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Review Article

Dentistry

Pediatric Rotary Files: Evolution to Revolution

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Abstract: The main goal of pulp therapy in primary dentition is to preserve the primary tooth thus protecting future normal occlusion. Routinely, pulp debridement and canal shaping are done by manual H-files, K-files, Broach, etc. Manual instrumentation may be time- consuming, thus impacting the behaviour of the child negatively. Thus arises the need for alternate instrumentation which will reduce the time required for treatment with better treatment outcomes. In 1988, Walia et al. introduced Nickel-Titanium (Ni-Ti), which revolutionized the discipline of Endodontics. These Ni-Ti files have advantage of shape memory and super elasticity thus improving the canal preparation and resulting in better shaped canals. In 2002, for first time Barr et al reported the use of rotary Ni-Ti files for the therapeutic purpose during Pulpectomy procedure in pediatric patient. He observed better acceptance by pediatric patient and good quality obturation. Till 2016, pulpectomy procedures were accomplished by the combination of hand files and adult rotary files. Adult rotary files are designed according to the morphology for permanent teeth and adult jaw size, thus the use of adult rotary files are in primary teeth may result in lateral perforation due to softer dentine of roots of primary teeth and may cause discomfort to the child thus making child unco-operative. But in 2016, Ganesh *et al.,* pioneered the specialization of Paediatric Endodontics with his invention of specially designed rotary files. Their shape was specially designated for application in tortuous canals of primary teeth. Presently, a variety of pediatric rotary files like Kedo-S™ (India), Pro AF Baby Gold™ (India),PrimePedo™ (India), DXL-ProPedo™ (India), Neolix™ (France),Denco® Kids files (China) and, Sani® Kid rotary files (China). This review is an album of these newer files and clinical and in-vitro research on them.

Keywords: Hand Instruments, Nickel-Titanium, Paediatric files, Pulpectomy, Rotary.

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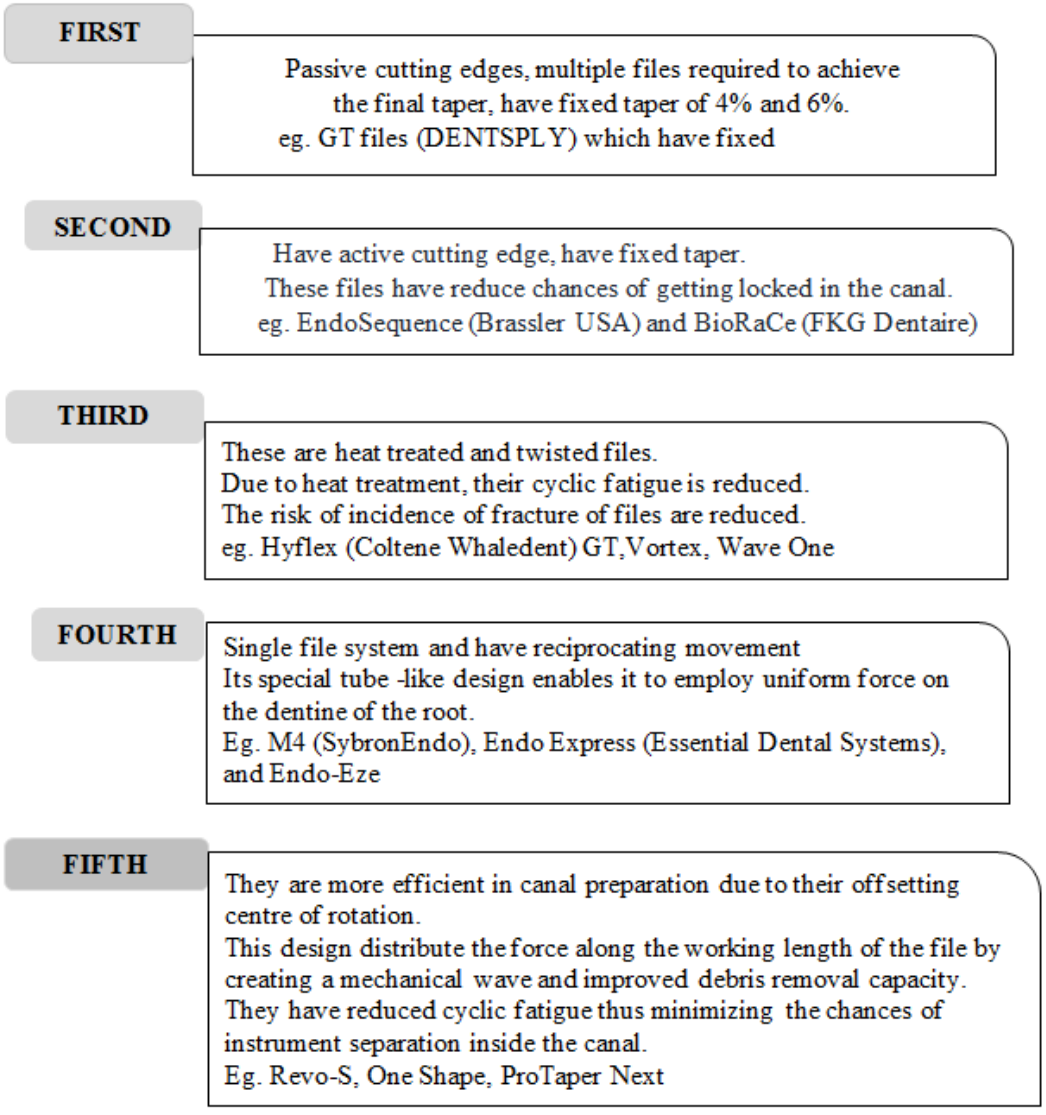
1. INTRODUCTION

