working area is 12 mm.[9] One of the remarkable feature of this file system is the presence of variable tapered design which imparts fexibility and efficacy to the files in rendering efficient treatment.[10]

Additional to it, the files also have a varying tip diameter (D1-0.25, E1-0.30, U1- 0.40) according to the diameter of narrow and wide root canal system in primary teeth.[11]

The tapering of the instrument is according to the diameter of the primary root canal to enable effective canal preparation and to avoid over-instrumentation.[8] With the use of Kedo-S instrument in curved canals, the original anatomy of primary root canal can be maintained, which is mainly because of the file design and flexibility. This enables it to closely adapt to the irregular and tortuous canals of primary teeth.[12]

D1 file: Tip diameter of 0.25 mm with a variable taper. It can be used in primary molars with narrow canals (mesial canals in mandibular molars and disto buccal canal in maxillary molars).

E1 file: 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).

U1: Tip diameter of 0.40 mm and used in primary incisor teeth. The taper of the instruments are designed according to the diameter of primary teeth with narrow and wide root canals.

In 2018, Jeevanandan and Govindaraju conducted a study to compare and evaluate the instrumentation time and quality of obturation between paediatric rotary file Kedo-S and manual instrumentation techniques in primary molars in children of age 4 - 7 years with pulp necrosis. They concluded that clinical use of paediatric rotary files Kedo-S was effective during root canal preparation of primary teeth with reduction in instrumentation time and better quality of obturation.[7]

The Kedo-S rotary files have instrumentation time of 2–3 minutes approximately. This greatly reduces the operator and patient's fatigue, thereby increasing the quality of the treatment.[13] These files render better quality of obturation while comparing with reciprocating and manual instrumentation. Yet, Kedo-S rotary files have some disadvantages that include the high cost of the constant torque handpiece and the files itself. For using Kedo-S files, it requires appropriate training for better results.[8]

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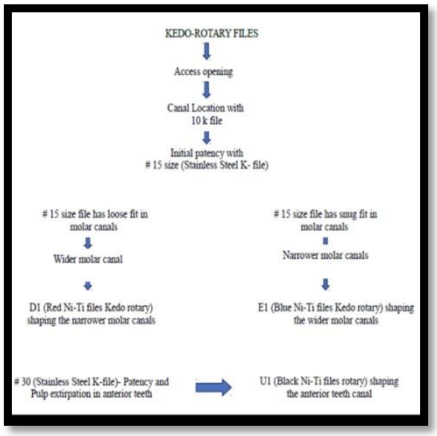

Figure 1: Method of using Kedo-S rotary file system.[14]

Recently introduced **Kedo-SG** rotary files has been designed specifically for use in primary teeth. This file system comprises of three NiTi rotary files named D1, E1 and U1. D1 file has a tip diameter of 0.25 mm and are to be used in primary molars with narrow canals (mesial canals in mandibular molars and disto buccal and mesio buccal canals in maxillary molars). E1 file has 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). U1 has a tip diameter of 0.40 mm and used in primary incisor teeth. The recommended rotation speed is 150-300 rpm. Primary teeth have curved, thinner, shorter roots and ribbon shaped canals which hampers the use of rotary files designed for permanent teeth.[7]

This file system is considered to be an effective tool to debride the tortuous and bizarre canals of primary teeth. It helps the clinician to perform the procedure relatively faster and renders better quality of treatment. Hence the use of Kedo-SG rotary files is recommended for pulpectomy in primary teeth. The working length, taper, file series, color coded, tip diameter, and clinical uses of the Kedo-S rotary files and Kedo-SG rotary files are same. The only difference between the two rotary files(Kedo-S and Kedo-SGfiles system) that is the metallurgy coating. The Kedo-S rotary files are made up of nickel-titanium and they are rigid in nature where as Kedo-SG rotary files are made up of nickel-titanium heat treated, they have controlled memory properties.[8]

Kedo SG blue: Is a controlled memory file system, the total length of the files is 16 mm with the working length of 12mm. It is manufactured by Reeganz Dental Care Pvt. Ltd, India in the year 2017. It has super flexibility and 75% greater resistance to cyclic fatigue. The ideal rotational speed for the files system is 250–300 revolution per minute and the torque required is 2.2-2.4 newton centimeter.[9]

