

Clinical Assessment Of Obturation Quality And Instrumentation Efficiency Of Two Rotary File Systems Versus Manual Instrumentation In Primary Teeth

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Abstract:

Background: To compare the effectiveness of traditional hand files and two rotary file systems in terms of obturation quality and instrumentation time during root canal treatment of deciduous molars.

Materials and Methods: A sample of 30 primary molars with irreversible pulpitis were taken per group between the age group of 4-8 years. The groups were divided as- Group I(n=30) treated using the Kedo-S File system, Group II(n=30)-treated using Neoendo Pedoflex File system, Group III(n=30)-treated using manual stainless steel K-file(Mani). The amount of time spent instrumenting, the quality of the obturation were documented.

Results: In this present study, Kedo-S rotary file system showed least instrumentation time and highest optimum filled followed by Neoendo PedoFlex rotary file system and Hand K File system.

Conclusion: Pediatric rotary file systems have demonstrated effectiveness in pulpectomies of primary teeth and may serve as a reliable substitute for conventional hand instrumentation, with advantages including improved efficiency and shorter chairside time.

Key Word: Pulpectomy; Kedo-S File system; Neoendo Pedoflex File system; K-file System;

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I. Introduction

Although preventive measures for dental caries have improved substantially over time, pulpal involvement of primary teeth persists as a prevalent issue in pediatric dentistry.¹ The anatomical complexity of primary tooth root canals poses significant challenges during pediatric endodontic procedures. Features such as accessory canals, canal interconnections, and variations in canal morphology can hinder effective cleaning. Therefore, thorough debridement of the root canal system is fundamental to achieving successful pulpectomy outcomes.² In pediatric dentistry, pulpectomy is considered the standard treatment for primary teeth with infected radicular pulp, provided that the teeth are suitable for restoration and retention in the dental arch.¹ Adequate debridement and disinfection of deciduous tooth root canals can be attained through mechanical instrumentation using hand-operated files or rotary NiTi systems.³ The traditional approach to root canal instrumentation in primary teeth involves the use of manual K-files. Nevertheless, stainless-steel hand files may increase the risk of procedural mishaps owing to their forceful cutting characteristics and limited flexibility.⁴ The shortcomings of stainless-steel hand files led to the adoption of nickel–titanium rotary systems in endodontic therapy. Owing to their flexibility and shape memory, these instruments facilitate more effective root canal preparation and cleaning while reducing the time required for treatment compared with conventional hand files.¹

Barr et al. were the first to demonstrate the application of nickel–titanium (NiTi) rotary files in primary molars. Their study suggested that the biomechanical preparation principles used for permanent teeth could also be applied to primary teeth.⁵ Despite the advantages of rotary instrumentation, its application in primary teeth remains challenging. In comparison with permanent teeth, primary dentin is less dense and exhibits greater brittleness, making it more susceptible to damage during canal preparation. Moreover, deciduous roots are generally narrower, shorter, and more curved, and apical root resorption is often not readily visible. These anatomical variations can complicate the use of Ni-Ti rotary systems in primary dentition.⁴ The Kedo-S File system and Neoendo Pedoflex File system were introduced specifically for pediatric endodontics to improve treatment safety and patient cooperation. In view of these advantages, the present investigation assessed the time required for root canal preparation and the quality of obturation achieved after pulpectomy in primary molars using both hand files and the Kedo-S and Neoendo Pedoflex rotary file system.

II. Material And Methods

Following approval from the Scientific and Ethics Committee, the study was conducted in the Department of Pediatric and Preventive Dentistry. A total of ninety children aged 4–8 years who attended the outpatient department and met the inclusion criteria were enrolled after obtaining written informed consent from their parents or guardians.

Sample Size-A sample of 90 primary molars with irreversible pulpitis were taken per group between the age group of 4-8 years. The groups was divided as- Group I(n=30) will be treated using the Kedo-S File system, Group II(n=30)-treated using Neoendo Pedoflex File system, Group III(n=30)-treated using manual stainless steel K-file(Mani).

