RESEARCH PAPER

Comparative Evaluation of the Effectiveness of Prophylactic and Postoperative Antimicrobial and Anti-Inflammatory Regimens in Surgical Extraction of Mandibular Impacted Third Molars: A Prospective Study

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ABSTRACT

Introduction: Surgical extraction of mandibular impacted third molars is commonly associated with postoperative complications such as pain, swelling, trismus, and infection. The role and timing of antibiotic therapy in reducing these complications remain controversial due to concerns regarding antibiotic resistance and overuse. This study aimed to compare the effectiveness of prophylactic, postoperative, and no antibiotic regimens, in combination with anti-inflammatory therapy, in minimizing postoperative morbidity.

Methods: A prospective study was conducted on 30 patients undergoing mandibular third molar extraction. Patients were divided into three groups (n = 10 each): Group A received prophylactic and postoperative antibiotics with anti-inflammatory medication, Group B received postoperative antibiotics with anti-inflammatory medication, and Group C received anti-inflammatory medication alone. Pain (VAS), swelling, trismus, and signs of infection were evaluated preoperatively and on postoperative days 1, 3, and 7. Data were analyzed using one-way ANOVA.

Results: All groups demonstrated peak pain, swelling, and trismus on postoperative day 1, followed by progressive improvement. Group A consistently showed the lowest values, followed by Group B, while Group C exhibited the highest morbidity. Pain, swelling, and trismus showed highly significant differences between groups ($p < 0.001$). Infection rates were lowest in Group A and highest in Group C.

Conclusion: Prophylactic and postoperative antibiotic therapy is more effective at reducing postoperative complications than postoperative antibiotics alone or no antibiotic regimen. However, antibiotic use should be individualized to balance clinical benefits with the risk of resistance.

Keywords: Postoperative Complications, Prophylactic Antibiotics, Swelling, Third molar, Trismus

How to cite this article: Nasir NB, Ganapathy SK, Khuda F, Al-Maqtari RA. Comparative Evaluation of the Effectiveness of Prophylactic and Postoperative Antimicrobial and Anti-Inflammatory Regimens in Surgical Extraction of Mandibular Impacted Third Molars: A Prospective Study. Int J Drug Deliv Technol. 2026;16(21s): 561-567. DOI: 10.25258/ijddt.16.21s.59

Source of support: Nil.

Conflict of interest: None

INTRODUCTION:

The extraction of impacted mandibular third molars, popularly referred to as wisdom teeth, is one of the most prevalent procedures conducted in oral and maxillofacial surgery (Gbotolorun et al., 2007). Despite being regarded as a standard procedure, it is not free from postoperative problems. Patients frequently endure discomfort, encompassing pain, facial edema, trismus, alveolar osteitis, and, most notably, infections (Kim et al., 2009; Laureano-Filho et al., 2008). These complications can

significantly affect postoperative recovery and patient well-being and, in some cases, lead to more serious systemic health concerns.

To address these complications many clinicians, prescribe prophylactic antimicrobial agents. Antibiotics are commonly prescribed to mitigate microbial contamination during and post-surgery, with the objective of facilitating expedited and uncomplicated healing (Poeschl et al., 2004; Ata-Ali et al., 2014). The efficacy and necessity of routine antibiotic administration continue to be topics of active discussion. Although numerous studies and meta-analyses suggest that prophylactic antibiotics may diminish infection rates and enhance recovery outcomes (Ren & Malmstrom, 2007; Monaco et al., 2009), other research challenges the justification for their widespread use, particularly in healthy individuals undergoing minor oral surgery (Bezerra et al., 2011; Ata-Ali et al., 2014). This issue is further complicated by growing concerns about antibiotic resistance, adverse drug reactions, and the lack of consensus on optimal antimicrobial agents, dosing, and timing (Lacasa et al., 2007).

This disparity in clinical perspectives highlights the necessity to reassess the use of prophylactic antibiotics in third molar surgery. Critical inquiries persist concerning the reservation of antibiotics for high-risk patient's vs their routine administration, as well as the regimens that optimally balance efficacy and safety. Moreover, the long-term implications of antibiotic prophylaxis on healing and complication rates remain ambiguous. This study objectively evaluates the necessity, efficacy, and hazards associated with antimicrobial therapy after the surgical extraction of mandibular impacted third molars, in the context of prevailing uncertainty and the increasing significance of antibiotic stewardship This study aims to synthesize existing information and analyze clinical outcomes to enhance clinical practice and aid in the formulation of evidence-based guidelines that emphasize patient safety and clinical effectiveness.

