

Postoperative Pain in Single-Visit Versus Multiple-Visit Endodontic Treatment of Permanent Teeth

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Disclaimers

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ABSTRACT

Background: Postoperative pain is a major concern following root canal treatment (RCT), influenced by factors such as patient anxiety, pulp status, mechanical and chemical irritation, and individual pain thresholds. Debate continues regarding whether single-visit or multi-visit endodontic treatment results in less postoperative discomfort.

Objective: To compare postoperative pain levels between single-visit and two-visit endodontic treatment in patients with vital and necrotic pulps.

Methods: This study included 100 patients (56 males, 44 females) requiring RCT at the Department of Operative Dentistry, Bolan Medical College. Patients were randomly assigned to either a single-visit (n=50) or two-visit (n=50) treatment protocol. Pain was assessed using the Visual Analogue Scale (VAS) at 6, 12, 24, and 48 hours postoperatively. Data analysis was performed using SPSS 25.0, with independent samples t-test used for group comparisons. A significance level of $p \leq 0.05$ was considered statistically significant.

Results: Pain scores were significantly lower in the single-visit group at 12 hours (3.2 ± 1.1 vs. 4.6 ± 1.3 , $p=0.003$) and 24 hours (2.8 ± 1.0 vs. 3.9 ± 1.2 , $p=0.008$). Female patients reported higher pain levels at all intervals ($p<0.05$). Ibuprofen use was similar in both groups (20% vs. 18%, $p=0.74$).

Conclusion: Single-visit endodontic treatment resulted in significantly lower postoperative pain at 12 and 24 hours compared to two-visit treatment. Age, gender, and pulp status influenced pain perception, with females and older patients experiencing higher discomfort.

INTRODUCTION

The commencement of root canal treatment (RCT) is frequently associated with postoperative pain, a significant concern for both clinicians and patients. This pain arises from various contributing factors, including patient anxiety, pre-existing pain conditions, individual pain tolerance, and procedural influences such as residual pulp tissue, mechanical irritation, and chemical trauma to the periapical tissues (1). The perception of postoperative pain has historically influenced treatment decisions, particularly in determining whether endodontic therapy should be completed in a single visit or multiple sessions. While some practitioners advocate for multiple-visit treatment based on the belief that it reduces complications, others support a single-visit approach due to its potential to minimize discomfort and enhance patient compliance (2).

A survey conducted among endodontists found that only 12.8% believed that necrotic pulps could be effectively treated in a single visit, with the majority reserving this approach for cases involving vital pulp or when immediate periradicular surgery was required (2). However, postgraduate endodontic programs increasingly incorporate single-visit protocols into their curricula, supported by evidence indicating no significant difference in treatment success or complication rates when compared to

multi-visit approaches (3). This trend suggests a gradual shift in clinical perspectives, with growing acceptance of single-visit endodontics as a viable treatment modality. Despite these advancements, many endodontists remain hesitant, primarily due to concerns about increased postoperative pain following single-session treatments (4).

Research has demonstrated that the pain experienced after RCT is not always indicative of underlying pathology and does not reliably predict long-term treatment outcomes (5). Nevertheless, pain management remains a critical aspect of endodontic care, as discomfort can significantly impact patient satisfaction and willingness to undergo future procedures. Studies investigating the incidence of post-treatment pain report a wide variation, with postoperative discomfort occurring in 3% to 58% of cases (6). Comparative analyses of single-visit and multi-visit endodontic treatments have yielded conflicting results, with some studies indicating a higher prevalence of pain in multi-visit cases, while others suggest no substantial difference (7,8). For instance, Roane et al. reported a significant reduction in postoperative pain in single-visit cases (15.2%) compared to those treated over multiple visits (31.2%) (7). Conversely, another study documented a higher incidence of post-obturation pain in single-visit treatments (64%) compared to two-visit procedures (38%) (8). Such discrepancies highlight

the complex interplay of biological, procedural, and patient-related factors in pain perception.

