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Postoperative Pain after Single-Versus-Multiple Visit Root Canal Treatment in Teeth with Vital or Non-Vital Pulp in a Turkish Population

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ABSTRACT

Postoperative pain is one of the most common complications following Root Canal Treatment (RCT) and visit number has been associated with intensity of pain. This study aims to compare the effect of single and multiple-visit RCT in vital versus non-vital teeth on postoperative pain and determine relationships between postoperative pain and pulp vitality, tooth type and gender in a Turkish population by using Visual Analogue Scale (VAS). Three hundred teeth were divided into two groups randomly. Group 1 had root canal treated teeth in a single-visit, while Group 2 had teeth that treated in multiple-visits. The RCT procedures were standardized, except the calcium hydroxide medicament used in multiple visit group. Subjects were recalled at 24, 48 and 72 h after obturation to record VAS scores. There was no statistically significant difference between Group 1 and Group 2 regarding the incidence of postoperative pain ($p>0.05$). Comparison of pain levels regarding pulpal status showed no significant difference between groups ($p>0.05$). In the light of these findings it can be concluded that, the intensity of postoperative pain after single or multiple visit root canal treatment does not depend on pulpal vitality.

Key words: Postoperative pain, single visit root canal treatment, visual analogue scale

INTRODUCTION

Postoperative pain is one of the primary problems in endodontic therapy and an unpleasant situation for both patient and clinician. According to patients, pain is a strong predictor for performance of RCT. When an unexpected pain is experienced, patient's confidence to dentist is undermined. However, etiology of pain is multifactorial and has not been determined precisely yet (Glennon *et al.*, 2004).

Pain after endodontic procedures is not an uncommon finding. Prevalence of postoperative pain after endodontic treatment has been reported to range from 3% and to more than 50%. Factors that play role in progression of postoperative pain are mechanical, microbial and chemical injury mechanisms as well as psychological influences (Seltzer and Naidorf, 1985). Postoperative pain has been associated with degree of preoperative symptoms, age, gender, type of tooth, dental anatomy, presence and size of periapical lesion, history of allergies, presence of sinus tract, vitality of dental pulp, use of intracanal medications and localization of tooth in numerous studies (Torabinejad *et al.*, 1988; Mor *et al.*, 1992; Rimmer, 1991; Bhagwat and Mehta, 2013).

Relationship between postoperative pain and completion of RCT in single or multiple visits has been investigated and different results have been reported. One study reported that postoperative

pain levels were significantly higher than single visit groups, especially in teeth with non-vital pulps (Albashaireh and Alnegrish, 1998). However, there are studies reporting no significant difference between visit numbers and postoperative pain in teeth with vital versus non-vital pulps (Fava, 1989; Ince *et al.*, 2009). Conventionally, endodontic treatment is performed in multiple visits with medication between root canal preparation and obturation protocols to maximize the bacterial eradication; therefore multiple visit RCT is accepted as a safe and approved choice of treatment especially teeth with periradicular pathosis (Sathorn *et al.*, 2009; Vera *et al.*, 2012). However, there are disadvantages of multiple visit RCT, such as the risk of recontamination of root canal system through the poor seal of temporary filling or breakage of temporary filling and higher flare-up incidence (Walton and Fouad, 1992; Imura and Zuolo, 1995).

Single visit RCT gained popularity due to patient acceptance and being time saving and economical (Fava, 1989; Inamoto *et al.*, 2002; Figini *et al.*, 2007). Recent advances in rotary nickel-titanium systems, irrigation dynamics and delivery systems along with other advantages including better patient tolerance, reduction of interappointment infection risks made single visit RCT a popular and acceptable treatment regime (Figini *et al.*, 2007). In vital cases, it is proven that pulp is infected superficially and infection rarely reaches the apical portion, therefore one visit RCT is indicated (Reeves and Stanley, 1966). Efficacy of one visit RCT of teeth with non-vital pulps to eradicate bacteria was reported to be controversial, especially in apical periodontitis cases, which usually all root canal system is infected (Fava, 1989). Recently introduced optimized single visit disinfection approach aims to reduce bacterial populations after chemomechanical procedures to levels undetectable by culture techniques in a single visit and showed promising results by using iodine potassium iodide and e chlorhexidin as final irrigant and photodynamic therapy to disinfect root canals, however, it also showed inconclusive results (Siqueira and Rocas, 2011).