Criteria For Patient Selection:

Inclusion criteria:

1. Primary molars with irreversible pulpitis(pain/tenderness on percussion).
2. Minimum two-thirds of root length remaining.
3. Teeth must be restorable.
4. Indicated in any deciduous tooth with severe pulpal necrosis provided there is no radiographic contraindication.
5. Adequate periodontal and bony support.

Exclusion criteria:

1. Pulpal floor perforation.
2. Excessive tooth mobility or tooth near exfoliation stage.
3. Teeth with internal or external resorption.
4. Excessive root resorption involving more than half of root length.
5. Children with medically compromised condition making them unfit for the endodontic procedure.

Clinical procedure:

- Following a comprehensive diagnosis, the teeth were randomly split into three groups.
- Pulpectomy treatment was carried out for all three groups in this study by a single operator.
- For the tooth that needed a pulpectomy, local anesthesia was provided using lignocaine hydrochloride and 1:80,000 epinephrine, and rubber dam isolation was used.
- Endodontic access was made with a sterile high-speed carbide bur. Barbed broaches was used to remove necrotic pulp. And DG16 instrument was used to find the canals.
- The next was to obtain the root canal patency using K- File of size 10.
- With an intraoral periapical radiograph, the length of each canal was measured using a number 15 stainless steel K-file. Working length terminated 1mm short of radiographic apex to minimize the chance of over-instrumentation apically and causing periapical damage.
- The biomechanical preparation of root canals was performed by using three different file system and two different instrumentation technique as follows-Group I was prepared using Kedo-S pediatric rotary files, Group II was prepared using Neoendo Pedoflex rotary files with endomotors, Group III was prepared using stainless steel K-Files (Mani).
- During the canal preparation, the instrumentation time was recorded in seconds using a stopwatch by an assistant
- To eliminate debris, root canals was thoroughly irrigated with saline. During the preparation of the canal, a lubricating paste made of 17% ethylene diaminetetra acetic acid gel was employed.
- Using paper points of the proper size, the canals was dried. Root canals was then filled with calcium hydroxide with iodoform (Metapex), available as preformed syringes. Excess coronal filling material was removed and the access cavity was filled using restorative glass ionomer cement. Finally, a preformed stainless steel crown was adapted and cemented using luting type glass ionomer cement.
- After the completion of pulp therapy, all the participants were given oral hygiene instructions and brushing technique was taught.
- Immediate post-operative radiograph was taken to assess the quality of obturation using criteria laid down by Coll and Sadrian (1996) as underfilled, optimal filled and overfilled.

III. Result

In this present study, Kedo-S rotary file system showed least instrumentation time and highest optimum filled followed by Neo endo PedoFlex rotary file system and Hand K File system. (Table 1 and 2). The mean time required for the instrumentation of canals using Kedo-S file (Group I) was 19.25min and for Neo Endo Pedoflex

files (Group II) was 21.89 min. And the mean time required for the instrumentation of canals using K-files (Group III) was 27.87 min.

On analyzing the radiographic quality of obturation after instrumentation with Kedo-S file (Group 1), 90% canals were optimally filled and for Neo Endo Pedoflex file(Group II) 83.33% were optimally filled followed by Hand K-File where 66.67% were optimally filled.

Table no 1: Descriptive data regarding mean timings taken for instrumentation for different file systems[minutes]

| File systems | n | Minimum | Maximum | Mean | SD |
|------------------------------|----|---------|---------|-------|------|
| Kedo-S file(Group I) | 30 | 16.05 | 25.55 | 19.25 | 2.98 |
| Neo Endo Pedo Flex(Group II) | 30 | 18.25 | 25.05 | 21.89 | 2.43 |
| K File (Group III) | 30 | 25.87 | 30.30 | 27.87 | 1.35 |

Table no 2: Descriptive data regarding obturation quality

| Group | n | Long fill | Optimum fill | Short fill |
|------------------------------|----|-----------|--------------|------------|
| Kedo-S file(Group I) | 30 | 2(6.67%) | 27(90%) | 1(3.33%) |
| Neo Endo Pedo Flex(Group II) | 30 | 3(10%) | 25(83.33%) | 2(6.67%) |
| K-File (Group III) | 30 | 4(13.33%) | 20(66.67%) | 6(20%) |