Pulpectomy aims[1] to conserve the primary tooth thus protecting future normal occlusion. The ideal pulpectomy procedure should: (a) be fast and simple, (b) be less time consuming, (c) have a minimum number of appointments, (d) successfully cleanse the root canals without weakening the tooth structure or endangering the underlying permanent teeth, (e) have few procedural complications, and (f) to rehabilitate the tooth functionally. Routinely pulp debridement and canal shaping are done by manual H-files, K-files, Broach, etc. The manual instrumentation may be time-consuming thus impacting the behaviour of the child negatively. Thus the requisite for better instruments that shortens the procedural time and outcomes are better taper and favorable influence on child's behaviour arises. The genesis of rotary Nickel-Titanium(Ni-Ti) files was the game changer for the field of endodontics. In 1959, Buehler *et al*., developed Nickel-Titanium in the Naval Ordinance Ordnance Laboratory (NOL) in Silver Springs, Maryland.[1] In 1988, Walia *et al*., initiated the utilization of Ni-Ti files files in the subject of Endodontics.[2] This revolution leads into better easier and faster than manual instrumentation resulting in consistent and predictable root canal shaping.[3] These technological upgradation improves the quality of the treatment delivered by dentist and results in better patient's satistfaction.[4] Since then, the rotary files applied in Endodontics are undergoing constant upgradations. Barr et al instituted the use of adult rotary Ni-Ti files in the Paediatric Endodontics in 2000. He used Ni-Ti ProFile® rotary instruments with 0.04 taper for canal preparation in primary teeth. Advantages reported by Barr *et al*., are better canal preparation and less amount of time required amount of time for the pulpectomy procedure.[5] But in this report, they have included only one incisor and one molar only. Most of the literature on pediatric rotary endodontics report the use of adult rotary files like Profile, ProTaper, MTwo, Flex Master, Light Speed LSX, Hero 642, K3, and Wave One rotary files.[6,7] These files are classified into five generations from their initiation. [8,9]



Morphology of tooth plays an important role during root canal treatment [9] and the architecture of the roots of primary teeth differs in comparison to the roots of permanent teeth. In comparison to the roots of permanent teeth, morphology of roots of primary teeth differs. The roots of primary teeth are thin, tortuous and slender. Even the dentin of primary teeth is less calcified making it softer. Thus use of Ni-Ti rotary files designed for Permanent teeth in primary teeth may affect the remaining root dentine thickness, so the requisite arises for specially designed Ni-Ti files for primary teeth. In 2016, Ganesh *et al*., introduced specially designed rotary files to Pediatric Dentistry.[10,11]

These files were fabricated keeping in view the structural configuration and morphology of primary teeth, small jaws, etc. At present use, various rotary files are Kedo-S™ (India), Pro AF Baby Gold™ (India), Prime Pedo™ (India), DXL-Pro Pedo™ (India),Neolix™ (France), Denco® Kids files (China), and Sani® Kid rotary files (China).[11] This is a composition of an overview of these file systems and numerous clinical and non-clinical research works documented in the literature.

