In Vitro Comparison of Instrumentation Time and Cleaning Capacity between Rotary and Manual Preparation Techniques in Primary Anterior Teeth

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Abstract:
Objective: The aim of this study was to evaluate and compare the cleaning ability and instrumentation time of manual and rotary methods used for preparation of primary anterior teeth.

Materials and Methods: Forty-four primary anterior teeth were used in this experimental study. Access cavities were prepared and India ink was injected into the canals. The samples were divided into three groups according to the instrument and preparation technique. In group I the root canals were manually instrumented with K-files. Rotary Flexmaster instruments were used for canal preparation in Group II, and the samples in Group III (control) were not instrumented. After canal preparation, the teeth were cleared with methyl salicilate and the removal of India ink was measured in the cervical, middle and apical thirds. The incidence of file breakage and instrumentation time was recorded in the three study groups. Statistical analysis was performed using Mann-Whitney and t-tests.

Results: There was no significant difference in cleaning capacity between the two techniques, but a significant difference was found between the experimental and control groups. Working time was significantly shorter when using the rotary system. No file fracture was observed during the study period.

Conclusion: Regarding the shorter working time for rotary instrumentation and the similar cleaning ability of the two techniques, the application of the rotary system is suggested for preparation of deciduous root canals during pulpectomy.

Key Words: Root Canal Therapy; Tooth, Deciduous; Root Canal Preparation

INTRODUCTION
Endodontic treatment in primary teeth can be challenging and time consuming, especially during canal preparation which is considered as one of the most important steps in root canal therapy [1]. Considering that rotary files are more convenient to use and can facilitate root canal treatment, their application may be more appropriate in children with behavior management problems [2,3].

Manual and rotary instruments fabricated from nickel-titanium (Ni-Ti) have been developed and are known to improve the quality of the final preparation [2,3]. Several investigators have reported the advantage of preparation with rotary Ni-Ti instruments over the manual method, for both experienced and inexperienced operators [4]. Since the early 1990s, different systems have used Ni-Ti in endodontic instruments with
various designs. Engine-driven rotary Ni-Ti instruments have been suggested to offer safe preparation of root canals and decrease the working-time. Flexmaster (VDW, Germany) rotary instruments have a modified cross sectional design which is more similar to K-files. This is in contrast to most rotary instruments that demonstrate a U-shape configuration. Rotary Flexmaster instruments are claimed to cut dentin more effectively and may therefore decrease stress on the individual instruments. Rotary instrumentation in permanent teeth has proven to be efficient and provides reduced working time, greater comfort for the patient and lower risk of flare-ups. The introduction of the rotary system with Ni-Ti files for preparation of primary teeth is recent, and so far there are few studies on the efficiency of these instruments in deciduous teeth [4-9].

Mechanical preparation of primary teeth utilizing Ni-Ti rotary files was first described by Barr et al [10]. The same principles of cleaning and shaping root canals of permanent teeth should be applied to deciduous teeth. Curvatures and irregularities of the root canal walls of primary teeth can be cleaned efficiently with Ni-Ti instruments using clock-wise rotation resulting in removal of pulp tissue, dentin and necrotic residues from the canals, similar to manual filing [11,12].

The purpose of the present study was to compare the cleaning ability and instrumentation time of rotary and manual instrumentation methods in the preparation of primary anterior teeth.

MATERIALS AND METHODS
Forty-four extracted anterior primary teeth with intact roots and without internal/external resorption were chosen for this investigation. All specimens were radiographically evaluated and stored in 0.5% sodium hypochlorite for 1 week. Coronal access was made with #08 diamond fissure burs (Tiscavan, Iran). After irrigation with saline, canal lengths were determined at 1mm from the apex using K-files (Mani, Japan) with compatible diameters. A #15 file was introduced into the root canal on a vibrator and India ink was injected with a 30 gauge insulin syringe. The teeth were then divided into 3 groups according to the instruments and preparation methods. In group I (N=20), the root canals were instrumented manually with K-files up to a # 40 and stepped back to a # 55 file. Similar to Sonntag et al [4], preparation of the 20 specimens in Group II was performed with 25-mm-long flexmaster Ni-Ti rotary files (VDW, Germany) driven by an Endo IT control (VDW, Germany) very low torque-controlled low speed motor adapted to individual instruments using a modified crown down technique with 35/0.06, 35/0.04, 30/0.06 and 40/0.02 tapers. Shaping was completed with a gentle advance-and-withdraw motion. Instruments were removed when resistance was felt and changed for the next instrument. Group III (control group) consisted of 4 samples and the root canals were not instrumented. All root canals in groups I and II were prepared by the same operator who was an undergraduate student.

