

Research Article

Post-Obturation Pain Following Single-Visit Versus Two-Visit Endodontic Treatment Using A Hybrid Root Canal Preparation Technique

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ABSTRACT

Background and Objective: The number of appointments required to complete root canal treatment remains a clinically relevant consideration, particularly because postoperative pain can influence patient comfort and treatment acceptance. This study compared the frequency of post-obturation pain 24 hours after single-visit and two-visit endodontic treatment performed using a hybrid root canal preparation technique.

Materials and Methods: This randomized clinical trial was conducted in the Operative Dentistry Department of Nishtar Institute of Dentistry, Multan, Pakistan, from 1st January 2023 to 30th June 2023. One hundred forty patients aged 12-40 years with acute pulpitis or asymptomatic non-vital maxillary anterior teeth through first molars were allocated equally to a single-visit group (n=70) or a two-visit group (n=70). Both groups underwent the same hybrid canal preparation protocol. Postoperative pain was assessed 24 hours after treatment using the Heft-Parker visual analogue scale. Categorical variables were compared using the chi-square test, with $p \leq 0.05$ considered statistically significant.

Results: At 24 hours, 18/70 (25.7%) patients in the single-visit group reported pain compared with 38/70 (54.3%) in the two-visit group. No pain was reported by 52/70 (74.3%) and 32/70 (45.7%) patients, respectively. The between-group difference was statistically significant (χ^2 test, $p=0.001$). Age and sex were not significantly associated with pain within either treatment group.

Conclusion: In this study population and under the treatment protocol used, single-visit endodontic treatment was associated with a lower frequency of pain at 24 hours than two-visit treatment. However, the findings should be interpreted in the context of the study's limited follow-up, single-center design, and the evolving evidence base regarding the influence of treatment visits on postoperative pain.

Keywords: Postoperative Pain, Post-Obturation Pain, Single-Visit Endodontics, Multiple-Visit Endodontics, Hybrid Root Canal Preparation, Visual Analogue Scale, Root Canal Treatment.

INTRODUCTION

Root canal treatment aims to control microbial infection within the root canal system through appropriate access, cleaning, shaping, irrigation, and three-dimensional obturation. Contemporary endodontic treatment emphasizes biologically effective shaping while maintaining the original anatomy of the canal and facilitating adequate irrigation and filling. The ultimate objective is to reduce the microbial burden and prevent reinfection by establishing an effective apical and coronal seal [1,2].

Several instrumentation strategies have been developed for this purpose. Traditional hand-instrumentation approaches include step-back

preparation, in which apical preparation is followed by progressive enlargement toward the coronal portion, and step-down preparation, in which coronal enlargement precedes apical instrumentation. Step-down principles may facilitate irrigant penetration and reduce the accumulation or extrusion of debris. Hybrid preparation combines selected features of these approaches and may incorporate both rotary and hand instruments [3,4].

The number of visits required to complete root canal treatment remains debated. A multiple-visit protocol permits an interappointment dressing and reassessment before obturation, whereas single-visit treatment allows

instrumentation, irrigation, and obturation to be completed during one appointment. Postoperative pain is an important patient-centered outcome because pain occurring after treatment may affect satisfaction, analgesic use, and confidence in endodontic therapy [4,5].

Postoperative pain may be influenced by several procedural and patient-related factors, including the preoperative pulpal and periapical status, instrumentation technique, apical extrusion of dentinal debris or irrigant, occlusal factors, and the presence of microorganisms in the periapical tissues. Consequently, the relationship between the number of treatment visits and postoperative pain has been investigated in numerous clinical trials and systematic reviews, with results that are not entirely consistent [5-7].

The present study was undertaken to compare the frequency of post-obturation pain 24 hours after single-visit and two-visit endodontic treatment when a hybrid root canal preparation technique was used. The study also examined whether age and sex were associated with postoperative pain within each treatment group.

MATERIALS AND METHODS

Study Design and Setting

This randomized clinical trial was conducted in the Operative Dentistry Department of Nishtar Institute of Dentistry, Multan, Pakistan, over six months, from 1st January 2023 to 30th June 2023. Ethical approval was obtained from the Institutional Ethical Review Committee of Nishtar Institute of Dentistry. Patients were recruited from the outpatient department after eligibility assessment and informed consent.