Pain is inherently subjective, influenced by an individual's psychological and physiological state, as well as external factors such as anxiety, previous dental experiences, and overall health (9). The assessment of pain is further complicated by the limitations of measurement tools, potential reporting biases, and interindividual variability in pain thresholds (10). Given these challenges, the Visual Analogue Scale (VAS) is widely used in clinical research to quantify postoperative pain. This scale has been validated as a reliable tool for measuring subjective pain experiences and is instrumental in evaluating treatment outcomes (5).

MATERIAL AND METHODS

This study was conducted at the Department of Operative Dentistry, Bolan Medical College, Quetta, from August 21, 2021, to February 22, 2022. The study adhered to ethical principles outlined in the Declaration of Helsinki, and ethical approval was obtained from the institutional review board before the initiation of data collection. Informed written consent was obtained from all participants after explaining the study's objectives, potential risks, and benefits. Confidentiality and anonymity of patient data were strictly maintained throughout the study period.

A total of 100 patients requiring endodontic treatment were recruited using a convenience sampling method. Eligibility criteria included patients aged between 18 and 50 years with mature permanent first and second molar teeth, either maxillary or mandibular, diagnosed with vital or necrotic pulps. Patients presenting with chronic pulpal disease, visible sinus tracts, pre-treatment swelling, endodontic retreatment cases, periodontally compromised teeth, diabetes, pregnancy, or those on corticosteroids were excluded from the study. Additionally, patients with any physical or mental condition preventing sufficient jaw opening for the duration required to complete treatment were also excluded.

The patients were randomly allocated into two groups, each consisting of 50 participants. Group 1 underwent single-visit endodontic treatment, whereas Group 2 received treatment over two separate visits. At the initial visit, a thorough dental history was recorded, followed by a clinical examination and radiographic assessment using standardized periapical radiographs. Local anesthesia was administered using 2% lidocaine with 1:100,000 epinephrine.

Caries excavation and standard endodontic access cavity preparation were performed. Pulp vitality was assessed

using ethyl chloride; a positive response confirmed pulp vitality, whereas an absence of response indicated pulp necrosis. Percussion sensitivity was determined by gently tapping the affected tooth using the handle of a dental mirror. The presence or absence of periapical radiolucency was recorded from the preoperative radiograph.

In the single-visit treatment group, complete root canal preparation and obturation were performed in one session, while in the two-visit group, root canal preparation was completed in the first session, and calcium hydroxide was placed as an intracanal medicament before final obturation in the subsequent visit. The canals were irrigated with normal saline, and final obturation was performed using the lateral condensation technique with gutta-percha and zinc oxide eugenol sealer. After treatment, patients were instructed on postoperative care and provided with a prescription for 600 mg ibuprofen, which they were advised to take as needed for pain relief.

Postoperative pain was assessed using the Visual Analogue Scale (VAS), which ranged from 0 (no pain) to 9 (most severe pain imaginable). Each patient received a VAS pain proforma and a stamped return envelope to record their pain levels at 6, 12, 24, and 48 hours postoperatively. To ensure accurate documentation, patients were asked to complete a baseline preoperative pain assessment in the presence of the clinician before leaving the dental clinic. Any patients who failed to return the VAS proforma were excluded from the final analysis.

Data analysis was performed using SPSS version 25.0. An independent samples t-test was applied to compare postoperative pain levels between the two groups. Categorical variables, such as gender and pulp status, were analyzed using the chi-square test. A significance level of $p \leq 0.05$ was considered statistically significant for all analyses.

RESULTS

The study analyzed postoperative pain levels among 100 patients undergoing single-visit and two-visit endodontic treatment. The participants were evenly distributed between the two groups, with 56 males and 44 females. Two patients from the two-visit group were excluded due to non-submission of the Visual Analogue Scale (VAS) pain assessment forms.

Postoperative pain was assessed at 6, 12, 24, and 48 hours using VAS. The mean pain scores in the single-visit group were consistently lower than those in the two-visit group at all time intervals.

