Original Article

PEDIATRIC ROTARY FILES FROM KEDO-S PLUS FRACTURE INCIDENCE: A PROSPECTIVE CLINICAL STUDY

Dr. Dinesh Kumar[1], Dr. Ganesh Jeevanandan[2]

[1]Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.
Email - dineshdk7797@gmail.com
[2]Reader, Department of Pediatric and Preventive dentistry, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.

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Abstract

INTRODUCTION: This clinical study's main objective was to investigate the likelihood that an instrument fracture would occur during the preparation of primary molar root canals using Kedo - S Plus rotary files.

MATERIALS AND METHODS: 3 months and a standardized protocol were used to treat 100 primary molars on the mandible and maxilla (335 root canals). Kedo-S Plus file was used for mechanical preparations that were carried out in accordance with the manufacturer's recommendations. Each instrument in Group A assisted in the management of three cases, as opposed to Groups B, C, and D assisted in the management of five, nine, and twelve cases, respectively. After being removed from the canal, the rotary files were examined under an operating microscope. Descriptive statistics were used once the numbers were tabulated.

RESULTS: One fracture of the Kedo S plus file was discovered (1%), and it happened in group D in the mesiobuccal canal's apical third of a maxillary molar.

CONCLUSION: The present research indicates that Kedo-S Plus rotary files fracture less frequently. The most likely places for the instrument to separate are the apical portion of the root canals and the buccal canal of the maxillary second molar.

KEYWORDS: Fracture incidence, rotary file Kedo-S Plus, and biomechanical preparation.

INTRODUCTION:

The preferred method of treating infected pulpal tissue in single-rooted teeth and molars with symptoms of furcal radicular involvement is pulpectomy operation for restorable primary teeth. Primary teeth's root canals are cleaned and shaped before pulpectomy paste is applied. Endodontic broaches and manual files have been used for this procedure historically (1). In the realm of pediatric dentistry, pulpectomy is undoubtedly a very difficult procedure, and a number of elements, such as diagnostic acuity, tools used, and technology,are several major components that support its success. Recently , the pediatric dentist's support for There has been a twofold growth in nickel-titanium (Ni-Ti) rotary instrumentation (2). Primary teeth can benefit from dentin contouring with NT and canal debridement utilizing the same approaches. With NT, the primary molars' sinuous and irregular canal walls are thoroughly cleaned because the rotary files' clockwise rotation draws pulpal tissue and dentin out of the canal as they are in use. The files can nearly mimic the initial root canal course because of

flexibility and instrument design (3). Studies have repeatedly demonstrated the effectiveness and efficiency of using NT for root canal preparation in permanent teeth.

Despite the fact that the majority of pediatric dentists use rotary instruments, The types, quantity, and usage patterns of the various instrumentation systems varied significantly. Intracanal tool fracture, which happens during the mechanical preparation of root canals, is the most annoying complication in the practice of endodontics.

According to a literature review, rotary tools had a correspondingly greater fracture incidence, with rates between 1.3% and 10.0%. However, when employed in clinical settings, the greater fracture incidence rate revealed in in vitro investigations changed (1). This suggests that the practical applicability of the outcomes in these cases is being handled without taking into account the actual clinical circumstances.

Ni-Ti rotary files, which are recommended for use on permanent teeth, have been used to prepare canals in primary teeth (3).Unique pediatric rotary file systems were developed from the ground up because of the complexities of primary tooth roots and how they are different from those of permanent teeth.Constant design advancements, such as instrument separation, ledging, and canal transit, are being made to permit superior and cautious shaping with the least amount of procedural error. One such development in the pediatric rotary file system is the Kedo-S plus file, which is in its fifth generation (KEDO Dental, India) (4). Kedo- S Plus is a single-file system with an apical cross-section that is triangular and a coronal cross-section that is tear-shaped. According to studies, this file system produces greater obturation in a shorter amount of time. Unfortunately, there was no information in the literature about the likelihood of fractures associated with the single file system (5). The main goal of this study was to determine whether utilizing the instruments in different clinical situations and during intracanal procedures increased the risk of Kedo-S plus pediatric rotary file fracture in mandibular teeth. According to studies, this file process delivers greater obturation in a shorter amount of time (6). Unfortunately, there was no information in the literature about the incidence of fractures associated with the single file system(3) (7). Determining the likelihood of Kedo-S plus paediatric rotary file fracture in primary molars during intracanal procedures and when utilizing the tools in varied clinical contexts was the main goal of this investigation.

MATERIALS AND METHODS

The Institutional Review Board has approved the study's ethical conduct and it has been registered with clinicaltrials.gov. This clinical trial was conducted in a dental institution's Department of Pedodontics and Preventive Dentistry.. For reporting the findings, the STROBE checklist's standards for enhancing the reporting of randomized trials in epidemiology were used.