Participants

A total of 140 patients were enrolled. Eligible participants were 12–40 years of age and had permanent teeth requiring endodontic treatment, including teeth with carious pulpal exposure and non-vital asymptomatic maxillary central incisors through first molars. Patients were excluded if the tooth had extensive intracanal calcification, an incompletely formed apex, previous endodontic treatment, grade II or III mobility, a weeping canal, acute periodontitis or acute apical abscess, or a periapical radiolucency greater than 5 mm. Patients taking analgesics, anti-inflammatory drugs, antibiotics, corticosteroids, or tricyclic antidepressants were excluded, as were pregnant or lactating patients, patients allergic

to endodontic medications, and patients with systemic or immunocompromising conditions.

Randomization and Treatment Allocation

Participants were allocated to two equal groups using a lottery-based randomization method. Group A (n=70) received single-visit treatment, whereas Group B (n=70) received treatment over two visits. The clinical procedures were performed under the supervision of a consultant with more than five years of postgraduate experience.

Clinical Procedure

After local anesthesia and rubber dam isolation, caries was removed when present and access cavities were prepared using round and long-tapering diamond burs. The pulp chamber was irrigated with 2.6% sodium hypochlorite. Canal patency was established with a size 15 K-file and working length was determined. Coronal enlargement was performed with Peeso reamers and Gates-Glidden drills. The remaining canal portions were prepared with K-files using a step-back approach, with 2.6% sodium hypochlorite used as the irrigant.

The canals were dried with paper points after instrumentation. The same preparation endpoints were used in both groups. In Group A, instrumentation and obturation were completed at the same appointment. In Group B, the prepared canals were temporarily sealed with a sterile dry cotton pellet and a double seal of Cavit and zinc phosphate cement, and patients were recalled after seven days. At the second appointment, the canals were obturated. In both groups, the same root canal sealer was used and obturation was performed by lateral condensation with gutta-percha cones.

Pain Assessment

Postoperative pain was assessed 24 hours after treatment using the Heft-Parker visual analogue scale. Patients were instructed to mark their perceived pain on a horizontal scale, with values ranging from 0 to 170. The assessment procedure was explained before treatment. Patients were prescribed ibuprofen 600 mg and instructed to use it only when required for pain relief and to contact the clinic if adequate relief was not achieved.

Statistical Analysis

Data were analyzed using SPSS. Descriptive statistics were used to summarize age, sex, and postoperative pain. Mean and standard deviation were calculated for age and visual

analogue scale scores, while frequencies and percentages were calculated for categorical variables. The chi-square test was used to compare postoperative pain between treatment groups and within age and sex strata. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 140 patients completed the treatment protocol, with 70 participants in each treatment group. Participants ranged from 12 to 40 years of age. The mean age was 26.47 ± 7.70 years in the single-visit group and 24.90 ± 7.64 years in the two-visit group.

At 24 hours, 52 (74.3%) participants in the single-visit group reported no pain, whereas 18 (25.7%) reported mild to moderate pain. In the two-visit group, 32 (45.7%) reported no pain and 38 (54.3%) reported mild to moderate pain. The difference between groups was

statistically significant ($p=0.001$). Overall, 84 (60.0%) participants reported no pain and 56 (40.0%) reported pain.

Age stratification did not demonstrate a significant association between age category and postoperative pain in either treatment group. In the single-visit group, 8 (34.8%) participants aged 12–20 years reported pain compared with 10 (21.3%) aged 21–40 years ($p=0.225$). In the two-visit group, pain was reported by 17 (53.1%) participants aged 12–20 years and 21 (55.3%) aged 21–40 years ($p=0.858$).

Sex was also not significantly associated with postoperative pain within either treatment group. In the single-visit group, pain was reported by 9 (24.3%) male and 9 (27.3%) female participants ($p=0.778$). In the two-visit group, pain was reported by 20 (54.1%) male and 18 (54.5%) female participants ($p=0.967$).

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Single Visit (N=70)	Two Visits (N=70)	Total (N=140)
Male, N (%)	37 (52.9)	37 (52.9)	74 (52.9)
Female, N (%)	33 (47.1)	33 (47.1)	66 (47.1)
Total, N (%)	70 (100)	70 (100)	140 (100)
Postoperative Pain At 24 H	Single Visit (N=70)	Two Visits (N=70)	Total (N=140)
No Pain	52 (74.3%)	32 (45.7%)	84 (60.0%)
Pain	18 (25.7%)	38 (54.3%)	56 (40.0%)
Total	70 (100%)	70 (100%)	140 (100%)
Age Group	Single Visit: Pain	Single Visit: No Pain	P Value
12–20 Years	8 (34.8%)	15 (65.2%)	0.225
21–40 Years	10 (21.3%)	37 (78.7%)	
Age Group	Two Visits: Pain	Two Visits: No Pain	P Value
12–20 Years	17 (53.1%)	15 (46.9%)	0.858
21–40 Years	21 (55.3%)	17 (44.7%)	
Sex	Single Visit: Pain	Single Visit: No Pain	P Value
Male	9 (24.3%)	28 (75.7%)	0.778
Female	9 (27.3%)	24 (72.7%)	
Sex	Two Visits: Pain	Two Visits: No Pain	P Value
Male	20 (54.1%)	17 (45.9%)	0.967
Female	18 (54.5%)	15 (45.5%)	

