The Incidence and Intensity of Post-Obturation Pain after Single-Visit and Two-Visit Root Canal Treatment: A Comparative Study on Vital and Non-Vital Maxillary and Mandibular Single-Rooted Teeth

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Research Article

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ABSTRACT

Background: Root canal treatment (RCT) is a standard element of dental therapy. Several studies have demonstrated that most of the clinicians complete RCT on patients in multiple visits. However, in the last few decades several researchers in over 70% of the medical centers worldwide have advocated a single-visit RCT.

Objective: The objective of this study was to compare the incidence and intensity of post-obturation pain after single- and two-visit RCT on vital and non-vital maxillary and mandibular single-rooted teeth.

Materials and Methods: Data were collected from the 140 patients who were classified and treated in two groups, Group A (n=70) with single-visit obturation and Group B (n=70) with two-visit obturation.

Results: In this study, it was observed that post-operative pain related with single-visit (Group A) RCT was overall similar as the post-operative pain associated with two-visit (Group B) treatment. In this study, sterile cotton pellet was positioned in the root canals between visits.

Discussion: In this comparative study, under the studied conditions no difference in post-operative pain between patients treated in single-visit and patients treated in two-visit was observed. Thus, the present study demonstrates that two-visit endodontics is not helpful in reducing the pain incidence and that RCT completion in single-visit can be safe.

INTRODUCTION

Root canal treatment (RCT) is a standard element of dental therapy and is performed on most of the tooth with reported success rates ranging from 30% to 98% [1]. Several studies have demonstrated that most of the clinicians complete RCT on patients in multiple visits. However, in the last few decades several researchers in over 70% of the medical centers worldwide have advocated a single-visit RCT [2]. Single-visit endodontic therapy is defined as the conventional, non-surgical treatment of an endodontically affected tooth, comprised complete biomechanical organization and obturation of the root canal system in single-visit [3]. It has numerous advantages over multiple-visit endodontics such as diminution in the number of appointments (repeated application of anaesthesia or rubberdam can be omitted), removal of the probabilities of contamination between different appointments, and flare-ups triggered by leakage or loss of short-term seal, and economy of time [3]. However, the most important question relating to the incidence of post-operative pain and its long-term outcome after healing needs to be explored.

Although, the incidence of postoperative pain and flare-ups have been compared in many studies in relevance to single- and multiple-visit procedures, till date, there is no consistent evidence to provide recommendation for the preferred methods of RCT (single- or multiple-visit) [4]. Approximately 40% of the patients reported post-operative pain 24 hour after RCT and decrease in pain up to 11% after one week [5]. No significant difference was monitored in terms of the risk of pain in single-visit versus multiple-visit RCT [6]. The majority of the studies to date have demonstrated either no significant difference in post-operative pain or less pain in single-visit RCT when it is compared with multiple-visit treatment [7-13]. However, the majority of these studies were either retrospective or prospective without satisfactory controls or randomization. Prospective randomized control studies provide the utmost support for evidence-based clinical practice.

Various studies conducted to evaluate the effectiveness and post-treatment pain of single-versus multiple-visit RCT

demonstrated that differences in effectiveness (healing rates) and post-operative pain between these two treatment regimens were not significant [14]. Ince demonstrated that pain perception of individuals, whether treated in a single-visit or in multiple-visit was not different [15]. In one survey, it was reported that approximately 70% of endodontists would prefer to treat teeth with a necrotic pulp and chronic apical abscess in single-visit [16]. In another survey, it was reported that about 70% of undergraduate teaching institutions in the United States recommended single-visit RCT [17]. However, the fact that various practices adopted widely does not specify that the practices are biologically comprehensive and/or appropriate. The argument for single-visit treatment depends heavily upon convenience, patient acceptance, and reduced post-operative pain. In contrast, bacterial infection cannot be completely minimized without the use of calcium hydroxide dressing between different visits; consequently, the healing potential may be compromised [18]. This issue is extremely controversial, and views about the relative risks and benefits of single- versus multiple-visit RCT vary greatly. Direct evidence comparing the healing rates following single- and multiple-visit RCT can provide insight with regard to effectiveness of regimen.

The objective of this study was to compare the incidence and intensity of post-obturation pain following single- and two-visit RCT on vital and non-vital maxillary and mandibular single-rooted teeth.

