



Effect of single dose Ibuprofen and Ketorolac Tromethamine as Pretreatment analgesic on Postoperative pain after Single Visit Endodontics – An in vivo study

Dr. Akshita Abrol¹, Dr. Anuradha Rani², Dr. Hitesh Gupta³

¹Post Graduate student, Department of Conservative Dentistry and Endodontics, Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh

²Professor and Head, Department of Conservative Dentistry and Endodontics, Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh

³Professor, Department of Conservative Dentistry and Endodontics, Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh

Date of Submission: 20-08-2025

Date of Acceptance: 30-08-2025

ABSTRACT

Introduction: The prevention and management of postoperative pain are one of the most important aspects of successful endodontic treatment. Although various anaesthetics, analgesics and sedation techniques have helped manage the pain during the endodontic treatment, but postoperative pain still remains a common and complex challenge for clinicians.

Aim: To compare and evaluate the efficacy of single oral dose of premedication with 10mg ketorolac tromethamine and 400mg Ibuprofen in reducing post endodontic pain following single visit endodontics in patients presenting with symptomatic irreversible pulpitis.

Materials and Methods: 30 patients diagnosed with symptomatic irreversible pulpitis were selected for the study and randomly allocated (1:1) to any of the two groups; Ketorolac tromethamine or Ibuprofen. Medications were administered 30 minutes before initiating the endodontic treatment. Pain intensity was recorded on 10cm visual analogue scale (VAS) at 6- and 12-hours interval.

Results: At 12 hours, mean \pm standard deviation (SD) of VAS scores (in cm) for Ketorolac tromethamine or Ibuprofen were 1.5333 ± 0.7432 and 2.4667 ± 1.40746 respectively. Tukey's post-hoc test showed no such statistically significant difference in VAS score among the two groups ($P=0.133$).

Conclusion: Single oral dose of Ketorolac tromethamine as well as Ibuprofen as pre-treatment analgesics reduced postoperative endodontic pain in patients with symptomatic irreversible pulpitis.

Keywords: Ketorolac tromethamine; Ibuprofen; pre-emptive analgesia; post endodontic pain; single visit endodontics

I. INTRODUCTION

The International Association for the Study of Pain defines pain as 'An unpleasant sensory and emotional experience associated with, or resembling that associated with actual or potential tissue damage.'^[1] Preventing and controlling postoperative endodontic pain is the most crucial aspect of endodontic treatment. Studies have reported incidence of postoperative pain after endodontic treatment in 25-69% of patients having preoperative pain (symptomatic irreversible pulpitis).^[2,3] Pain perception is inherently subjective and is modulated by a combination of inflammatory, mechanical, microbial, and host-related factors. Postoperative endodontic pain is predominantly inflammatory in nature, with prostaglandins serving as principal mediators.^[4] Non-steroidal anti-inflammatory drugs (NSAIDs) control pain by inhibiting cyclooxygenase (COX) enzymes, thereby reducing prostaglandin synthesis.^[5]

Among NSAIDs, Ibuprofen is most commonly used due to its dual analgesic and anti-inflammatory properties. It also enhances anaesthetic success when administered preoperatively in a hot tooth.^[6] Ketorolac tromethamine is another NSAID with potent analgesic action and moderate anti-inflammatory effects. It inhibits prostaglandin synthesis and has demonstrated promising outcomes in reducing postoperative dental pain.^[5,7,8] While both drugs have demonstrated clinical effectiveness, a direct comparison of their relative efficacy in managing post-endodontic pain has yet to be fully established.

The lack of a clear anti-inflammatory and pain control protocol after endodontic treatment highlights the need to identify and adopt the most effective method for managing such pain.^[9,10] The purpose of this study was to evaluate and compare



the effect of single oral dose of 10 mg of Ketorolac with 400 mg of Ibuprofen on postoperative pain after single visit endodontic treatment in patients diagnosed with symptomatic irreversible pulpitis.

II. MATERIALS AND METHOD

Institutional Ethical Committee approval for this research was obtained.

30 patients between 18-50 years of age reporting to the Department of Conservative Dentistry and Endodontics with the symptomatic irreversible pulpitis were enrolled into the study. A detailed medical and dental history was recorded, followed by comprehensive clinical examinations, including thermal (cold) and electric pulp testing, as well as radiographic evaluation.

