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Comparison of instrumentation time and cleaning efficacy between single file:KEDO – S and ONE SHAPE in primary teeth. – In vitro study

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Abstract

Introduction: Pulpectomies of primary teeth would still remain the treatment of choice. Usage of rotary instruments for primary tooth pulpectomies effectively produces a well tapered root canal form, with minimal risk of transporting the original canal and facilitating appropriate obturation.

Aim: Aim of this study is to compare cleaning efficacy and instrumentation time between two single rotary file systems in primary anterior teeth.

Method: A total of 30 single root primary anterior teeth were selected using standardized radiograph. The canal were injected with india ink with 30 gauge insulin syringe and divided into two groups. First group – KEDO -S . Second group – KEDO –S file. Teeth were sectioned and cleared in various solutions and then observed under a stereomicroscope.

Result: In coronal third, KEDO –S file showed better cleaning efficacy than ONE SHAPE and the difference was statistically significant. Mean instrumentation time

was shorter in ONE SHAPE as compared with KEDO-S and the difference was statistically significant.

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Keywords: Primary teeth, Rotary file, KEDO –S, ONE SHAPE

Introduction

Pulp therapy and pulpectomies specifically form an important part of the repertoire of a Pediatric dentist's clinical practice. The use of hand instruments dominated the pre-rotary 90's era. However the advent of rotary files has taken the field by storm, with their ease of use, time saved and enhanced efficacy that result in excellent obturations.

In order to overcome the limitations of stainless steel instruments, in 1988, Walia *et al*. introduced rotary files prepared of Nickel Titanium (NiTi) alloy, a chief improvement in root canal shaping. These instruments have increased flexibility and super elasticity, producing canal shapes that conform to the original anatomy. Canal preparation with the use of rotary file systems also considerably decreases the treatment time and operator fatigue.

Ni-Ti rotary files aimed for permanent teeth are used in primary teeth for root canal preparation. Barr et al in 2001 adapted multiple rotary files in primary teeth which were originally designed for permanent teeth.

Although credited with innumerable advantages, the clinical use of NiTi files can also be time consuming because they may require multiple exchanges of file sizes which would especially be tedious among pediatric patients. This led to the revolution of single-file NiTi reciprocating systems, which was introduced 2011, by Dentsply.

Considerations for the structural and morphological differences between primary and permanent teeth inspired the introduction of Ni-Ti rotary files specifically designed for primary teeth, by Jeevanandan G. et al in 2017.

Various single file systems eg. Wave one, One Shape designed for permanent, adapted to primary teeth were researched and demonstrated better cleaning efficiency. (Katge et al.,2014).In order to explore the efficacy of the newer file system "KEDO-S" this study aimed to evaluate and compare the cleaning ability and instrumentation time of Single rotary file (KEDO -S) and (ONE SHAPE) used for preparation of primary teeth.

Materials and Methods

Institutional Review Board granted approval for this research. Thirty extracted primary teeth were collected. The sample teeth were virgin without any prior treatment done on them. The exact reasons for tooth extraction were unknown to the researchers.

Inclusion and exclusion criteria are showing *in [TABLE – 1]*

Inclusion criteria	Exclusion criteria
Extracted teeth with no external or internal pathological root resorption	presence of pathological root resorption
Absence of perforation in the internal or external furcation area	Presence of perforation in the furcation area

Moderate root angulation	Severe root angulation and root length less than two third
Two-thirds of intact root	

The root canals prior to the instrumentation of root canal. Standard coronal access was achieved with BR 31 diamond round bur (Mani, Japan) and Endo Z (Denstsply Maillefer, Ballaigues, Switzerland) at high speed, under cooling with distilled water. All specimens were then rinsed with saline. The root canals were filled with India ink using a 30 gauge needle .The teeth were left in wet conditions at room temperature for 48 hours. The actual root canal length was determined visually by inserting a hand K-file (Dentsply Maillefer, Ballaigues, Switzerland) into the canal until the file tip was visible at the apical foramen. The working length was calculated by subtracting one millimeter from actual root canal length. Thirty teeth were randomly divided in two experimental groups Group one specimens were instrumented with KEDO -S file and Group two specimens with ONE SHAPE file. In both groups 30 root canals were instrumented manually with K-files (Denstply Maillefer, Ballaigues, Switzerland) with the step-back technique. In group one canal preparation done with KEDO -S single file at speed between 250-300 rpm and in group two canal preparations done with ONE SHAPE at speed between 250-300 rpm .All root canals preparations were performed by a single operator.