Kedo-SG Blue is a three files system consisting of D1, E1 and U1 files coated with titanium, adding greater flexibility to reach even the tortuous root canal system resulting in an effective and consistently successful cleaning and shaping. The uniqueness of this rotary file system lies in its variable taper, varying tip diameter D1-0.25, E1-0.30, U1-0.40 and the titanium coat, enhancing supreme flexibility and preventing inadvertent breakage of the files in the tortuous root canals of the primary teeth.[9] This rotary file system has an improved higher flexibility to negotiate even the narrowest canal in primary teeth because of the additional titanium coat. Its supremely higher flexibility prevents inadvertent file breakage thereby increasing its efficacy and effectiveness in root canal preparation over its earlier predecessor Kedo-S.

Naidu VD et al., compared the instrumentation time and quality of obturation between hand K-files, H-files and rotary Kedo-S file system, which have reported the reduced instrumentation time and better obturation quality with rotary Kedo-S system than the other two groups.

Pro Af baby gold file: consisting of five files and are made up of NiTi wire. They are flexible with constant taper of 4% and 6%. It has a unique

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orifices opener which available in five different sizes like B0, B1, B2, B3 and B4.[15] The length of the files are specially designed and registered of 17 mm, which have more safety with comfort to both dentist and patient. The files have unique short orifice enlarger to prevent cervical ledging of the root canal while cleaning the root canal of the primary teeth. The files are made with an advance NiTi wire with heat treated for better canal centricity, it has high flexibility with minimal chances of separation. Pro AF Baby Gold files are versatile rotary file system which is suitable for conservative preparation of all canals of the primary teeth. It shows improved shaping of canals with sequential combination of files from orifice enlarger, 4% and 6% taper of the files.[9]

Pro-AF Baby Gold files are specially designed for the primary teeth root canal preparation in the Pediatric rotary endodontic treatment, as in case where adult rotary endodontic cannot perform in conditions of restricted opening of mouth and third molar root canals.[9]

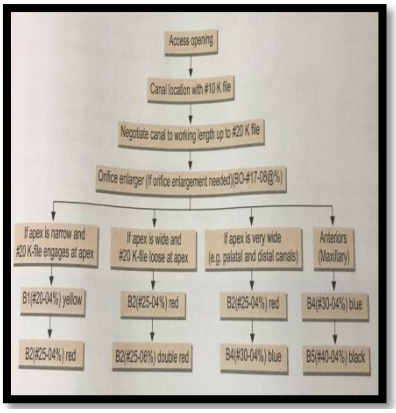

Figure 2: Method of using Pro AF-Baby Gold rotary file system.[9]

Prime Pedo rotary files: The new pediatric rotary files use in primary teeth which were developed in the year 2016 and available in India since 2017, the length of these files are 16mm with the working length of 13mm. They are consists of four files system that is, Starter, P1, P2, and endosonic file. These files are gold treated and also have memory controlled properties having a triangular cross section. So they have improved cleaning efficacy and produce better obturation compared to manual instrumentation.[12] Heat treated files are less prone to deformation and follow the original anatomy of the root canals. This triangular cross-section also reduces the contact areas between the file and the dentin and thus reduces the stress on the files, while doing the canal preparation in primary teeth.[12] Prime Pedo rotary files possess controlled memory which allows these files to be centered and follow original canal anatomy in primary molars. Ghadge et al., concluded the higher flexibility and potential fatigue resistance of this files and increased fatigue resistance might reduce fracture of rotary files in curved root canals of primary molars.[1]

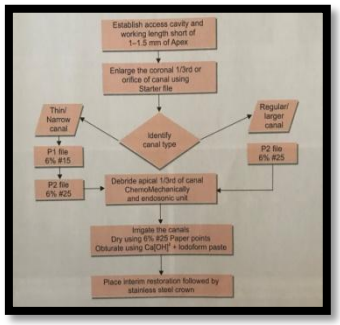

Figure 3:Technique for using Prime Pedo rotary files.[13]