2. KEDO FILES

These are the first Ni-Ti files designed for the utilization in deciduous teeth. They are invented by Ganesh *et al*., and introduced to market in November 2016. They are marketed by Reeganz Dental Care.[12] They are obtainable as Hand (Kedo SH) and Rotary (Kedo S & Kedo SG).

3. KEDO -S ROTARY FILES

This Ni-Ti system contains three files and are 16 mm long and of working length of 12 mm. The three files are identified as D1, E1, U1 respectively and their taper varies.

4. D1 FILE

The tip has a diameter of 0.25 mm. It is utilized in preparation of primary molars with narrow and thin canals like mesial canals of mandibular molars and distobuccal canals of maxillary molars.

5. E1 FILE

The tip of this file is having a 0.30mm diameter. It is employed in canal preparation of wider canals like distal canal of mandibular molar and palatal canal of maxillary molars.

6. U1 FILE

Tip of this file has 0.040 mm diameter and their use is indicated for the shaping of the root canal of primary incisors. The speed recommended for their use is 150-300 rpm (rotations per minute) with constant torque.[12]

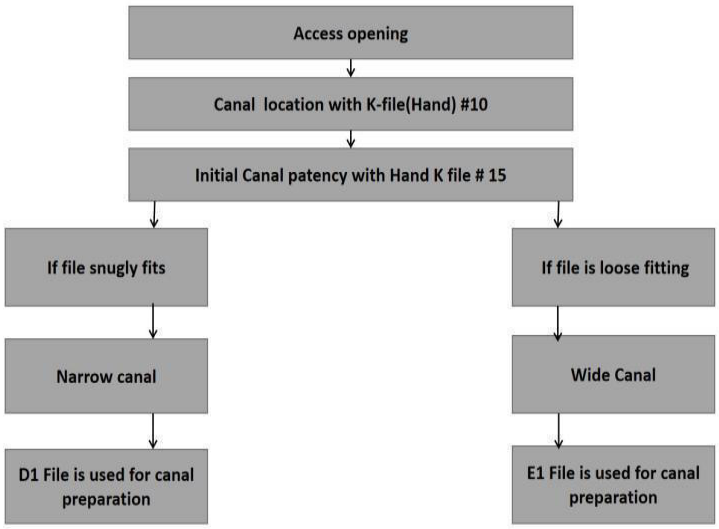
7. KEDO SG BLUE ROTARY FILES

These files are third generation files in Kedo S series and are heat-treated and has controlled memory. This also consists of three files-D1, E1and U1 with a working length of 12 mm and a total length of 16mm. They are more flexible and have less cyclic fatigue making them more superior. While using these files, the speed advised is 250-300 rpm and the torque of 2.2 to 2.4 N cm.[12]

8. KEDO-S SQUARE—FOURTH-GENERATION KEDO-S FILE SYSTE

This is the recently introduced generation in Kedo files, consisting of 2 files namely P1 and A1. The manufacturer recommends the utilization of P1 file in molars, while A1 file to be used in anterior teeth. Their design differs from designs of files of other generations. The cutting edge of these files have two different cross sections which improves their exposure to the tooth structure. The apical section of 5 mm have triangular cross-section whereas the coronal 7mm has a tear drop shaped cross-section. This design creates three-point contact in the apical region whereas two-point contact in the coronal area resulting in less apical dentin removal and less aggressive preparation thus in the end minimizes the risk of lateral perforation.[13]