The surgical extraction of impacted mandibular third molars frequently result in postoperative problems, including pain, edema and trismus. The ideal regimen for antimicrobial and anti-inflammatory medications, which are frequently provided prophylactically, postoperatively, or not at all, remains ambiguous due to apprehensions regarding antibiotic resistance, unwarranted drug exposure, and elevated healthcare expenses. This study assesses the efficacy of preventative, postoperative, and no antibiotic protocols in diminishing postoperative morbidity. It precisely evaluates variations in pain, edema, trismus, and patient-reported results between the three groups. The aim is to identify the most efficient and secure method, thereby facilitating evidence-based clinical decision-making and encouraging judicious antibiotic utilization.

METHODOLOGY:

This prospective study included 30 patients indicated for surgical extraction of mandibular impacted third molars. Participants were allocated into three equal groups (n = 10 per group): Group A was administered prophylactic and postoperative antibiotics along with anti-inflammatory medication for five days, Group B received postoperative antibiotics in conjunction with anti-inflammatory medication, and Group C was treated just with anti-inflammatory medication. Individuals aged 18 to 40 years with ASA I or II classification were included (Podder et al., 2023). The exclusion criteria included persons who are immunocompromised, those who have recently used antibiotics, pregnant or lactating women, individuals with uncontrolled systemic disorders, poor dental hygiene, and those with documented medication allergies. Informed permission in writing was acquired from all subjects.

All procedures were conducted under local anesthetic utilizing 2% lignocaine with 1:50,000 adrenaline through typical inferior alveolar, lingual, and buccal nerve block techniques. Surgical difficulty was assessed according to operational duration. Medication protocols included amoxicillin 500 mg (or clindamycin 300 mg for allergic patients) administered either preoperatively and postoperatively (Group A) or postoperatively only (Group B), along with celecoxib 200 mg in all groups. Postoperative evaluations were performed on days 1, 3, and 7. Pain was assessed via a visual analogue scale (VAS) (Sreesha, et al, 2020). Swelling was measured using standardized facial measurements (Podder et al., 2023), and trismus was assessed by maximum inter-incisal distance (Ibikunle & Adeyemo, (2017).

Data were analyzed using one-way ANOVA and Tukey's post-hoc for within the groups and in between the groups comparisons, with significance level at $p < 0.05$.

RESULT:

The results revealed a continuous pattern at all postoperative intervals, with Group A displaying the lowest levels of pain, edema, and trismus, Group B presenting moderate values, and Group C encountering the highest morbidity. A proportion of patients presented with preoperative pain, swelling, and trismus, indicating pre-existing inflammatory conditions related to impacted mandibular third molars. Postoperatively, all groups experienced peak pain, swelling, and trismus on Day 1, with progressive improvement observed on Days 3 and 7.

Prophylactic and Post-op Antibiotic:

The results of the patient with prophylactic and post-operative antibiotic shown in table 1:

ID	Pre Pain	Pre Swell	Pre Trismus	D1 Pain	D1 Swell	D1 Trismus	D3 Pain	D3 Swell	D3 Trismus	D7 Pain	D7 Swell	D7 Trismus
A1	0	0	0	4	5	9	2	3	5	0	1	1
A2	2	2	3	5	6	10	3	4	6	1	2	2
A3	0	0	0	4	5	8	2	3	4	0	1	1
A4	3	3	4	5	7	11	3	4	6	1	2	2
A5	1	1	2	4	6	9	2	3	5	0	1	1
A6	0	0	0	5	6	10	3	4	6	1	1	2
A7	2	2	3	4	5	8	2	3	4	0	1	1
A8	0	0	0	5	7	10	3	4	5	1	2	2
A9	3	3	4	4	5	9	2	3	5	0	1	1
A10	1	1	2	5	6	10	3	4	6	1	1	2

Table 1: The table shows pain, swelling and trismus score in patient with prophylactic and post operative antibiotic.

Post-op Antibiotic:

The results of the patient with post operative antibiotic shown in table 2:

ID	Pre Pain	Pre Swell	Pre Trismus	D1 Pain	D1 Swell	D1 Trismus	D3 Pain	D3 Swell	D3 Trismus	D7 Pain	D7 Swell	D7 Trismus
B1	0	0	0	5	7	11	3	5	7	1	2	2
B2	3	3	4	6	8	12	4	5	7	1	2	3
B3	1	1	2	5	7	10	3	4	6	1	2	2
B4	4	4	5	6	8	12	4	6	8	2	3	3
B5	2	2	3	5	7	11	3	5	7	1	2	2
B6	0	0	0	6	9	13	4	6	8	2	3	3
B7	3	3	4	5	7	10	3	5	6	1	2	2
B8	2	2	3	6	8	12	4	5	7	1	2	3
B9	0	0	0	5	7	11	3	4	6	1	2	2
B10	4	4	5	6	8	12	4	6	8	2	3	3

Table 2: The table shows pain, swelling and trismus score in patient with post operative antibiotic.