Since the patients were minors, parental permission was acquired to use the treatment because participation was entirely voluntary. 100 volunteer pediatric teeth from children between the ages of 4 and 9 were used in the study. Of the 100 teeth, 55 were mandibular primary molars and 45 were maxillary. The only primary molars required a single-visit pulpectomy were those with appropriate crown structure and at least two-thirds of intact root structure. Those were the only primary molars included in the research.The study did not include teeth with sinus tract and pathogenic resorptions, root canal calcifications, or teeth that had already received root canal therapy. All instrumentation methods involved the use of a Kedo-S Plus rotary file. The teeth were divided into four groups of 25 teeth each using computer-generated random sampling, sequentially labeled, opaque, and sealed envelope procedures. In clinical cases, each Kedo S plus file was used three times in group A, but according to the manufacturer's recommendations, groups B, C and d used each Kedo S plus file five, nine, and twelve times, respectively Figure 1. Three pediatric dentists who were extremely skilled and knowledgeable about the system being tested carried out the entire treatment process. They were also calibrated and standardized to a previously authorized rule, such as the one described below.The tooth under investigation was only then isolated using a rubber dam after receiving local anesthetic that includes 2% lignocaine in a combination of 1:200,000 adrenaline (LOX 2% Adrenaline, Neon Research labs Ltd., India). The deroofing pulp chamber was finished with the non-end cutting burr (Mani, Inc., Japan), and the access cavity was produced

with the #6 round burr to give the investigator straight-line access (Mani, IncJapan). Using a manual K-file of #15 size from Mani, Inc. in Tochigi, Japan, the canal's patency was verified, and the working length was calculated using Ingle's approach using a radiograph. The Kedo-S Plus rotary file was used for biomechanical preparations till the working length, depending on the groups assigned to each. The torque measured was 2.2N and the endodontic motor speed was precisely 250 rpm (X-Smart Plus electric motor, Dentsply, India Private. Company limited, Delhi, India); both values precisely met the manufacturer's requirements.

Each rotary file was checked for signs of fracture after each use using a dental operating microscope with an 8-time magnifying effect. Lubrication was provided by 17% of EDTA is ethylenediaminetetraacetic acid (Endo Prep RC) during intracanal instrumentation. Normal saline was used for intermittent irrigation, with a typical volume of 5 mL. After the canals had been thoroughly dried using absorbent paper tips, Metapex was used to plug them. A complete restoration was made using a stainless steel crown and type II GIC from GC, India (3M ESPE).

Figure 1: Kedo S Plus File

After the procedure, the dentist filled out a standard questionnaire with details on the likelihood of fracture, the position of the fracture (the coronal, middle, or apical third of the root canal), and any procedures used to stop or retrieve any broken tools. Descriptive statistics were performed using SPSS software version 23.0 (SPSS Inc., Chicago, IL, USA) once all the data had been tabulated.

RESULTS

43 men and 57 women made up the study's 100 participants, who were split evenly between the male and female sexes. The participants were all between the ages of 4 and 9; the average age group included in the study was 6.4 ± 1.5 years.

The details of the study sample are fully explained in [Table 1] below, including the types of teeth and statistics on root canals in each group. [Table 2] provides information on the total number of broken tools, accounting for the teeth and root canals present in each group. Broken instruments were not used.

TABLE 1: Distribution of research sample according to the kind of tooth and the number of root canals.

Group	Overall no: of mandibular teeth	Overall no: of maxillary teeth	Overall no: of mandibular canals	Overall no: of maxillary canals
a	**12**	**11**	**50**	**33**

b	**15**	**10**	**50**	**33**
c	**13**	**11**	**58**	**30**
d	**15**	**13**	**42**	**39**
Total	**55**	**45**	**200**	**135**

TABLE 2: Incidence of fracture distribution according to tooth type and location

Group	Overall no: of fractured instruments	Canal/teeth	Location (root)
a	**Nil**	**Nil**	**Nil**
b	**Nil**	**Nil**	**Nil**
c	**Nil**	**Nil**	**Nil**
d	**1**	**Maxillary 2nd molar in the (MesioBuccal Canal)**	**Apical 3rd**

DISCUSSION

Ni-Ti rotary instruments are being developed and used more frequently in the field of endodontics, without a doubt. Each file system has distinct advantages and disadvantages, as well as usage guidelines that must be adhered to (8).The Kedo-S Plus rotary file system was introduced with the goal of minimizing the quantity of root dentin preparation and decreasing the pace of primary root resorption. This file system with variable taper abrades the dentin, removing a thin layer from the entire circumference of the root canal while maintaining dentin integrity for successful three-dimensional obturation, in contrast to previous rotary files with big taper that remove too much dentin, weakening roots (9). This prospective clinical study provides more effective and stronger evidence when compared to a laboratory inquiry, but only provided each operator adheres to the established protocol guidelines (8). However, a laboratory experiment cannot always predict a clinical situation.