9. PROCEDURE TO USE KEDO ROTARY FILES



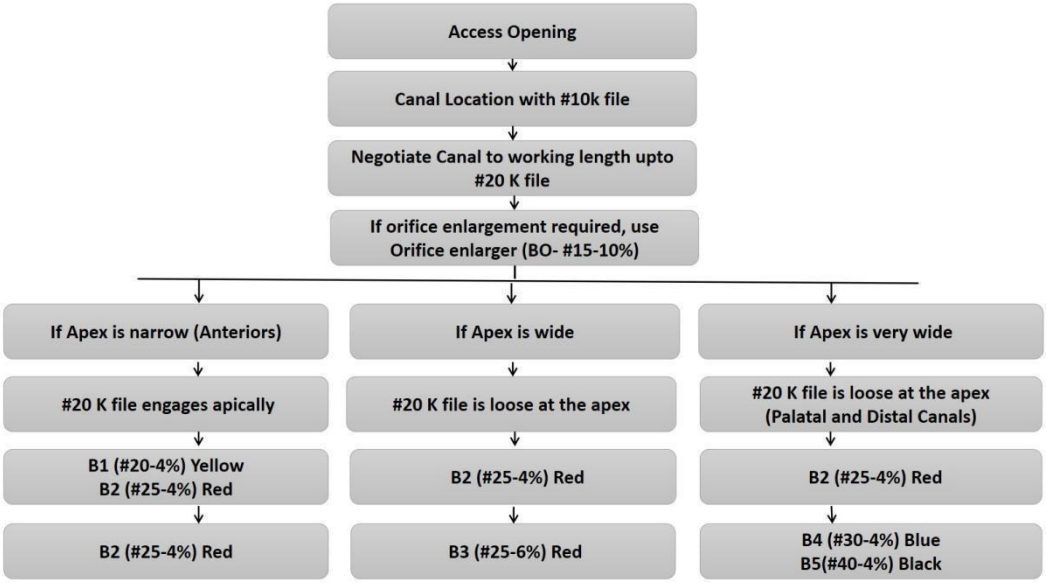
Jeevanandan *et al*., observed that rotary files Kedo-S were more advantageous during pulpectomy procedures of primary teeth with a benefits of reduction in time span of instrumentation and better quality of obturation in their double-blinded randomized clinical trial of rotary Kedo S files and Hand K files.[14] Priyadarshini *et al*., compared Kedo SG(Blue), Kedo S, Kedo SH, and hand K files and concluded that a marked reduction in instrumentation time and superior quality of obturation was found with rotary Kedo-SG Blue file system followed by Kedo-SH, Kedo-S, and H and K-files.[15] Insha Showkat *et al*., compared Hand K Files, rotary Kedo SG Files, and rotary Protaper Gold Files for the time required for instrumentation and quality of obturation. They concluded that Pediatric rotary Kedo-SG files reduce instrumentation time whereas Protaper Gold rotary files produced a better quality of obturation.[16] But Panchal *et al*., in their clinical trial compared the span required for completing the pulp therapy and the quality of the obturation with H-files and Kedo S files and concluded that latter resulted in better obturation quality with minimum

instrumentation time.[17] Thakur Seema *et al*., assessed the remaining dentin thickness and taper of the root canal after instrumentation with Hand K files, Rotary Protaper files, and Rotary Kedo S files. Remaining dentin thickness was evaluated with Cone-beam computed tomography (CBCT) and duration required for cleaning and shaping of the canals with a stopwatch in primary molars. They concluded that at the level of coronal third, Kedo-s files removed significantly less amount of dentin as compared to other two files systems whereas at middle third and apical third, no statistical difference was observed in all three file systems. Taper of the prepared root canals was almost the same in all three groups.[18] Asif *et al*., assessed the volume of apical extrusion of the debris by using rotary Kedo -s files, rotary pro taper, and hand files and observed that the rotary kedo-s group showed the minimal quantity of extrusion of debris.[19] Abhinaya Srinivas *et al* ., studied the shaping property of rotary Kedo-S and hand K-files in primary canines using CBCT and concluded that rotary Kedo -S files resulted in more conical & uniform canals creating excellent form of obturation in contrast to hand K files.[20] Sharma S *et a*l., compared clinical and radiographic efficacy of Kedo – S rotary files and hand K-files and teeth in Kedo-S pedo rotary file group were clinically asymptomatic and radiographic complete healing was observed after nine months follow-up, resulting in complete success.[21] Based on their clinical trial, Haseeb Ahmed *et al* ., summed up that Kedo-S rotary files had better patient acceptance and produced better clinical outcomes.[22] Pawar B.A. *et al*., observed that the use of adaptive XP-endo Shaper instrumentation resulted in faster instrumentation and better obturation quality compared to pediatric rotary files (Kedo-S; D1 and E1) and manual instrumentation in their clinical trial.[23]

10. PRO AF BABY GOLD FILES

Dentobizz is the manufacturer of Pro AF Baby Gold Files and they are marketed by Kids-e- dental Pvt. Ltd.in India. The kit consists of 5 different files of varying taper of 4-6 % and are fabricated with NiTi CM wire. These files are heat-treated and 17 mm in length. They are categorised as : B1, B2, B3, B4, B5 and are yellow, red, blue, black. B2 and B3 are both red but B2 has 4% taper whereas B3 is having 6% taper. B1-B4 files are used in molars while B4 and B5 files are designed to use in anterior teeth.