Table I Patient Demographics

Category	N	%
Total Patients	100	100
Male	56	56
Female	44	44
Single-Visit Group	50	50
Two-Visit Group	50	50

Table 2 VAS Pain Scores at Different Time Intervals

Time Interval	Single-Visit Mean $\pm$ SD	Two-Visit Mean $\pm$ SD	p-value
6 Hours	2.1 $\pm$ 0.8	2.5 $\pm$ 0.9	0.12
12 Hours	3.2 $\pm$ 1.1	4.6 $\pm$ 1.3	0.003
24 Hours	2.8 $\pm$ 1.0	3.9 $\pm$ 1.2	0.008
48 Hours	1.4 $\pm$ 0.6	1.9 $\pm$ 0.8	0.09

Statistically significant differences were observed at 12 hours ($p = 0.003$) and 24 hours ($p = 0.008$), with the two-visit group experiencing higher pain levels. However, at 6 hours (p

$= 0.12$) and 48 hours ($p = 0.09$), the differences between the groups were not statistically significant.

Table 3 Ibuprofen Consumption

Group	Patients Taking Ibuprofen (N)	%
Single-Visit	10	20
Two-Visit	9	18

Table 4 Gender-Based Pain Analysis

Time Interval	Male Mean $\pm$ SD	Female Mean $\pm$ SD	p-value
6 Hours	2.0 $\pm$ 0.7	2.6 $\pm$ 0.9	0.015
12 Hours	3.1 $\pm$ 1.0	4.5 $\pm$ 1.2	0.002
24 Hours	2.7 $\pm$ 0.9	3.8 $\pm$ 1.1	0.005
48 Hours	1.3 $\pm$ 0.5	1.8 $\pm$ 0.7	0.021

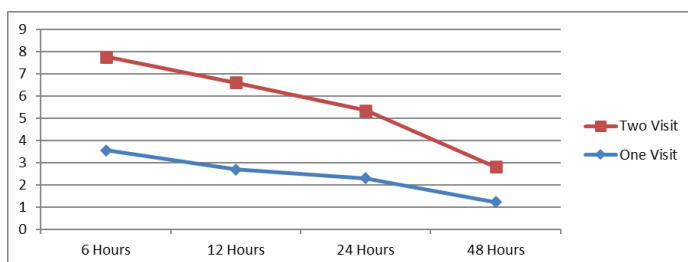
A total of 10 patients (20%) in the single-visit group and 9 patients (18%) in the two-visit group reported the use of ibuprofen for pain relief. The difference in analgesic consumption between the groups was not statistically significant. Female patients reported significantly higher pain levels compared to male patients across all time

intervals. The differences in pain perception were statistically significant at 6 hours ($p = 0.015$), 12 hours ($p = 0.002$), 24 hours ($p = 0.005$), and 48 hours ($p = 0.021$), confirming a greater postoperative pain response in females.

Table 5 Age-Based Pain Analysis

Age Group	Mean Pain Score $\pm$ SD (12 Hours)	Mean Pain Score $\pm$ SD (24 Hours)	p-value (12 Hours)	p-value (24 Hours)
18-34 Years	3.1 $\pm$ 1.1	2.7 $\pm$ 0.9	0.017	0.011
35-50 Years	4.5 $\pm$ 1.2	3.8 $\pm$ 1.1	0.017	0.011

Age-based subgroup analysis demonstrated that younger patients (18-34 years) experienced significantly lower pain levels compared to older patients (35-50 years). At 12 hours, the mean pain score was 3.1 in the younger group versus 4.5 in the older group ($p = 0.017$). Similarly, at 24 hours, younger patients reported a mean pain score of 2.7, whereas older patients had a score of 3.8 ($p = 0.011$), indicating a statistically significant increase in pain perception with advancing age.

**Figure 1 Mean VAS Pain Measurement for all Cases One Visit VS Two Visits Patients**

These results indicate that single-visit endodontic treatment is associated with significantly lower postoperative pain levels at 12 and 24 hours compared to two-visit treatment. Additionally, gender and age significantly influenced pain perception, with female and older patients reporting higher postoperative pain scores. These findings suggest that single-visit endodontic treatment may be preferable for reducing postoperative discomfort, particularly in younger and male patients.

