A COMPARISON OF Ni-Ti ROTARY AND HAND FILES INSTRUMENTATION IN PRIMARY MOLARS

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Abstract

The aim of the study was to compare the manual and rotary endodontic instruments focusing on risk of perforation when the whole root canal length is instrumented as well as the time required for preparation in primary teeth

Fifty four teeth were divided randomly into three groups.Group I: The root canals were prepared manually with K-files. Group II : ProTaper instruments were used in a crown-down manner, Group III: The root canals was prepared with the Hero 642 system.

The perforations were made by Hero 642 was %22 and there was no significant differences between groups (P>0.05). Also there was no significant differences between primary maxillary and mandibular teeth (P>0.05) according to perforations.For maxillary and mandibular teeth, the longest time shaping time was recorded when manual technique was used (p<0.05). Also, no statistically difference was found between ProTaper and Hero 642 according to time. Finally, there was statistically significant difference between rotary and manuel techniques for time of instrumentation (p<0.05).

Care must be taken with each rotary file, for overpreparation can lead to unexpected lateral perforation, especially in severely curved canals. Rotary preparation for primary teeth was faster than hand preparation and this is very important for shorten the chairtime in pediatric dentistry.

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Introduction

One of the most important components of successful root canal treatment depends on mechanically performed root canal shaping that preserves the radicular anatomy.[1] The primary objectives of cleaning and shaping the root canal system are removing soft and hard tissue containing bacteria, providing a path for irrigants to the apical third, supplying space for medicaments and subsequent obturation, retaining the integrity of radicular structure.[2]

Root canal instrumentation may be performed with manual or rotary instruments.[3] Since most hand preparation techniques are time consuming and may lead to iatrogenic errors, much attention has been directed toward root canal preparation techniques with Ni-Ti rotary instruments.[3, 4] However, the application of Ni-Ti rotary instruments is still largely limited to permanent teeth.[5]

Despite advantages of rotary instrumentation and studies performed on primary molars, there are no clear guidelines or instructions for the suitable preparation technique of these teeth.[4] The rotary instrumentation technique for deciduous teeth was initially described by Barr et al.,[6, 7] who advocated the same principles of root canal cleaning and shaping used in rotary instrumentation of permanent teeth. Barr et al. used Ni-Ti ProFile® .04 taper rotary instruments (Dentsply/Tulsa, Tulsa, OK, USA) for primary root canal preparation and concluded that the

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use of Ni-Ti rotary files for root canal preparation in primary teeth was cost-effective and faster, and resulted in consistently uniform and predictable fillings.[7] However, they mentioned the risk of over instrumentation and perforation of thin dentin walls.[8] Also, Silva et al. reported that Ni-Ti rotary preparation for extracted primary teeth was faster than hand preparation.[8]

Therefore, the aim of the study was to compare the manual and rotary endodontic instruments focusing on risk of perforation when the whole root canal length is instrumented as well as the time required for preparation in primary teeth.

Materials and Methods

The total sample of this study comprised 54 human primary second molars (27 maxillary and 27 mandibular) extracted for reasons not related to the study. Mainly, teeth were donated by patients from oral health hospital pediatric dentistry clinics where tooth extraction is the only treatment available for teeth with compromised pulp and periradicular tissues. Others were extracted because they were unrestorable. Teeth were stored in saline solution and were immersed in 1% sodium hypochlorite for 15 min for disinfection. Coronal access was performed with a round carbide bur #02 at high speed, under cooling with distilled water. An approximate working length was terminating approximately 1mm above the root apex. Before instrumentation, the pulp chamber was copiously irrigated with 2.5% sodium hypochlorite.

All roots were selected after macroscopic examination with magnifying glasses and artificial light, on the basis of established selection criteria: minimal apical resorption with presence of at least two-thirds of remaining root structure, patent root canals, and absence of visual perforating resorption.

The teeth were then randomly divided into 3 groups. Each group contains 9 maxillary and 9 mandibulars second molar teeth:

Group I: The root canals were prepared manually with K-files (Dentsply-Maillefer, Ballaigues, Switzerland) up to a file size #30 and “step back” up to size #35. Each instrument performed nearly 15 circumferential filing movements on the root canal walls.