Fig-(a) Optimum fill (b) Long fill (c) Short fill

IV. Discussion

Pediatric endodontic therapy presents unique challenges owing to the tortuous and delicate root canal architecture of primary dentition.² Compared with permanent teeth, primary teeth possess shorter, thinner, and curved roots along with softer, less dense dentin and subtle root resorption patterns. In addition, the ribbon-shaped morphology of primary root canals presents challenges during instrumentation, thereby necessitating the use of specially designed rotary files for effective cleaning and shaping procedures.⁶ One of the notable advancements in the field of pediatric endodontics is the utilization of Ni–Ti rotary instruments, which facilitate efficient canal shaping and preparation in primary teeth.⁷ According to Barr et al. (2000), the use of Ni-Ti rotary instruments for primary root canal preparation decreases treatment time and facilitates the creation of a more consistent, tapered canal shape, resulting in improved obturation.⁸

In our study, we compared the quality of obturation and instrumentation time between traditional hand files and two rotary file systems where Kedo-S rotary file system showed least instrumentation time and highest optimum filled followed by Neoendo PedoFlex rotary file system and Hand K File system.

The Kedo-S pediatric rotary system (Reeganz Dental Care Pvt. Ltd., India), pioneered by Jeevanandan in 2017, utilizes three Ni-Ti files (D1, E1, and U1) configured with a 12 mm active cutting length to streamline primary tooth endodontics. A defining characteristic of these instruments is their variably variable taper. For molar preparation, the D1 file offers a 0.25 mm tip diameter with sequential tapers of 4–8%, making it ideal for the narrow mesiobuccal and mesiolingual channels. For the wider distal canals, the E1 file is utilized, featuring a 0.30 mm tip diameter alongside 4%, 6%, and 8% variable tapers across its length.⁶

In our study, the average time required for canal instrumentation was 19.25 minutes in the Kedo-S file group (Group I) and 21.89 minutes in the Neo Endo Pedoflex file group (Group II). In comparison, the K-file group (Group III) demonstrated a higher mean instrumentation time of 27.87 minutes. Studies by **Govindaraju et al. (2017)**⁹, and **Makarem et al. (2014)**¹⁰, **Rishi Tyagi et al. 2021**¹¹, **Swaminathan K et al. (2022)**¹², **Hadwa et al. (2023)**¹³, **Bala Anusha Durairaj et at. (2023)**¹⁴ have similar conclusion that rotary files have shorter instrumentation time over manual k files.

Regarding obturation quality, optimal filling was observed in 90% of canals instrumented with Kedo-S files (Group I). In the Neo Endo Pedoflex group (Group II), 83.33% of canals exhibited optimal obturation, whereas the Hand K-File group (Group III) showed the lowest percentage of optimally filled canals at 66.67%. These results are consistent with previous studies that have reported the superiority of rotary file systems in terms of efficiency, reduced procedural errors, and improved obturation quality (Govindaraju et al., 2017¹⁵; Jeevanandan & Govindaraju. 2018⁶, Kalita S et al.2021¹, Rajain T. 2023³).

From a clinical perspective, the findings of this study highlight the advantages of using pediatric-specific rotary systems such as Kedo-S for root canal treatment in primary teeth. The increased success rates, reduced chairside time, and improved obturation quality support its adoption in pediatric endodontics. Furthermore, the ability of rotary systems to achieve better debris removal and canal centering plays a crucial role in enhancing treatment outcomes. While the Neo Endo Pedo Flex system also showed good clinical performance, its slightly lower success rate compared to Kedo-S suggests that further modifications in design may be necessary to optimize its effectiveness for pediatric use.

The use of 2D radiographic imaging to measure obturation quality represents a potential limitation of this study. Future investigations featuring extended clinical and radiographic follow-ups are necessary to validate these findings, while additionally exploring patient acceptance of the Kedo-S rotary system.

V. Conclusion

Compared with hand instrumentation, rotary systems provide superior obturation quality and facilitate faster canal preparation during pulpectomy in primary molars. Therefore, rotary file systems can serve as reliable alternative approaches for the biomechanical preparation of root canals in primary dentition.

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