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ORIGINAL RESEARCH

Comparing the number of Enterococcus Faecalis and pain in necrotic second primary mandibular molar with Rotary and Manual endodontic files

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Abstract

Background: Considering the mechanical properties essential for effective root canal cleaning, this study aimed to compare the effectiveness of pediatric rotary and manual files in reducing Enterococcus faecalis bacteria and postoperative pain in root canals of necrotic primary molars.

Materials and Methods: In this clinical trial, 36 necrotic second primary mandibular molars of 6 to 8 years old children were selected. First, x-rays were performed then children were divided into two groups. In first group (A) canals were cleaned using Universal Protaper rotary files and manual endodontic files in the second group(B). For bacterial evaluation, sampling was carried out using paper points sizes 15 and 20, before and after cleaning the canals. The samples were then transferred to the laboratory. I n the second session a questionnaire was filled by parents concerning postoperative pain. A week after patients was recalled for repairing the tooth crown with a stainless steel crown. Data were analyzed using Wilcoxon and Mann-Whitney tests.(α=0.05)

Results: The pain level in group B was significantly higher than group A ($p<0.001$). Enterococcus faecalis colony count was significantly lower in group A after treatment ($p<0.001$).

Conclusion: Rotary files showed a better ability to remove Enterococcus faecalis bacteria in necrotic primary molars. Also, children were more satisfied with rotary files because of the reduction of postoperative pain.

Keywords: Pediatric rotary file, Enterococcus Faecalis, Primary molars, Post-operative Pain

Introduction

Enterococcus faecalis (E. faecalis) is a gram-positive anaerobic coccus and the most common component in root canals which has resistance to endodontic treatment. E. faecalis is seen more often in cases with failed endodontic treatment than in primary infections, Post-endodontic pain and infection have been observed with outbreaks of E. faecalis (1-3). This bacterium has the capacity to grow as a biofilm on the wall of the root canals, and it even can grow and reproduce in treated root canals bacteria. It is also referred to as a very resistant pathogen to endodontic treatments (4). The most common cause of endodontic failure is bacterial debris due to improper mechanical and chemical preparation and insufficient filling of the canal (5).

The initial stage of root canal cleaning is performed using intra-canal cleaners such as sodium hypochlorite, which is a strong antimicrobial agent that can be effective against E. faecalis and effectively dissolves pulp debris and organic components of the dentin. In the next step, as final step of cleaning, manual and rotary files are used to clean the canals, with different efficacy in removing the smear layer, root filling materials, calcium hydroxide paste, reducing the number of Candida clones and, etc. (6).

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Rotary nickel-titanium instruments have gained great popularity among dentists in recent years since they facilitate shaping canals while reducing iatrogenic errors and are more flexible than manual stainless steel instruments (7-9). The design and flexibility of NiTi rotary instruments not only preserves the original anatomy of the curved canals, but also reduces errors and makes the treatment faster and the patient cooperates more frequently. However, it requires prior training since it reduces the dentist's sense of touch. Protaper rotary systems can be a good alternative for manual files during the preparation of primary teeth root canals (8). All canal preparation techniques, even ones with apical constrictions debris might penetration to the apical area. Dentists need to pay more attention to this problem in primary teeth due to their internal and external morphology, physiological resorption, and adjacent permanent tooth buds. The apical extrusion of debris is caused by improper canal preparation technique and lack of recapitulation, which in turn leads to inflammation and postoperative pain. Rotary system causes much less debris than manual files (10).

Elmancy et al. (11) reported that the rotary Protaper was more effective than the manual file in reducing the number of E. faecalis bacteria in the infected root canal. Nair et al. (12) showed after pulpectomy of necrotic molars with rotary files, the level of pain was significantly lower than with manual files.

The mechanical properties of manual and rotary files are taken into account in root canal cleaning and root treatment is of importance in necrotic primary molars. Therefore, the purpose of this study was to compare the efficacy rotary files to manual files in regard to postoperative pain and the amount of E. faecalis bacteria in the root canals of primary molars with necrotic pulp.