Visual Analogue Scales (VAS) are used in clinical research to determine the intensity of subjective symptoms particularly pain are shown to have validity for assessment of pain intensity (Paul-Dauphin *et al.*, 1999). VAS is a 10 cm straight horizontal line with “no pain” at one end and “worst possible pain” at the other end. Patients rate their pain intensity by marking a mark on scale and VAS is scored by measuring the distance from the “no pain” end on the line (Jensen *et al.*, 2003).

There are few studies on postoperative pain after single or multiple visit RCT in Turkish population (Ince *et al.*, 2009). Aim of this clinical study was to compare the effect of single and multiple visit RCT in vital versus non-vital teeth on postoperative pain and to determine the relationships between postoperative pain between pulp vitality, tooth type and gender in a Turkish population by using visual analogue scale.

MATERIALS AND METHODS

Ethics committee approval: Outline of present clinical study was approved by Ethics Committee of University (no: 539). All the subjects were treated in accordance with the Helsinki Declaration of 1975 as revised in 2002. Written informed consent form was obtained from all subjects after clinical procedures and risks were explained and all questions raised by patients were clarified.

Subject selection: Three hundred patients with teeth requiring RCT were recruited from the regular pool of patients presenting to the Ondokuz Mayıs University Department of Endodontics. Two research assistants in the Department of Endodontics provided all RCTs. Patients, who were younger than 18 years, pregnant, taking antibiotics or corticosteroids at the time of treatment or immunocompromised were excluded from the study. Patients, who had multiple teeth requiring RCT were excluded to eliminate the possibility of referral pain.

Clinical procedures: Relevant features and condition of each subject were recorded, which were; personal information, medical and dental history of patients, tooth type and vitality. By preoperative periapical radiographic examination teeth with periapical pathosis, calcified canals and immature roots were stated and excluded from the study. Pulp vitality was based on both the result of electric pulp test (Parkell Digitest D626D, Farmingdale, NY, USA) and ultimately clinical observation of hemorrhage in the canal while opening access cavities. Teeth were considered to be vital if hemorrhage was observed. Both vital and non-vital teeth were included with only condition that being asymptomatic.

Random division of study subjects occurred after informed consent but before the initiation of treatment. Consequently, 150 patients received single-visit RCT (Group 1), whereas 150 patients received multiple-visit RCT (Group 2). Group 1 included 80 vital and 70 non-vital teeth, whereas Group 2 included 78 vital and 72 non-vital teeth.

In both groups, standard procedures were applied. Following administration of local anaesthesia with 4% Articaine containing 1:100,000 epinephrine (Ultracaine DS Forte; Aventis Pharma, Istanbul, Turkey), a rubber dam was applied. Endodontic access cavity was prepared, canals were located and pulp tissue was removed with a barbed broach. The working length was determined by Root ZX mini apex locator (J. Morita, MFG. Corp. Kyoto, Japan) and periapical radiographs. Canals were prepared with ProTaper Universal rotary nickel-titanium files (Dentsply Maillefer, Ballaigues, Switzerland) according to manufacturer's instruction. Usage of each file was followed by irrigation with 2 mL of 5.25% NaOCl (Sultan Chemists INC., Englewood, USA) in a disposable syringe with a 27-gauge needle (Life set, Hamburg, Germany). The smear layer was removed by using 17% EDTA (Vista dental products, Inter-med Inc, Racine, WI, USA) in the canal for 1 min followed by irrigation with 4 mL of 5.25% NaOCl. Canals were dried with sterile paper points. In Group 1 root canals were obturated with gutta-percha points (Diadent; Diadent Group International, Korea) and AH Plus root canal sealer (Dentsply, Maillefer, Ballaigues, Switzerland) using cold lateral compaction technique. In Group 2, canals were dressed with calcium hydroxide containing medicament paste (Metapaste, Meta Biomed Co, Cheongju City, Korea) and access cavities were sealed with sterile dry cotton pellets and minimum of 3-4 mm of temporary filling material (Cavit G, 3M ESPE Dental AG, Seefeld, Germany). In Group 2, one week after the initial visit the teeth were isolated with rubber dam, the temporary restoration was removed, canals were irrigated with 5.25% NaOCl, dried with paper points and obturated with gutta-percha points (Diadent, Korea) and AH Plus root canal sealer (Dentsply, Switzerland) using cold lateral compaction technique. The quality of the root fillings was evaluated by periapical radiographs, immediately. Patients were not prescribed any systemic medication during or after endodontic treatment.

