

Assessment of Postoperative Pain after Single Visit Root Canal Treatment for Single Canal Teeth Performed by Under Graduate Students in Taibah University

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Received: January 28, 2022; **Published:** February 26, 2022

Abstract

Objectives: This study was to compare the prevalence of postoperative pain after single visit nonsurgical root canal treatment regarding gender, age, preoperative pain, tooth position, pulpal, and periapical conditions. These factors might predispose postoperative pain need to be avoided; when postoperative pain is suspected it should be controlled carefully.

Methods: 42 patients were selected and Root canal treatment was performed in a single visit. Straight-line access cavity was made, working length was determined, root canals prepared manually utilizing step-back technique; Irrigation was performed between each file with the use of 2.5% NaOCl solution. Root canals obturation was performed utilizing cold lateral compaction technique. Postoperative pain was assessed using the Visual Analogue Scale (VAS) on the 1st, 2nd, and 7th days following the treatment. Data were analyzed using Mann-Whitney and Kruskal-Wallis H tests and the significance was set at $P < 0.05$.

Results: There was a significant difference between male (48%) and female (52%) patients in postoperative pain values at study intervals, while other studied variables had an insignificant role in postoperative pain induction or aggravation.

Conclusion: Non-surgical root canal treatment could be safely applied with low potentials of postoperative pain regarding the studied variables, except patient gender that might be considered as a predisposing factor for postoperative pain.

Keywords: Nonsurgical Root Canal Treatment; Single Visit Endodontic Treatment; Postoperative Pain; Visual Analogue Scale (VAS); And Post-Endodontic Pain Control

Introduction

Dental pulp infection generally occurs via dental caries, trauma, tooth cracks or chips, and operative procedures in which pulpal space is contaminated and spread of pulpal infection of pulp necrosis with a subsequent apical lesion [1]. Hence, the goals of Nonsurgical Root Canal Treatment (NSRCT) are the prevention and management of post-endodontic pain and apical periodontitis to preserve the natural dentition [2,3]. Therefore, providing successful treatment through effective root canal contents removal, disinfection of the root canal, and apical and coronal sealing against leakage is necessary.

Unfortunately, even with the utmost care during the treatment performance some patients might report postoperative pain [4], which might be due to over instrumentation and filling, medicine, or infected debris passage into the periapical tissues [1].

As long as pain is a detestable consequence of NSRCT for patients and dentists, the factors that might predispose postoperative pain must be avoided carefully. Among these factors; gender, tooth type, preoperative pain, pulpal and periapical pathological condition, intra-canal medications used, Instrumentation and obturation techniques, and number of treatment visits [5,6].

Single-visit endodontics is now an acceptable alternative treatment procedure for NSRCT with favorable results [7]. In addition, the patient and the clinician will accept this technique because it is less stressful, less anesthesia is needed, minimum time required, more economical, and more productive [8]. On the other hand, many studies have shown an insignificant difference between multiple and single-visit NSRCT outcomes [1,2,8]. Regardless of these ameliorations in single-visit NSRCT outcome, many factors must be considered for the clinical decision-making of a single or multiple visit endodontic treatment such as preoperative pain, pulpal and periapical diagnosis, and the complexity of the case [7,8].

Despite numerous studies in Taibah University, Medina, there is a lack of studies regarding assessment of postoperative pain after single visit root canal treatment for single canal teeth. This cross-sectional analytical observational study aimed to compare the frequency and nature of postoperative pain among TUDCH patients after receiving single visit nonsurgical root canal treatment performed by under graduated dental students regarding gender, age, preoperative pain, tooth position, pulpal, and periapical condition. The null hypothesis of this study was that there are no differences in postoperative pain scales among treated patients regarding the included factors; gender, age, preoperative pain, tooth position, pulpal, and periapical conditions.