DXL-Pro Niti files: These files are manufactured from novel controlled memory NiTi wire and respond to pressure, torque, and resistance with lengthening of spirals and therefore increases fracture resistance. Controlled memory properties of these files give the 30% more resistant to fatigue failures than the other files which are made from like conventional NiTi wire.[10] DXL-Pro™ file system are consist of three files i.e., 30size, 20size, and 25size. So these files are used as follows first of all file size of 30 is being used with 8% taper for orifice enlargement, followed by the use of file size 20 with 6% taper and then size 25 file with 6% taper. These files have a convex triangular cross section, guiding non-cutting tip and controlled memory,

along with orifice enlarging properties. The total length of file is 16 mm.[10] Katge et al. conducted a study to evaluate and compare cleaning efficacy of pediatric rotary files (Prime Pedo™, DXL-Pro™) and H files in root canals of primary molars using clearing technique, it was concluded that two pediatric rotary files (Prime Pedo™, DXL-Pro™) provide significantly better cleaning efficacy at the coronal and apical third of the root canals in primary molars. However, at the middle third all the three file systems had similar cleaning efficacy. Between two pediatric rotary files, DXL-Pro™ showed better cleaning efficacy as compared to Prime Pedo™.

Sani kids rotary files system: These are new introduced in the field of dentistry in the year 2019, which has every unique features like super flexibility, simple to use and smartly designed. These files system is comprised of three sizes they are 1S, 2S and 3S.[15]

1S Size is 04/20（taper 04, 20# ring, it comes in yellow color with the working length of 21mm, 25mm, 28mm and 31mm, 2S Size is 06/25（taper 06, 25# ring, it comes in red color with the working length of 25 mm, 3S Size is 04/35（taper 04, 35# ring, it comes in green color with the working length of 28mm.[15]

The file system provides a very unique pre-bendable technique, which makes the operation easier especially for the patients who have limitation of mouth opening. It also has highly auto adaptation properties in the root canal of the primary teeth and keeps the root canal form more natural. These rotary files system also have high anti bending strength, which will be very safe to work with curved canal, but it can be rebound when temperature is higher than 60 degree. Sani kids rotary files are safely designated so they can prevent the over cutting of the dentin on the root tip of the primary teeth and also can reduce the risks of ledge formation and perforation. Because of their unique design of the files they provide the treatment more safer.[15]

1S Sani rotary files: It has a very unique technique which makes the biomechanical preparation and keeps the root canal form more natural, and also reduces the root canal transportation. It also has an unique design of the thread with automatic deceleration function making the treatment safer.[2]

2S Sani rotary files:

The clinical application indicate that the file have h uge advantages while work with curved canal.

3S Sani rotary file: Avoid over-cutting the dentine, main working area is at the 1/3 of the root tip, therefore over cutting of dentin is avoided.

Fanta professional universal niti files endodontic rotary files: This file has variable cross-section on one file, increases the volume for upward debris eliminations, minimum radial contact to ensure better cutting, the variable pitch enable efficient debris transport and reduces the screwing effect, and AF-H wire tech provides superior ability to negotiate curves.[21]

Kedo-S plus rotary pedo files: Kedo S plus has a uniform cross section with dual core material, the dual core material is heat treated titanium oxide coated at apical and middle region and only heat treated at coronal region. The advantage is one file will prepare the apical region without lateral perforation but with more coronal preparation helping in easy flow of obturating material.[22]

Advantages pediatric rotary files: Tissue and debris are more easily and quickly removed, more flexible, easy access to all canals, nickel titanium files do not need to be precurved, follow original root canal anatomy, prepared canals are funnel shaped, and resulting in a more predictable uniform paste fill.

Disadvantages pediatric rotary files: Cost of the endomotor and handpiece, **i**ncreased cost of NiTi endodontic files, **c**yclic fatigue of endodontic instruments, **e**ndodontic instruments are prone to fracture.

II. CONCLUSION:

The pediatric rotary files system will help the pediatric dentist in performing the pulpectomy procedure faster and easily. These instrumentation techniques are considered to be an effective method to debride the uneven walls of root canals of primary teeth. The root canal preparation with the pediatric rotary file system has consistently resulted in uniform and predictable quality of obturation in lesser time.

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