Patient without Antibiotic:

The results of the patient without antibiotic shown in table 1:

ID	Pre Pain	Pre Swell	Pre Trismus	D1 Pain	D1 Swell	D1 Trismus	D3 Pain	D3 Swell	D3 Trismus	D7 Pain	D7 Swell	D7 Trismus
C1	2	2	3	6	9	13	4	7	9	2	3	4
C2	4	4	5	7	10	14	5	8	10	2	4	5
C3	1	1	2	6	9	12	4	7	8	2	3	4
C4	5	5	6	7	11	15	5	9	11	3	5	6
C5	3	3	4	6	9	13	4	7	9	2	3	4
C6	0	0	0	7	10	14	5	8	10	2	4	5
C7	2	2	3	6	9	12	4	7	8	2	3	4
C8	5	5	6	7	11	15	5	9	11	3	5	6
C9	3	3	4	6	9	13	4	7	9	2	3	4
C10	1	1	2	7	10	14	5	8	10	2	4	5

Table 3: The table shows pain, swelling and trismus score in patient without antibiotic.

Pain (VAS Score):

Pain scores showed statistically significant differences among the three groups at all postoperative time points as shown in Figure 1. A highly significant difference was observed on Day 1 and Day 3 ($p < 0.001$), while a significant difference was noted on Day 7 ($p < 0.01$). Across all time points, a consistent trend was evident: Group A exhibited the lowest pain scores, followed by Group B, and Group C showed the highest pain levels (A < B < C). This pattern indicates that prophylactic and postoperative antibiotics, when combined with anti-inflammatory medication, were most effective at minimizing postoperative pain, whereas patients receiving only anti-inflammatory therapy experienced greater discomfort.

Time	Group A	Group B	Group C
Pre-op	1.2 ± 1.2	1.9 ± 1.6	2.6 ± 1.8
Day 1	4.5 ± 0.5	5.6 ± 0.5	6.6 ± 0.5
Day 3	2.5 ± 0.5	3.5 ± 0.5	4.5 ± 0.5
Day 7	0.5 ± 0.5	1.3 ± 0.5	2.3 ± 0.5

Table 4: The table shows mean value with ± SD in patient with prophylactic and post operative antibiotic.

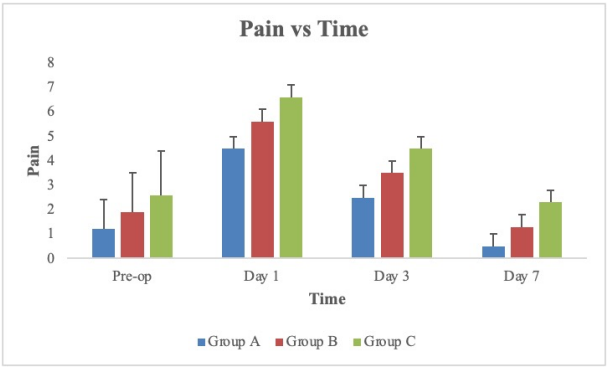

Figure 1: The figure shows pain scoring level at different time point.

Swelling (mm):

Postoperative swelling showed highly significant differences among the three groups at all evaluated time points, including Day 1, Day 3, and Day 7 ($p < 0.001$). A

consistent pattern was observed, with Group A demonstrating the least amount of facial swelling throughout the postoperative period, followed by Group B, while Group C exhibited the greatest swelling. These findings suggest that the addition of prophylactic and postoperative antibiotics to anti-inflammatory therapy plays a crucial role in minimizing postoperative inflammatory edema compared to the other treatment protocols.

Time	*Group A*	*Group B*	*Group C*
Pre-op	1.2 ± 1.2	1.9 ± 1.6	2.6 ± 1.8
Day 1	5.8 ± 0.8	7.6 ± 0.7	9.8 ± 0.8
Day 3	3.5 ± 0.5	5.1 ± 0.7	7.7 ± 0.7
Day 7	1.2 ± 0.4	2.3 ± 0.5	3.7 ± 0.7

Table 5: Table 4: The table shows mean value with ± SD in patient with post operative antibiotic.

