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Comparative Evaluation of Cleaning Efficacy of Two Rotary Systems with Conventional K File in Root Canals of Primary Teeth

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ORIGINAL STUDY

Comparative Evaluation of Cleaning Efficacy of Two Rotary Systems With Conventional K File in Root Canals of Primary Teeth

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Abstract

Purpose: Comparison of cleaning quality and instrumentation time between manual instrumentation with that of rotary systems (Kedo SG and AF Fanta baby) in the preparation of deciduous root canals. (*In vitro* study). **Patients and methods:** A total of 30 extracted primary canines were divided into three groups each one consists of 10 teeth group I were manually prepared using stainless steel K-files (Mani) group II were cleaned with Rotary file system Kedo-SG blue group III were prepared with Rotary file system (AF Baby file system). The samples were prepared for scanning electron microscope analysis by using a stainless steel chisel, to split each sample in two. Photomicrographs of each canal's cervical, middle, and apical thirds were taken for the final assessment. This was done with a magnification of 350 × (for debris score) and 1500 × (for the smear layer). **Results:** According to debris and smear layer scale the results were in favor of two rotary systems with statistically significant difference between fanta and kedo groups with manual files. **Conclusion:** Using rotary files to prepare primary teeth is superior to using manual K-files. This is due to shortened work time, improving children's compliance. Additionally, they have reasonable cleaning capacity.

Keywords: Debris and smear layer, K- file, Rotary files, Scanning electron microscope

1. Introduction

Management of a primary tooth with pulpectomy restores it to a functional and healthy condition until exfoliation occurs naturally to prevent pain, recurrence of infection and early extraction. It is done successfully through decomposed pulp tissue and contaminated dentine removal. Also, the canal is shaped, cleaned and finally filled with a biomaterial, which is an intact coronal seal, for maximum results in restoration and pulpectomy [1].

The most important determinant that guarantees endodontic treatment success is microorganism removal from the canal system through optimum cleaning and shaping. This highlights the importance of proper root canal cleaning, shaping and sealing [2].

For many decades, management was dependent on hand instrumentation which had its disadvantages, mainly longer preparation time, and the use of stainless steel files bigger than numbers 15 or 20 is associated with inflexibility and increased rigidness and tends to be straight in the root canal, which can lead to complications such as perforation, ledge or apical displacement of necrotic debris, that are common with canal preparation [3].

Numerous modifications have been made to instruments and techniques of endodontics to ensure the maximum cleaning and shaping efficacy possible. NiTi engine-driven files have gained popularity at present due to their safety and efficiency in the preparation of fine-curved canals owing to their flexibility and elasticity [4].

On dealing with primary teeth through endodontic preparation, the characteristics of rotary instrumentation are significantly apparent, especially since the pediatric patient's compliance is dependent on appointment length, and the permanent successor's germ's integrity is also dependent on maintenance of the root canal's original path [5].

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Higher magnification levels that can only be acquired through scanning electron microscope use are required for the estimation of fine debris and smear layer. This was proven as an efficient method of investigation, as well as comparing the varied endodontic tools' influence on the dentin surfaces' texture and sanitation [6].

Therefore, this study will differentiate the cleaning quality and instrumentation time between manual instrumentation with that of rotary systems (Kedo −SG blue and AF fanta baby rotary files) in deciduous root canals preparation.

2. Patients and methods

2.1. Armamentarium

(a) Stainless steel K-file from size 15–40 (china tooth material trading CO., LTD)
(b) Kedo-SG rotary file (Fig. 1) Kedo-SG Blue file system (Reeganz Dental Care Pvt. Ltd, India).
(c) AF baby Fanta (Fig. 1) (shanghai fanta dental materials CO., LTD)

2.2. Methods

2.2.1. Ethical approval

Ethical approval is attained from the research and ethics committee of the Faculty of Dental Medicine for Girls, Al-Azhar University, Cairo, Egypt under code (REC-PE-23-12).

