

Influence Of Three Different Flap Designs on The Sequelae Of Impacted Mandibular Third Molar Removal

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ABSTRACT

Aim: This study aimed to compare the influence of envelope, triangular, and linguallly-based flaps on pain, facial swelling, and trismus after mandibular third molar surgery.

Study Design: The randomized prospective comparative study included 60 patients with impacted mandibular third molars. Three flap designs, namely the envelope flap (Koener's incision) (n=20), the triangular flap (Ward's incision) (n=20) and linguallly based flap (n = 20), were used. The pain was determined using a visual analogue scale (VAS), trismus was determined by measuring the maximum interincisal opening, and facial swelling was evaluated using the Laskin method. Intraoperative time was measured from the time of giving the incision to the completion of the closure of the flap.

Results: The VAS scores and facial swelling measurements were lowest in the envelope flap group and highest in the linguallly-based flap ($P < 0.05$). The linguallly-based flap group had the highest mean intraoperative time ($P < 0.05$). There was no significant difference between the envelope flap and the triangular flap in intraoperative time ($P > 0.05$). There was no significant difference between the flap designs in the maximum interincisal opening.

Conclusion: In impacted mandibular third molar removal, The envelope flap design causes less pain and swelling than triangular flap and linguallly based flap. Linguallly-based flap design caused the highest pain, swelling and intraoperative time.

Keywords: envelope flap, triangular flap, linguallly based flap, impacted mandibular third molar removal

INTRODUCTION

Postoperative pain, oedema, and trismus are common after the extraction of an impacted mandibular third molar tooth [1]. The severity of these is determined by the surgical method, the surgeon's experience, the presence of prior periodontal or periapical pathology, the administration of preoperative or postoperative drugs, and the difficulty of extraction. Clinicians are particularly concerned with minimising the patient's discomfort [2]. The proper surgical approach is critical to improving postoperative patient outcomes and comfort. So a good flap design can decrease the morbidity of the patient [3].

The aim of this study was to compare the influence of envelope, triangular, and linguallly-based flaps on pain, facial swelling, and trismus after mandibular third molar surgery. For secondary objectives, intraoperative time was also compared between the three groups.

MATERIALS AND METHODS

Sixty patients (28 females and 32 males) referred to the Department of Oral and Maxillofacial Surgery from November 2022 to March 2023 were enlisted for the study. The patients were between 20 and 35 years of age (26 ± 5.2) and had impacted mandibular third molars. Before any surgical intervention, a dental orthopantomogram was taken for each participant in the study to assess the impaction and to rule out any underlying pathology. Mandibular third molars in classes 1 or 2 and positions A or B (Pell and Gregory classification) were included in

the study. Exclusion criteria were patients with any systemic disease, pericoronitis, or recent NSAID use. The patients were informed of the details of the study, and written informed consent was obtained. All patients were randomly allocated into three groups: Group A [envelope flap] (n=20), Group B [triangular flap] (n=20) and Group C [lingually based flap] (n=20).

