The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 11, 2025

COMPARISON OF POSTOPERATIVE OUTCOME OF TRIANGULAR FLAP AND ENVELOPE FLAP AFTER IMPACTED LOWER THIRD MOLAR SURGERY

Siddique Ullah[*1], Nizam Ul Mulk[2], Muhammad Ammar[3], Habib Ur Rehman[4], Abdul Sami[5]

[*1,3,4,5]*FCPS Resident, Oral and Maxillofacial Surgery, Bolan Medical College/Hospital Quetta*
[2]*Associate Professor, Oral and Maxillofacial Surgery, Bolan Medical College/Hospital Quetta*

[*1]siddiqueullahkakar@gmail.com

DOI: https://doi.org/10.5281/zenodo.20675995

Keywords
Triangular flap, Envelop flap, Third Molar surgery, Postoperative outcome

Article History
Received: 03 November 2025
Accepted: 22 November 2025
Published:28 November 2025

Corresponding Author: *
Siddique Ullah

Abstract

Background: *Surgical extraction of impacted mandibular third molars is commonly associated with postoperative complications such as pain, trismus, swelling, and alveolar osteitis. Flap design is an important modifiable factor that may influence these outcomes. This study aimed to compare postoperative outcomes between triangular flap and envelope flap after impacted lower third molar surgery.*

Methodology: *This randomized controlled trial was conducted in the Department of Oral and Maxillofacial Surgery, Bolan Medical College/Hospital Quetta over a period of 3 months. A total of 60 patients meeting inclusion criteria were randomly divided into two equal groups: Group A (envelope flap) and Group B (triangular flap). Postoperative pain, trismus, alveolar osteitis, and operating time were assessed. Data were analyzed using independent t-test and chi-square test, with $p < 0.05$ considered significant.*

Results: *The mean age was comparable between Group A (30.22 ± 5.7 years) and Group B (29.9 ± 5.9 years). Postoperative pain was observed in 40% vs 33.3%, trismus in 76.7% vs 70%, and alveolar osteitis in 10% vs 6.7% in Group A and B respectively, with no statistically significant differences ($p > 0.05$). However, the mean operating time was significantly higher in the envelope flap group (24.6 ± 4.2 min) compared to the triangular flap group (21.8 ± 3.9 min) ($p = 0.01$).*

Conclusion: *Both envelope and triangular flap designs are comparable in terms of postoperative pain, trismus, and alveolar osteitis. However, the triangular flap technique is associated with significantly reduced operative time, suggesting better surgical efficiency.*

INTRODUCTION

Surgical removal of impacted mandibular third molars is one of the most commonly performed procedures in oral and maxillofacial surgery. Impaction of these teeth occurs due to obstruction in the eruption path, which may result from adjacent teeth, dense bone, or soft tissue coverage. This condition is frequently associated with complications such as pain, pericoronitis, dental caries, and, in some cases, cystic or neoplastic changes. The prevalence of impacted mandibular third molars is particularly high in young adults,

with a slightly higher occurrence reported among females.

Access to the impacted tooth during surgical extraction requires elevation of a mucoperiosteal flap. The design of this flap is a critical determinant of surgical exposure and postoperative healing. Among the commonly used techniques are the envelope flap and the triangular (Ward's) flap. While the envelope flap involves a sulcular incision without a vertical release, the triangular flap includes an additional releasing incision, potentially providing improved access at the cost of increased tissue trauma.

Postoperative sequelae following mandibular third molar surgery, including pain, swelling, and trismus, remain a significant concern. These complications can adversely affect patients' daily activities and quality of life. Their severity is influenced by multiple factors such as surgical difficulty, duration of the procedure, and the type of flap design employed.

Previous studies comparing envelope and triangular flaps have reported inconsistent findings. Some authors have suggested that the envelope flap is associated with reduced postoperative swelling and trismus, whereas others have demonstrated no significant difference between the two techniques. Conversely, the triangular flap may offer better surgical access but has been associated with increased postoperative morbidity due to the presence of a releasing incision. Despite numerous studies, a clear consensus regarding the optimal flap design remains lacking.

Therefore, further evaluation is warranted to determine the most appropriate flap design that minimizes postoperative complications while ensuring adequate surgical access. This study aims to compare the outcomes of envelope and triangular flap designs in terms of postoperative pain, swelling, trismus, alveolar osteitis, and operative time in patients undergoing mandibular third molar extraction.