The instrumentation time in each root canal was dignified by a chronometer. In all experimental groups the canals were irrigated with normal saline and dried up with absorbent paper points. The pulp chamber was then filled with temporary cement (Coltosol, Coltene/Whaledent AG, Switzerland) and apical ends were sealed with sticky wax. The prepared teeth were then stored in wet conditions.

For evaluation of cleaning efficacy, the teeth were placed separately in 7% hydrochloric acid for decalcification for 2 days and the acid solutions were reformed daily. The teeth were then washed under running water and dehydrated in a series of ethyl alcohol concentrations: 70% alcohol for 16 hours (changed after eight hours) followed by 80% alcohol for eight hours, 95% alcohol for eight hours, and 100% alcohol for 12 hours.

After dehydration, the teeth were sectioned and observed under a stereomicroscope (SMZ-143 series, Motic Company). The scoring was done by an independent blinded examiner. They were recorded according to the amount of India ink remaining in the coronal, middle, and apical thirds of the canal on a scale of 0-3

0 — Total clearing in which the whole canal was completely clean.

1 — almost complete ink removal.

2 — Partial ink removal.

3 — No ink removal.

The scores thus achieved were tabulated and statistically analyzed by Kruskal-Wallis test using MedCalc Statistical Software version 12.7.2 (MedCalc Software bvba, Ostend,

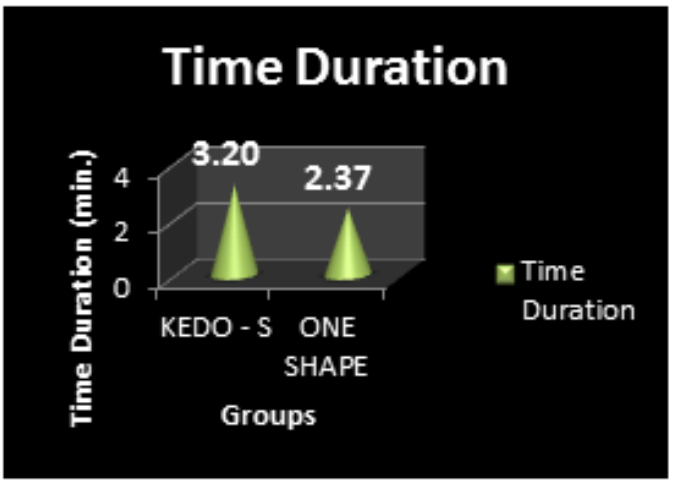
The significance of values of time taken for instrumentation with manual, reciprocation and rotary techniques was performed with Student's t-test.

Results

Mean time duration was less in ONE SHAPE group (2.37 minutes) than KEDO – S group (3.20 minutes).

Statistically, significant difference was present in time duration between two groups. ($p \leq 0.05$).

Intergrousp comparison of time duration [Figure –1]



Intergroup comparison of cleaning efficacy [Table – 2]

Area	Group	Cleaning efficacy		Z Value	p Value
		Mean	SD		
Cervical Third	KEDO – S	0.22	0.50	-2.844	p ≤ 0.05
	ONE SHAPE	0.77	0.44		
Middle Third	KEDO – S	0.33	0.50	-0.470	p > 0.05
	ONE SHAPE	0.44	0.52		
Apical Third	KEDO – S	0.22	0.44	-0.620	p > 0.05
	ONE SHAPE	0.44	0.72		
Over all	KEDO – S	0.88	0.33	-2.077	p > 0.05

Mean cleaning efficacy was better in KEDO-S file than in ONE SHAPE in cervical third which is not statistically significant.Mean cleaning efficacy was better in KEDO-S file than in ONE SHAPE in middle third which is notStatistically significant.Mean cleaning efficacy was better in KEDO-S file than in ONE SHAPE in overall area which is not statistically significant.Mean cleaning efficacy was better in KEDO-S file than in ONE SHAPE in apical third which is not statistically significant.Stereomicroscopic image of the two group [Figure – 2]

Kedo –S

One – Shape

Discussion

Throughout cleaning and shaping the root canal system is elimination of soft and hard bacteria-containing debris. Proper cleaning and shaping facilitates the irrigant to reach the apical third of the root canal, ensuring a sterile root canal for obturation.