Pain measurement: Patients were informed to use Visual Analogue Scale (VAS) and given standardized scripts (Fig. 1).

This study used a VAS that was a 10 cm straight horizontal line with “no pain” at one end and “worst possible pain” at the other end. Patients were instructed to place a mark on the horizontal

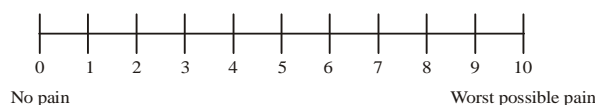


Fig. 1: Visual analogue scale used in the study

scale to represent the intensity of pain they experienced. Each patient assigned a value between 0 and 10 on the VAS script. Patients were recalled at 24, 48 and 72 h to record pain levels they experienced on VAS forms at clinic.

Differences between groups were analyzed by Mann-Whitney U test, while effect of pulpal status, patient gender and tooth type on postoperative pain scores were analyzed by chi-square test. The significance level was set at 5%.

RESULTS

A total of twelve patients which 10 of from Group 1 and two of from Group 2, were excluded from the study, because they failed to attend postoperative reviews. Data were obtained from remaining 288 patients. One hundred and forty patients had RCT performed in single appointment (Group 1), whereas one hundred and forty eight patients had RCT completed in two appointments (Group 2). The distribution of patients and treated-teeth according to pulp vitality, gender, tooth type and visit numbers are detailed in Table 1.

There was no significant difference in the incidence of postoperative pain at all intervals between the two groups (Table 2) ($p > 0.05$). Majority of patients from both groups reported no pain after obturation. The intensity of pain gradually reduced over the follow-up period. A comparison of pain levels regarding to pretreatment pulpal vitality showed no significant difference at 24th and 48th time intervals ($p > 0.05$), while at 72nd time interval teeth with non-vital pulps showed higher incidence of postoperative pain than teeth with vital pulps ($p = 0.636$).

Between 175 female and 113 male patients, no significant difference was detected related to postoperative pain levels ($p > 0.05$) (Table 3).

Table 1: Distribution of subjects according pulpal status, tooth type and gender

Variable	Groups	N	%
Pulpal Status	Vital	150.0	52.02
	Non-vital	138.0	47.08
Tooth type	Anterior	68.0	23.61
	Premolar	98.0	80.33
	Molar	122.0	42.36
Gender	Male	113.0	39.24
	Female	175.0	60.76

Table 2: Mean and standard deviation values of VAS scores of subjects according to experimental groups and gender

Time intervals (h)	Gender					
	Experimental groups		Group 1		Group 2	
	Group 1	Group 2	Female	Male	Female	Male
24	1.63±0.57	1.19±0.55	1.73±0.31	1.63±0.18	1.17±0.27	1.23±0.31
48	1.36±0.73	0.78±0.29	1.09±0.71	1.99±0.71	0.51±0.92	1.09±0.71
72	0.46±0.15	0.75±0.02	0.45±0.12	0.50±0.12	0.50±0.26	1.04±0.14

Table 3: Mean and standard deviation values of VAS scores of subjects according to pulpal status

Time intervals (h)	Group 1		Group 2	
	Non-vital	Vital	Non-vital	Vital
24	1.98±0.26	1.32±0.12	1.28±0.24	1.09±0.87
48	1.75	1.53	0.97±0.32	0.57±0.11
72	0.70	0.25	0.86±0.34	0.63±0.29

Table 4: Distribution of VAS scores of subjects according to tooth type

Time intervals (h)	Tooth type		
	Anterior	Premolar	Molar
24	1.60±1.70	1.79±1.38	2.08±1.69
48	1.03±1.20	0.92±1.09	1.34±1.29
72	0.41±0.74	0.54±0.97	0.72±1.12

The present study included 68 incisor, 98 pre-molar and 122 molar teeth. Related to tooth type no significant difference in postoperative pain was detected ($p>0.05$) (Table 4).