MATERIALS AND METHODS

After approval of Ethical Committee of Ministry of Health (MOH REC 180037) we started the collection of sample size.

Study Participants

One hundred forty patients (aged between 15 to 70 years) with maxillary and mandibular single rooted teeth, seeking for root canal therapy, which was routinely referred from medical center to Endodontic Department of Al-Basheer Hospital, Amman, Jordan were enrolled in this study. Patients aged 15 to 70 years with maxillary and mandibular single rooted teeth since canal is almost straight, including both vital and non-vital teeth were included. Exclusion criteria were patients with systemic diseases, acute apical periodontitis, acute apical abscess, or re-treatment of root canal cases; teeth with calcified canals or teeth with periapical lesions; or pregnancy. Eligible patients were explained the proposed treatment and design of the study.

Randomization

Biased coin randomization method was used to assign the patients into two groups; each group contains 70 patients. Patients in Group A were treated with one-visit and patients in Group B were treated with two-visits.

Root Canal Treatment Procedure

Thorough medical and dental history was recorded before actual treatment. Pre-operative data was recorded for each patient in the patient's history sheet which includes age, sex, and intensity of pain before the treatment.

For both the groups, standard procedure at the first visit included local anesthesia, rubber dam isolation, followed by canal patency (cheeked with k-file size 15), then working length was determined with k-file using apex locator (Dentaport ZX, JMorita corp, Kyoto, Japan) and confirmed with periapical X-ray taken by Carestream sensor RVG 5200 (NY, USA). Instrumentation was performed using NITI K3 (Syborn Endo, CA, USA) rotary files in crown down technique start with #25 .10 taper tip followed # 25 .08 taper, #35 .06, #30 .04, #25 .06, #20 .04 along with copious irrigation after each size using 2.5% sodium hypochlorite (NaOCL) and normal saline, ethylene di-amine tetra acetic acid (EDTA, META, koria) was used as lubricant during filling. After completing the instrumentation, canal was dried with paper points as shown in **Figure 1**. Teeth of Group A patients were obturated with gutta-percha cones and ADSEAL (META, Korea) is a resin-based root canal sealer using lateral condensation technique and temporary restoration was performed. Teeth of group B patients were sealed with a sterile dry cotton pellet and temporary restoration. After one week, patients of group B were revisited for obturation with similar manner as of patients in group A. The modified Verbal Descriptor Scale (VDS) form was provided to the patients to record the pain scale after 12, 24, 48 hours and 1 week of obturation. No systemic medications were prescribed; however, patients were instructed to take ibuprofen (600 mg) in case pain was intolerable and patients were requested to record the maximum pain level before taking analgesic.

Pre- and Post-Operative Pain Measurement

The modified VDS was used to measure the intensity of pain for which, medical staff was trained. To characterize the intensity of experienced pain, patients were instructed to place a mark on the horizontal scale. Furthermore, patients used verbal descriptors as a guide. Discomfort level was rated as; i) no pain- the treated tooth felt normal, ii) slight pain- the treated tooth was slightly painful for a time, irrespective of the duration, however there analgesics were not required, iii) moderate pain- the tooth involved caused discomfort and/or pain, which was either tolerable or was controlled by analgesics, iv) strong pain- the pain caused by the treated tooth disturbed normal sleep and require narcotic analgesics, v) severe pain- the pain caused by the treated tooth disturbed normal activity or sleep and analgesics were ineffective, and vi) maximum pain- unable to sleep and other general symptoms appeared as shown in **Figure 2**.

After receiving the VDS forms, the data were recorded for the post-obturation periods of 12, 24, 48 h, and 1 week.

Figure 1: Instruments used during dental surgery.
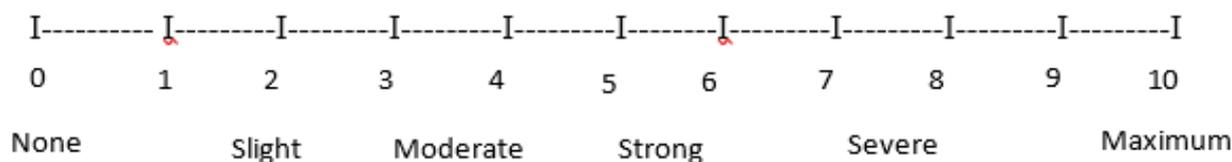
Figure 2: Modified verbal descriptor scale instrument. The scale on the horizontal line ranged from 0 to 10.