DISCUSSION

The present randomized clinical trial found a lower frequency of pain 24 hours after single-visit treatment than after two-visit treatment when the same hybrid preparation strategy was used. Pain was reported by 25.7% of participants in the single-visit group compared with 54.3% in the two-visit group, producing a statistically significant between-group difference. Within the limitations of the study, these findings suggest that completing instrumentation and obturation in one appointment did not increase early post-

obturation pain and, in this cohort, was associated with less pain at 24 hours [8].

The biological basis of postoperative endodontic pain is multifactorial. Instrumentation can result in the apical extrusion of dentinal debris, microorganisms, pulpal remnants, or irrigant, which may stimulate an inflammatory response in the periapical tissues. Canal preparation geometry and the direction and extent of instrumentation may therefore influence postoperative symptoms. The hybrid preparation protocol

used in the present study combined coronal enlargement with hand instrumentation of the remaining canal, while sodium hypochlorite irrigation was used throughout the preparation [9].

The findings should, however, be interpreted against the broader evidence base. Earlier systematic reviews reported that postoperative pain and other complications were generally similar between single- and multiple-visit treatment, although some analyses suggested differences at specific follow-up intervals. The 2022 Cochrane review, which included 47 studies and 5,693 analyzed teeth, found no clear difference in pain up to 72 hours after obturation, but reported a higher proportion of pain within one week in single-visit treatment in the pooled evidence. The review also concluded that neither treatment strategy was clearly superior overall. More recent evidence syntheses have likewise emphasized that differences in pain outcomes are inconsistent and may be affected by heterogeneity in treatment protocols, pain measurement, patient selection, and follow-up periods [10].

The discrepancy between the present findings and some contemporary pooled evidence may be explained by the specific characteristics of this trial. The study used a defined hybrid instrumentation approach, assessed pain at a single early time point, and included a relatively restricted clinical population. The two-visit group also underwent an interappointment period of seven days, which introduces a treatment interval that may itself influence pain reporting. In addition, the original study did not report a detailed pain-intensity distribution, analgesic consumption, or longer-term outcomes, limiting direct comparison with modern trials and systematic reviews [11].

Age and sex were not significantly associated with postoperative pain within either treatment group. Although demographic factors can influence pain perception, the subgroup analyses in this study were relatively small and should therefore be considered exploratory rather than definitive. The balanced sex distribution between the treatment groups strengthens comparability, but the study was not designed or powered primarily to investigate demographic predictors of pain [12].

From a clinical perspective, single-visit treatment offers practical advantages, including completion of treatment in one appointment and elimination of an interappointment temporary restoration. Nevertheless, the

decision to complete treatment in one or multiple visits should be individualized according to the pulpal and periapical diagnosis, complexity of the case, ability to achieve adequate disinfection and drying, patient factors, and operator judgment. Current evidence does not support the conclusion that single-visit treatment is universally superior with respect to postoperative pain.

Limitations

Several limitations should be acknowledged. First, the study was conducted at a single institution and included a relatively modest sample. Second, postoperative pain was assessed only at 24 hours, preventing evaluation of the trajectory of pain over subsequent days. Third, the study included selected tooth types and clinical conditions, limiting generalizability. Fourth, the use of a visual analogue scale requires patient understanding and may introduce measurement variability. Fifth, the study did not include a separate control or sham group. Finally, the original report provides limited information regarding allocation concealment, protocol registration, and a formal sample-size calculation; these methodological details should be clarified if the original study records are available.

CONCLUSION

Within the limitations of this randomized clinical trial, single-visit endodontic treatment using the described hybrid root canal preparation technique was associated with a significantly lower frequency of post-obturation pain at 24 hours than two-visit treatment. Age and sex were not significantly related to pain within either treatment group. These findings support the feasibility of single-visit treatment in appropriately selected cases, but they should not be interpreted as evidence that single-visit treatment is universally preferable. Contemporary evidence indicates that the choice between single- and multiple-visit treatment should be based on the clinical condition of the tooth, treatment complexity, infection-control considerations, patient factors, and clinician judgment.

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