Materials and Methods

This clinical trial was approved with ethics code IRCT20130812014333N208, and the study population included 36 necrotic second primary mandibular molars of 6 to 8 years old children referred to a private pediatric clinic. Inclusion criteria included children with a history of mild to moderate pain based on VAS and no history of pain relief medication consumption, good cooperation, and lack of internal and external resorption, no apical root resorption in the coronal radiograph. Exclusion criteria were non-cooperative children with systemic disease, presence of abscess and tooth resorption and too short or too long roots.

Prior to the treatment, the children were x-rayed and divided into two groups.

In the first group, the root canals were cleaned using universal dentsply protaper rotary files according to manufacture setting at speed of 350 rpm. In this group, the area in question was first anesthetized with 2% lidocaine with epinephrine and isolated. After access was made, the position of the canals was determined and the pulp tissue of the canal was removed. We used digital periapical radiography to determine the length of canals .Sterile paper point size 15 was placed in the distal canal and transferred from the tooth to thioglycolate medium (Avan Azma, Iran). Then, the root canal was filed using a Protaper rotary file (Densply, Maillefer, Switzerland) according to the instructions of the manufacturer. Then the canals were washed using normal saline (Data China). A paper point size 20 was placed in the distal canal and transferred to the thioglycolate medium and then transferred to the laboratory (13). Finally, the canals were obturated using Metapex Metabiomed paste (Meta, South Korea) and VAS was given to the parents of the children participating in the study to evaluate the level of postoperative pain, and the questionnaires were collected in the second treatment session.

In the children of the second group, manual files were used to clean the canals. For this purpose, after determining the canal length from the graph, the canals were cleaned by moving the endodontic file (manual file size 10). Then, the canals were cleaned with files No. 15, 20, and 25, and if there is a palatal canal or a large distal canal, the canal cleaning was completed using file No. 30 (k file mani) with a length of 21 mm. Then the canals were obturated using Metapex Meta Biomed. In the children of this group, normal saline was used to wash the canals, and like the first group, before filing and after the cleaning of the canals, sampling was carried out using paper points sizes 15 and 20. The samples were then transferred to the laboratory, and the questionnaire were collected in the second session. The pre- and post-treatment samples underwent streak culture and were incubated in 10 ml of thioglycolate (Avan Azma, Iran) in a blood agar culture medium (Merck, Germany). Then, E. faecalis colonies were visually counted based on cfu/ml (13). Finally, the number of colonies before and after treatment were compared.

The pain intensity was determined and recorded using VAS. VAS is a criterion that measures the level of pain

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felt by patients on a graduated line that is graded from zero to 10. In this scoring system, the patient can choose 0 (no pain), 1 (mild pain), 2 (moderate pain), 3 (severe pain) and 4 (very severe pain) (14).

The normality of the data distribution was confirmed by the Kolmogorov–Smirnov test, and the data were analyzed using Mann-Whitney and Wilcoxon statistical tests in SPSS ver. 25. P-value<0.05 was also considered as the significance level.

Results

The Mann-Whitney test was used to assess the amount of pain and Enterococcus faecalis colony in rotary file and manual file groups. The results showed that the mean pain after treatment in the manual group increased significantly compared to the rotary group (P<0.001). The mean colony of E. faecalis before treatment was significantly different between the rotary and manual groups (P<0.001), that is the colony value was lower in the manual group. There was a significant difference between the rotary and manual groups in terms of mean colony forming units of E. faecalis after treatment (P<0.001), that is the colony amount was lower in the rotary group (Table 1).

Table 1. Mean pain and Enterococcus faecalis colony in two groups of rotary file and manual file

Variable		Sample size	Mean± SD	P value
Level of pain	Rotary group	18	0.22±0.43	<0.001
	Manual group	18	2.22±0.43	
Enterococcus faecalis colony before treatment	Rotary group	18	1344916.67±2606119.44	<0.001
	Manual group	18	30888.89±62167.60	
Enterococcus faecalis colony after treatment	Rotary group	18	288.89±805.05	<0.001
	Manual group	18	1411.11±2088.73	

The Wilcoxon test was also used to compare the mean colony forming units of E. faecalis before and after treatment in manual and rotary files. The results showed a significant decrease in the mean colony in both groups after treatment compared to the pre-treatment phase (P<0.001) (Table 2).