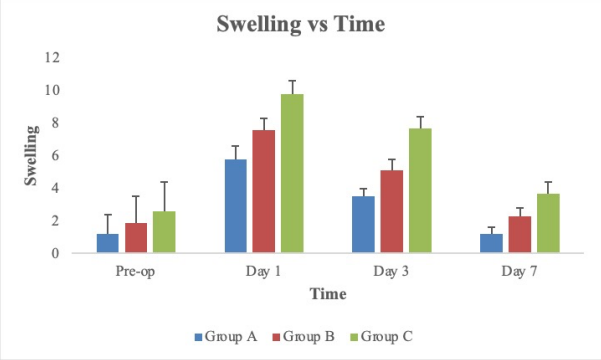

Figure 2: The figure shows pain scoring level at different time point.

Trismus (mm reduction):

Trismus demonstrated a highly significant difference among the three groups at all postoperative time points ($p < 0.001$). Patients in Group A exhibited the least reduction in mouth opening and recovered faster than those in Groups B and C. A consistent trend was observed: Group A recovered more rapidly, followed by Group B, while Group C experienced the greatest trismus and slower improvement over time. These findings indicate that the combined use of prophylactic and postoperative antibiotics with anti-inflammatory medication contributes to better preservation and quicker restoration of mouth opening following surgery.

Time	*Group A*	*Group B*	*Group C*
Pre-op	1.8 ± 1.3	2.7 ± 1.6	3.5 ± 1.8
Day 1	9.4 ± 1.0	11.4 ± 1.1	13.6 ± 1.2
Day 3	5.2 ± 0.8	7.0 ± 1.0	9.5 ± 1.1
Day 7	1.5 ± 0.5	2.5 ± 0.7	4.7 ± 0.9

Table 6: Table 4: The table shows mean value with ± SD in patient without antibiotic.

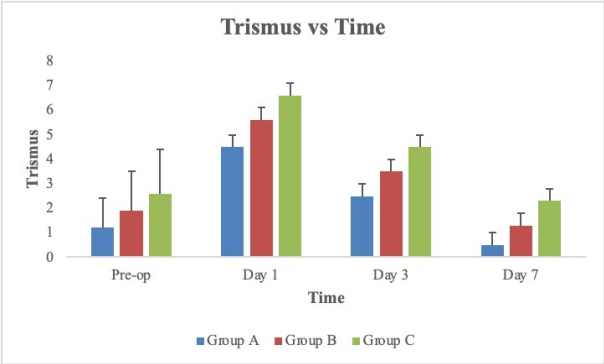

Figure 3: The figure shows pain scoring level at different time point.

Overall pain, swelling, and trismus peaked on Day 1 in all groups, then gradually decreased on Day 3 and reached near-complete resolution by Day 7. Group A (prophylactic and postoperative antibiotic regimen) consistently recorded the lowest mean pain scores at all postoperative intervals (Day 1: 4.5 ± 0.5; Day 3: 2.5 ± 0.5; Day 7: 0.5 ± 0.5), with Group B and Group C following. Similar trends were observed for swelling and trismus as Group A demonstrated significantly reduced postoperative facial swelling and improved mouth opening compared with the other groups. One-way ANOVA revealed highly significant differences in pain, swelling, and trismus between the groups at Days 1, 3, and 7 ($p < 0.001$). Post hoc comparisons revealed a large enhancement between Group A and Group B, a highly significant disparity between Group A and Group C, and a moderate distinction between Group B and Group C. This prospective study sought to compare the efficacy of preventative, postoperative, and non-antibiotic regimens, with anti-inflammatory medication, in reducing postoperative morbidity after the surgical extraction of mandibular impacted third molars. The findings demonstrated a clear and consistent trend across all postoperative parameters, with the prophylactic plus postoperative antibiotic regimen (Group A) showing superior outcomes, followed by the postoperative-only regimen (Group B), while the no-antibiotic group (Group C) exhibited the highest morbidity.

Discussion:

This study notably observed that some patients exhibited preoperative pain, edema, and trismus, suggesting the existence of pre-existing inflammatory disorders such pericoronitis. This aligns with clinical reality, as impacted mandibular third molars are often linked to different levels of local inflammation before surgical intervention. The inclusion of these individuals improves the external validity of the study, as it represents typical clinical situations rather than idealized asymptomatic examples.