Materials and Method

Patients' selection

A total of 42 cases had been selected from outpatients attended at the dental clinic in Faculty of Dentistry, Taibah University in Medina, Saudi Arabia receiving single visit nonsurgical root canal treatment was carried out during a period from 14 February 2021 to 14 March 2021 by under graduated dental students. Sample size was calculated based on population size, the expected mean difference and standard deviation to enable detection of the potential difference with a power of 90% and $P < 0.05$. This cross-sectional analytical observational study was approved by the Ethics Committee of the University (TUCDREC). Approval of the study reference number is (C/27122020/RAAbdelgawad). Study participants were informed about the aim and the protocol of the study, and written consent was taken. Subsequently, the individual diagnosis was performed through data collection about medical history, dental history, and chief complaint, followed by clinical examination including; periodontal probing, percussion, and pulp vitality cold test (EndoIce; Coltène/Whaledent Inc, Cuyahoga Falls, OH). Radiological examination via periapical X-ray was done as well to inspect the canal morphology, periodontal status as well as presence or absence of periapical radiolucency. Patients having any systemic condition, pregnancy, non-restorable teeth, periodontally compromised teeth, teeth with calcified canals, and retreatment cases were excluded. Patients with normal pulp that been included in this study were referred from restorative department for intentional NRCT for need of intra-canal restoration retention or teeth reduction into Dom shaped abutment will cause pulp exposure.

Preoperative pain assessment

The pain perception was recorded in terms of Visual Analogue Scale (VAS) [9] to determine the frequency and degree of pain recorded by each patient. 0, no pain; 1 - 3, mild pain; 4 - 6, moderate pain; 7 - 9, severe pain; and 10, the worst pain, and patients were instructed how to record their pain values as well.

Endodontic treatment protocol

Root canal treatment performed in a single visit. Local anesthesia was achieved via local infiltration using 4% Articaine with 1:100,000 epinephrine (Laboratories Inibsa, Barcelona, Spain). After anesthesia confirmation, rubber dam isolation was performed; an endodontic access cavity was established by using 014 round carbide and Endo Z burs (Dentsply International, York, PA). Straight-line access cavity was made, pulp chamber irrigation, and vital pulp tissue extirpation using Barbed Broach (Dentsply Maillefer, Ballaigues, Switzerland) in vital cases. A glide path was established, canal's patency was assessed using stainless steel hand instruments #10 K file (Dentsply Maillefer, Ballaigues, Switzerland). Working length was determined using an electronic apex locator (Root ZX (J Morita, Tokyo, Japan) then confirmed by periapical radiographs.

Root canals biomechanical preparation was performed manually utilizing step-back technique at 1-mm increments using hand K-files (Dentsply Maillefer, Ballaigues, Switzerland). The final apical size (master apical files) was three sizes larger than the first file binds at established working length, apical instrumentation size was determined as three sizes larger than the first file binding file at the working length (initial file). Root canals Irrigation was performed between each file used with 2.5% NaOCl solution (karamji, india). Sterile paper points (Dentsply Maillefer, Ballaigues, Switzerland) used for canals drying. Master cone was chosen matching the size of master apical file and confirmed reaching full working length, have tug-back on withdrawal, and confirmed by periapical radiographs.

Root canals obturation performed utilizing cold lateral compaction technique, using spreader size which reaches 1mm shorter than WL, matching GP points, and calcium hydroxide-based sealer Sealapex™ (Sybron Endo, USA), excess GP was removed with a warm excavator, and access cavities were restored using temporary restoration Cavit (3M, St Paul, MN, USA).

Postoperative pain assessment

The frequency and degree of pain were recorded by each patient as mentioned previously in preoperative pain assessment using Visual Analogue Scale (VAS) to register their post-endodontic pain at the 1st, 2nd, and 7th day after the treatment.

Statistical analysis

Raw data about the factors included in the study (gender, age, preoperative pain, tooth position, pulpal and, periapical condition) were collected and tabulated, the role of these factors on the degree of postoperative pain were analyzed using the SPSS statistical software (version 17, SPSS Inc., Chicago, IL, USA) at $p < 0.05$.