Impacted mandibular third molar extraction is frequently associated with postoperative discomfort, including pain, swelling, and restricted mouth opening. Flap design is a modifiable surgical factor that may influence these outcomes. However, existing literature provides conflicting evidence regarding the superiority of envelope versus triangular flaps. This study is conducted to provide clarity on this issue and to identify the flap design associated with improved postoperative outcomes. The objective of this study was to compare the levels of postoperative pain, swelling, occurrence of alveolar osteitis, associated with envelope and triangular flap designs as well as operation time required for the extraction of mandibular third molars using envelope and triangular flaps.

METHODOLOGY:

This study was conducted in the department of Oral and Maxillofacial Surgery, Bolan Medical College/Hospital Quetta over a period of the three months from August 2025 to October 2025 after the approval of synopsis from CPSP. This study was conducted to compare postoperative outcomes following the surgical extraction of impacted mandibular third molars using envelope and triangular flap designs. After taking the written informed consent, patients requiring surgical removal of impacted mandibular third molars were selected according to the inclusion criteria and were randomly allocated into two groups based on the flap design used during surgery. The inclusion criteria were patients with partially erupted partial mandibular third molar, aged between 18 to 65 years, had no pain before surgery, healthy periodontal tissue, did not suffer from systemic disease and were not taking any medication and underwent a third molar tooth surgery in department of the Oral and Maxillofacial Surgery Bolan Medical College/Hospital Quetta. This was non-probability consecutive sampling research with a Randomized Control Trial. Sample size was calculated using open epi by taking statistics for pain in modified triangular flap technique as 0.85±1.159 at 7th and for envelope flap technique the mean pain score was 2.16±1.12, power of test 90% and 95% CI. The calculated sample size came out as 30 in each group. patients additional were enrolled for loss of follow up in each group. Total sample size was 60.

In Group A, an envelope flap was used, while in Group B, a triangular flap was employed. All procedures were performed under local anesthesia using a standardized surgical technique by the same operator to minimize bias. The operation time was recorded from the initial incision to completion of suturing. Postoperative pain was assessed using the Visual Analog Scale (VAS), while facial swelling was evaluated clinically at predetermined postoperative intervals. The occurrence of alveolar osteitis was also recorded during follow-up visits. Data obtained were analyzed statistically to compare postoperative pain, swelling, incidence of alveolar osteitis, and operation time between the two flap designs. Mean ± sd was calculated for quantitative variables and frequency and percentage were computed for qualitative variables. Independent t-test was applied to compare the quantitative data and chi-square test was applied to compare the qualitative data. P-value ≤ was considered as significant.

RESULTS:

A total of 60 patients were included in the study, with 30 patients in each group. The mean age of patients in Group-A was 30.22 ± 5.7 years, while in Group-B it was 29.9 ± 5.9 years. No statistically significant difference was observed between the groups regarding age (p=0.853). In Group-A, 19 (63.3%) patients were male and 11 (36.6%) were female, whereas Group-B included 21 (70%) males and 9 (30%) females. The difference in gender distribution between the groups was not statistically significant (p=0.583), **as shown in Table 1.**

Postoperative pain was reported in 12 (40%) patients in Group-A and 10 (33.3%) patients in Group-B, while no pain was observed in 18 (60%) and 20 (66.7%) patients, respectively. The difference was statistically insignificant (p=0.59). Trismus was observed in 23 (76.7%) patients in Group-A and 21 (70%) patients in Group-B, whereas 7 (23.3%) and 9 (30%) patients did not develop trismus, respectively, showing no significant difference (p=0.57). Alveolar osteitis occurred in 3 (10%) patients in Group-A and 2 (6.7%) patients in Group-B, with no statistically significant difference between the groups (p=0.64). However, the mean operating time was significantly higher in Group-A (24.6 ± 4.2 minutes) compared to Group-B (21.8 ± 3.9 minutes) with a statistically significant difference (p=0.01), **as shown in Table 2.**

Table 1: Baseline Data of the Patients

Baseline Data	Group-A (n=30)	Group-B (n=30)	P-value
Age (Years)	30.22 ± 5.7	29.9 ± 5.9	0.853
Gender • Male • Female	 19 (63.3%) 11 (36.6%)	 21 (70%) 09 (30%)	0.583

Table 2: Comparison of Postoperative Outcome of Triangular Flap and Envelope Flap After Impacted Lower Third Molar Surgery