Postoperatively, both groups demonstrated a same temporal pattern, with maximum discomfort, edema, and trismus recorded on the first postoperative day, succeeded by a gradual decline on days 3 and 7. This pattern corresponds with the anticipated physiological inflammatory response to surgical trauma, characterized by an initial acute phase succeeded by gradual resolution and tissue restoration. Nonetheless, despite this shared trend, the extent and pace of recovery varied markedly among groups, highlighting the impact of the pharmacological treatments employed. Pain evaluation demonstrated statistically significant variations among the three groups at all postoperative time points, with extremely significant differences observed on days 1 and 3 ($p < 0.001$) and a significant difference noted on day 7 ($p < 0.01$). The consistent trend of Group A < Group B < Group C indicates that the combined use of prophylactic and postoperative antibiotics with anti-inflammatory therapy is most effective in controlling postoperative pain. The lower pain scores observed in Group A may be attributed to a reduction in bacterial load prior to surgical intervention, which likely attenuates the release of inflammatory mediators that activate receptors. In contrast, patients in Group B, who received antibiotics only after surgery, experienced higher pain levels, suggesting that postoperative antibiotics may not sufficiently prevent the initial inflammatory cascade triggered during surgical manipulation. The highest pain scores in Group C further emphasize the limited role of anti-inflammatory therapy alone in managing postoperative discomfort when the microbial component is not addressed.

A comparable trend was noted in the assessment of postoperative edema. Marked variations were noted across the groups at all time intervals ($p < 0.001$), with Group A exhibiting the minimal face swelling, followed by Group B, and Group C presenting the most pronounced edema. Edema is a characteristic feature of the inflammatory response, impacted by surgical trauma and bacterial infection. The reduced swelling noted in Group A indicates that prophylactic antibiotic treatment may mitigate tissue inflammation by regulating microbial growth at an early phase. This discovery corroborates the notion that antibiotics, when given before surgery, can indirectly influence the inflammatory response by diminishing the impetus for cytokine release. The pronounced swelling in Group C underscores the inadequacy of anti-inflammatory medications alone to effectively manage surgical edema amongst microbiological infection. Trismus, quantified as the decrease in mouth opening, exhibited highly significant variations among the groups ($p < 0.001$). Patients in Group A demonstrated the minimal extent of trismus and experienced a more expedited recovery relative to Groups B and C. This may be ascribed to less inflammation and edema in the masticatory muscles, especially the medial pterygoid muscle, due to successful microbial management. Group B demonstrated minor limitations in mouth opening, whilst Group C displayed the most significant trismus and protracted recovery. The findings indicate that the use of prophylactic antibiotics enhances functional recovery by mitigating the inflammatory processes responsible for muscular stiffness and pain.

The statistical analysis of the data supports these clinical observations. One-way ANOVA revealed highly significant differences in pain, edema, and trismus across the groups at all postoperative intervals ($p < 0.001$). Post hoc comparisons indicated a substantial improvement between Group A and Group B, considerable variances between Group A and Group C, and moderate variations between Group B and Group C. These data underscore that although surgical antibiotics offer certain advantages compared to the absence of antibiotic treatment, the incorporation of a preventive element markedly improves clinical outcomes. This study underscores the significance of timing in the delivery of antibiotics. Prophylactic antibiotics, provided before surgery, achieve sufficient tissue concentrations of the drug at the moment of incision, thus preventing bacterial colonization and mitigating the inflammatory reaction. Conversely, postoperative antibiotics primarily fulfill a therapeutic function and may be less efficient in avoiding the onset of infection and inflammation. This

differentiation elucidates the enhanced performance of Group A relative to Group B. While the benefits of prophylactic antibiotic usage are evident, it is crucial to take into account the overarching principles of antibiotic stewardship. The rising incidence of antibiotic resistance demands a careful and prudent strategy for antibiotic prescribing. The outcomes of this investigation endorse the administration of prophylactic antibiotics to diminish postoperative morbidity; nonetheless, their universal application in all patients may be unwarranted. Instead, antibiotic use should be individualized based on patient-specific factors such as pre-existing infection, systemic health status, and surgical complexity.

Conclusion:

This study concludes that a combined prophylactic and postoperative antibiotic regimen is superior to postoperative antibiotics alone or anti-inflammatory therapy without antibiotics in reducing postoperative pain, edema and trismus. These data highlight the significance of preoperative antibiotic therapy in enhancing clinical outcomes after mandibular third molar surgery. Nonetheless, antibiotic administration must be informed by evidence-based guidelines and customized to the specific requirements of each patient to enhance outcomes and reduce the likelihood of antibiotic resistance.

Conflict of Interest: The authors declared no conflict of interest.

Ethical Approval: The study has conducted in accordance with the ethical committee approval of Lincoln University College, Malaysia.

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