RANDOMIZED CONTROL TRIAL

Postoperative Pain After Root Canal Preparation with Hand and Rotary Files in Primary Molar Teeth

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Abstract: ***Purpose:*** *The purpose of this study was to evaluate the intensity and duration of postoperative pain after root canal preparation of primary maxillary molar teeth using two preparation techniques.* ***Methods:*** *A total of 110 patients requiring pulpectomy for asymptomatic primary molar teeth with non-vital pulps were included in the study. The patients were randomly assigned to two groups of 55 patients each, according to the canal preparation method used. In Group one, teeth were prepared up to size 35 with hand files. In Group two, teeth were prepared up to size 35 with Revo-S rotary instruments. Following canal preparation, teeth were obturated with zinc-oxide eugenol paste and then permanently restored. The presence of postoperative pain was assessed after six, 12, 24, 48, and 72 hours and after one week, using a four-point pain-intensity scale.* ***Results:*** *Except for those assessed after 72 hours and one week, patients who had their teeth prepared with hand files reported more intense postoperative pain than those who had their teeth prepared with Revo-S rotary files (P<0.05). In both groups, postoperative pain decreased over time.* ***Conclusions:*** *Hand files caused more postoperative pain after pulpectomy in primary maxillary molar teeth compared to the rotary system.* *(Pediatr Dent 2017;39(3):192-6) Received October 22, 2016 | Last Revision February 22, 2017 | Accepted March 7, 2017*

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Endodontic treatment in primary teeth can be challenging and time consuming, especially during canal preparation, which is considered one of the most important steps in pulpectomy. Although the morphology of root canals in primary teeth renders endodontic treatment difficult, pulpectomy of primary teeth with severe pulpal involvement should be considered as the treatment of choice.[1]

The most common complications from pulpectomy, postoperative pain, and/or swelling, which commence a few hours or days after treatment, are always unpleasant experiences for both patients and clinicians.[2] The apical extrusion of infected debris during root canal instrumentation may worsen the inflammatory response and cause periradicular inflammation.[3] However, with the development of nickel titanium (**NiTi**) rotary systems, reduced extrusion of debris has been reported in previous studies comparing NiTi rotary instruments and hand files.[4,5] Barr et al.[6] were the first to undertake mechanical preparation of primary teeth utilizing NiTi rotary files. They determined that the use of NiTi rotary files for root canal preparation in primary teeth was cost effective and faster and resulted in consistently uniform and predictable fillings.

Several studies have evaluated the effect of the canal preparation method used on the intensity and duration of postoperative pain in permanent teeth.[7-10] However, there is no study evaluating intensity and duration of postoperative pain after pulpectomy in primary teeth. Therefore, the purpose of this study was to evaluate intensity and duration of postoperative pain after pulpectomy in primary maxillary molars.

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Methods

This randomized clinical trial was approved by the Ethics Committee of Erciyes University of Medical Sciences, Kayseri, Turkey. Based on data from a previous study,[8] results of a power calculation revealed that the sample size for each group was a minimum of 50. This value had been determined by projecting the power as 0.91, effect size equals 0.713, and a significance level of 0.05. Finally, 55 participants in each group were selected for this study, allowing for loss due to no follow-up.

The patients' parent(s) were given adequate information regarding the required treatment. Participation in the study was voluntary, and written consent was obtained from the parents. This clinical study included 110 volunteer patients between six and eight years old with no systemic diseases and no history of taking analgesics 12 hours before pulpectomy treatment. Patients with physical or psychological disabilities or inability to understand study instructions were excluded. Only asymptomatic primary maxillary molar teeth with more than two-thirds of the root length remaining and with a diagnosis of pulp necrosis caused by carious exposure were included in the study. Periapical status was examined via periapical radiographs. Radiographic examination revealed the absence of a periapical lesion and interradicular radiolucency.

