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COMPARISON OF CELECOXIB VERSUS ACETAMINOPHEN AS PRE-EMPTIVE ANALGESICS FOR MANAGEMENT OF POST OPERATIVE PAIN AFTER IMPACTED MANDIBULAR THIRD MOLAR SURGERY

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ABSTRACT

Background: Pain following impacted mandibular third molar surgery is a common postoperative complaint that may negatively affect patients' comfort and quality of life. Administration of analgesics before surgical trauma has been proposed as an effective strategy to reduce postoperative pain and analgesic requirements.

Objective: To compare the effectiveness of oral celecoxib and oral acetaminophen administered as pre-emptive analgesics for postoperative pain control after impacted mandibular third molar surgery in terms of pain intensity and rescue analgesic consumption.

Methods: A prospective randomized controlled trial was conducted in the Department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry (AFID), Rawalpindi, from June 2025 to December 2025. Seventy patients aged 17–50 years requiring surgical removal of an impacted mandibular third molar were randomly allocated into two equal groups. Group A received oral acetaminophen 500 mg, whereas Group B received oral celecoxib 200 mg, both administered 30 minutes before surgery. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 4, 6, and 8 hours after surgery. Ibuprofen tablets consumed during the first 24 hours served as the rescue analgesic outcome.

Results: Patients receiving celecoxib demonstrated significantly lower mean postoperative pain scores at 4, 6, and 8 hours than those receiving acetaminophen ($p<0.0001$). Mean rescue analgesic consumption during the first 24 hours was also significantly lower in the celecoxib group (0.97 ± 0.66 tablets) compared with the acetaminophen group (2.40 ± 0.88 tablets) ($p<0.001$).

Conclusion: Pre-emptive oral celecoxib was more effective than oral acetaminophen in reducing postoperative pain and decreasing rescue analgesic requirements following impacted mandibular third molar surgery.

KEYWORDS: Celecoxib; Acetaminophen; Pre-emptive analgesia; Third molar surgery; Postoperative pain; Randomized controlled trial.

INTRODUCTION

Impacted teeth are those that fail to erupt into their normal functional position within the expected period because of insufficient space, obstruction, or abnormal eruption pathways. Among all impacted teeth, mandibular third molars are the most frequently encountered in clinical practice, with reported prevalence ranging from approximately 9% to 25% in different populations (1,2). Surgical removal of impacted mandibular third molars is one of the most common procedures performed by oral and maxillofacial surgeons. Although it is a routine procedure, it is frequently associated with postoperative pain, swelling and limited mouth opening, which can negatively impact the quality of life of patients in the early recovery period. Post-operative pain following third molar surgery is chiefly an inflammatory response following tissue injury during the surgical procedure. Surgical trauma induces the release of inflammatory mediators including prostaglandins, histamine, bradykinin and leukotrienes that activate peripheral nociceptors and contribute to pain perception (3,4). Effective post-operative pain management is therefore an essential component of

care of patients as inadequate analgesia may delay recovery, reduce patient satisfaction and increase the demand for additional analgesic medications.

Pre-emptive analgesia has been focused as an important method to decrease postoperative pain by administering analgesic agents prior to surgical injury. The fundamental principle is to block or diminish the central and peripheral sensitization caused by noxious surgical stimuli, thus lowering postoperative pain intensity and decreasing the requirement of rescue analgesics (5,6). Many pharmacologic agents have been studied for this purpose, including nonsteroidal anti-inflammatory drugs (NSAIDs), cyclooxygenase-2 (COX-2) selective inhibitors, and acetaminophen. Acetaminophen is frequently used to treat mild-to-moderate postoperative pain because of its favorable safety profile and central mechanism of analgesia. It inhibits prostaglandin synthesis mainly in the central nervous system and has minimal gastrointestinal adverse effects as compared with conventional NSAIDs (7). However, its anti-inflammatory activity is weak which can reduce its efficacy in the management of pain caused by large surgical tissue injury. Celecoxib is a selective cyclooxygenase-2 (COX-2) inhibitor that produces analgesic and anti-inflammatory effects by selectively inhibiting prostaglandin synthesis at inflammatory sites. It has a lower incidence of gastrointestinal toxicity than non-selective NSAIDs because it mostly preserves cyclooxygenase-1 activity (8). Several clinical studies have found that preoperative administration of celecoxib may provide better postoperative pain control and reduce consumption of rescue analgesics following impacted mandibular third molar surgery. However, differences in study populations, drug regimens and outcome measures have resulted in inconsistent results, suggesting the need for further clinical studies.

