

Research Paper: Pain Before, During and After Single-Visit Root Canal Therapy and Associated Factors



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ABSTRACT

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Introduction: Pain is one of the most important factors affecting patients' fear and anxiety in dental appointments. The aim of current study is to evaluate the pain experienced by patients before, during and after endodontic treatment.

Materials and Methods: This descriptive longitudinal study was performed on 100 patients aged 18-60 years old who referred to the department of endodontics of Guilan University of Medical Sciences. Age, gender, type of teeth and arch, pulpal condition, periapical status, and pre-treatment pain were recorded. The pain experienced during and 6, 12, 18, 24, 48 and 72 hours after Root Canal Therapy (RCT) was measured using VAS. The collected data were analyzed by SPSS version 21.0.

Results: The prevalence of post-operative pain in first 6 hours post treatment was 49%. The factors that significantly influenced patients' pain were age ($p=0.005$) and pulp vitality ($p=0.021$ before treatment, $p=0.001$ during treatment).

Conclusion: Age had a significant reverse relation with Post-operative Pain (POP) in vital teeth but it was not significant in non-vital teeth. Gender, type of teeth and arch, peri-apical status had no statistically significant relation with POP. Pain in vital teeth was significantly higher compared to non-vital teeth before and during RCT but not after treatment.

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Introduction

Pain during and after endodontic treatment is a common undesirable occurrence and might be considered as a criterion to benchmark clinicians' expertise. (1) Previous experiences and one's anticipations affect the level of pain that is felt. (2) Pain during the RCT is frequently affected by the type of anesthesia solution, effectiveness of injection method and preoperative pain. (3) Pain after the RCT is a multifactorial phenomenon and is related to inadequate cleaning and shaping, apical extrusion of irrigation solutions, maintaining apical patency, over-instrumentation, over-filled materials, over-bite restoration, missed canals or bacterial accumulation in the peri-apical region. (4-7) Despite POP being an unreliable predictor for endodontic treatment success, it may tarnish the patients' trust and may result in a poor relationship between patient and dentist. (8,9) Thus, successful prevention and management of endodontic pain are crucial and are guaranteed by a detailed knowledge acquisition about factors that affect level of experienced pain. (10-12)

Relation of endodontic pain and factors such as age, gender, number of dental appointments, type of teeth and arch, peri-apical and pulpal status is still unknown and the results are contradictory. (3,7-9,11-18) Therefore, the aim of this study was to carry out a research which compares the pain before, during and after RCT, and analyze the relationship of certain factors (age, gender, peri-apical condition, pulpal status, type of teeth and arch) with patients' pain.

METHODS AND MATERIALS

This descriptive longitudinal study was carried out at department of endodontics, dental faculty of Guilan University of Medical Sciences (GUMS). 100 patients who had signed the written consent forms containing explanations of the study objectives and refusal rights, participated in the study. Approval was taken from ethical committee of GUMS.

Inclusion criteria were patients who were 18-60 years, requiring single visit endodontic treatment, having permanent tooth and no

continuous consumption of analgesics. Patients with canal calcification, multiple teeth that require endodontic treatment, in need of emergency dose of antibiotics and analgesics, weak cooperation through the study and those contraindicated to use ibuprofen were excluded.

Patients' demographic information including gender and age were collected. Type of tooth undergoing RCT was recorded using Palmer Notation Method. Pulpal condition was demonstrated as non-vital or vital. If the tooth did not respond to vitality tests it was recorded as Non-vital or Necrosis pulp. Otherwise it was recorded as vital pulp. Periapical status was recorded as 1) Clinically normal periapical tissue [If the tooth was not tender to percussion and mucosal palpation, had no swelling, had intact Lamina Dura (LD) and constant periodontal ligament (PDL) space radiographically, and the patient reported no symptom] 2) Acute Periapical Periodontitis (APP) [If the tooth was notably tender to percussion or palpation. The PDL space and LD could be radiographically normal or not. Patient reported unexpected considerable pain] 3) Chronic Periapical Periodontitis (CPP) (If the tooth was not tender to percussion and palpation, and the patient reported no/slight symptoms but a radiolucency was observed in the radiography) or 4) Periapical Abscess (PA) (if the presence of pus was evident).