(i) Teeth collection and their storage:

30 extracted primary canines (anonymous) were provided by Al-Azhar University, Faculty of Dentistry's Pedodontic Clinic. The freshly extracted teeth were thoroughly cleaned underwater to remove fragments of soft tissue remnants on the teeth's root exterior. The teeth were then saved in a sterilized solution (saline). At the end of the study, the teeth were disposed of in specified container for medical waste.

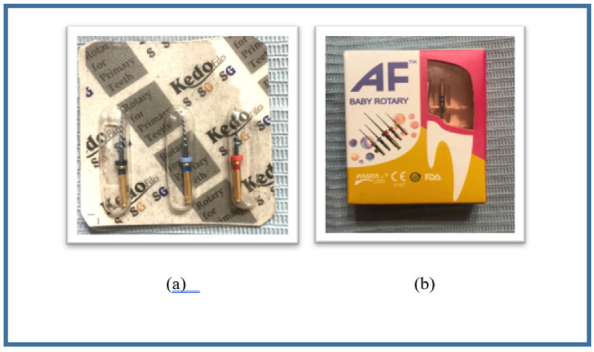

Fig. 1. (a) Kedo SG file kit, (b) AF baby rotary file kit.

(a) Inclusion criteria [7]:

Human Primary maxillary and mandibular canines that had been recently extracted will be collected from patients aged 4–7 years with systemic diseases as diabetes or suffering from papillon lefevre syndrome.

(b) Exclusion criteria [7]:

Deciduous teeth with confirmation of sever internal/external root resorption, developmental defects will not be included in the study.

(ii) Grouping of teeth: 30 primary canines were split up into three groups each one consists of 10 teeth group I were manually prepared using stainless steel K-files (Mani) group II were cleaned with Rotary file system Kedo-SG blue group III were prepared with Rotary file system (AF Baby file system).
(iii) Method of root canal preparation: Cavity access was done in all of the teeth. This was followed by introducing the #10 K- file to dictate the canal apparency in the teeth. Periapical radiographs were used to determine the length of preparation (1 mm short of the apex).

The step-back technique was utilized in performing manual instrumentation with K-files. Through using file sizes 15–40. Rotary canal instrumentation using Kedo-SG rotary files was completed with 16-mm Ni–Ti files that were driven by a hand piece (E connect E-xtreme endo motor) at a speed of 300 rpm as per the recommendations of the manufacturer. One instruments (U1; as recommended by the manufacture) were utilized for the preparation to the working length of canals. Rotary canal preparation using AF fanta baby files (Shanghai fanta dental materials CO., LTD) two instruments (#20/0.04 then #25/04) was used in a pecking-like motion to full working length. Canal irrigation was done between files. The files were used in crown down technique with E connect E-xtreme endo motor used at 350 rpm, 2 N cm torque.

The canals in all of the three groups were sprayed with 1% Naocl after each file used afterward normal saline was used. Ethylene diamine tetra acetic acid (EDTA) solution 17% was used as a lubricant during preparation of the canals. The canals were dried by use of sterilized paper points [8] a stopwatch was used to measure instrumentation time for each canal.

2.2.2. Scanning electron microscope examination

Before the roots are cut longitudinally, a small piece of cotton is placed in the access cavity to

prevent dentin residues from entering the root canal. On a low speed handpiece Root were also cut longitudinally on the lingual and buccal sides by a bilateral diamond disc. Then divide it into two equal parts with a chisel. Sections were dried with a point dryer and analyzed by scanning electron microscope. Photomicrographs of the cervical, the middle and the apical third of each canal with a magnification of 350× (For debris score). And 1500x (For the smear layer) were taken for final assessment. Blindly, one investigator (Endodontics Professor) record the appearance of debris and smear layer on the canal surface at the coronal, middle, and apical parts of each of the canals [6]. Hulsmann scoring system was used for debris and smear layer [9].

Debris Scale: Score 1: clear canal walls and little debris. Score 2: little accumulation of fragments Score 3: numerous accumulation of fragments less than half (50%) of channel walls Score 4: debris casing greater than 50% of channel walls Score 5: complete or almost entirely channel wall casing with debris.