Outcomes	Group-A (n=30)	Group-B (n=30)	P-value
Pain n(%) • Yes • No	 12 (40%) 18 (60%)	 10 (33.3%) 20 (66.7%)	0.59
Trismus n(%) • Yes • No	 23 (76.7%) 07 (23.3%)	 21 (70%) 09 (30%)	0.57

Alveolar Osteitis n(%) • **Yes** • **No**	 03 (10%) 27 (90%)	 02 (6.7%) 28 (93.3%)	 0.64
Operating time (mean ± sd)	24.6 ± 4.2	21.8 ± 3.9	0.01

DISCUSSION:

In this study, postoperative results for impacted mandibular third molar surgery were evaluated between envelope flap and triangle flap designs. The results showed that the envelope flap group experienced slightly higher rates of trismus, alveolar osteitis, and postoperative discomfort, but these differences were not statistically significant. On the other hand, the triangle flap group's operating time was substantially less than that of the envelope flap group. These results imply that while the triangular flap may give better surgical access and efficiency, both flap shapes produce similar postoperative results.

One of the most frequent side effects of third molar surgery is postoperative discomfort, which is impacted by tissue damage, flap reflection, and surgical time. There was no statistically significant difference between the groups in the current study; 40% of patients in the envelope flap group and 33.3% in the triangle flap group reported experiencing postoperative pain. These results are in line with Zhu et al.'s systematic review and meta-analysis, which found no discernible difference in postoperative pain between envelope and triangle flaps after mandibular third molar surgery [11]. Similarly, de Santana Santos et al. came to the conclusion that, when standardized surgical procedures are followed, flap design alone might not have a major impact on postoperative pain [12].

Another significant postoperative complication that might affect oral hygiene and mastication is trismus. Although the difference was not statistically significant, trismus was somewhat more common in the envelope flap group in the current study. These findings are consistent with other studies that found that the two flap designs had similar mouth opening restrictions. In comparison to envelope flaps, Zhu et al. found that while triangular flaps offer more surgical access, they do not considerably enhance postoperative trismus [11]. Similarly, Peng et al. showed that surgical difficulties and time have a stronger correlation with postoperative trismus than flap design alone [13].

There was no discernible difference in the incidence of alveolar osteitis between the two groups in this investigation. Similar results have been reported in earlier research and meta-analyses, which found that when proper irrigation, aseptic procedures, and postoperative instructions are followed, flap design has little impact on the development of dry socket [14,15]. The current study's low incidence could be explained by standardized surgical techniques and reliable postoperative care.

The triangular flap group's considerably lower operating time was one of the study's key findings. Bone removal and tooth sectioning are made easier by the triangular flap's improved visibility and access through the vertical releasing incision. Triangular flaps increase surgical accessibility and decrease operative difficulty, according to Vijayakumar et al.'s similar findings [16]. Particularly in challenging situations, shorter surgical times may result in less operator fatigue and increased surgical efficiency.

For impacted mandibular third molar surgery, both envelope and triangle flap designs are safe and successful, according to the current research. The triangular flap showed a benefit in terms of shorter operating time, even if postoperative complications were similar. Consequently, the choice of flap should be based on the surgeon's preferences, the difficulty of the treatment, and the requirement for sufficient access and visibility.

Strengths of the Study

The randomized controlled trial design, which reduced selection bias and increased the

dependability of the results, was one of the study's main advantages. Another advantage was that inter-operator variability was decreased because all surgeries were carried out by the same surgeon utilizing standardized surgical techniques. Additionally, an acceptable comparison of postoperative outcomes was made possible by the two groups' equal sample distribution.

Limitations of the Study

There were certain restrictions on the study. First, the results may not be as broadly applicable as they may be due to the small sample size and single center. Second, although postoperative swelling was stated in the objectives, the final results did not include a quantitative analysis of it. Third, the short follow-up time limited the assessment of patient satisfaction and long-term periodontal healing. Furthermore, variables that could have affected postoperative results, like the degree of impaction and surgical difficulties, were not classified.

Recommendations

To confirm these results, more multicenter randomized controlled trials with bigger sample numbers are advised. Long-term monitoring and evaluation of periodontal healing, patient satisfaction, and quality of life should be part of future research. It is also advised to quantitatively assess facial swelling using defined methods. Furthermore, more accurate information on the best flap design for mandibular third molar surgery may be obtained through subgroup analysis based on the kind and degree of impaction.