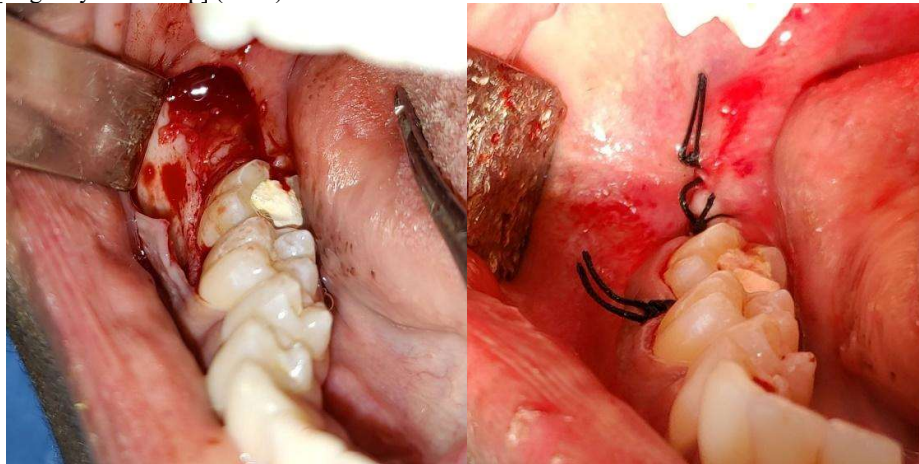


Figure 1 & 2 : Envelope flap

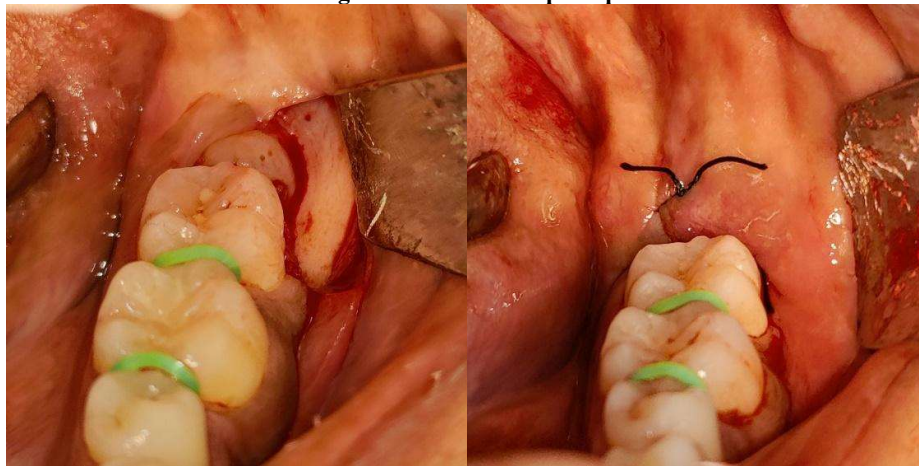
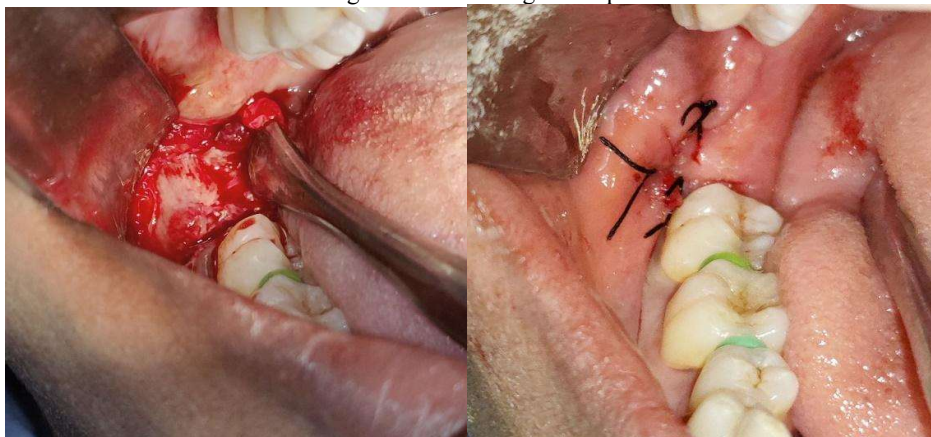


Figure 3 & 4: Triangular flap



Figures 5 and 6: lingually based flap

For all participants, the procedure was done by the same surgeon. Standard scrubbing and draping were done. All patients received local anaesthesia using 2% lignocaine with 1:80,000 adrenaline. Inferior alveolar nerve block, lingual nerve block, and long buccal nerve infiltration were given. Bone guttering was performed using a No. 702 Tungsten carbide bur, and a full-thickness mucoperiosteal membrane was raised. In all groups, the standard irrigant during guttering was normal saline (0.9%). The suturing was performed using a straightforward

interrupted technique with a 3-0 black braided silk suture. For a period of five days, patients were administered oral Amoxiclav 625 mg twice daily as a standard antibiotic, Aceclofenac 100mg + paracetamol 325 mg twice daily as an analgesic, and pantoprazole 40 mg once daily as an antacid. The measurements were taken by a separate surgeon who was blinded.

Patient review was done on both the first and seventh postoperative days, and the following was recorded.

Pain:

Postoperative pain was recorded by the Visual Analogue Scale (VAS) on a 10-point scale, with 0 as no pain and 10 as the worst pain.