Every root canal preparation carried out in this study complied with all manufacturer guidelines in addition to the stated standardized technique. Although single-use is normally advised to reduce the risk of rotary instrument fracture, the higher costs associated with rotary files encourage users to reuse them frequently (10). The safe reuse of rotary files is influenced by a number of variables, such as the total number of times the file is used, preparation technique, glide path preparation, proper orifice expansion prior to rotary instrumentation, widening of the root canal using conventional hand files, and the use of suitable irrigants or lubricants in conjunction with the rotary files.

No other instruments were used; only hand files measuring #15 in diameter were used in the current investigation to create the glide path. The best method to minimize instrument fracture is to prepare a manual guide path before performing rotational instrumentation. On advice, a brushing motion was utilized with the Kedo-S Plus file system. A quick use of the instrument and light apical pressure is preferable to a steady pecking motion in order to reduce the risk of rotary instrument fracture (11). Additionally, EDTA was used to

remove the smear layer and lubricate the instruments, which decreased the likelihood of instrument fracture. According to reports, coronal blockage is reduced using the crown down approach, which also virtually reduces torque load and any procedural errors. The question of how frequently an endodontic file may be used safely for root canal preparation is one of the most divisive issues in endodontics (12).Several investigations have suggested that the instruments can be reused. According to Yared et al. in a simulated clinical research, up to four molar teeth could be produced using the same rotary instrument without concern for instrument fracture. According to Parashos et al., stainless steel manual files may actually have a lower rate of fracture than rotary instruments, and the causes of rotary instrument fracture are complex and multivariate (13). Numerous studies have shown that there are important elements that may affect the rate of instrument fracture, including the operator's handling of the instruments and his or her assessment of the maximum number of uses that an instrument may see. According to the literature, there is no connection between the total number of times an instrument is used and the frequency of instrument fracture (14).

The maximum number of times a rotary file can be used, according to studies, varies depending on a number of factors, including the instrument's properties, the form of the root canal, and the operator's expertise (15). These data show that there are only suggestive arguments, and not conclusive ones, in the literature supporting the use of rotary files only once to reduce fracture rate occurrence (16). It has been discovered that the Kedo-S plus rotary files experience very different wear and tear based on whether it's placed on a tooth with a single canal or a tooth with multiple canals. The manufacturer's recommendations stated that the instrument could only be used 14 times before it needed to be discarded. This study was conducted to shed light on this puzzle (17).After each use for root canal preparation, the rotary files were examined for any symptoms of fracture under an 8-times magnifying dental operating microscope. Bueno et al. recommended this 8x magnification since they believed that operators most frequently employed this level. Instrument fractures were seen in 2% of root canals in the current analysis, and they typically occurred in the apical portion of the canals (18). The apical portion of root canals, where canals commonly twist and have their lowest diameter, is 33.5 times more likely to undergo instrument breakage than the coronal third, according to a review of multiple endodontists. When there are obvious root curvatures, instrument fracture is more likely to happen because cyclic fatigue is more probable.

The Kedo-S Plus file integrates the advantages of heat treatment, which aid in enhancing flexibility, providing protection against repetitive fatigue, and enhancing cutting efficiency. It also has Titanium oxide coated in the apical third of the file, which makes it more flexible in the curved canals and prevents file breakage (19). The regulated memory impact on the files is another result of the thermal regimen. An instrument's capacity to withstand breaking even under the strain of flexural and torsional strain varies depending on the design of its cross-sectional area and file (20). Generally speaking, larger diameter instruments are more prone to flexural fatigue than smaller diameter instruments, and these larger diameter devices are also more prone to internal stress generation.

Any instrument which is designed to come into contact with the root dentinal walls as little as feasible will surely be subjected to less compression force. This would explain the low breaking incidence with the Kedo - S plus system files since the diameter of the file is 0.28 mm, has a dual cross-sectional area (triangular cross-section at the apical third and teardrop cross-section at the coronal area), and has flexibly variable taper (21). Any broken tool's likelihood of being managed depends on a variety of factors, but the likelihood of removing such tools is mostly influenced by the tooth's origin, the maximum amount of canal curvature, and the specific location of the fragment (22). Our team has extensive knowledge and research experience that has translate into high quality publications(23–32)

In this trial, all broken instruments were avoided, and patients underwent routine follow-up. However, the possibility of removing such tools is mostly controlled by the origin of the tooth, the degree of canal curvature, and the precise location of the fragment. Any broken tool's likelihood of being managed depends on a multitude of circumstances. All broken equipment was avoided in this trial, and patients received the usual follow-up.

CONCLUSION

The current investigation discovers that the incidence of breakage of Kedo - S Plus rotary files is decreased given the study's conditions. The most likely places for the instrument to separate are the apical portion of the root canals and the buccal canal of the maxillary second molar.

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