# Evaluation of Postoperative Pain After Endodontic Treatment in Molars With and Without Foraminal Enlargement: A Prospective Randomized Clinical Trial

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**Abstract**

**Aim:** This randomized clinical study evaluated how two different auxiliary chemical substances affect postoperative pain in 301 single-visit endodontic treatments, where the apical foramen was enlarged and cement was extruded into the periapical area. **Material and method:** The study used two auxiliary chemicals: 2% chlorhexidine gel (2% CHX; n = 145) and 5.25% sodium hypochlorite (5.25% NaOCl; n = 156). Postoperative pain and discomfort were assessed at 24 hours and reported as percentages. Statistical analysis involved the Fisher exact test and the Chi-square test to compare variations in pain. Variables analyzed included previous pain, pulp status, age, and number of root canals.**Result:** In teeth with previous pain, those treated with 2% CHX gel showed a postoperative pain incidence of 22.22% (6/27), compared to 11.11% (3/22) with 5.25% NaOCl. For teeth without previous pain, postoperative pain was 8.5% (6/118) with 2% CHX gel and 2.33% (3/129) with 5.25% NaOCl, with no statistically significant difference between groups. Previous pain significantly influenced postoperative outcomes ($p < 0.001$). At 24 hours post-treatment, 93.7% (282/301) of teeth were pain-free, while 6.3% (19/301) experienced some pain and took one or two doses of medication. **Conclusion:** Based on the results, it can be concluded that the auxiliary chemical substances had no influence on postoperative pain.

**Keywords:** Root canal therapy; chlorhexidine; sodium hypochlorite; pain, postoperative.

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## INTRODUCTION

In the field of endodontics, the development and control of pain and discomfort following endodontic treatment are crucial issues for both patients and dentists.[1] Preoperative discomfort, pulp and periapical alterations, tooth type, location, and other factors have all been linked to the development of postoperative pain in the relevant literature. The number of visits, initial therapy or retreatment, iatrogenic technical procedures related to chemical or mechanical injuries, and harm from microbes and their products are other factors that have been documented in the literature and may also be linked to postoperative complaints.[2,3] Some authors found no connection between overfilling and overinstrumentation as mechanical variables and postoperative pain. However, excessive instrumentation combined with an enlarged apical foramen may make auxiliary chemical extrusion more likely.[4] As a result, the current prospective randomised study's goal was to evaluate the impact of various auxiliary chemicals on postoperative pain in 301 single-visit endodontic procedures involving apical foramen enlargement and endodontic cement extrusion into the periapical area.

## METHODOLOGY

The present study was conducted at the Department of Conservative Dentistry and Endodontics, Rama Dental College, Hospital, and Research Centre, Kanpur. A total of 301 single-visit endodontic treatments were performed on 240 patients aged 13 to 79 years. Oral and written consent was obtained from all participants. Data on personal information, general health status, probable diagnosis, indicated treatment, and pre-, intra-, and post-operative procedures were recorded and filed.

All patients seeking treatment during the study period who met the inclusion criteria were selected in order of arrival. Since pulp and periapical diagnoses and the tooth to be treated were initially unknown, selection was effectively random. Both primary endodontic treatments and retreatments involving all dental groups were included.

Exclusion criteria were teeth with open apexes, root resorptions, dental trauma, treatments not completed in a single session, root canals without achieved apical foramen patency, and teeth without overfilling.

Pulp and periapical diagnoses were established using periapical radiographs and the cold pulp vitality test. The initial clinical examination assessed the presence of pain, fistula, swelling, sensitivity to palpation, and response to cold pulp tests. These examinations were performed on both affected teeth and control (contralateral unaffected) teeth. Intraoral periapical radiographs were used to detect any periapical lesions. Teeth were divided into two groups based on the auxiliary chemical used for root canal preparation. In Group 1 (n = 145), 2% chlorhexidine gel (2% CHX gel; Essencial Pharma, Itapetininga, SP, Brazil) was used, while in Group 2 (n = 156), 5.25% sodium hypochlorite (5.25% NaOCl) was employed.

The auxiliary chemicals were introduced into the root canals using a 3 mL hypodermic syringe with a 20 × 5.5 needle, applied only during instrumentation. For irrigation in both groups, physiological saline solution was used, delivered under pressure with a 5 mL hypodermic syringe and a 20 × 5.5 needle at each instrument change. The auxiliary chemical was then reintroduced after irrigation with saline.

After root canal preparation and shaping, the final diameter of the apical foramen was determined using an anatomical finishing file. This involved identifying the size of the K-type hand file that best fit the prepared apical foramen. This diameter served as the reference for calibrating the master gutta-percha cone used to fill the root canal.

