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Original Article

In vivo Comparison of the Duration between two Endodontic Instrumentation Techniques in Deciduous Teeth

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Abstract

Objective: To make an in vivo comparison of the amount of time required for root canal instrumentation of inferior deciduous molars either using rotary or manual techniques, and root canal filling of the same teeth. **Material and Methods:** Eight participants ranging from six to eight years of age that presented mandibular deciduous molars with root canal treatment indication were selected. Manual instrumentation with stainless steel K-files was performed in group I, and rotary instrumentation with Pro Taper rotary system was performed in group II. **Results:** T-test was used to determine mean value differences for the mesiolingual (ML) and distal (D) canals, showing no statistically significant differences ($p = 0.912$ and $p = 0.366$, respectively). The Mann-Whitney test was performed to detect mesiobuccal canal (MB) mean value differences, which were not statistically significant ($p = 0.200$). As to mean time required to perform canal filling for each group (manual and rotary) no statistically significant differences ($p = 0.715$) were found. **Conclusion:** Root canal preparation with rotary nickel-titanium instruments can be an alternative to mechanical instrumentation, although instrumentation and obturation time was not reduced.

Keywords: Deciduous dentition; Endodontics; Dental pulp..

Introduction

Primary dentition integrity and function maintenance until its physiological exfoliation is the main goal of pediatric dentistry [1].When the pulp vitality of a tooth is affected by caries, traumatic injury, or other conditions, endodontic treatment may be necessary.

The primary aim of endodontic therapy is to maintain the integraty and function of teeth and their supporting tissues [2]. Besides, successful root canal treatment of deciduous teeth contributes to the healthy development of permanent dentition and of the stomatognathic system as a whole. Deciduous tooth endodontic therapy follows the same biological principles applicable to root canals of permanent teeth [3].

The cooperation of the child during the endodontic treatment of deciduous teeth is related to several factors, among which the visit duration. A delay in endodontic technique implementation might be caused by deciduous tooth anatomical and physiological constraints, such as proximity to permanent tooth germ, irregular physiological root resorption [4], and clinical procedures. Therefore, in-depth anatomical knowledge of the area and the use of an accurate technique are necessary for a fast and efficient treatment.

Root canal instrumentation can be either accomplished with files, burns, sonic or mechanical instruments, or with rotary tools [5]. Deciduous tooth rotary instrumentation techniques should follow the same root canal cleaning and shaping principles as those for rotary instrumentation in permanent teeth [6]. The rotary technique has proven to be efficient in reducing instrumentation time in atresic curved root canals[7,8], thus allowing faster endodontic procedures; in addition, it preserves technique quality and safety, and reduces the patient's and professional's fatigue [3].

Few studies in literature have so far reported instrumentation time in deciduous dentition, most of them in vitro [5,9] or ex-vivo [3]. The aim of this study was to make an in vivo comparison between the time required for deciduous inferior molar root canal instrumentation using either rotary or manual techniques, and their influence on root canal filling time.

Material and Methods

Patient Selection

This study was approved by the Research Ethics Committee of Pelotas Dentistry School under n. 163/2010 (Federal University of Pelotas, Brazil) and an informed consent agreement was signed by parents / caretakers of children who took part in the research.

Eight 6 to 8 year-old children presenting mandibular deciduous molars with an indication of root canal treatment who attended the Pediatric Dentistry Clinic of the Federal University of Pelotas (UFPel) were selected for the study.

Only teeth that showed at least two-thirds of remaining root structure and enough coronal structure to receive absolute rubber dam isolation were included in the study. All procedures were accomplished by an endodontics and pediatrics expert, thus providing security for the rotary instrumentation procedure. Due to the homogeneity of the population (all children had deciduous

teeth with pulp necrosis), the subjects were randomly divided into two groups. An unbiased sample using the random number table was performed. Group I: manual instrumentation with stainless steel K-files (Denstsply, Maillefer, Ballaigues, Switzerland); Group II: rotary instrumentation with Pro Taper rotary system (Denstsply, Maillefer, Ballaigues, Switzerland).

A periapical radiograph was taken to establish the length of the work area (1.5 mm from the physiological root resorption limit). Teeth showing visual pathological resorptions were excluded.

Clinical Procedures

Clinical procedures were performed during two visits, so that both the approach performed at the first visit and the instrumentation and obturation collection time at the second visit could be standardized. All deciduous teeth selected had pulp necrosis.

First visit

A rubber dam was placed shortly after infiltration anesthesia had been administered. Coronal access was performed with #02 carbide (SS White, Rio de Janeiro, Brazil) and high-speed Endo Z (Denstsply, Maillefer, Ballaigues, Switzerland) burs. Afterwards, the tooth was sealed with a formocresol-soaked cotton pellet and temporary restorative material (Denstsply, Maillefer, Ballaigues, Switzerland).