Inclusion criteria

- Symptomatic irreversible pulpitis with the baseline pain score greater than 6.
- Single rooted teeth
- Pulp exposure due to deep extent of caries
- Teeth without root resorption

Exclusion criteria

- Periapical pathosis
- Teeth with periapical index score >3,
- Patients with known allergy, sensitivity, or history of adverse reactions to the medications to be administered,
- Analgesics or anti-inflammatory drugs taken within last 6 hours and
- Medically compromised patients.

The selected patients were randomly assigned (1:1) to any of the two groups:

Group 1- Ketorolac tromethamine (Ketromist-DT 10mg, ALCHEMIST Ltd.)

Group 2- Ibuprofen (Brufen 400mg, Abbott Healthcare Pvt. Ltd.)

Single oral dose of medication was given 30 min before the initiation of endodontic therapy. Isolation of the operating field was obtained with rubber dam application after successful anaesthesia with 2% lidocaine with 1:80,000 adrenaline. Access cavity was prepared with a round diamond bur using an airtor handpiece under copious water cooling. The canal was negotiated till working length using a size 15 k file while maintaining apical patency. Working length was confirmed using electronic apex locator as well as radiographically. Biomechanical preparation was carried out with hybrid technique using hand K files and Dentsply ProTaper Gold files up to the working length and prepared to a minimum of F1.

The file system was operated with Dentsply X-Smart Endomotor under the manufacturer's recommendations. Copious irrigation with 3% Sodium hypochlorite and 17% EDTA was accomplished using a side vented irrigation needle during canal preparation. Final irrigation was done with saline. After completely drying the canal with sterile absorbent paper points, obturation was accomplished using lateral compaction of gutta percha with AH Plus root canal sealer. Obturation was followed by post endodontic restoration with composite. The tooth was relieved of occlusion at the end of the procedure. A rescue medication (Etoricoxib) was prescribed, and the patients were instructed to take it only if they experienced severe pain postoperatively. If rescue medication was taken within the 12 hours after the treatment, then the patient was excluded from the study. Patient's postoperative pain was then recorded at 6- and 12-hours interval using Visual Analogue Scale [VAS]. Each patient was provided with a postoperative pain questionnaire incorporating a Visual Analog Scale (VAS). To ensure comprehension of the tool, patients were first asked to record a baseline preoperative pain score (T_1). They were then instructed to complete the questionnaire at 6 hours (T_6) and 12 hours (T_{12}) postoperatively. Pain intensity was measured using a 10-cm VAS, anchored at one end with 'no pain' and at the other with 'worst possible, unbearable, excruciating pain.' In cases where patients were unable to report to the clinic in person, pain scores were obtained via telephone follow-up. The statistical analysis was done using SPSS (IBM SPSS Statistics for Windows, Version 19.0 Armonk, NY, USA: IBM Corp.) The comparison of VAS scores among the two groups at T_6 and T_{12} was done using Tukey's post-hoc test. The level of significance for the study was set at a P-value of less than 0.05.



Figure 1. Rubber dam isolation followed by access opening of mandibular premolar



Figure 2. Copious irrigation in between biomechanical preparation



Figure 4. Post obturation radiograph

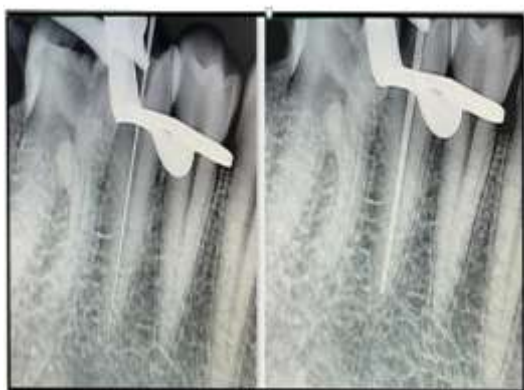


Figure 3. Working length determination followed by master cone radiograph

III. RESULTS

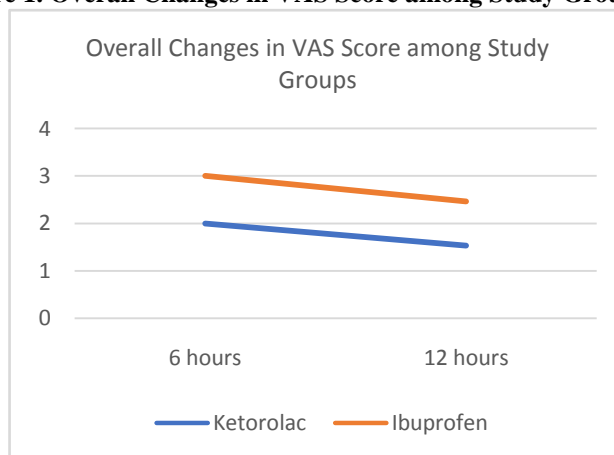
The analysis was carried out for 30 fully compliant patients on the basis of Visual Analogue scale (VAS) ranging from 0-100mm. Both the drugs effectively reduced the postoperative pain perception after single visit endodontics by the end of 12 hours. No significant difference was observed among the two groups with respect to post-operative pain scores at 6 and 12 hours. Table 1 and 2 shows the mean and standard deviations (SDs) of VAS scores for Ketorolac Tromethamine and Ibuprofen at 6 and 12 hours. Figure 1 depicts the overall changes in VAS Score among study groups using line chart.