Although both acetaminophen and celecoxib are commonly used for perioperative pain management, limited local evidence is available comparing their effectiveness as pre-emptive analgesics in patients undergoing impacted mandibular third molar surgery. Generating evidence within the local population is important for optimizing perioperative analgesic protocols and improving postoperative patient outcomes.

Therefore, the present randomized controlled trial was conducted to compare the effectiveness of oral celecoxib and oral acetaminophen administered before surgery for the management of postoperative pain after impacted mandibular third molar extraction. The primary outcomes included postoperative pain intensity measured using the Visual Analogue Scale (VAS) at 4, 6, and 8 hours after surgery, as well as rescue analgesic consumption during the first 24 hours following the procedure.

MATERIALS AND METHODS

This prospective randomized controlled trial was conducted in the Department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan, from June 2025 to December 2025. The study included 70 patients of either sex, aged 17–50 years, who presented with at least one mesioangular, distoangular, horizontal, or vertical impacted mandibular third molar indicated for surgical extraction and confirmed radiographically using periapical radiographs. Patients with systemic diseases including hepatic, renal, or cardiovascular disorders, known hypersensitivity to celecoxib, acetaminophen, or non-steroidal anti-inflammatory drugs, pregnancy or lactation, chronic use of analgesics, or any contraindication to the study medications were excluded. Written informed consent was obtained from all participants before enrolment, and the study was conducted after obtaining approval from the institutional ethical review committee in accordance with the principles of the Declaration of Helsinki.

The sample consisted of 70 patients who were randomly allocated into two equal groups using the lottery (registration slip) method. Patients assigned to Group A received 500 mg oral acetaminophen, whereas those in Group B received 200 mg oral celecoxib. Both medications were administered 30 minutes before surgery as pre-emptive analgesics. All surgical procedures were performed under local anaesthesia using the standard surgical protocol of the department. The duration of surgery was recorded for each patient to evaluate its possible influence on postoperative outcomes.

Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS) at 4, 6, and 8 hours after completion of surgery. The VAS was a 10-point scale where 0 was defined as no pain, 1–3 was defined as mild pain, 4–6 was defined as moderate pain, 7–9 was defined as severe pain and 10 was defined as the worst pain imaginable. Patients were asked to record their pain scores at each defined postoperative interval. Rescue analgesia was 400 mg ibuprofen, which was only recommended when the postoperative VAS score was higher than 3. Participants were asked to record the total number of ibuprofen tablets consumed during the first 24 hours after surgery. The primary outcome measure was postoperative pain intensity at 4, 6, and 8 hours, whereas the secondary outcome was the total rescue analgesic consumption during the first 24 postoperative hours. Data regarding age, gender, duration of surgery, postoperative pain scores, and rescue analgesic consumption were recorded prospectively on a structured proforma and entered into the Statistical Package for the Social Sciences (SPSS) for analysis. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. Independent-samples t-test was used to compare postoperative pain scores and rescue analgesic consumption between the two treatment groups. To assess their probable effect on post-operative pain and rescue analgesic consumption,

stratification on the basis of age, gender and duration of surgery was done. A p-value ≤0.05 was considered statistically significant.
This formatting is consistent with the style used in most medical journals, where section headings are retained but the body text is not bolded.

RESULTS

A total of 70 patients were enrolled and completed the study, with 35 patients randomly allocated to the acetaminophen group (Group A) and 35 patients to the celecoxib group (Group B). The overall mean age of the participants was 32.61 ± 6.88 years. The majority of patients (57.14%) belonged to the 31–50 years age group, while females constituted 58.57% of the study population. The mean duration of surgery was 29.89 ± 2.31 minutes. No statistically significant differences were observed between the two groups with respect to age, gender distribution, or duration of surgery ($p > 0.05$), indicating comparable baseline characteristics (Table 1).

Table 1. Baseline characteristics of the study participants

Variable	Acetaminophen (n = 35)	Celecoxib (n = 35)	Total (n = 70)
Age (years), mean ± SD	32.66 ± 6.71	32.57 ± 7.01	32.61 ± 6.88
Age group, n (%)			
17–30 years	14 (40.0)	16 (45.7)	30 (42.86)
31–50 years	21 (60.0)	19 (54.3)	40 (57.14)
Gender, n (%)			
Male	15 (42.86)	14 (40.0)	29 (41.43)
Female	20 (57.14)	21 (60.0)	41 (58.57)
Duration of surgery (minutes), mean ± SD	29.74 ± 2.23	30.11 ± 2.48	29.89 ± 2.31
Surgery duration group, n (%)			
≤30 minutes	22 (62.86)	20 (57.14)	42 (60.0)
>30 minutes	13 (37.14)	15 (42.86)	28 (40.0)

Postoperative pain intensity was assessed using the Visual Analogue Scale (VAS) at 4, 6, and 8 hours following surgery. Patients who received pre-emptive celecoxib experienced significantly lower postoperative pain scores than those receiving acetaminophen at all postoperative assessment intervals. Likewise, rescue analgesic consumption during the first 24 hours after surgery was significantly lower among patients treated with celecoxib (Table 2).