11. SEQUENCE FOR USING PRO AF GOLD BABY FILES



S Jain *et al* .,in their study compared the canal transportation and centring ability of Pro AF Baby Gold rotary files and Kedo-S rotary files. They noticed that Pro AF Baby Gold rotary files produce lesser canal aberrations in contrast to Kedo-S rotary files when used in root canals of primary dentition.[24]

12. PEDOFLEX ROTARY FILES

Pedoflex rotary files are specially designed for primary teeth by Neoendo. The length of files is 16mm, whereas they have a taper of 4%. Pack of pendaflex files contains 3 files of sizes # 20,#25, and #30. Initially canals should be explored with hand K-files #10, #15 numbered K-files to the use of PedoFlex rotary files and the speed of 350 RPM is advised while using these files.[25] Shah *et al*., concluded that the time span required for canal preparation clinically with PedoFlex rotary files was significantly less compared to hand K files.26

13. PRIME PEDO ROTARY FILES

Prime PedoTM file system has four files : Starter, P1, P2, Endosonic file. Endosonic file have 2% taper in Prime PedoTM kit, allows for conservative apical preparation of primary molars. These files are gold treated. The file used for apical preparation has a 6% taper.[11] Ghadge *et al* ., compared the quality of obturation using Prime PedoTM pediatric rotary file, rotary Protaper Universal TM and H File in the root canal of primary molars and concluded that pediatric rotary files-Prime PedoTM resulted in better extent and quality of obturation as compared to Protaper Universal TM and conventional H files.[27]

14. DXL-PROTM

DXL-ProTM file system has three files (#30, #20, and #25). The DXL-ProTM file used for apical preparation has a 6% taper.[11]Farhin Katge *et al*., compared the cleaning ability of paediatric rotary files : Prime PedoTM, DXL-ProTM with H files in root canals of primary molars and observed that both

the paediatric rotary files Prime PedoTM, DXL-ProTM showed better cleaning efficacy as compared to H files.[28]

15. DENCO® KIDS FILES

These NiTi files are manufactured by Shenzhen Denco Medical Co. Pvt. Ltd. It comes in four sizes - #25(4% taper), #25 (6% taper), #30(4% taper), and #40(4%taper). The black file is 19 mm in length and the remaining three are 17mm in length. Their threads have changed from the tip of the files to the back to facilitate chip evacuation. [29]

16. SANI® KID ROTARY FILES

These are made in China, NiTi rotary files designed to be used in primary teeth. They come in a pack of 3 files – blue, red, yellow. Their length is of 16 mm to 19 mm and the manufacturer advises the use of these files at 300 rpm and torque advised is 2.0 N.cm.[30]

17. ADVANTAGES & DISADVANTAGES OF PAEDIATRIC ROTARY SYSTEM

Advantages of Pediatric Rotary systems

1. Reduction in procedural time span.
2. Uniform canal preparation.
3. Better quality of obturation.
4. Better acceptance by the patient
5. Beneficial impact on the child's behaviour.

18. DISADVANTAGES

1. Expensive
2. Special equipment like Endo Motor is required.
3. Special training is required.

19. CONCLUSION

Pediatric Rotary files have become a revolution in Paediatric Dentistry especially in the discipline of pediatric endodontics. These files have improved canal shaping, obturation quality, and most importantly in quicker clinical procedures resulting in better cooperation and a positive impact on the pediatric patients. But this does not eliminate the use of hand instrumentation and requires expertise and is costly. Pediatric rotary systems are still in the initial stages of their evolution. The literature available is limited. More exploration is required to analyse the properties and their effect on remaining root dentine, canal transportation, and safety clinically as well as non-clinical

20. AUTHORS CONTRIBUTION STATEMENT

Dr Neeta Padmawar has conceptualized the idea of this review and did literature search. Dr Aparna Palekar corrected and guided during the conceptualization. Dr Savita S Thakkannavar, Dr Sridhar Shetty, Dr Satish Manthena & Dr Swati Pustake did the literature search and guided while preparing this manuscript. All the authors read and approved the final version of the manuscript

21. CONFLICT OF INTEREST

Conflict of interest declared none.