Table 1. Comparison of VAS Score at 6 Hours

	N	Mean VAS score	Std. Deviation	P value
Ketorolac	15	2.0000	.84515	0.061*
Ibuprofen	15	3.0000	1.06904	

Table 2 Comparison of VAS Score at 12 hours

	N	Mean VAS Score	Std. Deviation	P value
Ketorolac	15	1.5333	.74322	0.133*
Ibuprofen	15	2.4667	1.40746	

**Figure 1. Overall Changes in VAS Score among Study Groups**

IV. DISCUSSION

A successful endodontic treatment should result in effective pain relief and complete resolution of associated clinical symptoms, but in single visit root canal treatment more than 50% of patients experience severe pain as reported by Gotler.^[3] Controlling postoperative pain after single visit root canal treatment remains one of the persistent challenges in endodontic practice.^[11] This is largely due to the biological response triggered during the removal of inflamed or infected pulp tissue along with mechanical irritation to the apical periodontal ligament during routine steps like establishing canal patency and cleaning and shaping procedure.^[12] This initiates the release of inflammatory mediators such as prostaglandins, interleukins, bradykinin, leukotrienes, cytokines, Substance P, Calcitonin Gene Related Peptide (CGRP) which inadvertently stress the surrounding periapical tissues and contribute to post-operative inflammation and pain.^[12] Pain perception generally involves three main stages. The initial stage is pain sensitivity. The second stage is characterized by transmission of the signals to the peripheral nervous system followed by the third stage in which these signals are transmitted to the higher brain centres via the central nervous system.^[14] Postoperative pain is more likely to occur within the first 24 h following endodontic treatment.^[13] Effective management of postoperative endodontic pain requires a multifaceted approach that addresses both peripheral and central mechanisms of pain perception.

Both non-pharmacological and pharmacological measures can be utilized to reduce postoperative pain. Patient counselling helps to lower anxiety, sets realistic expectations, enhances

compliance, all of which can lower perceived post operative pain. Among pharmacologic options, nonsteroidal anti-inflammatory drugs (NSAIDs) have shown consistent efficacy in gaining effective analgesia during the procedure as well as pain control after single visit root canal treatment.^[15] Preoperative administration of NSAIDs effectively inhibit the cyclo-oxygenase (COX) pathway at an early stage, thereby reducing the synthesis of prostaglandins and help in alleviating pain.^[16] Pre-emptive pre-operative administration of these NSAID's has been found beneficial in achieving profound analgesia during endodontic treatment as well as reduced postoperative pain score after single visit endodontic treatment of symptomatic teeth.^[17,18] In the present study, Ketorolac and Ibuprofen were orally administered 30 minutes before starting the single visit endodontic treatment in patients diagnosed with symptomatic irreversible pulpitis to see the effect on postoperative pain score at 6- and 12-hours interval.

Ketorolac tromethamine is a potent non-narcotic analgesic exhibiting both analgesic and anti-inflammatory activity.^[19] Ketorolac provides pain relief by inhibiting the synthesis of prostaglandins at peripheral sites, reducing the sensitization of pain receptors.^[20,21] Ketorolac has been found to be more effective than both acetaminophen as well as acetaminophen combined with codeine in managing postoperative pain.^[22]

Ibuprofen, a non-selective COX inhibitor which is a derivative of propionic acid, has both analgesic and anti-inflammatory action.^[23] The action is similar to that of Ketorolac tromethamine in inhibiting cyclo-oxygenase enzyme responsible for the synthesis of prostaglandins.^[6,7,23] In various studies, oral administration of Ibuprofen 1 hour prior to the root canal treatment has proven to



enhance the efficacy of inferior alveolar nerve block in acute irreversible pulpitis^[24] Oral administration of Ibuprofen 1 hr before anaesthetic administration has shown to increase the success of the inferior alveolar nerve block in patients presenting with irreversible pulpitis.^[25]