Pulpectomies for all patients were performed in a single visit by an experienced clinician, who was blinded to the purpose of the study. All patients who agreed to participate in the study were randomly divided into two groups of 55 patients each, according to root canal preparation method. To randomize the patients, each patient was assigned a number. The numbers in each group were written on paper, and each one was kept in a sealed envelope. Each patient's parent was blinded to the aim of the study, and asked to choose one of the envelopes used to assign the child to one of the groups on the basis of the number. Allocation was completed by a trained dental assistant who was blinded to the study procedures in order to

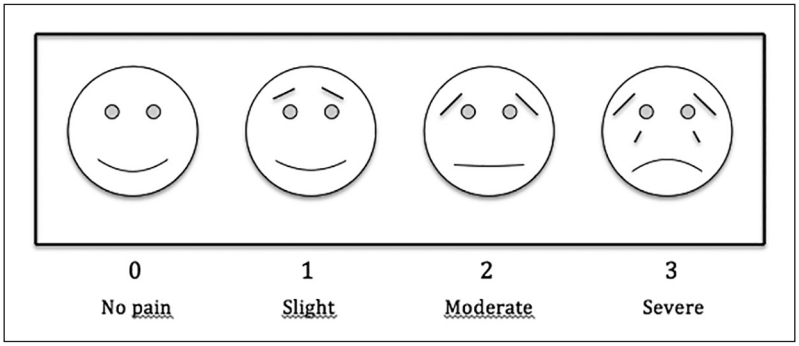

Figure 1. Pain scale used in this study.

Table 1. DEMOGRAPHICS AND CLINICAL FEATURES OF PATIENTS RECEIVING TWO DIFFERENT ROOT CANAL PREPARATION TECHNIQUES

	Hand file	Revo-S	*P*-value
Gender			
Girl	26	27	0.42*
Boy	28	29	0.35*
Age (years)			
Mean±SD	7±0.2	7±0.1 0.81*	

* *P*>0.05, statistically not significant; SD=standard deviation.

prevent bias. After application of a topical anesthetic, the teeth were anesthetized with a local anesthetic solution containing four percent articaine with one in 200,000 epinephrine (Ultracaine DS fort; Hoechst-Marion Roussel, Frankfurt, Germany). Following rubber dam isolation, caries removal and the initial access opening were accomplished with sterile high-speed burs (Dentsply Maillefer, Ballaigues, Switzerland). The necrotic pulp was ultimately confirmed by absence of hemorrhage in the canal. The cavity access preparation was completed, and the canal orifices were localized. Working length (**WL**) was determined using an electronic apex locator (ProPex Pixi; Dentsply Maillefer)[11]. The WL of each root canal was set at one mm shorter than the '0.0' mark of the ProPex Pixi apex locator.

For the hand file preparation group (N equals 55), 29 primary maxillary first molars and 26 primary maxillary second molars were treated. The root canals were prepared up to size 35 with K-files (Dentsply Maillefer) using the balanced force technique, as described by Roane et al.[12] The canals were irrigated with two mL of one percent sodium hypochlorite (**NaOCl**) between each file size, using a syringe and a 29-gauge double-side port NaviTip irrigation needle (Ultradent, South Jordan, Utah, USA).

For the next group (N equals 55), 28 primary maxillary first molars and 27 primary maxillary second molars were treated. The root canals were prepared using Revo-S rotary files (Micro-Mega, Besancon, France) up to master apical size 35. The files were used at 300 rpm in a sequence of SC1, SC2, SU, AS 30, and AS 35. SC1 was used to enlarge the coronal two thirds of the canal. The other instruments were used to the WL. The canals were irrigated in the same fashion as the hand file group. The root canals were then dried with paper points and obturated with zinc oxide eugenol paste. The paste was inserted into the root canals using a lentulo spiral at low speed. The quality of the obturation was evaluated by periapical radiography, and the teeth were then permanently restored by composite filling material.

A questionnaire was given to the participants' parent(s) for the purpose of asking their children the intensity of pain post-operatively at six, 12, 24, 48, and 72 hours, and at one week after the RCT pulpectomy was completed. All participants and their parents were trained to use the pain-intensity scale by an investigator blinded to the study groups. To ensure standardization, the participant's pain intensity at all time intervals was noted by his/her same parent. Each patient was given a prescription for ibuprofen (if contraindicated, paracetamol), with instructions to take only if needed for severe pain. Post-operative pain was measured using a four-point pain intensity

Table 2. FREQUENCY AND PERCENTAGE OF POST-OPERATIVE PAIN IN PATIENTS RECEIVING TWO DIFFERENT ROOT CANAL PREPARATION TECHNIQUES