Pre-operative pain was evaluated using VAS (Visual analogue scale). (score 0 (no pain), 0-2 (slight pain), 2-5 (moderate pain), 5-8 (intense pain) and 8-10 (unbearable pain)).

Local anesthesia was given (2% lidocaine with 1/80000 epinephrine). More local anesthesia was performed if needed. RCT protocol was performed including; removal of caries and restorative materials, rubber dam application to provide isolation and access cavity preparation using an air-turbine handpiece under water coolant. Canal patency was achieved with a hand instrument K file (size 15). To enlarge the coronal and middle third of the canal, orifice openers were used with a slow movement. RCPrep was used to lubricate the canal. Hypochlorite (Chloraxid 2%) and normal saline were

used as irrigations. Then, working length was measured using apex locator (Raypex6, VDW) and was reconfirmed using peri-apical radiography. Shaping was carried out 0.5 mm shorter than the measured working length using M two rotary system (VDW) (size 15 (0.05 taper)- 20 (0.06 taper)- 25 (0.06 taper)- 30 (0.05 taper)- 35 (0.04 taper)) in a crown down manner. Cleaning was carried out using Hypochlorite (Chloraxid 2%) and normal saline. After completing instrumentation, canals were dried with paper points. Lateral condensation method was performed for obturation (Meta Biomed gutta percha and AH26 Dentostply sealer). Temporary restoration was done. Post obturation radiograph was taken. A single visit endodontic treatment was performed by one endodontist for all patients. 2 ibuprofen 400mg were prescribed for patients to consume if needed and the researcher was informed. POP was recorded using VAS over the phone after 6-12-18-24-48-72 hours. Data was entered in to SPSS Version 21.0 and Chi square, Kruskal-Wallis test and Mann Whitney tests were applied for finding out significant differences, if any.

Results

100 patients participated. 64% of participants were females and 36% were males. The mean age of patients was 38.40 ± 13.26 . Distribution of participants according to gender, teeth type, arch type and periapical status is described in (Table1).

The results stated that gender had no statistically significant relationship with pain before, during and after endodontic treatment in vital or non-vital teeth. (respectively $p=0.064$ and $p=0.151$) Also, aging significantly decreased pain score in vital teeth from baseline to 72 hours post-treatment however, it was not significant in non-vital teeth. (respectively $p=0.005$ and $p=0.610$) (Table2)

Relation between peri-apical status and pain level through the study is presented in (Table2)

No significant relation was observed between level of pain and type of teeth or type of arch.

Mean score of pain significantly decreased through study in vital teeth but it was not

statistically significant in non-vital teeth (respectively $P \leq 0.001$ and $P=0.225$). (Table3)

Discussion

The aim of current study was to compare the level of pain before, during and after single visit RCT in 100 patients. In the current study, male patients reported higher level of pain before and during RCT, while female patients experienced higher pain after RCT which were not statistically significant. Ng et al. (11), Kim et al. (16), Udoye et al. (8), Ali et al. (19), Gotler et al. (18), Hepsenoglu et al. (7) and Shresha et al. (9) stated higher POP in female patient, unlike Upadhayay et al. (12) who found a higher POP in males compared to females. Different physical and psychological characteristics between male and female may explain the incongruous results regarding the relation between pain and gender.

Although some studies failed to find any relation between age and pain level during (3) and after RCT (7-9,17), the results of current study and Watkins et al. (15) identify a significant reverse relation between age and POP. Advancing age leads to a secondary cementum deposition, a coronal movement of apical foramen, probably a decreased sensibility leading to less frequent pain in older patients. In contrary, Ali et al. (19) demonstrated that aging results in less blood circulation, delayed tissue healing, less pain tolerance threshold and more POP.

Pain level had no statistically relation with type of teeth in current study, as concurrent with findings of Walton et al. (14), Watkins et al. (15), Segura-eggea et al. (17) and Gotler et al. (18) Conversely, Ng et al. (11), Upadhayay et al. (12) and Shresha et al. (9) reported that posterior teeth were significantly more susceptible to POP due to more complex morphology, greater numbers of root canals, more complex access preparation, difficult debridement, and higher incidence of missed root canals compared to anterior teeth.