Priyank Sethi et al. evaluated 19 patients for reduction in pain score using Ketorolac as pre-emptive analgesic in symptomatic teeth with baseline score >3 and achieved pain score of 0.53 ± 1.17 at 6 hours and 0.42 ± 0.77 at 12 hours intervals. The reduction in postoperative pain score was estimated to be around 2.5. In the present study, for the Ketorolac group, the baseline pain score was >6. The mean VAS scores reduced to 2.0 ± 0.84 at 6 hours and 1.53 ± 0.74 at 12 hours. The reduction in postoperative pain score was approximately around 4 in the present study whereas in Sethi et al the reduction in postoperative pain score was around 2. The difference may be

attributed to the higher initial pain levels in the present study as compared to milder pain scores in the Priyank Sethi's study. (Table 3)

Teja et al. used Ibuprofen in 50 patients for reduction in post-operative pain and reported a 6-hour score of 3.86 ± 0.82 with a baseline score >7. In the present study, for the Ibuprofen group, 15 patients were included with a baseline pain score >6. The mean VAS scores reduced to 3.0 ± 1.06 at 6 hours and 2.46 ± 1.40 at 12 hours. The results are comparable. (Table 3)

The findings of the present study indicate that both Ketorolac and Ibuprofen as preoperative analgesics reduced the postoperative pain after single visit endodontic treatment in symptomatic cases at 6- and 12-hours intervals. Although no significant difference was observed between the two medications however, Ketorolac showed a better pain relief than Ibuprofen.

Table 3. Comparison of mean pain scores (VAS) at 6 and 12 hours between present study and previous studies

Groups	Study	N	Mean of pain score ± standard deviation		Baseline Score
			6 hours	12 hours	
Ketorolac	Present Study	15	2±0.84	1.53±0.74	>6
	Priyank Sethi et al (2014)	19	0.53±1.17	0.42±0.77	>3
Ibuprofen	Present study	15	3±1.06	2.46±1.40	>6
	Teja et al (2022)	50	3.86±0.82	-	>7

V. CONCLUSION

Within the constraints of the present study, in symptomatic irreversible pulpitis cases, administering a pre-emptive single oral dose of 10 mg of Ketorolac or 400 mg of Ibuprofen 30 minutes prior to single visit endodontic treatment significantly decreased postoperative pain scores. Additional studies are required to investigate the effectiveness of these medications in diverse clinical scenarios, including comparison of effect of these medications in single-visit and multiple-visit endodontic treatment cases in mandibular molars, as well as studies comparing pain control utilizing different modes of drug administration

REFERENCES

- [1]. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, Keefe FJ, Mogil JS, Ringkamp M, Sluka KA, Song XJ, Stevens B, Sullivan MD, Tutelman PR, Ushida T, Vader K. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. *Pain*. 2020 Sep 1;161(9):1976-1982
- [2]. Praveen R, Thakur S, Kirthiga M. Comparative Evaluation of Premedication with Ketorolac and Prednisolone on Postendodontic Pain: A Double-blind Randomized Controlled Trial. *J Endod*. 2017 May;43(5):667-673.
- [3]. Gotler M, Bar-Gil B, Ashkenazi M. Postoperative pain after root canal



