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Comparison between stainless steel and nickel–titanium rotary preparation time for primary molar teeth by endodontists and pedodontists

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Objective: To compare the time taken by endodontic and pedodontic residents for stainless steel and nickel–titanium (NiTi) root canal preparation time for primary molar.

Methods: Nineteen deciduous molar teeth were selected and divided into two groups: group I instrumented with NiTi rotary files (G-files followed by Revo-S) and group II instrumented with manual K-files.

Results: The preparation time required per canal by the endodontist subgroup was 151.9±39.2 and 57.47±12.03 s in the stainless steel and NiTi groups, respectively. The preparation time required per canal in the pedodontist group was 157.5±42.5 and 68.05±15.8 s in the stainless steel and NiTi groups, respectively. There was a significant difference between the stainless steel and NiTi groups ($p<0.05$). However, there was no significant difference between the endodontist and pedodontist subgroups ($p>0.05$).

Conclusion: Within the limitation of the present study, the preparation time required in the stainless steel group was significantly shorter than that in the NiTi rotary group. However, there was no significant difference between endodontic and pedodontic residents in terms of root canal preparation time.

Keywords: Endodontist; pedodontist; root canal preparation.

The primary goal of endodontic treatment is to cure or prevent apical periodontitis.[1] Adequate shaping, cleaning, and obturation, followed by a good coronal seal, are prerequisites for a favorable outcome.[2,3] The goal of root canal preparation is to create optimized canal geometry to allow effective irrigation and obturation with preservation of the original canal morphology.[4] Stainless steel (SS) files are less suitable for negotiating curved canals due to the inherent stiffness of the alloy. Furthermore, preparation of curved canals with SS files may cause procedural errors such as straightening of canals, zipping, stripping, and perforations.[5] The introduction of rotary nickel–titanium (NiTi) files in the last 3 decades has led to a great improvement in the shaping quality and efficiency of these procedures. The use of NiTi rotary instruments has facilitated faster and easier instrumentation with better pres-

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ervation of the canal center and less procedural errors.[6] Higher rates of good quality obturation have also been observed with the increased use of rotary NiTi files.[7]

Endodontic treatment of primary teeth is relatively difficult because of the different anatomy and patient cooperation compared with that of permanent teeth. A previous study reported that root canal preparation was related to the operator's experience.[8]

The aim of the present study was to compare the SS and NiTi root canal preparation time for primary molar between endodontic and pedodontic residents. The first null hypothesis tested was that there would be no significant difference between SS and NiTi preparation time. The second null hypothesis tested was that there would be no significant difference between endodontic and pedodontic residents.

Materials and methods

Sample selection

Based on data from a previous study,[9] a power calculation was performed using G*Power 3.1 (Heinrich Heine University, Dusseldorf, Germany) software to identify the sample size for each group. The calculation indicated that the sample size should be a minimum of 20 files. Thus, 40 extracted human primary mandibular second molars were included in the present study. The teeth were extracted due to questionable prognosis for orthodontic treatment or over-retention beyond the age of exfoliation. Teeth were stored in saline with 1% thymol until the experiment. Only teeth with no evidence of previous root canal treatment, no evidence of root resorption, and similar diameters were included. Teeth having root resorption and short root length (>7 mm both distal and mesial) were excluded from the study and replaced.

Root canal preparation

After the endodontic access cavity preparation using C1 diamond-coated burs (Strauss, Ra'anana, Israel), canal orifices were located and confirmed with a #15 K-file (VDW, Munich, Germany). In addition, the size of the apical foramen of the teeth was confirmed to be <0.20 mm using a #20 K-file (VDW). The #15 K-file was advanced within the canal until the tip was seen through the major apical foramen and the working length was determined by subtracting 1 mm from the inserted length.

Stainless steel group

In the SS group (n=20), #15, #20, #25, and #30 K-files were used to the working length, and #35 and #40 K-files were used in a step-back technique along the external form of the root canal orifice. The main preparation method was based on a circumferential filing motion. Tiny-turn and pull motion was added for curved and narrowed areas that showed resistance during circumference filing. Irrigation with a total of 20-ml 3% NaOCl (Coltene-Whaledent, Allstetten, Switzerland) using a 30-gauge needle (NaviTip, Ultradent, South Jordan, UT, USA) was performed.

Nickel-titanium group

In the nickel titanium group (n=20), teeth were prepared using G-files (Micro-Mega, Besancon, France)—G1 (12/.03), G2 (17/.03), and Revo-S (25/.04)—according to the manufacturer's recommendation of 400 rpm and 1.2 Ncm torque for G-files and 300 rpm and 0.8 Ncm torque for Revo-S via VDW Gold (VDW, Munich, Germany). Irrigation was performed with a total of 20-ml 3% NaOCl (Coltene-Whaledent) using a 30-gauge needle (NaviTip, Ultradent).