DISCUSSION

The findings of this study demonstrated that single-visit endodontic treatment was associated with significantly lower postoperative pain levels compared to two-visit treatment, particularly at 12 and 24 hours postoperatively. These results aligned with previous research that reported a lower incidence of pain in single-visit endodontic procedures, suggesting that fewer treatment sessions may contribute to reduced postoperative discomfort (7). The higher pain levels observed in the two-visit group may have been attributed to factors such as increased microbial

activity between sessions, heightened inflammatory responses, or residual intracanal bacterial contamination despite the use of intracanal medicaments (8). Although calcium hydroxide has been widely used as an interappointment medicament, its effectiveness in pain reduction remains controversial, with some studies indicating no significant advantage in preventing postoperative pain (9).

Pain perception is highly subjective, influenced by multiple biological and psychological factors, including preoperative pain intensity, anxiety levels, and individual pain thresholds (10). The present study identified that female patients experienced significantly higher pain levels at all postoperative time intervals, consistent with previous research that reported greater pain sensitivity among women undergoing endodontic treatment (12). The underlying mechanisms for this disparity may involve hormonal influences, differences in pain processing pathways, and psychological factors such as heightened anxiety levels in female patients (13). Additionally, younger patients exhibited lower postoperative pain levels compared to older individuals, a finding that corresponded with existing literature indicating that age-related changes in pain perception and healing responses may contribute to variations in postoperative pain experiences (14).

Despite the significant differences observed at 12 and 24 hours, pain levels between the single-visit and two-visit groups converged by 48 hours, suggesting that the impact of treatment protocols on postoperative pain may be transient. This observation was in agreement with studies that reported no long-term difference in pain levels between single- and multi-visit endodontic treatments, reinforcing the notion that both approaches are viable, with short-term pain being a manageable consideration rather than a determinant of treatment success (16). The findings also indicated that maxillary teeth were associated with lower pain levels than mandibular teeth, consistent with prior research attributing this difference to variations in innervation patterns, bone density, and anatomical factors influencing pain perception (17).

The study had several strengths, including a standardized clinical protocol, objective pain assessment using the Visual Analogue Scale (VAS), and statistical adjustments for confounding factors such as gender and age. The inclusion of ibuprofen consumption as an auxiliary measure provided additional insights into pain management trends across treatment groups. However, limitations must be acknowledged. The study relied on patient-reported pain scores, which, despite the reliability of VAS, remained subjective and susceptible to individual variability in pain tolerance and reporting bias. Furthermore, the exclusion of patients with systemic conditions such as diabetes limited the generalizability of findings to a broader patient population. Another limitation was the relatively short follow-up period, which did not account for potential delayed pain episodes or long-term treatment outcomes.

Future research should consider incorporating larger sample sizes, longer follow-up durations, and additional objective pain assessment tools such as inflammatory biomarker analysis to enhance the understanding of pain mechanisms in endodontic therapy. Investigating the role of different intracanal medicaments in modulating postoperative pain may further refine treatment protocols for multi-visit endodontics. Furthermore, psychological factors such as dental anxiety and pain anticipation should be explored as potential contributors to pain perception, as addressing these variables could optimize patient management strategies.

Overall, the results supported the growing body of evidence favoring single-visit endodontic treatment as a viable approach with comparable or lower postoperative pain levels than multi-visit procedures. While clinician preference and case-specific considerations remain pivotal in treatment selection, these findings reinforced the importance of individualized patient care, balancing pain control with treatment efficacy and patient comfort.

CONCLUSION

The findings of this study indicated that single-visit endodontic treatment resulted in significantly lower postoperative pain levels compared to two-visit treatment, particularly at 12 and 24 hours postoperatively, with pain differences diminishing by 48 hours. Gender and age were significant factors influencing pain perception, with females and older patients experiencing higher pain levels. These results support the clinical feasibility of single-visit endodontics as an effective treatment approach, minimizing patient discomfort while maintaining therapeutic efficacy. From a human healthcare perspective, adopting single-visit endodontic treatment can enhance patient compliance, reduce appointment burden, and optimize resource utilization in dental healthcare settings, ultimately improving overall patient satisfaction and accessibility to endodontic care.

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