Unlike Walton et al. (14), Gotler et al. (18) and the current study that failed to find a relation between pain level and arch type, Absi (3) et al. and Upadhayay et al. (12)

Table1: Distribution of Subjects According to Gender, Type of Teeth, Type of Arch and Peri-apical Status in Vital and Non-vital teeth

Pulpal status	Gender		Type of Teeth		Type of Arch		Peri-apical Status				Total
	Female	Male	Ant. ¹	Post. ²	MAX. ³	Mand ⁴	Normal	APP	CPP	PA	
Vital teeth	58	32	11	79 ⁵	52	38	28	47	15	0	90
Non-vital Teeth	6	4	3	7 ⁶	5	5	0	10	0	0	10
Total	64	36	14	86	57	43	28	57	15	0	100

Table2: Relation of Mean Score of Pain and Gender, Age Peri-apical status from Baseline to 72 hours Post-treatment.in Vital and Non-vital Teeth

Time	Pulpal Status	Mean Score of Pain According to Gender		Mean Score of Pain According to Age	Mean Score of Pain According to Peri-apical Status		
		Male	Female		Normal	APP	CPP
Before Treatment	Vital Teeth	4.55±2.87	3.02±3.52	3.61±3.35	3.20±3.18	5.21±2.99	0.81±1.94
	Non-vital Teeth	2±3.46	0	0.75±2.12	-	0.75±2.12	-
During Treatment	Vital Teeth	1.77±2.34	1.51±2.32	1.61±2.44	2.05±2.66	1.96±2.63	0.63±1.43
	Non-vital Teeth	0	0.40±0.98	0.25±0.70	-	0.25±0.70	-
6 hours after Treatment	Vital Teeth	2.25±1.93	2.18±2.72	2.21±2.43	2.45±2.83	2.40±2.12	2.72±2.79
	Non-vital Teeth	0	3±2.82	1.87±2.64	-	1.87±2.60	-
12 hours after Treatment	Vital Teeth	0.85±1.06	1.23±2.13	1.08±1.79	1.68±1.60	1.66±2.08	0.45±1.03
	Non-vital Teeth	0	2±2.82	1.25±2.37	-	1.25±2.37	-
18 hours after Treatment	Vital Teeth	0.25±0.65	0.95±1.99	0.68±1.64	1.05±2.25	0.75±1.56	0.18±0.60
	Non-vital Teeth	0	1±1.41	0.62±1.18	-	0.62±1.18	-
24 hours after Treatment	Vital Teeth	0.07±0.26	0.34±0.92	0.24±0.75	0.45±1.14	0.21±0.59	0.09±0.30
	Non-vital Teeth	0	0.40±0.89	0.25±0.70	-	0.25±0.70	-
48 hours after Treatment	Vital Teeth	0	0.13±0.51	0.08±0.40	0.20±0.61	0.06±0.34	0
	Non-vital Teeth	0	0	0	-	0	-
72 hours after Treatment	Vital Teeth	0	0	0	0	0	0
	Non-vital Teeth	0	0	0	-	0	-
P value	Vital Teeth	P=0.064		P=0.005 (Significant)	P=0.324		
	Non-vital Teeth	P=0.064		P=0.610	P=0.225		

Table3: Mean Score of Pain in Vital and Non-vital Teeth and Pain Severity from The Baseline to 72 hours Post-treatment

	Mean Score of Pain According to Pulpal Status		P value	Severity of Pain Using VAS					Total
	Vital Teeth	Non-vital Teeth		None (0)	Slight (0-2)	Moderate (2-5)	Intense (5-8)	Unbearable (8-10)	
Before Treatment	3.61±3.35	0.75±2.12	0.021 (Significant)	49%	5%	30%	12%	4%	100%
During Treatment	1.61±2.44	0.25±0.70	0.001 (Significant)	69%	12%	15%	3%	1%	100%
6 hours after Treatment	2.21±2.42	1.87±2.64	0.712	51%	19%	24%	5%	1%	100%
12 hours after Treatment	1.08±1.79	1.05±2.37	0.814	65%	20%	12%	2%	1%	100%
18 hours after Treatment	0.68±1.64	0.62±1.18	0.920	79%	12%	6%	3%	0%	100%
24 hours after Treatment	0.25±0.75	0.24±0.70v	0.980	89%	8%	3%	0%	0%	100%
48 hours after Treatment	0.08±0.4	0	0.556	95%	4%	1%	0%	0%	100%
72 hours after Treatment	0	0	-	100%	0%	0%	0%	0%	100%