Half of the teeth (n=10) in each group were instrumented by graduate endodontic residents having 5 years' experience with rotary instruments and the other half (n=10) by graduate pedodontic residents having no experience with NiTi rotary instruments. For practice, the pedodontic residents were informed about the use of the NiTi files in the present study.

Time required for gutta percha removal

A chronometer was used to calculate the time required for root canal preparation of each root canal. The total time was defined as the time between the start of the insertion of the first file into the root canal and access to the working length. The chronometer was started at the insertion of the file into the canal and stopped with its removal from the canal. Time required to prepare each canal of the teeth was measured.

Statistical analysis

Data were found to be normally distributed. Therefore, the Mann–Whitney U Test was used to analyze the differences between the groups with a significance level of $p<0.05$. All statistical analyses were performed using SPSS version 21 (IBM-SPSS Inc., Chicago, IL, USA).

Results

Thirty root canals were instrumented in each group. The means and standard deviations of the time required per

Table 1. Means and standard deviations of time (s) required for rotary and hand instrumentation

	Rotary Instrumentation	Hand Instrumentation	p
Endodontist	57.47[a,x]	151.9[b,x]	<0.05
Pedodontist	68.05[a,x]	157.5[b,x]	<0.05
P-value	>0.05	>0.05	

*Different superscript letter indicates statistically difference at p=0.05 ([a,b]for rows; [x]for columns).

canal for the SS and NiTi groups and endodontist and pedodontist subgroups are shown in Table 1. The preparation time required per canal in the endodontist subgroup was 151.9±39.2 and 57.47±12.03 s in the SS and NiTi groups, respectively. The preparation time required per canal the in pedodontist subgroup was 157.5±42.5 and 68.05±15.8 s in the SS and NiTi groups, respectively. There was a significant difference between the SS and NiTi groups ($p<0.05$). However, there was no significant difference between the endodontist and pedodontist subgroups ($p>0.05$).

Discussion

There is a common consensus among pedodontists that the operation time in pediatric dentistry should be as short as possible. The need to perform high-quality treatments under a strict limitation of time is crucial, whether the pediatric patient is under general anesthesia or treated in the dental chair with or without sedation. There is no doubt that pulpectomy of primary teeth is an effective treatment. Recent studies have reported high success rates and excellent prognosis of root canal treatment.[10,11]

The traditional and most common method of pulpectomizing primary teeth as described by Fuks et al.[12] involves the use of a series of endodontic files, which are adjusted to stop short of the radiographic apex of each canal, while using canal irrigation. Other methods of pulpectomy using rotary or ultrasonic instrumentation were described[13–15] and reported better cleaning and shaping of canals, but some drawbacks, including the cost of the equipment and learning curve needed, were present.

Primary teeth are characterized by narrow root canals with a significant curvature.[16] In these cases, clinicians may choose NiTi rotary files of small diameter and with a moderate taper that are highly flexible and not aggressive in the thin curved canals of the primary teeth. The rotary technique used in the present study included G-files for glide path followed by the use of single Revo-S files (25/.04) for minimal root canal widening for effective irrigation and obturation.

According to the present study results, the preparation time required using NiTi rotary files was significantly shorter than that using SS files. Thus, the first hypothesis of the present study was rejected. The results of the present study were similar to those of previous studies.[14,15] The shortened preparation time using rotary files is not surprising. Fewer rotary files are needed for preparation, and their activity is less time consuming and easier for the operator since they are motor powered.

According to the present study results, there was no significant difference in the preparation times of endodontic and pedodontic residents. Thus, the second null hypothesis of the present study was accepted. The operators of the procedure were endodontic and pedodontic residents having different experience with the use of NiTi rotary files. Despite the present study result, Mesgouez et al.[8] reported that the NiTi preparation time is related to the operator's experience. The different results can be attributed to the use of different types of teeth (primary vs. permanent). The preparation time required was not statistically different between the endodontist and pedodontist subgroup, suggesting a relatively easy learning process for NiTi rotary file use.

Conclusion

Within the limitation of the present study, the preparation time required for SS files was significantly shorter than that for NiTi rotary files. However, there was no significant difference between endodontic and pedodontic residents in terms of root canal preparation time.

Acknowledgments

The author denies any conflicts of interest related to this study.

Conflict of interest: None declared.

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