22. REFERENCES

1. Shanthi M, Soma Sekhar EV, Ankireddy Swetha. Smart materials in dentistry: think smart! J Pediatr Dent. 2014;2(1):1-4. doi: 10.4103/2321-6646.130375.
2. Padmawar N, Pawar N, Joshi S, Mopagar, Pendyala G, Vadvadgi V. Biosmart Dental. Materials: A New Era in dentistry. Int J Oral Health Res. 2016;3(1):171-6.
2. Thakkar Trushana K, Naik Shilpa, Ghule Kiran. Advances in rotary endodontics in pediatric dentistry. E.C. Dent Sci. 2019;18(6):1320-30.
3. Dr. Shetty K, Dr. Almehmadi N M, ;Dr. Alghamdi S.A. Dr. Redwan M.S. Dr. Turkistani T.A. Dr. Abdulghani A. H., Visual Enhancement and Experiences with Magnification Devices among the undergraduate dental students and Interns around Makkah region– A Questionnaire based study. Int J Life Sci Pharma Res. 2020;10(5):L79-90.
4. Barr ES, Kleier DJ, Barr NV. Use of nickel–titanium rotary files for root canal preparation in primary teeth. Pediatr Dent. 2000 Jan–Feb;22(1):77-8. PMID 10730297.
5. Farhin K, Devendra P, et al. Application of rotary instrumentation in paediatric endodontics -A review. Int J Prev Clin Dent Res. 2014;1(3):48-52.
6. George Sageena, Anandaraj S, Issac Jyoti S, John Sheen A, Harris Anoop. Rotary endodontics in primary teeth - a review. Saudi Dent J. 2016 Jan;28(1):12-7. doi: 10.1016/j.sdentj.2015.08.004, PMID 26792964.
7. Gopikrishna V, Suresh Chandra B. Grossman's endodontic practice. 12th ed. Wolters Kluwer Health; 2013.
8. Nasrin R, Khalilakzohreh Mehrdad P, Mahboubeh G. Evaluation of root anatomy and morphology of mandibular premolars with cbct in Iranian population. Int J Life Sci Pharm Res. 2016;6(3):32-P39.
9. Ruddle Clifford J, Machtou Pierre, West John D The shaping movement: fifth-generation technology. Dent Today. 2013;32(4):94, 96-9. PMID 23659098.
10. Santos Lde A, Bahia MG, de Las Casas Estevam Barbosa, Buono Vicente Tadeu Lopes. Comparison of the mechanical behavior between controlled memory and super elastic nickel–titanium files via finite element analysis. J Endod. 2013 Nov;39(11):1444-7. doi: 10.1016/j.joen.2013.07.030, PMID 24139271.
11. Govindaraju Lavanya et al. Application of rotary endodontics in pediatric dentistry - a review of literature. J Pharm Res. 2018;12(4):480-3.
12. Pitchiah PA, Shivashankarappa PG. Rotary files in pediatric dentistry: from then till now. J Sci Dent. 2020 Jul–Dec;10(2):55-7.
13. Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. Eur Arch Paediatr Dent. 2018 Aug;19(4):273-8. doi: 10.1007/s40368-018-0356-6, PMID 30003514.
14. Priyadarshini P, Jeevanandan G, Govindaraju L, Subramanian EMG. Clinical evaluation of

instrumentation time and quality of obturation using paediatric hand and rotary file systems with conventional hand K-files for pulpectomy in primary mandibular molars: a double-blinded randomized controlled trial. Eur Arch Paediatr Dent. 2020 Dec;21(6):693-701. doi: 10.1007/s40368-020-00518-w, PMID 32185634.