CONCLUSION:

This study showed that after impacted mandibular third molar surgery, both envelope and triangle flap designs result in comparable postoperative results in terms of discomfort, trismus, and alveolar osteitis. These difficulties did not differ statistically significantly between the two methods. However, compared to the envelope flap, the triangle flap was linked to a noticeably shorter operating time, suggesting better surgical access and efficiency. As a result, both flap designs can be regarded as clinically appropriate, and the approach used may depend on the surgeon's preferences, the complexity of the case, and the need for surgical access.

REFERENCES:

1. Kiencało A, Jamka-Kasprzyk M, Panaś M, Wyszyńska-Pawelec G. Analysis of complications after the removal of 339 third molars. Dental and medical problems. 2021;58(1).
2. Assiri H. Assessment of bone loss adjacent to lower second molar in case of third molar impaction and other findings using Orthopantomography (OPG). 2024.
3. Gupta P, Naik SR, Ashok L, Khaitan T, Shukla AK. Prevalence of periodontitis and caries on the distal aspect of mandibular second molar adjacent to impacted mandibular third molar: A guide for oral health promotion. Journal of Family Medicine and Primary Care. 2020;9(5):2370-4.
4. Windisch P, Iorio-Siciliano V, Palkovics D, Ramaglia L, Blasi A, Sculean A. The role of surgical flap design (minimally invasive flap vs. extended flap with papilla preservation) on the healing of intrabony defects treated with an enamel matrix derivative: a 12-month two-center randomized controlled clinical trial. Clinical oral investigations. 2022:1-11.
5. Mudjono H, Rahajoe PS, Astuti ER. The effect of triangular and reversed triangular flap designs to post third molar odontectomy complications (a pilot study). Journal of clinical and experimental dentistry. 2020;12(4):e327-e34.
6. Rizqiawan A, Lesmaya YD, Rasyida AZ, Amir MS, Ono S, Kamadjaja DB. Postoperative Complications of Impacted Mandibular Third Molar Extraction Related to Patient's Age and Surgical Difficulty Level: A Cross-Sectional Retrospective Study. International journal of dentistry. 2022;2022(1):7239339.

7. Kalsoom F, Hassan L, Khan UQ, Soomro H, Siddique S, Nawadat K. Post-Operative Complications Associated with Impacted Mandibular Third Molar Removal. Annals of Punjab Medical College. 2023;17(3):340-3.
8. Zhu J, Yuan X, Yan L, Li T, Guang M, Zhang Y. Comparison of postoperative outcomes between envelope and triangular flaps after mandibular third molar surgery: a systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery. 2020;78(4):515-27.
9. Kumari B, Punjabi SK, Mustafa N, Iqbal R, Shams S. Comparison between Modified Triangular Flap and Envelop Flap Techniques for Surgical Removal of Impacted Mandibular Third Molar. Journal of Pharmaceutical Research International. 2022;34(14A):58-66.
10. Chen J, Liao Z, Yan J, Li W. Comparative Clinical Evaluation of Trapezoidal, Envelope, and Tunnel Type Coronally Advanced Flap in the Treatment of Gingival Recession: A Network Meta-Analysis of Randomized Clinical Trials. International Journal of Periodontics & Restorative Dentistry. 2023;43(1).
11. Zhu J, Yuan X, Yan L, Li T, Guang M, Zhang Y. Comparison of postoperative outcomes between envelope and triangular flaps after mandibular third molar surgery: A systematic review and meta-analysis. J Oral Maxillofac Surg. 2020;78(4):515-527.
12. de Santana Santos T, Albuquerque AFM, de Moraes M, de Souza Tolentino E. Envelope or triangular flap for surgical removal of third molars? A systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2020;49(8):1073-1086.
13. Peng Q, Xu E, Jin C, Liu C. Modified envelope flap, a novel incision design, can relieve complications after extraction of fully horizontal impacted mandibular third molar. J Dent Sci. 2021;16(2):718-722.
14. Vijayakumar G, Sundaram GA, Krishnaswamy V, Krishnan M, Kumar SP, Lakshmanan S. Influence of three different flap designs on the sequelae of impacted mandibular third molar removal. Library Progress International. 2024;44(3):1-7.
15. Habib AM, Shararah AEA. Evaluating envelope vs triangular flap techniques in impacted mandibular wisdom tooth extraction: A comparative study. 2025. Available from: ResearchGate preprint PDF.
16. Albericio F. Clinical wound healing after lower third molar surgery with envelope and bayonet flaps: A randomized clinical trial. Methods Protoc. 2025;8(5):101