Table 2. Mean Colony of Enterococcus faecalis before and after treatment in manual and rotary file groups

Variable	Manual	Rotary
	Mean± SD	Mean± SD
Before treatment	30888.89±62167.6	1344916.67±2606119.4
After treatment	1411.11±2088.7342	288.89±805.04942
P-value	<0.001	<0.001

Discussion

The removal of microorganisms from the root canal system is necessary for successful endodontic treatment, among which the removal of E. Faecalis is of particular importance because this gram-positive anaerobic bacterium is commonly isolated from endodontically treated teeth with peri radicular lesions (15). Mechanical instrumentation, if used effectively, plays an important role in root canal cleaning (16).

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The results of the present study showed a significant difference between the amount of pain after treatment and the amount of reduction of E. faecalis bacteria by using Protaper and manual rotary files, and rotary files outperformed manual files.

Apical debris extrusion is common across all canal preparation methods, but the amount of apically extruded debris varies. A lesser amount of apical debris extrusion indicates a better treatment result.

The patient experiences less pain when a rotary file is used because it removes less debris from the apical end. This is due to the fact that the coronal preparation is performed first, resulting in less debris being packed apically. In a review and comparative study by Tyagi et al. (17), the levels of pain and cooperation among children with necrotic primary teeth were examined, comparing the use of manual, rotary, and reciprocating files.

In a comparative study of pain levels following pulpectomy of necrotic primary molars, Nair et al. (12) concluded that the pain experienced in endodontically treated necrotic primary teeth was significantly lower when rotary files were used compared to manual files. Similarly, Poonacha et al. (18) reported that children treated with manual files experienced significantly more pain than those treated with rotary files.

Govindaraju et al. (19) also stated in their study that the manual file takes much more time to clean the root canal. The results of these studies, which indicate a more tangible reduction in pain level when using a rotary file compared to a manual file, are consistent with the results of the present study. The removal of microorganisms from the root canal system is one of the principles in successful endodontic treatment, among which the removal of E. Faecalis is particularly important because this facultative anaerobic gram-positive bacterium is commonly isolated from endodontically treated teeth with peri radicular lesions (14).

In the present study, manual files showed poorer results than rotary files in reducing E. Faecalis colony. This could be due to the difference in the skillful use of manual tools by the operator, the skill of the dentist, and the lower file diameter of the manual instrument, while the rotary file has a higher file diameter and does not depend on the operator, and a larger surface of the tooth will be involved during preparation.

In the study of rotary instruments in pediatric dentistry, Chauhan et al. (20) stated that the rotary system, considering its high flexibility, not only maintains the anatomy of curved root canals, but also reduces technical errors, accelerates root cleaning and treatment steps, and increases the cooperation of the patient. All of these properties are of great importance in pediatric dentistry, compared to manual files. Ochoa-Romero et al. (21) investigated the effect of four types of NiTi manual files and MTWO, Race, and Pro Taper rotary files on reducing the amount of E. Faecalis in maxillary first molars. They concluded that all rotary files reduced the E. Faecalis colony, but the Pro Taper files were more effective. Pinheiro et al. (22) also stated in their study that all the tested techniques are capable of significantly reducing the number of E. faecalis, with the difference that the hybrid technique led to the greatest reduction of bacteria inside the canal and thus demonstrated a statistically significant difference with the manual method. Compared to rotary and hybrid, manual resulted in the lowest amount of debris and the highest amount of smear layer. They concluded that NiTi rotary files are a suitable alternative for the treatment of primary teeth, which are consistent with the results of the present study.

Labivala et al. (23) and Elmancy et al. (11) indicated that rotary files are more effective at removing E. faecalis compared to manual files, which aligns with the findings of the current study. This increased effectiveness may be attributed to the rotary file's closer proximity to the canal wall, which enhances the penetration of the washing solution and improves the flushing action.

Conclusion

Rotary files are more effective in removing E. faecalis when treating necrotic primary molars. Children who were treated with rotary files reported less pain and greater satisfaction with their endodontic treatment.

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