Results

All 42 patients were available for follow-up with a 100% response rate. Out of whom 22 (52%) were females and 20 (48%) were males, their age range was 18-60 years old, 26 (62%) of them had non-vital pulp and 16 (38%) had vital pulp was subjected to single visit root canal treatment, 31 (74%) of cases were anterior teeth while posterior recorded only 11 (26%) cases, and 15 (36%) case had preoperative pain while 27 (64%) didn't record preoperative pain. The role of the assessed variables on degree of postoperative pain was carried as follow:

Gender

Using Mann-Whitney test there is a significant difference between male and female groups' postoperative pain values at all study intervals (Table 1) where the female group showed the highest postoperative pain values in all three intervals compared to the male group.

Gender	Number	Postoperative Pain Assessment Intervals		
		Mean Rank/Sum of Ranks		
		1 st day	2 nd day	7 th day
Female	22(52%)	25.32/557.00	24.95/549.00	24.82/546.00
Male	20(48%)	17.30/346.00	17.70/354.00	17.85/357.00
Asymp. Sig.	42	0.020*	0.013*	0.010*

Table 1: Postoperative pain recorded after single visit root canal treatment among male and female study Patients (n = 42) using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days). * Indicates significant differences (p < 0.05).

Age

Patients who participated in this study were in the ages ranging 18 - 60 years old; they were divided into four groups according to their age. By using Kruskal-Wallis H test there is no significant difference between these four age groups in recorded postoperative pain values in all study intervals, but the age group 32 - 42 years old shows the highest postoperative pain score while age group 43 - 60 years old reported the least postoperative pain score in all study intervals (Table 2).

Age group	Number	Postoperative pain assessment intervals		
		Mean Rank		
		1 st day	2 nd day	7 th day
18-28	13(31%)	23.38	20.92	21.46
29-31	10(24%)	22.45	22.65	21.50
32-42	9(21%)	23.44	25.39	22.00
43-60	10(24%)	16.35	17.60	21.10
Asymp. Sig.	42	0.419	0.334	0.997

Table 2: Postoperative pain recorded after single visit root canal treatment among study Patients (n = 42) age groups using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days).

Tooth position

Mann-Whitney test was used to analyze the role of tooth position in values of postoperative pain at study intervals showed non-significant between anterior and posterior teeth in all intervals (Table 3). The posterior teeth showed the highest values of postoperative pain on the first and second days, while the posterior teeth showed the lowest postoperative pain values on the 7th day.

Tooth position	Number	Postoperative pain assessment intervals		
		Mean Rank/Sum of Ranks		
		1 st day	2 nd day	7 th day
Anterior	31(74%)	20.73/642.50	20.73/642.50	22.31/691.50
Posterior	11(26%)	23.68/260.50	23.68/260.50	19.23/211.50
Asymp. Sig.	42	0.498	0.498	0.480

Table 3: Postoperative pain recorded after single visit root canal treatment in anterior and posterior teeth of study Patients (n = 42) using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days).

Preoperative pain

Mann-whitney test was used to analyze the role of preoperative pain existence in postoperative pain values at study, all intervals showed non-significant between cases recorded preoperative pain and other didn't record in postoperative pain values in all intervals (Table 4). Patients who recorded preoperative pain showed the highest postoperative pain values at 1st interval (1 day) after root canal treatment, while the lowest postoperative pain values were for patients who didn't record preoperative pain at the same interval (1st).

Preoperative pain	Number	Postoperative pain assessment intervals		
		Mean Rank/Sum of Ranks		
		1 st day	2 nd day	7 th day
No	27 (64%)	19.52/527.0	20.65/557.5	20.94/565.5
Yes	15 (36%)	25.07/376.0	23.03/345.5	22.50/337.5
Asymp. Sig.	42	0.124	0.435	0.582

Table 4: Postoperative pain recorded after single visit root canal treatment among the study Patients (n = 42) regarding existence of preoperative pain, using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days).