Frequency	Pain score	Hand file (N=53) N (%)	Revo-S (N=53) N (%)	*P*-value
6 hours				
	None	16 (30.1)	25 (47.1)	<0.05
	Slight	20 (37.7)	16 (30.1)	
	Moderate	17 (32.07)	12 (22.6)	
	Severe	0 (0)	0 (0)	
12 hours				
	None	22 (41.5)	30 (56.6)	<0.05
	Slight	18 (33.9)	13 (24.5)	
	Moderate	13 (24.5)	10 (18.8)	
	Severe	0 (0)	0 (0)	
24 hours				
	None	27 (50.9)	34 (64.1)	<0.05
	Slight	15 (28.3)	10 (18.8)	
	Moderate	11 (20.7)	9 (16.9)	
	Severe	0 (0)	0 (0)	
48 hours				
	None	30 (56.6)	41 (77.3)	<0.05
	Slight	14 (26.4)	7 (13.2)	
	Moderate	9 (16.9)	5 (9.4)	
	Severe	0 (0)	0 (0)	
72 hours				
	None	43 (81.1)	45 (84.9)	>0.05
	Slight	10 (18.8)	8 (15.09)	
	Moderate	0 (0)	0 (0)	
	Severe	0 (0)	0 (0)	
1 week				
	None	53 (100)	53 (100)	>0.05
	Slight	0 (0)	0 (0)	
	Moderate	0 (0)	0 (0)	
	Severe	0 (0)	0 (0)	

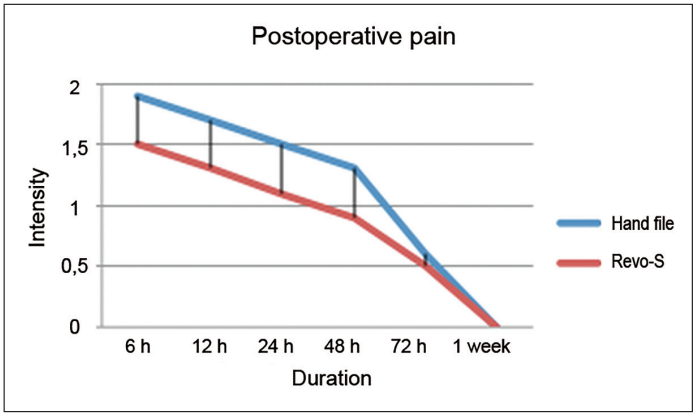

Figure 2. Mean postoperative pain scores of groups at the various time intervals.

scale.[13] The four pain categories were: (1) zero–no pain; (2) one–slight pain; (3) two–moderate pain; and (4) three–severe pain (Figure 1). One week after the root canal filling, the patients returned to the clinic with their questionnaire forms.

Independent sample *t* tests were used to compare the intensity and duration of postoperative pain for the two groups at each time interval. Statistical analyses were performed using SPSS 20.0 software (SPSS Inc., Chicago, Ill., USA). Statistical significance was set at $P<0.05$.

Results

This study included 57 (52 percent) boy and 53 (48 percent) girl patients (Table 1). Four patients (two from each group) were excluded from the study, because they did not attend the recall visit and could not be contacted. The mean postoperative pain scores associated with each canal preparation technique at the various time intervals are shown in Table 2. No patient reported severe pain, resulting in the use of analgesic, at any of the time intervals assessed. At six, 12, 24, and 48 hours, the intensity of pain experienced by patients in the hand file group was significantly higher than in the Revo-S group ($P<0.05$). At 72 hours and at one week, there was no significantly difference between the hand file and Revo-S groups in terms of pain severity ($P>0.05$). In both groups, the highest postoperative pain scores were recorded six hours after the postoperative pain scores and decreased over time (Figure 2).