Group II : ProTaper instruments (ProTaper Universal, Dentsply Maillefer); (Sx, S1, S2) were used in a crown-down manner, then S1, S2, F1, and F2 up to the finishing file F3 reached the full working length. The Protaper instruments were used in in a torque- and speed-controlled endodontic motor (Endo-Mate DT, NSK Nakanishi, Inc., Tochigi, Japan).

Group III: The root canals was prepared with the Hero 642 system (Micro-Mega, Besançon,France) and a reducing 50:1 handpiece (08XE;Micro-Mega). Preparation was performed with nickel-titanium instruments with 2% and 4% taper using the crown-down technique and following the manufacturer’s instructions.

During the preparation, the root canals were irrigated, frequently with sodium hypochlorite and a water-soluble preparation containing 15% EDTA in order to reproduce normal clinical conditions.

Root canal shaping time and perforation of root was recorded for each tooth.

Data was statistically analyzed using chi-squared, Mann-Whitney U and *t* tests. The significance level was set at *P* less than 0.05. Statistical analysis was carried out using the SPSS 16.0 software (SPSS, Inc., Chicago, IL).

Results

Number and percentage of perforations according to the type of instrumentation and group of teeth are shown in Table 1. Although the perforations were made by Hero 642 was %22 and there was no significant differences between groups (P>0.05). While seven of thirty six teeth were perforated rotary instruments, three of eighteen teeth were perforated by manual instruments.

	Maxillary Molars		Mandibular Molars		Total	
	n	(%)	n	(%)	n	(%)
Manual	1	(11%)	2	(22%)	3	(17%)
ProTaper	1	(11%)	2	(22%)	3	(17%)
Hero 642	2	(22%)	2	(22%)	4	(22%)

No significant differences were found between groups (P>0.05)

Table 1. Number and percentage of perforations according to the type of instrumentation and group of teeth

Also there was no significant differences between maxillary and mandibular teeth (P>0.05) according to perforations. In the primary mandibular second molars perforations occurred in distal root canals (66%) Also in the primary

maxillary second molars fifty percent of perforations were seen in the mesiobuccal root.

The mean shaping time for maxillary and mandibular teeth is shown in Table 2 for all kinds of techniques. For maxillary and mandibular teeth, the longest time was recorded when manual technique was used ($p<0.05$). Also, no statistically difference was found between ProTaper and Hero 642 according to time. Finally, there was statistically significant difference between rotary and manuel techniques for time of instrumentation ($p<0.05$).

	Maxillary Molars	Mandibular Molars
Manual	16.2±5.7	16.4±6.1
ProTaper	7.9±4.2	8.1±5.2
Hero 642	8.4±4.8	8.5±4.9

Statistically significant differences between maual and rotary groups (P<0.05)

Table 2. Time of instrumentation (min) for the different groups of teeth and type of instrumentation

Discussion

The majority of the available papers on automated root canal preparations have focused on few systems; therefore, conclusions are difficult to draw, since comparability of the varying study design is limited.[9]

Anatomic characteristics of root canals in deciduous teeth may be dramatically changed by the presence of physiologic or pathologic root resorption,[10, 11] leading to problems related to root perforations.[3] In the study of Kuo et al.,[5] they avoided lateral perforation by using only SX and S2 files during preparation. They didn't use S1 and F series files as they said the increased taper and tip size resulted in excessive apical dentin removal in primary molars but they conclude that with teeth already undergoing physiological root resorption, the greater taper and F2 file might be a better choice than S2. In the present study, the perforation might be related the use of the F files and the absence of remaining apical structure partially contributed to the perforation.

The mesiobuccal root of primary maxillary second molars and distal root of primary mandibular second molars were at higher risk during instrumentation. These findings were in consistent with Kummer[3] et al. study. They reported that this might be explained by the tendency of the operator to perform more intensive instrumentation at the side opposite to the most favorable support.

Clinically, time efficacy in primary molar endodontics, especially with the unpredictability and difficulty of canal morphology, is invaluable. Previous studies[3, 4, 8] concluded the same findings with the present study that rotary preparation for primary teeth was faster than hand preparation. Young patients and their parents will appreciate every minute saved with rotary files.

Consequently, more research is required to determine the exact perforation reasons and to optimize instrumentation guidelines in primary teeth.

Conclusions

Care must be taken with each rotary file, for overpreparation can lead to unexpected lateral perforation, especially in severely curved canals. Rotary preparation for primary teeth was faster than hand preparation and this is very important for shorten the chairtime in pediatric dentistry.

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