Data collection

Second visit

A rubber dam was placed shortly after infiltration anesthesia had been administered. Following, coronal access was performed with a #02 carbide bur, and the cotton pellet was removed. Then root canals were previously enlarged with a #15 K file, and irrigated with 2 ml 1% sodium hypochlorite [10] at each file change [11].

Group I: Manual instrumentation involved 3 21 mm first series stainless-steel K-files. All root canals were prepared sequentially using size 20 to 30 files with a half-turn clockwise motion followed by a similar counterclockwise motion and file removal. Ten filing motions were made in the root canal walls with each of the three files [3].

Group II: Rotary instrumentation involved 3 Pro Taper (Denstsply, Maillefer, Ballaigues, Switzerland) nickel-titanium (NiTi) instruments. The files were 25 mm thick and had a 150-300 rpm working speed using a low-torque motor (VK Driller Equipamentos Elétricos LTDA, São Paulo, Brazil). NiTi instruments were introduced into the canal with a push-pull motion, and the root canals were shaped using S2, F1 and F2 files.

After each instrument was used, irrigation was performed with 2 ml 1% sodium hypochlorite for both groups [10,11]; all canals were dried with absorbent paper points.

Root canal filling was performed with iodoform-based paste [3] which was introduced up to the working length with a #20 file. The teeth were restored with resin-modified glass ionomer

(Vitremer, 3M-ESPE, St. Paul, USA). Total active instrumentation and root canal filling times, as well as duration of all procedures performed from absolute rubber dam isolation at the second visit to tooth filling (including irrigation) were recorded with a digital watch chronometer by a previously calibrated operator.

Statistical Analysis

Data were entered into a spreadsheet and statistically analyzed using Sigma Stat 3.5 (STATCON, Witzenhausen, Germany) software. Tests performed included Student's t test, Mann-Whitney test and significance level was set at 5 % ($p < 0.05$).

Results

Five of the teeth included in this study were second lower molars and three were first lower molars. All teeth had three root canals (MB, ML and D). Teeth with four canals were excluded from the study. Four children were male and four were female, and all of them behaved properly during the visits.

Figure 1 shows active rotary and manual instrumentation technique mean time for each (mesiobuccal [MB] mesiolingual [ML] and distal [D]) root canal.

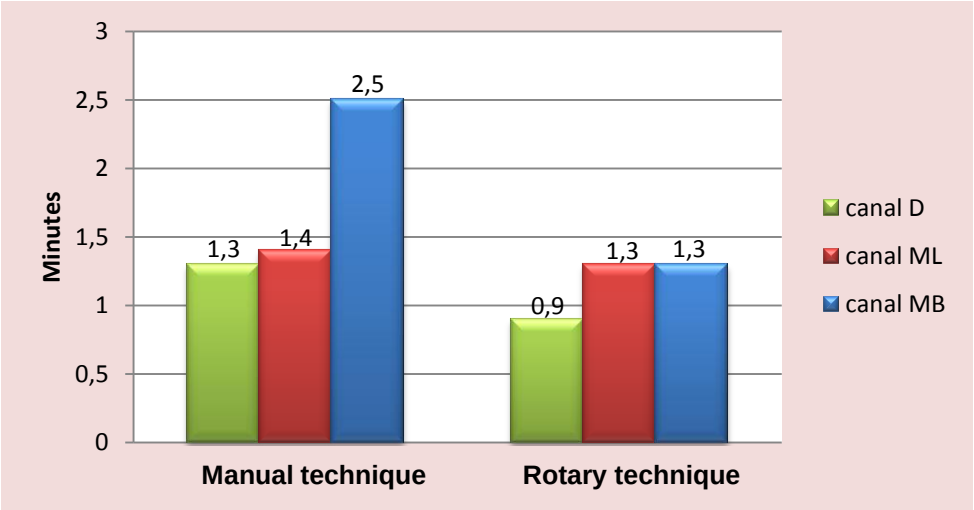

Figure 1. Active instrumentation measures of manual and rotary techniques in D, ML and MB canals.

The Student's t test showed no statistically significant differences in mean instrumentation values of mesiolingual and distal canals ($p = 0.912$ and $p = 0.366$, respectively). The Mann-Whitney test showed no statistically significant differences in mean instrumentation values for the mesiobuccal canal (MB) ($p=0.200$). Also, there were no statistically significant differences between the times of the two different instrumentation techniques ($p = 0.944$).

Figure 2 shows the mean time taken to perform root filling for each group (manual and rotary).No statistically significant differences between the two groups (p = 0.715) were found.