- treatment: a prospective cohort study. *Int J Dent.* 2012;2012:310467.
- [4]. Mehrvarzfar P, Abbott PV, Saghiri MA, Delvarani A, Asgar K, Lotfi M, Karamifar K, Kharazifard MJ, Khabazi H. Effects of three oral analgesics on postoperative pain following root canal preparation: a controlled clinical trial. *Int Endod J.* 2012 Jan;45(1):76-82.
- [5]. Burian M, Geisslinger G. COX-dependent mechanisms involved in the antinociceptive action of NSAIDs at central and peripheral sites. *Pharmacol Ther.* 2005 Aug;107(2):139-54.
- [6]. Stamos A, Drum M, Reader A, Nusstein J, Fowler S, Beck M. An Evaluation of Ibuprofen Versus Ibuprofen /Acetaminophen for Postoperative Endodontic Pain in Patients with Symptomatic Irreversible Pulpitis and Symptomatic Apical Periodontitis. *Anesth Prog.* 2019 Winter;66(4):192-201.
- [7]. Aggarwal V, Singla M, Kabi D. Comparative evaluation of effect of preoperative oral medication of ibuprofen and ketorolac on anesthetic efficacy of inferior alveolar nerve block with lidocaine in patients with irreversible pulpitis: a prospective, double-blind, randomized clinical trial. *J Endod.* 2010 Mar;36(3):375-8.
- [8]. Mrosczak E, Combs D, Chaplin M, Tsina I, Tarnowski T, Rocha C, Tam Y, Boyd A, Young J, Depass L. Chiral kinetics and dynamics of ketorolac. *J Clin Pharmacol.* 1996 Jun;36(6):521-39.
- [9]. Attar S, Bowles WR, Baisden MK, Hodges JS, McClanahan SB. Evaluation of pretreatment analgesia and endodontic treatment for postoperative endodontic pain. *J Endod.* 2008;34:652-5.
- [10]. Sethi P, Agarwal M, Chourasia HR, Singh MP. Effect of single dose pretreatment analgesia with three different analgesics on postoperative endodontic pain: A randomized clinical trial. *J Conserv Dent* 2014;17(6):517- 521.
- [11]. Levin L, Amit A, Ashkenazi M. Post-operative pain and use of analgesic agents following various dental procedures. *Am J Dent* 2006;19:245-7.
- [12]. Siqueira JF, Barnett F. Interappointment pain: Mechanisms, diagnosis, and treatment. *Endod Topics* 2004;7:93-109.
- [13]. Menhinick KA, Gutmann JL, Regan JD, Taylor SE, Buschang PH. The efficacy of pain control following nonsurgical root canal treatment using ibuprofen or a combination of ibuprofen and acetaminophen in a randomized, double-blind, placebo-controlled study. *Int Endod J* 2004;37:531-41.
- [14]. Jain N, Gupta A, N M. An insight into neurophysiology of pulpal pain: facts and hypotheses. *Korean J Pain.* 2013 Oct;26(4):347-55.
- [15]. Holstein A., Hargreaves K.M., Niederman R. Evaluation of NSAIDs for treating postendodontic pain- a systematic review. *Endod. Topics.* 2002;1:3-13.
- [16]. Gopikrishna V, Parameswaran A. Effectiveness of prophylactic use of rofecoxib in comparison with ibuprofen on postendodontic pain. *J Endod* 2003;29:62-4
- [17]. Flath RK, Hicks ML, Dionne RA, Pelleu GB Jr. Pain suppression after pulpectomy with preoperative flurbiprofen. *J Endod* 1987;13:339-47.
- [18]. Teja KV, Ramesh S, Vasundhara KA. Comparative Evaluation of Pre-emptive and Preventive Analgesic Effect of Oral Ibuprofen in Single Visit Root Canal Treatment- A Prospective Randomised Pilot Study. *Eur Endod J.* 2022 Jun;7(2):106-113.
- [19]. Mrosczak E, Combs D, Chaplin M, Tsina I, Tarnowski T, Rocha C, Tam Y, Boyd A, Young J, Depass L. Chiral kinetics and dynamics of ketorolac. *J Clin Pharmacol.* 1996 Jun;36(6):521-39.
- [20]. Johansson S, Josefsson G, Malstam J, Lindstrand A, Stenstroem A. Analgesic efficacy and safety comparison of Ketorolac tromethamine and Doloron for the alleviation of orthopaedic post-operative pain. *J Int Med Res* 1989;17:324-32.
- [21]. Forbes JA, Kehm CJ, Grodin CD, Beaver WT. Evaluation of ketorolac, ibuprofen, acetaminophen, and an acetaminophen/codeine combination in postoperative oral surgery pain. *Pharmacotherapy* 1990;10:94-105.
- [22]. Penniston, S. G., & Hargreaves, K. M. Evaluation of periapical injection of ketorolac for management of endodontic pain. *J Endod.* 1996 22(2), 55-59
- [23]. Bushra R, Aslam N. An overview of clinical pharmacology of Ibuprofen. *Oman Med J.* 2010 Jul;25(3):155-1661.



- [24]. de Geus JL, Wambier LM, Boing TF, Loguercio AD, Reis A. Effect of ibuprofen on the efficacy of inferior alveolar nerve block in patients with irreversible pulpitis: A meta-analysis. *AustEndod J.* 2019 Aug;45(2):246-258.
- [25]. Ramachandran A, Khan SI, Mohanavelu D, Kumar KS. The efficacy of pre-operative oral medication of paracetamol, ibuprofen, and aceclofenac on the success of maxillary infiltration anesthesia in patients with irreversible pulpitis: A double-blind, randomized controlled clinical trial. *J Conserv Dent.* 2012 Oct;15(4):310-4.