Table 2. Comparison of postoperative pain scores and rescue analgesic consumption between the study groups

Outcome	Acetaminophen (n = 35)	Celecoxib (n = 35)	p-value
VAS score at 4 hours	5.60 ± 1.29	3.00 ± 1.24	<0.001
VAS score at 6 hours	5.34 ± 1.16	2.97 ± 1.10	<0.001
VAS score at 8 hours	5.66 ± 1.26	2.86 ± 1.22	<0.001
Rescue analgesic consumption (ibuprofen tablets/24 hours)	2.40 ± 0.88	0.97 ± 0.66	<0.001

To determine whether demographic and operative variables influenced postoperative pain, stratified analyses were performed according to age, gender, and duration of surgery. Celecoxib consistently demonstrated significantly lower postoperative pain scores than acetaminophen across all subgroups at 4, 6, and 8 hours after surgery (Table 3).

Table 3. Stratified comparison of postoperative pain scores according to age, gender, and duration of surgery

Variable	Time point	Acetaminophen (n = 35)	Celecoxib (n = 35)	p-value
Age ≤30 years	4 hours	5.93 ± 1.14	3.58 ± 1.07	<0.001
	6 hours	5.29 ± 1.20	3.21 ± 0.98	<0.001
	8 hours	5.43 ± 1.40	3.13 ± 1.20	<0.001
Age >30 years	4 hours	5.38 ± 1.36	2.31 ± 1.08	<0.001
	6 hours	5.38 ± 1.16	2.69 ± 1.20	<0.001
	8 hours	5.81 ± 1.17	2.63 ± 1.21	<0.001
Male	4 hours	5.27 ± 1.16	3.00 ± 1.24	<0.001
	6 hours	4.93 ± 1.28	3.29 ± 1.44	<0.001
	8 hours	5.00 ± 0.93	3.29 ± 1.38	<0.001

Female	4 hours	5.85 ± 1.35	3.00 ± 1.26	<0.001
	6 hours	5.65 ± 0.99	2.76 ± 0.77	<0.001
	8 hours	6.15 ± 1.27	2.57 ± 1.03	<0.001
Surgery duration ≤30 min	4 hours	5.18 ± 1.30	3.00 ± 1.31	<0.001
	6 hours	5.23 ± 0.92	3.20 ± 1.08	<0.001
	8 hours	6.00 ± 1.07	2.93 ± 1.22	<0.001
Surgery duration >30 min	4 hours	6.31 ± 0.95	3.00 ± 1.21	<0.001
	6 hours	5.54 ± 1.51	2.80 ± 1.11	<0.001
	8 hours	5.08 ± 1.38	2.80 ± 1.24	<0.001

A similar trend was observed for rescue analgesic consumption. Across all age groups, both sexes, and both categories of surgical duration, patients receiving celecoxib required significantly fewer rescue analgesic tablets than those receiving acetaminophen (Table 4).

Table 4. Stratified comparison of rescue analgesic consumption according to age, gender, and duration of surgery

Variable	Acetaminophen (n = 35)	Celecoxib (n = 35)	p-value
Age ≤30 years	2.29 ± 0.61	1.00 ± 0.73	<0.001
Age >30 years	2.48 ± 1.03	0.95 ± 0.62	<0.001
Male	2.27 ± 0.88	1.00 ± 0.68	<0.001
Female	2.50 ± 0.89	0.95 ± 0.67	<0.001
Surgery duration ≤30 minutes	2.50 ± 1.01	1.00 ± 0.65	<0.001
Surgery duration >30 minutes	2.23 ± 0.60	0.95 ± 0.69	<0.001

Overall, pre-emptive administration of celecoxib resulted in significantly lower postoperative pain scores and reduced rescue analgesic consumption compared with acetaminophen. These findings remained consistent across all stratified analyses, supporting the superior analgesic efficacy of celecoxib following impacted mandibular third molar surgery.