Smear layer scale: Score 1: all dentinal tubules are open and absent smear layer Score 2: dentinal tubules are partially open anda bit of smear layer Score 3: uniform coating layer surrounding the canal with not many open dentinal tubules Score 4: completely hidden canal wall by a uniform smear layer and hardly any open dentinal tubules Score 5: casing the entire canal wall a dense and uniform smear layer.

2.3. Statistical analysis

To study the efficacy of cleaning of the two rotary system with conventional K File in canals of deciduous teeth. Analysis of variance test or a nonparametric equivalent test was used for comparison between groups. According to a study done previously by Azar et al. (2012) [10], the total score for cleaning efficacy in K file group was 38 in the apical segment, 36 in the middle segment, and 32 in the coronal segment. This is in comparison to two different rotary files recording 31, 28, 26 for the first one, and 32, 26, 22 for the second one, respectively.

Sample size determination was done by using the statistical power analysis program G Power (Version 3.1.9.7). A total sample size of 30, divided by 10 in each group, was sufficient for detecting an effect size range from 0.6 to 0.62, with an actual power of 0.8 or 80% (1-β error) and a significant level error (a error) 0.05 or 5% for the two-sided hypothesis test (Fig. 2).

3. Results

Based on cleaning records, no completely clean canals were demonstrated on any group. Overall cleaner canal walls was provided by AF Fanta rotary file and Kedo SG blue when compared with K-file in all root canal sections. The difference between the two groups of rotary in comparison with manual K-

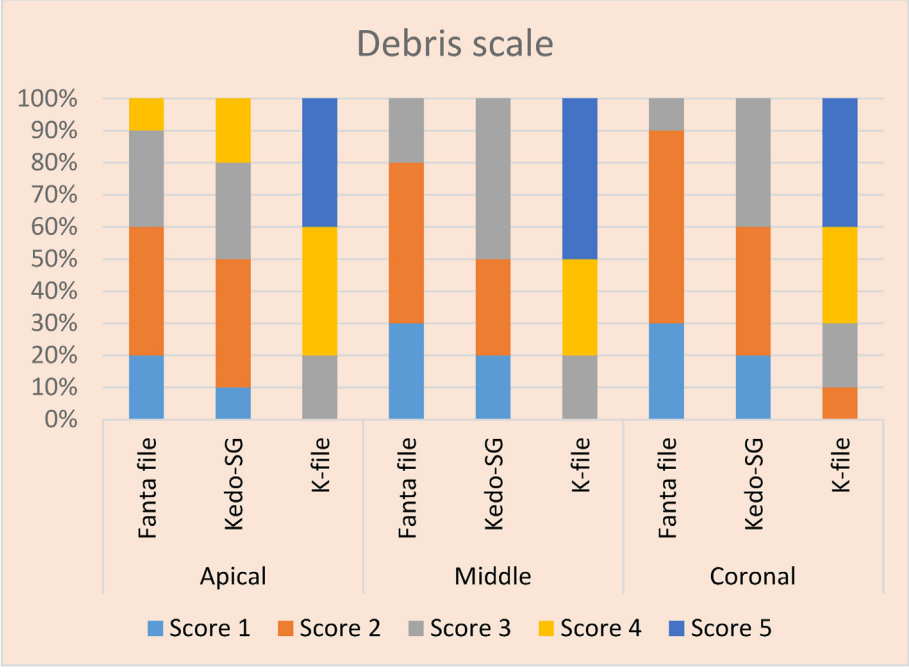

Fig. 2. Frequency of different scores of debris scale in different root levels in different groups.

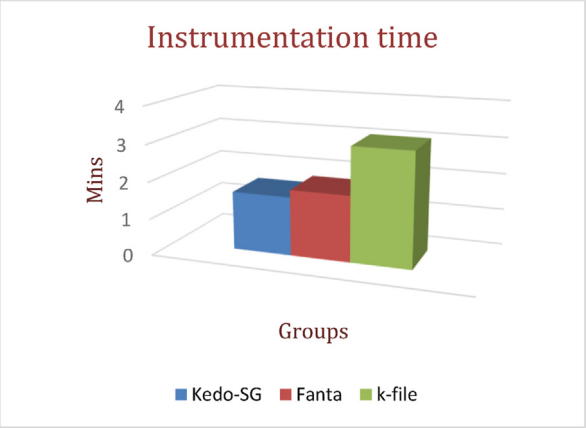

Fig. 3. Mean instrumentation time (min) in different groups.

file showed high significance for both debris and smear layer. The three canal levels in all of the groups cleanliness variation was nonsignificant.