Biomechanical preparation with manual instruments is time consuming and can result in iatrogenic errors like ledging, apical blockage zipping, and canal transportation. Alternative Rotary systems for the biomechanical procedure which diminish these complications were pursued.

Certain studies[10, 11] have reported the benefits of manual instrumentation over rotary files concerning root canal wall preparation; however, others have conveyed better results with rotary NiTi systems.

In a clinical trial (Barr ES et al 1999-2000.,) the forerunners of Ni-Ti ProFile rotary files for pulpectomy procedures, established that use of Ni-Ti files lead to a uniform and expectable obturation. This was affirmed further by (Kuo et al., 2016) who concluded that Protaper NiTi rotary files were safe and efficient for pulpectomy in primary teeth. ONE SHAPE instruments are electro polished for cutting efficacy and integrate variation of cross sections along the active length of file, which provides optimal cutting action. Although these files were designed for permanent teeth they find common application in primary teeth as well. A major concern with this practice is the predesigned greater taper which increases the prospects of lateral perforation on the inner surface of primary teeth. These teeth have curved roots, shorter, ribbon-shaped morphology, and thinner related to permanent teeth.

The KEDO -S file system (Reeganz dental care Pvt. Ltd. India) comprises of three Ni-Ti rotary files- D1, E1, U1. The total length of the files is 16 mm. The working length of the files is 12 mm. U1 has a 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. This file system must be used in a low speed (150-300RPM) constant- torque handpiece. These files have a gradual taper that aids easy coronal enlargement and straight line access. In addition it also ensures proficient canal preparation and avoids over instrumentation of the inner wall of root surface.

In the current study Mean cleaning efficacy was better in KEDO-S file than in ONE SHAPE in cervical third which is statistically significant. In agreement with our findings, (Katge F et al., 2014) concluded that the reciprocating and the rotary systems exhibited improved cleaning efficacy when compared to manual instrumentation especially, in coronal and middle one third. (Kuo et al., 2006) concluded that Protaper NiTi rotary files were safe and efficient for pulpectomy in primary teeth. (Foschi et al., 2013) reported that both the Mtwo and Protaper rotary systems shaped a clean canal in the coronal and middle thirds, but were incompetent to produce dentine surfaces free from smear layer and debris in the apical third. Mean time duration was lower in ONE SHAPE group than KEDO – S group which is statistically significant. According to (Schafer et al., 2001) and (Vahid et al., 2005) Mtwo instruments were significantly faster than other rotary NiTi files.

The benefit of KEDO-S NiTi alloy instruments is to retain the original anatomy of the curved canals in primary teeth during preparation of canal. The clockwise motion of KEDO-S rotary file pulls pulpal tissue and dentin out of the canal resulting in active cleaning of primary molar canals. The duration of canal preparation is less using KEDO-S rotary file system. This would contribute toward reduced patient and operator fatigue, causing enhanced quality of treatment. Uniform canal preparation attained using rotary files results in superior

obturations. The cost of constant torque hand-piece and Ni-Ti rotary files are the drawbacks. In the present study, we found that instrumentation Time recorded was shorter in ONE SHAPE than KEDO-S file system and it was statistically significant. The efficacy of KEDO-S file was superior to that of ONE SHAPE especially in the coronal 1/3 region.

Conclusion

Single rotary file which is specially designed for primary teeth is definitely a boon to the Pediatric dentist. Lack of adequate biomechanical preparation of root canal can be attributed to multiple factors including the type of instrumentation materials and technique, irrigation regimen as well as canal anatomy. Our study appears to support the concept that rotary files which is specially designed for primary teeth is suggested for better root canal preparation and quality of obturation in primary teeth .However further research is required.

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