DISCUSSION

The present randomized controlled trial compared the effectiveness of oral celecoxib and oral acetaminophen as pre-emptive analgesics for the management of postoperative pain following impacted mandibular third molar surgery. The findings demonstrated that patients receiving pre-emptive celecoxib experienced significantly lower postoperative pain scores at 4, 6, and 8 hours after surgery and required significantly fewer rescue analgesic tablets during the first 24 postoperative hours compared with those receiving acetaminophen. These findings indicate that celecoxib provides superior postoperative analgesia and reduces the need for additional pain medication following third molar surgery.

These findings are in line with previous clinical studies that indicated that the preoperative administration of celecoxib markedly decreased postoperative pain scores and the requirement for rescue analgesics compared to acetaminophen following third molar surgery (9). Similar outcomes were observed in patients undergoing periodontal surgery where preemptive celecoxib significantly decreased postoperative pain intensity and the need for analgesics, reinforcing its effectiveness in oral surgical procedures (13). The concordance of these results with the present study strengthens the evidence supporting the use of celecoxib as an effective preemptive analgesic. The enhanced analgesic effect of celecoxib is attributed to its selective inhibition of cyclooxygenase-2 (COX-2), which inhibits the production of inflammatory prostaglandins that cause postoperative pain while preserving cyclooxygenase-1 activity. Therefore, celecoxib is effective in relieving pain with a lower incidence of gastrointestinal adverse effects compared to traditional non-selective non-steroidal anti-inflammatory drugs, making it an attractive choice for perioperative pain management (10,11). Previous studies have shown that pre-operative administration of celecoxib is more effective than post-operative administration in controlling acute post-operative pain, and therefore, pre-emptive analgesia is important (12). Moreover, the 200 mg pre-operative dose has been shown to provide effective control of post-operative pain following periodontal surgery which supports the dosage regimen used in the present study (14).

Low-dose of celecoxib has been shown to provide superior analgesic efficacy, compared to traditional non-steroidal anti-inflammatory drugs, following oral surgical procedures (15). The observed reduction in rescue analgesic consumption in the present study is also supported by previous studies which demonstrated that patients receiving celecoxib had prolonged analgesic effects, delayed need for rescue medication, and improved postoperative pain relief after third molar surgery (17). Similar results have also been reported when celecoxib was compared with tramadol, in which celecoxib provided superior postoperative analgesia after mandibular third molar extraction (18). Evidence from ambulatory, orthopedic and other surgical procedures further indicate that perioperative celecoxib reduces postoperative opioid and analgesic requirements, supporting its important role in multimodal pain management strategies (23–25).

An important finding of the present study was the consistency of celecoxib's analgesic efficacy across different patient subgroups. Stratified analyzes according to age, gender, and duration of surgery consistently showed significantly

lower postoperative pain scores and decreased rescue analgesic consumption in patients receiving celecoxib. These findings imply that the analgesic effect of celecoxib is preserved in various patient groups and operative durations, indicating its broad clinical use in impacted mandibular third molar surgery. The current study has some advantages. The randomized controlled design minimized selection bias, whereas standardized surgical procedures and uniform postoperative pain assessment improved the reliability of the findings. However, some limitations should be acknowledged. The study was performed in a single institution with a small sample size and the postoperative outcomes were only assessed during the first 24 hours postoperatively; thus, larger multicenter randomized trials with longer follow-up periods are suggested for further evaluation of the long-term efficacy and safety of pre-emptive celecoxib in oral and maxillofacial surgery.

Overall, the findings of the present study, together with the available evidence, demonstrate that pre-emptive administration of oral celecoxib provides significantly better postoperative pain control and reduces rescue analgesic requirements compared with oral acetaminophen following impacted mandibular third molar surgery. These results support the routine use of celecoxib as an effective pre-emptive analgesic in appropriately selected patients undergoing third molar surgery.

CONCLUSION

Pre-emptive administration of oral celecoxib was significantly more effective than oral acetaminophen in controlling postoperative pain following impacted mandibular third molar surgery. Patients receiving celecoxib experienced significantly lower pain scores at 4, 6, and 8 hours after surgery and required fewer rescue analgesic tablets during the first 24 postoperative hours than those receiving acetaminophen ($P<0.001$). The superior analgesic efficacy of celecoxib remained consistent across different age groups, gender categories, and surgical durations. These findings suggest that oral celecoxib may be considered an effective pre-emptive analgesic for improving postoperative pain control following impacted mandibular third molar surgery.

Ethical approval

The study was approved by the Institutional Ethical Review Committee of the Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan. Written informed consent was obtained from all participants before enrolment.

Consent to participate

Written informed consent was obtained from all study participants.

Conflict of interest

The authors declare that they have no conflict of interest.

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Authors' contributions

All authors contributed substantially to the conception and design of the study, data collection, statistical analysis, manuscript preparation, and approved the final version of the manuscript.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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