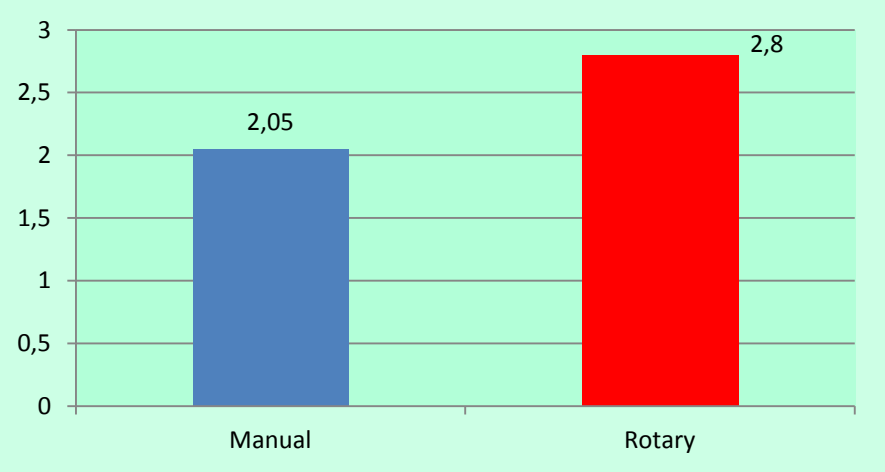

Figure 2. Mean manual and rotary technique filling times.

Total visiting mean was 22.1 minutes when the rotary technique was used, whereas it took 22.42 minutes on average with the manual technique. The manual technique showed the highest and the lowest visiting times (33.73 and 18.53 minutes, SD: 7.79). In the rotary technique, the longest visit took 23.93 and the shortest, 19.98 minutes (SD: 1.62).

Discussion

Rotary instruments can be used both to model root canals and to remove filling materials and their residues in permanent dentition [14]. In deciduous dentition, these instruments have been used with the instrumentation technique, replacing manual instruments [2]. Instrumentation by rotary technique can be as safe as that by the manual technique for deciduous dentition, once all stages are strictly followed and every care taken [3].

Both in vitro and ex vivo studies comparing the ability and time of dentin removal using nickel-titanium (Ni-Ti) rotary and manual instrumentation have been conducted. However, a detailed literature review did not detect any other in vivo studies using the rotary instrumentation technique in deciduous teeth. Nor were any studies comparing it to other techniques that took into account the instrumentation time and root canal filling found.

In the present study, there were no significant statistical differences between manual and rotary techniques as to procedure duration. Nevertheless, previous study [6] reported a time reduction during root canal preparation of deciduous teeth using the rotary instrumentation technique in two clinical cases. In an ex vivo study, some authors [3] found that, upon contrasting the rotary to the manual instrumentation technique, there was less dentin removal during root canal preparation when the former was applied, allowing a more uniform shape and shorter instrumentation time.

The results of this study suggest that root canals of deciduous teeth can be instrumented either by manual or rotary techniques in relation to visit duration. It was not possible to compare the results of the present study with other deciduous dentition in vivo studies, inasmuch as similar reports have not been found in literature. However, both in vitro [5] and ex vivo [3] studies of deciduous and permanent dentition [5] have shown a reduction in root canal instrumentation time when rotary techniques are used. The more likely explanation for not finding these differences in this study is that the rotary system used was not developed specifically for deciduous teeth. Therefore, access to the oral cavity, child mouth aperture and instrument size may have interfered in the in vivo rotary instrumentation dynamics.

Even though there were no statistical significant differences between canals, the MB canal showed the highest average instrumentation for both techniques, which was already expected due to difficulty of access to this canal. Besides, in one group I patient, MB canal instrumentation was delayed because the child was too tired and less cooperative at the end of the visit.

In theory, rotary instrumentation should give root canals a more conical shape, allowing for a better and faster deciduous tooth filling. However, rotary instrumentation did not decrease root canal filling time in this study. In addition, one may speculate that rotary instrumentation generates a higher cost to deciduous tooth treatment, as nickel titanium instruments are more expensive and require a sharper operator training [5].

Simple and efficient clinical procedures for endodontic treatment of deciduous teeth are paramount to maintain the visit as short as possible, providing more comfort to the child. Even though differences in instrumentation time and obturation improvement were not observed in this study, this should be cautiously interpreted, as the sample size was not big enough to avoid influence of random sampling variability in statistical analysis. The lack of studies that evaluate instrumentation techniques in deciduous teeth in literature reveals the need for further research on this theme. This way, new, faster and safer protocols for endodontic treatment of deciduous teeth can be developed.

Conclusion

Root canal instrumentation with rotary nickel-titanium instruments can be an alternative to manual instrumentation in pediatric dentistry. However, it does not reduce total service, root canal preparation or filling times.

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