Normal saline (1.8 ml) was used for irrigation and instrumentation time was measured by a chronometer during both techniques. The duration of irrigation and file exchange was not calculated. Therefore the active instrumentation time was recorded and the time consumed for changing the sequence of the instruments and irrigation was disregarded. In this manner the results would actually reflect the quality of canal preparation and the effect of operator experience would be minimal.

The specimens were cleaned and placed separately in 7% chloridric acid for 2 days. The acid solution was renewed every 24 hours, until the teeth were completely decalcified. All samples were washed under running water for 8 hours and immersed in 70% alcohol for 16 hours (changed after 8 hours) followed by
80% alcohol for 8 hours, 90% alcohol for 8 hours and 100% alcohol for 24 hours (changed every 8 hours).

After dehydration, the teeth were cleared in methyl salicylate and India-ink was examined in the cervical, middle, and apical thirds, by two observers with a stereomicroscope (×6 magnification, Nikon, Japan). A 4-point scoring scale was devised as follows: (0) total clearing, the canal was completely clean and without ink; (1) almost complete ink removal, there were dots of ink in some areas of the canal; (2) partial ink removal, linear regions of ink were observable in some areas of the canal; (3) no ink removal.

Statistical analysis was performed using Mann Whitney and t-tests.

RESULTS

There was no significant difference (P>0.05) among the cervical, middle and apical root thirds after manual (group I) and rotary instrumentation (group II).

The mean (SD) time spent for instrumentation was 100.95 S (31.59) and 150.25 S (47.09) in the rotary and manual methods, respectively (P=0.0001). None of the files fractured during the study period.

DISCUSSION

One of the most important objectives of endodontic treatment is the elimination of microorganisms from the root canal system which is achieved through removal of vital tissues, residual necrotic material, infected dentin and debris. In the current study, the cleaning efficacy of two instrumentation methods was examined in the coronal, middle and apical portions of the root canals, by means of microscopic evaluation.

We did not observe a significant difference in cleaning capacity between the two instrumentation techniques, which was in agreement with the results obtained by Silva et al [12] and Barr et al [10]. File fracture did not occur in the present study, which may be due to the use of Endo IT control motor (AEU, 25VDW, USA). The unique feature of this device is precise control of the speed and torque of individual files. It also provides reverse motion in cases that a file becomes engaged in the canal wall and thus protects it from fracture. The use of such motors seems to offer the advantage of reducing breakage and increasing working safety [13].

Our results indicated a significantly shorter working time for the rotary system as compared to the manual technique. Considering that preparation time is an important clinical factor in patient management, the use of rotary instruments for pulpectomy of primary teeth is recommended.

The experience of the operator and number of instruments could be responsible for the various results reported by different investigators [14]. The present study disregarded the time of instrument exchange, thus the effect of operator experience was minimized. On the other hand, rotary instrumentation in primary teeth has several disadvantages such as higher cost of Ni-Ti instruments and possibility of file fracture. However, using the Endo IT control system can help regulate the torque and speed of the files, leading to a significant decrease in fracture rate.

CONCLUSION

According to the findings obtained in the current study, root canals of anterior primary teeth could be prepared effectively with rotary instruments. The cleaning ability of both techniques was similar, but working time was significantly shorter for the rotary instrumentation method. Further investigation should be conducted to evaluate the effectiveness of rotary instruments in primary teeth.

REFERENCES