According to instrumentation time: The highest mean value was scored in K-file group (3.09 ± 0.21), followed by fanta file (1.85 ± 0.21), then Kedo-SG file (1.65 ± 0.25). Analysis of variance test revealed that K-file was significantly higher than the two other groups ($P = 0.000$). *Post hoc* test showed no significant difference between Fanta file and Kedo-SG ($P = 0.14$) (Fig. 3).

4. Discussion

For treatment of nonvital primary teeth in case of irreversible inflammation, as well as radicular pulp that has undergone necrosis, pulpectomy is considered an option one of the objectives of which is reduction or elimination of bacteria and their byproducts from root canals. But, as proper instrumentation of bizarre and tortuous root canals of primary molars is a main challenge of the procedure, pulpectomy for primary teeth can be time-consuming [11].

The present study' aim was the evaluation of and comparison between cleaning quality and instrumentation time of Kedo-SG rotary system and Fanta baby rotary file system with K-file in deciduous teeth, especially that the technique of rotary preparation permit for a preparation that is more rounded and conservative, and its efficiency in required time reduction is proven which leads to better cooperation of the patient in comparison to the conventional manual technique [12].

The good manners of a pediatric patient for a dental approach is a critical factor to ascertain the successful outcomes of the procedure [13].

It has been clinically proven that decreased instrumentation time has a favorable impact on the child's manners and collaboration in the dental unit, subsequently resulting in a faster treatment delivery and a better prognosis [14].

Also, with the rotary system, instrumentation time was significantly shorter in comparison to the manual one due to the lesser need of a significant number of files as well as the power provided by motor. But despite its high cost in comparison to manual instrumentation, its reduced working time can compensate for this fact [15].

1% Naocl were flood in the canals of all the three groups, then with normal saline. Ethylene diamine tetra acetic acid 17% was used as a lubricating solution for preparation of the canal as well as an irrigating solution [16].

In this study, cleaning efficacy was evaluated which showed favorable results with AF baby Fanta rotary files over Kedo-SG. Most cases of the Fanta group got a score 2 in the apical, middle and coronal levels. However, these results were shown to not be statistically significant. In contrast, the difference between the manual group and the rotary groups was otherwise statistically remarkable [17].

Also with the Kedo-SG and Fanta system, significantly cleaner walls in the apical third, middle third and coronal third, as well as superior elimination of the smear layer, were observed in contrast to the ones done by K-files. These outcomes are in acceptance with preceding studies that reported an overall more significantly efficient cleaning with different rotary systems in comparison to the manual technique.

This present study's outcomes are also in difference of opinion with those of previous studies that established no remarkable variance in cleaning efficacy between the rotary and manual systems. A number of factors can take part in deciding the significance of this difference which can include: the curve of the canal degree, count of files, instrumentation manner, approach of irrigation and cleaning evaluation process.

On the other hand, reduced instrumentation time was proven by means of pediatric rotary files (Kedo-SG) compared with the AF Fanta baby files. But even though the difference between them was not significant, it was otherwise the opposite when both were compared with the K-file [18].

4.1. Conclusion

In comparison with manual files, rotary files used to prepare root canals of primary canines resulted in less procedure time. Rotary files were also found to provide better cleaning capacity compared with manual ones. Assessment of the efficiency of the files should be considered in future studies.

4.2. Recommendation

Additional studies using larger sample sizes are needed to evaluate the comparison between rotary and manual instrumentation.

Future research should evaluate the efficiency and rigidity of files.

Some of the suggestions of those file is to increases the active part with keeping the total length. Future studies should assess, the long-term prognosis up to primary tooth exfoliation.

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Conflict of interest

There are no conflicts of interest.

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