Discussion

Pulpectomy is the treatment of choice for primary teeth with necrotic or irreversibly inflamed pulps. Root canal preparation is the most time-consuming step of pulpectomy, especially in pediatric dentistry.[14] This study evaluated the effects of two canal preparation techniques on postoperative pain following pulpectomy in primary molars. Su et al.[15] determined that the intensity of pain after single-visit pulpectomy treatment was significantly lower than that for patients who received multiple-visit pulpectomy treatments. In the current study, the pulpectomy was completed in a single-visit based on the results of two systematic reviews.[15,16]

It should be noted that there is no study evaluating the incidence of postoperative pain after pulpectomy in primary teeth, and the two reviews revealed the findings of studies performed in permanent teeth. Risso et al.[17] stated that the limitations of the research evaluating postoperative pain are related to the difficulty and differences in the study designs, preoperative conditions of the tooth, treatment protocol, definition of pain, pain measurement, and collection methods of results. Additionally, there may be other limitations of these studies. Different situations can complicate distinguishing the source of pain, such as pain caused by a rubber dam or matrix/wedge, or the pain caused by the composite restoration of heavy occlusal contacts, especially in child patients. Arias et al.[18] stated that one of the main problems in studies evaluating pain is the patient's subjective evaluation and its measurement. Therefore, questionnaire design is critical and should ensure that it will be fully understood by patients and easily interpreted by investigators. The study design was explained in detail to each participant's parent(s) because the present study was conducted on pediatric patients. This study included primary molar teeth that had asymptomatic pulp necrosis to ensure standardization and to eliminate variables such as tooth type, preoperative pain, and preoperative condition of pulp. All treatment procedures were performed by one operator and pain measurement was evaluated via the scale used in many previous studies.[13,19,20]

Kielbassa et al.[21] stated that measurement of the apex locator is not affected by tooth type, apex morphology (with or without resorption), or clinical condition of pulp. Many studies on the use of an apex locator in primary teeth found them to be highly accurate in teeth with and without root resorption.[22-24] In the present study, the WL was determined using an electronic apex locator.

The American Academy of Pediatric Dentistry recommends one percent NaOCl and/or chlorhexidine as the irrigation solution during a pulpectomy in primary molars, because the chemomechanical procedure with an inert solution alone cannot adequately reduce the microbial population in a root canal system.[25] The higher concentration of NaOCl is not recommended during pulpectomy in primary teeth because of the open root apex, which depends on physiological resorption. In the present study, therefore, one percent NaOCl was used as the irrigation solution during canal preparation.

Recently, canal preparation using a NiTi rotary system in primary teeth has gained popularity because of such advantages as decreased preparation time, promotion of a more uniform filling, and minimization of errors compared to hand files.[25,27] Soares et al.[28] reported that, in primary teeth, rotary instrumentation provided superior canal cleanliness and required less time for completion of canal preparation compared to hand files. It has been shown that the crown-down technique is associated with less debris extrusion compared with other preparation techniques. The crown-down technique is used with many NiTi rotary systems during root canal preparation.[29] Therefore, it is possible that early preflaring is associated with less debris extrusion and postoperative pain. All preparation techniques cause apically extruded debris during root canal preparation, even if the preparation ends shorter than the apical terminus.[30,31]

Additionally, the apical extrusion of debris could occur more easily due to physiological root resorption in primary teeth compared to permanent teeth that have a mature apex. It is well-known that apically extruded debris is one factor that contributes to postoperative pain and swelling after pulpectomy.[32] In the present study, the intensity of postoperative pain after pulpectomy were significantly higher in patients in the hand file group than those in the Revo-S group. Topçuoğlu et al.[33] evaluated the amount of debris extrusion during root canal preparation in primary molar teeth using hand files and three different rotary files. They determined that hand files extruded

more debris than the Revo-S file. This may explain why the hand files group experienced greater postoperative pain compared to the Revo-S group.

The greatest postoperative pain level occurred at six hours after treatment; it is thought that this may be due to the time required for the effects of the anesthetic to completely dissipate. Pain scores decreased over time. This is compatible with the findings of previous studies evaluating the incidence and severity of postoperative pain at different time intervals after pulpectomy.[2,8,34]

Conclusions

Based on this study's results, the following conclusions can be made:

1. Canal preparation with hand files causes more intense postoperative pain compared to the Revo-S rotary system.
2. In primary molar teeth, rotary systems could be considered as a means to decrease the intensity of postoperative pain.
3. Further studies evaluating the effect of several variables on postoperative pain during pulpectomy of primary teeth are required.

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