DISCUSSION

Self-reporting has been found to be the most effective method for pain evaluation (American Geriatrics Society, 1998; Price *et al.*, 1983) even though, assessment of pain is complicated by being subjective and hard to classify (Soltanoff, 1978). Visual analogue scale has absolute values ranged from 0-10 and word descriptors of pain levels at each end placed on horizontal axis and were chosen. In this study, patients' marks on VAS at 24th, 48th and 72nd h intervals were recorded and compared.

Present clinical study aimed to compare the effect of completion of RCT in single or multiple visits on postoperative pain and evaluate the relationship between tooth vitality, type, gender and postoperative pain in a Turkish population. Symptomatic teeth were excluded to eliminate the effect of preoperative pain on postoperative pain scores. Including patients with only one tooth requiring RCT also eliminated possibility of referring pain. Exclusion of symptomatic teeth allowed a clear evaluation of treatment regime effectiveness on postoperative pain, however it is also a limitation not to evaluate effect of preoperative pain on postoperative pain scores.

There was no statistically significant difference between group 1 and group 2 regarding the intensity of postoperative pain. This result is in agreement with some previous studies (Pekruhn, 1981; DiRenzo *et al.*, 2002; ElMubarak *et al.*, 2010), however in disagreement with others reporting postoperative pain with single visit RCT is higher than multiple visit RCT (Albashaireh and Alnegrish, 1998; Soltanoff, 1978). A previous study proved that sterile saline does not possess any antibacterial and tissue resolving effect as irrigation solution (Haapasalo *et al.*, 2010). So, higher incidence of postoperative pain than single visit group could be attributed to use of a different irrigation solution. Another previous study reported significantly higher pain in the multiple visit RCT group, did not use any medicament in multiple visit group (Albashaireh and Alnegrish, 1998). Medicaments are known to limit bacterial ingress into root canal in two ways. They act as a physical barrier and show antimicrobial properties (Siqueira and Lopes, 1999). Differences might be attributed to disadvantages of multiple visit treatment such as decontamination of root canals through seal of temporary filling material as well as the differences in RCT procedures. In the present study, strict aseptic rules were carried out during treatment and between visits, Cavit-G, which was shown to provide a bacterial tight seal, applied in Group 2 in order to minimize decontamination via temporary seal.

Previous studies reported incidence of postoperative pain decreased gradually over time, pain levels showed a steady reduction in the following days in both single visit and multiple visit group (Yoldas *et al.*, 2004; Genet *et al.*, 1986). Present study showed reduction of postoperative pain incidence over follow-up period and the difference between Group 1 and Group 2 was not significant.

No significant difference was found regarding postoperative pain between vital and non-vital teeth at 24 and 48 h intervals but there was statistically significant difference at 72 h interval. This finding shows postoperative pain intensity was not affected by pulp vitality however pulp vitality might affect the duration of pain experienced. A previous systematic review also focused on comparing procedures without considering the pretreatment pulpal status (Figini *et al.*, 2007). These results agree with previous studies (DiRenzo *et al.*, 2002; ElMubarak *et al.*, 2010; Topcuoglu *et al.*, 2012; Prashanth *et al.*, 2011) that reported postoperative pain was not related to preoperative pulpal status. In the present study, the mean VAS value of subjects was 1.38 ± 0.18 out of 10 at 24th h interval and gradually decreased with time. It could be concluded that following a RCT procedure, which during strict aseptic rules and scientific-based techniques were applied, a low incidence of postoperative pain can be expected regardless of pulpal status whether the treatment is completed in single- or multiple-visits.

Gender of patient had no significant influence on postoperative pain, consistent with the findings of previous studies (Albashaireh and Alnegrish, 1998; Clem, 1970). Present study showed that molar teeth showed the higher level of pain supporting the findings of other studies (Glennon *et al.*, 2004; Risso *et al.*, 2008). However, this difference was not statistically significant. Complex structure of molar teeth and difficulty of root canal procedures in posterior regions for patients might contribute to higher postoperative pain incidence.

Under the limitations of present study there was no difference in the incidence and intensity of postoperative pain whether treatment was completed in a single- or multiple-visits in teeth with vital or non-vital pulps, whereas patient gender, pulp vitality and tooth type also showed no influence on the postoperative pain.

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Authors deny any conflict of interest.

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