Statistical Analysis

Descriptive statistics was used to represent the mean, standard deviation (SD), and range for all the parameters using Chi-square test and Independent-Sample T-Test. Pre-operative and post-obturation pain was measured using chi-square test. To compare the VDS pain measurement, independent sample T-test was used. Differences were considered significant at $P<0.05$.

RESULTS

Data were collected from the 140 patients who were treated in two groups, Group A (n=70) with single-visit obturation and Group B (n=70) with two-visit obturation. Mean ± SD intensity of preoperative pain was 2.4±2.8 in Group A and 2.3±3.0 in Group B (**Table 1**).

For groups A and B, pre-operative pain & Post-obturation pain after 12, 24, and 48 hours; however, post-obturation pain was very much reduced after 1 week of surgery (**Table 2**).

As measured by VDS pain measurement, in pre-operative interval difference between Group A and Group B was non-significant. In post-obturation interval, significant difference was observed after 48 hours (P=0.08) and 1 week (P=0.03) between Group A and Group B, however, in other intervals difference in the intensity of pain was non-significant (**Table 3**).

Change in the intensity of preoperative and post-obturation pain was non-significant between the group A and B after 12 hours (P=0.4) and 1 week (P=0.27). However, post-obturation pain was significant after 24 (P=0.01) and 48 hours (P=0.009) between the two groups (**Table 4**).

Distribution of different clinical courses of preoperative pain at 12-hour post-obturation in the subgroup with the absence of pre-operative pain and presence of pre-operative pain demonstrated that there was no significant (P=0.15) difference between group A and group B (**Table 5**). This data suggests that, the intensity of post-obturation pain between the two groups did not differ significantly.

DISCUSSION

In this comparative study, the incidence and intensity of post-obturation pain after single- or two-visit RCT on vital and non-vital maxillary and mandibular single-rooted teeth was evaluated. In this study, we have observed that post-operative pain related with single-visit (Group A) RCT was overall same as the post-operative pain related with two-visit (Group B) treatment. Majority of the patients reported no or only minimal post-obturation pain after 24 hours to 1 week of treatment in both the groups. These findings are in concordance with a previous study performed in 72 patients requiring RCT on permanent molars and reported that the post-operative pain between patients treated in one-visit and versus two-visits RCT was almost similar [19]. Furthermore, in another study, difference was non-significant in the success, post-operative pain, and tenderness when patients were treated with either single- or multiple-visit endodontic therapy [20]. Additionally, a study conducted in 200 patients of Jammu population reported similar results as the current study with no difference in the incidence of post-operative pain between vital and non-vital teeth. The number of visits does not have any impact on the amount of pain [21]. However, Sharma et al also suggested that the number of visits for endodontic treatment should be minimum to reduce the patient's discomfort (Sharma et al 2017).

In a study with 120 patients, the incidence and degree of post-operative pain was statistically non-significant between single- and two-visit endodontic procedures. The rate of post-obturation flare up was 11.6% and 3.6% after 2 and 7 days, respectively in asymptomatic endodontically treated non-vital maxillary central incisors [22]. In a systematic review, it was noticed that the healing rate of single- and multiple-visit RCT was similar for infected teeth. The frequency of short-term post-obturation pain was less after single-visit than multiple-visit RCT [23].

In a systematic review and meta-analysis, it was observed that the risk of long-term complications was not different [24]. It is noteworthy that this was supported by various studies (e.g., studies with high- or low-risk, small or large sample sizes, adults or adolescents, vital or non-vital teeth, teeth with or without periapical lesions) with comparatively homogeneous results. Most of the studies have not reported single-visit RCT to be significantly superior over the other except one study which reported that the differences were significant between groups (favoring single-visit treatment).

Pain perception is an extremely subjective and inconstant occurrence modulated by multiple psychological and physical factors. Pain reporting is affected by many factors other than the experimental procedure. Furthermore, the pain measurement is burdened with hazards and chances for error. In this study, a modified VDS was selected; this is a bounded scale with absolute values at each end and word descriptors of pain levels placed in ascending order along the horizontal axis. It is the way to get the degree of pain from patient with different ages.