Pulp condition

Kruskal-Wallis and Mann-Whitney tests of the postoperative pain values showed a non-significant difference in postoperative pain values between vital and necrotic teeth` pulp at all study intervals (Table 5). Patients who had normal pulp tissue showed the lowest postoperative pain values at all intervals, while patients who had symptomatic irreversible pulpitis on the first day showed the highest postoperative pain values followed by those who had asymptomatic irreversible pulpitis.

Pulp condition		Number	Postoperative pain assessment intervals					
			Mean Rank/Sum of Ranks					
			1 st day	2 nd day	7 th day			
Vital	Normal	4 (10%)	12.00	337.50	17.00	375.00	16.00	315.50
	AIP	3 (7%)	20.50		26.67		18.00	
	SIP	9 (21%)	24.39		23.89		22.61	
Necrotic		26 (62%)	21.75/565.50		22.60/587.50		20.31/528.00	
Asymp. Sig.		42	0.423		0.419		0.141	

Table 5: Postoperative pain recorded after single visit root canal treatment among the study Patients (n = 42) regarding condition of pulp tissue, using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days).

AIP (asymptomatic irreversible pulpitis), SIP (symptomatic irreversible pulpitis).

Periapical condition

By using Kruskal-Wallis test, results showed a non-significant difference in postoperative pain values at all study intervals regarding periapical tissues condition (Table 6). Patients who had symptomatic apical periodontitis reported the highest postoperative pain values at all test intervals, while patients with chronic abscess showed the lowest postoperative pain values at all test intervals.

Periapical condition	Number	Postoperative pain assessment intervals		
		Mean Rank		
		1 st day	2 nd day	7 th day
Normal	10 (24%)	22.35	19.80	19.05
SAP	11 (26%)	25.91	23.95	22.64
AAP	20 (48%)	19.13	21.28	22.33
Ch. Abscess	1 (2%)	12.00	16.00	17.00
Asymp. Sig.	42	0.336	0.704	0.705

Table 6: Postoperative pain recorded after single visit root canal treatment among the study Patients (n = 42) regarding condition of periapical tissue, using visual analogue scale score (VAS) at different study intervals (1, 2, and 7 days).

SAP (symptomatic apical periodontitis), AAP (asymptomatic apical periodontitis), Ch (chronic).

Discussion

Postoperative mild pain is a noxious experience after root canal treatment reported by 1.7% to 70% of patients [10]. Multiple factors have been reported to initiate/increase post endodontic pain; bacterial, mechanical, and chemical [11,12]. Investigation of possible predisposing factors that might initiate and/or maintain pain after root canal treatment has the potency to positively shift the ideas and attitudes towards root canal treatment, granting more probability for natural teeth preservation. Moreover, the data recorded about expected postoperative pain should be used for patient reassurance before and after root canal treatment, on the other hand, to recognize other cases who reported extreme records in-order to investigate possible additional causes and preventive measures to be considered.

Unfortunately, it is clinically hard to determine if one or more factors are the major cause that elicits the pain, moreover, the methodology of pain assessment depends on the patient’s subjective rating which makes it a critical step [13]. Various pain assessment scales and methods used to assess and evaluate post root canal treatment pain including a 5-level pain scale [14], a 4-point pain intensity scale [15], and Visual Analogue Scale (VAS) [16]. Thence, this study was designed to compare the frequency and nature of postoperative pain after single-visit nonsurgical root canal treatment regarding; gender, age, preoperative pain, tooth position, pulpal, and periapical condition, and the VAS has been used as it has been reported as a valid assessment tool using both numeric and verbal scores for pain intensity.

The patient’s gender has been considered as a prime postoperative pain predisposing factor while performing root canal treatment [17,18]. Female patients have reported greater postoperative pain than male patients, which has been inferred to the reduced pain threshold in female patients than male [19,20]. The present study results support these studies as female patients recorded significantly higher postoperative pain than male patients regardless of other variables. In contrast, other studies reported a non-significant role of patient gender on postoperative pain [4,21].