If there was no apical stop for anchoring, the calibration diameter for the cone was set two sizes larger than the final apical foramen diameter. The root canal was filled with chlorhexidine gel, and the gutta-percha cone was shaped with apical pressure to achieve a snug fit against the canal walls, reaching an ideal lodgment point approximately 2 mm short of the full root canal length, as confirmed radiographically.

Endodontic sealer was applied with the gutta-percha cone to fill the entire canal length. The cone was then placed at the lodgment point for thermoplasticization and vertical compaction. The cervical portion of the root canal was sealed with Coltosol, and the coronal access cavity was restored with composite resin or glass fiber post cementation, as needed. Necessary occlusal adjustments were made.

Post-treatment, patients were instructed to take 100 mg of Nimesulide every 12 hours for 3 days only if severe pain occurred. The operator contacted all patients by telephone 24 hours after treatment to assess their postoperative status. Patients with persistent symptoms were asked to return to the clinic for further management.

Postoperative pain was evaluated as either absence or presence of pain, regardless of its intensity. The incidence of postoperative pain and discomfort was recorded and expressed as percentages. Statistical analysis was performed using the Fisher exact test and the Chi-square test for non-parametric data. Analyses were conducted with SPSS software, and differences were considered statistically significant at p-values ≤ 0.05.

## RESULTS

A total of 301 teeth endodontically treated with foraminal enlargement were assessed. After 24 hours, 93.7% (282/301) presented no pain and 6.3% (19/301) had some level of postoperative pain (sensitivity, mild pain, moderate pain or severe pain) and used one or two doses of medication. Among the latter, only 0.66% (2/301) had severe spontaneous pain (flare-up) and returned for further assessment.

Table 1. Frequency distribution of descriptive clinical factors analysed in the sample

| Clinical factors | Categories | Total n (%) | Absence of pain | Presence of pain | p-values |
|---|---|---|---|---|---|
| Previous pain | Yes | 54 (17.94 %) | 45 (83.33%) | 9 (16.67%) | p < 0.001 |
| | No | 247 (82.06 %) | 238 (96.36%) | 9 (3.64 %) | |
| Pulp status | Vital tooth | 123 (40.86 %) | 118 (95.94%) | 5 (4.07 %) | p > 0.05 |
| | Non-vital tooth | 100 (33.22 %) | 94 (94.00%) | 6 (6.00 %) | |
| | Retreatment | 78 (25.92 %) | 71 (91.03%) | 7 (8.97 %) | |
| Number of root Canals | 1 | 121(40.20%) | 118 (97.52%) | 3 (2.48 %) | p > 0.05 |
| | 2 | 47 (15.61 %) | 42 (89.36%) | 5 (10.64%) | |
| | 3 | 114 (37.87 %) | 106 (92.98%) | 8 (7.02 %) | |
| | 4 or more | 19 (6.31%) | 17 (89.47%) | 2 (10.53%) | |
| Age | Up to 35 years | 64 (21.26 %) | 58 (90.63%) | 6 (9.37 %) | p > 0.05 |
| | 36 to 45 years | 98 (32.56 %) | 91 (92.86%) | 7 (7.14 %) | |
| | 46 to 55 years | 80 (26.58 %) | 77 (96.25%) | 3 (3.75 %) | |
| | Over 55 years | 59 (19.60 %) | 57 (96.61%) | 2 (3.39 %) | |

Table 2. Influence of auxiliary chemical substances on teeth with (n = 54) and without (n = 247) previous pain

| | Auxiliary chemical | Total n (%) | Absence of Pain | Presence of Pain | p-values |
|---|---|---|---|---|---|
| | CHX | 27 (50%) | 21 (77.78%) | 6 (22.22%) | p > 0.05 |
| Teeth with previous pain | NaOCl | 27 (50%) | 24 (88.89%) | 3 (11.11%) | p > 0.05 |
| Teeth without previous pain | CHX | 118 (47.77%) | 112 (94.92%) | 6 (5.08%) | p > 0.05 |
| | NaOCl | 129 (52.23%) | 126 (97.67%) | 3 (2.33%) | p > 0.05 |

CHX = 2% chlorhexidine gel; NaOCl = 5.25% sodium hypochlorite; "p" values calculated using Fisher's Exact test.

Table 2 depicts the analyses of the influence of the auxiliary chemical substances in teeth with and without preoperative pain. Neither of the auxiliary chemical substances reduced or exacerbated postoperative pain after 24 hours.