15. Dr. Showkat Insha, Dr. Chaudhary Seema. Comparison of instrumentation time and obturation quality between hand k-files, rotary Kedo SG and rotary Protaper Gold files in root canal treatment of primary teeth. Int Jrnl Sci Res. 2020 Jun;9(6):79-81.
16. Panchal Veerale, Jeevanandan Ganesh, Subramanian Emg. Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. J Indian Soc Pedod Prev Dent. 2019 Jan–Mar;37(1):75-9. doi: 10.4103/JISPPD.JISPPD_72_18, PMID 30804311.
17. Seema Thakur, Ahammed Haseeb, Parul Singhal, Cheranjeevi Jayam. Comparative evaluation of dentin removal and taper of root canal preparation of hand K File, ProTaper rotary file, and kedo S rotary file in primary molars using cone-beam computed tomography. Int J Clin Pediatr Dent. 2020 Jul–Aug;13(4):332-6. doi: 10.5005/jp-journals-10005-1787, PMID 33149404.
18. Asif Ahsana, Jeevanandan Ganesh, Govindaraju Lavanya, Vignesh R, G Subramanian EM. Comparative evaluation of extrusion of apical debris in primary anterior teeth using two different rotary systems and hand files: an in vitro study. Contemp Clin Dent. 2019 Jul–Sep;10(3):512-6. doi: 10.4103/ccd.ccd_884_18, PMID 32308330.
19. Srinivas Abhinaya, Jeevanandan L, Govindaraju Lavanya, Subramanian Erulappan Muthu Ganapathi. Comparative Evaluation of the Efficacy of Rotary file system (Kedo-S) vs Hand K- Files In Root Canal Preparation of Primary Teeth Using Cone Beam Computed Tomography (CBCT) – an in vitro Study. Braz Dent Sci. 2019 Apr/Jun;22(2):197-202. doi: 10.14295/bds.2019.v22i2.1705.
20. Sharma Shruti, Khanduja Ritu, Masih Updesh, Gupta Sonal, Kaushik Manisha. Comparative evaluation of clinical and radiographical assessment of manual and rotary technique during pulpectomy procedure in primary teeth – in vivo study. jida. 2019 Sep;13(9):20-6. doi: 10.33882/jida.13.25059.
21. Ahammed Haseeb, Seema Thakur, Parul Singhal. Evaluation of patient behavior, instrumentation time and quality of obturation of Kedo s rotary files in primary molars: an in vivo study. Int Jrnl Sci Res. 2020 Mar;9(3):81-3.
22. Pawar Bhaggyashri A, Pawar Ajinkya M, Bhardwaj Anuj, Wahjuningrum Dian Agustin, Rahardjo Amelia Kristanti, Luke Alexander Maniangat, Metzger Zvi, Kfir Anda. Effect of adaptive, rotary, and manual root canal instrumentation in primary molars: A triple-armed, randomized controlled clinical trial. Biology. 2021 Jan;10(1):1-11. doi: 10.3390/biology10010042, PMID 33435165.
1. 24. Dr. Jain Shreyans, Dr.Nilesh Rathi, Dr Nilima Thosar, Dr. Sudhindra Baliga. Comparative evaluation of canal transportation and canal centring ability in primary root canals using PRO AF BABY GOLD and KEDO-S pediatric endodontic rotary files with cone beam computed tomography- an invitro study. International Journal Of Pure Medical Research. 2020 May; 5(5):12-15.
23. Available from: https://orikamhealthcare.com/product/pedoflex/ [cited 16/10/2021].
24. Shah Shimoli, et al. Comparative evaluation of instrumentation time between Hand K-files and Rotary Pedoflex files in primary mandibular Molars. Eur J Mol Clin Med. 2020;07(11):7394-7.
25. Ghadge S et al. Clinical evaluation and comparison of obturation quality using pediatric rotary file, rotary endodontic file and H File in root canal of primary molars: A double blinded randomized controlled trial. IJRRD. 2020 Nov;3(4):12-9.
26. Katge Farhin, Ghadge S, Poojari M, Jain K, Patil D. Comparative evaluation of cleaning efficacy of prime Pedo™ and DXL-Pro™ pedo rotary files with conventional H Files in root canals of primary teeth: an in vitro study. J.C.D.R. 2019 Jul;13(7). doi: 10.7860/JCDR/2019/41425.12983. ZC. ZC09.
27. Available from: https://www.dencodent.com/niti-files-system/kids-files.html [cited 16/10/2021].
28. Available from: https://biometricdental.com/product/sani-rotary-endo-files-g3/.