claimed that due to a higher bone density, patients experienced more pain in mandible compared to maxilla. However, Segura-egea et al. (17) explained that patients experienced slight pain more frequently in treatment of mandibular teeth but experience severe pain less frequently in treatment of maxillary teeth. Watkins et al. (15) stated that technique sensitivity of inferior alveolar nerve block and failure possibility of this injection may result in higher level of pain experienced during the treatment of mandibular teeth when compared to infiltration injection of maxillary teeth.

The frequency of APP was more in patients involved in the study followed by normal peri-apical condition and CPP respectively. No teeth with periapical abscess was involved as these patients required multi-appointment endodontic treatment. Patients with non-vital teeth had APP in clinical and radiographic assessment while patients with vital teeth were diagnosed with normal, APP or CPP as their peri-apical condition. Evaluation of the association between peri-apical status and pain in this study, revealed that mean score of pain was higher in

teeth with APP before endodontic treatment in comparison to teeth with normal peri-apical condition. However, during and after RCT, the relationship was contrariwise. And through the study, patients with CPP experienced less pain compared to the other two peri-apical condition. None of above findings were statistically significant. APP leads to a considerable pain before treatment; accordingly, the pain may secondarily irritate peri-apical tissue causing more pain during and after RCT. Besides, a tooth with normal peri-apical condition has an intact LD and apical bone, therefore the pressure caused by inflamed pulp or instrumentation is trapped locally in periodontium leading to more pain after RCT. Ng et al. (11), Segura-egea et al. (17) and Udoeye et.al (8) found that patients with APP experience more pain while Siqueira et al. (10) and Shresha et al. (9) stated that POP was more frequent in patients with normal peri-apical condition. Hepsenoglu et al. (7) showed that peri-apical lesions larger than 2 mm radiographically demonstrated higher POP.

In consistent with the findings of Siqueira et al. (10), Segura-egea et al. (17) Udoeye et

al. (8) and Gotler et al. (18), the current study states that pain level was higher in vital teeth compared to non-vital teeth in all time intervals, however, the difference was statistically significant only before and during RCT and not post treatment. Pulp inflammation may be the cause of nerve hypersensitivity and nerve resistance to anesthesia in vital teeth. As opposed, Walton et al. (14) found significantly more pain in necrotic pulp compared to

vital teeth and explained that non-vital teeth advocate inflammatory reaction and mediator secretion leading to more pain in the teeth. Harrison et al. (20) and Yesilsoy et al. (13) reported no association between pain and pulp vitality.

Also, this study found that level of pain decreased from baseline to 72 hours post treatment however, the relation was only significant in vital teeth. Patients reported that RCT brought relief but the pain worsened in the first 6 hours post treatment and lessened afterwards which is in consistence with the findings of Udoye et al. (8), Gotler et al. (18) and Shresha et al. (9)

Pre-treatment, during treatment and 6 hours post treatment most, patients chose none or moderate pain score (2-5) more frequently, afterwards, none was the most reported pain score followed by slight pain (0-2). 6 hours post treatment, 49% of patients experienced pain and 72 hours post treatment, no patients reported pain. In the study of Shresha et al. (9), 79.2% of patients had suffered from pain in first 6 hours post treatment which was decreased to 22% at the end of 72 hours. Severity of pain in their study was mainly mild to moderate. 33.1% of patients in the study of Upadhayay et al. (12) experienced pain in 6 months follow-up.

Due to different designs of studies and widely variable RCT protocols, it is difficult to compare the results of studies. Limitation of this study was the small sample size of non-vital teeth.

Conclusion:

In this study, age had a significant reverse relation with POP in vital teeth but it was not significant in non-vital teeth. Gender, type of teeth, type of arch and peri-apical

status had no statistically significant relation with POP. Pain in vital teeth was significantly higher compared to non-vital teeth before and during RCT but not after treatment.

Conflicts of interest:

This study has no conflict of interest.

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