## DISCUSSION

Postoperative pain following endodontic treatment is common, with a reported prevalence ranging from **3% to 58%**. It may result from chemical, mechanical, or microbiological injuries to periradicular tissues. Psychological factors have also been suggested as potential contributors to postoperative pain.[5] This study included vital, non-vital, and endodontically retreated teeth. Neither pulp status nor the treatment modality showed a significant influence on postoperative pain. These findings align with previous research that reported no difference in the occurrence of postoperative pain between primary endodontic treatments and retreatments.[6,7,8] The results of this study demonstrated that **apical overinstrumentation and overfilling had minimal impact on postoperative pain**, as all teeth assessed were overinstrumented and overfilled. These findings align with previous research indicating that achieving apical patency and overinstrumentation with apical foramen enlargement does not increase the incidence, severity, or duration of postoperative pain.[9]

Our results differ from those of Georgopoulou et al.,[10] who reported an increased incidence of flare-ups with overinstrumentation, and from Nobuhara et al.,[11] who found that endodontic instruments extended beyond the apical foramen can extrude irritants into periapical tissues, increasing both the incidence and severity of pain. In their studies, progressive crown-apex decontamination was crucial in preventing such occurrences.

Teeth were treated in a single visit because the combination of effective mechanical instrumentation, use of antimicrobial irrigants, and three-dimensional root canal obturation can effectively reduce intracanal microbiota and promote favorable outcomes. Additionally, several previous studies found no significant difference in pain incidence between single- and multiple-visit treatments.[1,2,12]

Some studies have reported that single-visit treatments are associated with a lower rate of postoperative pain, while others have found contrary results. Sathorn et al.[13] found no convincing evidence of differences in flare-up incidences between single- and multiple-visit treatments.

## CONCLUSION

Based on the results of this study, it can be concluded that the chemical substances used in single-visit endodontic treatments or retreatments, combined with enlargement of the apical foramen and apical extrusion of the endodontic sealer, had no influence on spontaneous postoperative pain.

## REFERENCES


1. ElMubarak AH, Abu-bakr NH, Ibrahim YE. Postoperative pain in multiple-visit and single-visit root canal treatment. J Endod. 2010 Jan;36(1):36-9.
2. Walton R, Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. J Endod. 1992 Apr;18(4):172-7.
3. Glennon JP, Ng YL, Setchell DJ, Gulabivala K. Prevalence of and factors affecting postpreparation pain in patients undergoing two-visit root canal treatment. Int Endod J. 2004 Jan;37(1):29-37.
4. Ng YL, Glennon JP, Setchell DJ, Gulabivala K. Prevalence of and factors affecting post-obturation pain in patients undergoing root canal treatment. Int Endod J. 2004 June;37(6):381-91.
5. Siqueira JF Jr, Rôças IN, Favieri A, Machado AG, Gahyva SM, Oliveira JC, et al. Incidence of postoperative pain after intracanal procedures based on an antimicrobial strategy. J Endod. 2002 June;28(6):457-60.
6. Harrison JW, Baumgartner CJ, Zielke DR. Analysis of interappointment pain associated with the combined use of endodontic irrigants and medicaments. J Endod. 1981 June;7(6):272-6. http://dx.doi.org/10.1016/S0099-2399(81)80006-4.
7. Harrison JW, Baumgartner JC, Svec TA. Incidence of pain associated with clinical factors during and after root canal therapy.

Part 1. Interappointment pain. J Endod. 1983 Sept;9(9):384-7. http://dx.doi.org/10.1016/S0099-2399(83)80190-3. PMid:6579198

8. Ince B, Ercan E, Dalli M, Dulgergil CT, Zorba YO, Colak H. Incidence of postoperative pain after single- and multi-visit endodontic treatment in teeth with vital and non-vital pulp. Eur J Dent. 2009 Oct;3(4):273-9. PMid:19826598.
9. Walton R. Interappointment flare-ups: incidence, related factors, prevention, and management. Endod Top. 2002 Nov;3(1):67-76. http:// dx.doi.org/10.1034/j.1601-1546.2002.30107.x.
10. Georgopoulou M, Anastassiadis P, Sykaras S. Pain after chemomechanical preparation. Int Endod J. 1986 Nov;19(6):309-14. http://dx.doi. org/10.1111/j.1365-2591.1986.tb00495.x. PMid:3466868
11. Nobuhara WK, Carnes DL, Gilles JA. Anti-inflammatory effects of dexamethasone on periapical tissues following endodontic overinstrumentation. J Endod. 1993 Oct;19(10):501-7. http://dx.doi.org/10.1016/S0099-2399(06)81491-3.
12. Buchanan LS. Continuous wave of condensation technique. Endod Prac. 1998 Dec;1(4):7-10
13. Sathorn C, Parashos P, Messer H. The prevalence of postoperative pain and flare-up in single- and multiple-visit endodontic treatment: a systematic review. Int Endod J. 2008 Feb;41(2):91-9.