It is tough to compare results from different studies due to use of different instrumentation and obturation techniques. The number of visits involved to complete RCT is the only one of the many variables. For e.g., when this protocol was developed, a sterile, dry cotton pellet was the standard intra-appointment dressing for most of the teeth that were treated in >2 visits. Our current treatment of choice for teeth performed in >2 visits is to place sterile cotton pellet in the tooth.

This study has a number of strengths and limitations to note that includes a large sample size. The results reported in this study are based on a sample of adults collected in the residential care facilities. Although approximately 60% patients were newly admitted, these results do not inevitably generalize to community-dwelling healthier populations. In multiple visits RCT, intra-canal medicament such as calcium hydroxide is mostly placed in the root canals to eradicate and preclude the multiplication of residual microorganisms. However, in the present study, calcium hydroxide was not used in two-visit group, which could be a limitation to this study.

The incidence of post-operative pain is one of the primary concerns while evaluating endodontic treatment alternatives. In the scenario of this comparative study, no difference in post-operative pain between patients treated in single-visit and patients treated in two-visit RCT was noticed.

Table 1: Intensity of preoperative pain in the two groups.

Type of treatment*	Intensity of preoperative pain
N=140	(Mean ± SD)
Group A, n=70	2.4 ± 2.8
Group B, n=70	2.3 ± 3.0
*Patients in group A were treated with single-visit and in group B were treated with two-visit RCT.	

Table 2: Incidence of pre-operative and post-obturation pain between the two groups.

	Pre-operative			Post-obturation											
	pain	No pain	% pain	12 hr	No pain	% pain	24 hr	No pain	% pain	48 hr	No pain	% pain	1 week	No pain	% pain
Group A, n=70	44	26	62.8	39	31	55.7	33	37	47.1	21	49	30	1	69	1.4
Group B, n=70	34	36	48.5	42	28	60	36	34	51.4	30	40	42.8	30	40	24.8
X²	2.8			0.2			0.2			2.8			34.8		
P-value	0.08			0.6			0.6			0.1			32.4		

P value was measured by Chi-square test

Abbreviation: hr = hour; X² Chi-square

Table 3: Verbal Descriptor Scale pain measurements for all cases.

Interval	Pre-operative Mean ± SD	Post-obturation 12hr Mean±SD	Post-obturation 24 hr Mean±SD	Post-obturation 48hr Mean±SD	Post-obturation week Mean±SD
Group B, n=70	2.3±3.0	2.6 ±3.0	2.6± 3.3	2.4 ±3.6	0.1±0.5
P-value	0.3	0.4	0.08	0.03	0.02

P values are calculated using independent- sample T-Test

Abbreviations: hr= hour; SD= standard deviation

Table 4: Verbal descriptor scale pain measurements for all cases.

	Post-obturation pain, n=140, mean±SD			
	Δ 12 hour	Δ 24 hour	Δ 48 hour	Δ 1 week
Group A, n=70	0.27±2.0	0.54±2.6	-1.01±2.8	-2.4±2.8
Group B, n=70	0.36±2.0	0.34±2.2	0.14±3.6	-2.14±2.9
P-value	0.4	0.01	0.009	0.27

Δ = Change of intensity between post-obturation pain and pre-operative pain
P value was calculated using independent Sample T-Test.

Table 5: Distribution of various clinical courses of preoperative pain at 12 hour post-obturation.

	Absence of preoperative pain		Presence of preoperative pain				
Type of treatment	No pain	Pain	Pain disappeared	Pain intensity reduced	Pain intensity remained	Pain intensity increased	Total
Group A, n=70	18	8	13	31	0	0	70
Group B, n=70	30	6	4	30	0	0	70
Total	48	14	17	61	0	0	140

CONCLUSION

In this study, post-operative pain associated with single-visit RCT was generally the same as post-operative pain associated with two-visit RCT. Majority of the patients in both the groups reported no or only minimal post-obturation pain after 24 hours to 1 week of treatment. Thus, the current study demonstrates that two- visit endodontics does not help in reducing the pain incidence and that RCT can be performed safely in single-visit. Simultaneously, it certainly cannot be interpreted that all of the endodontic cases can be easily treated with single-visit RCT. Therefore, physicians should cautiously evaluate the case before deciding to go either for single-visit or two-visit RCT.

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