The patient’s age is another studied factor to clear its role in initiation or aggravation of pain after non-surgical root canal treatment, the plurality of studies [15,22,23]. This study as well proved it’s a non-significant role, as there was non-significant difference between study age groups in postoperative pain values; the older age group (43 - 60 years old) recorded least postoperative pain amongst all study intervals. On the other hand, other studies [24,25] reported an inverse relation between patients age and postoperative pain, which couldn’t be inferred to progressive loss of nociceptive sensitivity as there isn’t definitive evidence to prove this [26], so the decreased pain sensitivity with increasing age isn’t related to physiological pain system changes.

When studies about postoperative pain were correlating its incidence to the treated tooth position (anatomic location), they revealed a non-significant correlation regardless of other contributing factors [27-29] which is in coincidence with the results of the present study as; there was a non-significant difference in postoperative pain values between anterior and premolar teeth among all the study intervals. These findings are not consistent with those [30-32] who reported a significant role of tooth position as postoperative pain predisposing factor; this contradiction might be to selection of single-rooted, single canaled teeth in the present study, sample size, and study protocol.

In this study, patients who didn't report preoperative pain (64%) showed lower postoperative pain values than those who reported preoperative pain (36%) at all study intervals, but the difference is not significant, in agreement with Gers., *et al.* [33]. However, Parirokh., *et al.* [34], and El-Mubarak., *et al.* [15] mentioned that the presence of moderate-severe preoperative pain might be considered as a strong indication about the possibility of postoperative pain occurrence; recommend an analgesic prescription to control these cases after root canal treatment. They related this to, physiological factors, and the existence of preoperative pulpal and periapical inflammation. This contrariness might be inferred to a small sample size, a higher percentage of cases do not report preoperative pain included in the sample (64%).

In concern with, Inconsistency in research findings of the correlation between pulpal vitality and its role in initiation or aggravation of postoperative pain after non-surgical root canal treatment. Several have reported the contribution of pulp condition in postoperative pain [3,17], while others have not reported such role [14,35]. This study reported insignificant difference between vital and non-vital pulp on postoperative pain values, however; symptomatic irreversible pulpitis recorded non-significantly highest postoperative pain values, and this was previously inferred to the role of inflammatory mediators during pulp inflammation in central and peripheral sensitization [36].

On the other hand, preoperative periapical tissue status achieves another conflict about its role in the initiation or aggravation of postoperative pain after non-surgical root canal treatment. Studies by Iqbal., *et al.* [37], Tanalp., *et al.* [38], and de Olivera Alves [39] proved the risk of postoperative pain in cases of periapical involvement rather than those with normal periapical tissues. However, the present study is in agreement with other studies [40,41] reported an insignificant correlation between the presence of periapical lesion and incidence of postoperative pain. This contradiction in results could not be explained, it might be correlated to differences in treatment modalities, pain assessment methods, and the samples population that included 76% patients with periapical lesions, but only 26% of them were symptomatic.

Conclusion

Upon the situations of the current study, it concluded that; scientific-based non-surgical root canal treatment procedure could be safely applied under aseptic conditions with low potentials of postoperative pain. Regarding the studied variables in the study that might induce or increase pain after non-surgical root canal treatment; except for patient gender, which might be considered as a predisposing factor for postoperative pain, appropriate precautions should be considered.

Recommendations

Further researches should be conducted with larger sample size including multirouted teeth, studying other variables that might contribute to postoperative pain control as; premedication, intra-canal medication occlusal reduction.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest

There is no conflict of interest among the research group.

Authors Contribution

Abdelgawad RA: Conceptualization, Validation, Writing - Review and Editing, Supervision.

Ghadah AA: Methodology, Writing - Original Draft, Investigation.

Hadeel AA: Investigation, Writing - Original Draft.

Hatoon EM: Methodology, Writing - Original Draft, Investigation.

Morouj AB: Investigation, Writing - Original Draft.

Amirah AA: Investigation, Writing - Original Draft,

Eisawi AS: Software, Formal analysis, Investigation, Data Curation.

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Volume 21 Issue 3 March 2022

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