Trismus:

The postoperative trismus was evaluated by recording the maximum mouth opening.

Swelling:

A tape measure was employed to conduct a three-point analysis of oedema. The mandibular angle to the lateral canthus, tragus to labial commissure, and tragus to pogonion were measured at the preoperative, 1-day postoperative, and 7-day postoperative periods.

Statistical analyses:

The results were analysed with SPSS software version 23.0. The normality of the data was assessed by the Shapiro-Wilk test. The frequency and percentage were determined to assess the incidence of alveolar osteitis. Repeated measures ANOVA was used to assess the difference in swelling and trismus within the group across the timeline and a one-way ANOVA was used to assess the difference in swelling and trismus between the groups. For pain, the Friedman test was used to assess the difference within the group across the timeline, and the Kruskal-Wallis test was used to assess the difference between the groups.

RESULTS:

The VAS scores and facial swelling measurements were lowest in the envelope flap group and highest in linguallly-based flap ($P < 0.05$). The linguallly-based flap group had the highest mean intraoperative time ($P < 0.05$). There was no significant difference between envelope flap and triangular flap in intraoperative time ($P > 0.05$). There was no significant difference between the flap designs in the maximum interincisal opening.

Mean pain score	Group A [Envelope flap]	Group B [Triangular flap]	Group C [Linguallly based flap]	p value
Pre OP	7.35±0.42	6.21±0.9	6.74±1.72	0.574
Day 1	3.57±2.4	5.13±1.62	6.76±0.82	0.004
Day 7	0.94±1.03	1.45±2.03	2.31±1.85	0.017
p value	0.000	0.033	0.042	

Trismus	Group A [Envelope flap]	Group B [Triangular flap]	Group C [Linguallly based flap]	p value
Pre OP	18.19±5.88	19.23±8.32	20.71±7.97	1.017
Day 1	25.34±7.03	27.67±7.89	22.41±8.5	0.967
Day 7	45.26±7.78	47.21±7.71	50.26±5.55	0.973
p value	0.000	0.000	0.000	

	Mean intraoperative time (minutes)
Group A [Envelope flap]	27 ±2.7
Group B [Triangular flap]	22 ±3.1
Group C [Linguallly based flap]	41±4.7

Mean swelling score	Group A [Envelope flap]	Group B [Triangular flap]	Group C [Linguallly based flap]	p value
Pre OP	107.82±5.33	111.89±8.22	112.96±2.08	0.897
Day 1	113.53±5.98	120.32±5.35	119.34±1.88	0.000
Day 7	100.29±4.57	105.31±3.67	117.24±4.69	0.000
p value	0.000	0.000	0.054	

DISCUSSION:

Mandibular third molar removal is the most frequently performed procedure [4]. Flap elevation with a good design for access to impacted mandibular third molar removal is a crucial step for a successful outcome. More than 50 flap designs and their modifications have been proposed to have less trauma to patients, improve visibility and access, and minimise postoperative pain and swelling [5-6]. The primary objective of this investigation is to evaluate the postoperative sequelae of two flap designs that are frequently employed by oral and maxillofacial surgeons. Assessing the influence of flap design in postoperative pain and swelling can be a difficult task because the perception of pain which is subjective, and the severity of swelling can differ from patient to patient [7].

Among the many flap designs described in the literature, the envelope flap with distal releasing and modified wards incision, which is a triangular flap design, is the most commonly used by oral and maxillofacial surgeons. Both of these flaps are buccal flap designs. Both designs provide adequate visibility to the operator. These two flap designs have been compared in the literature to assess which is best. Z. H. Baqain et al. (2019) in a split-mouth study showed envelope flaps had better outcomes in postoperative swelling and trismus. A total of 19 patients requiring removal of bilaterally impacted mandibular 3rd molars were included in this study [8]. The flap design used is largely determined by the training centre's or surgeon's preferences. Both flap designs are used and taught in our clinic by consultants, and the necessity for a comparative study arose as a result of various patient feedback at first-week follow-ups and a scarcity of publications comparing the early postoperative morbidity associated with flap design [9-10].

When Monaco et al. evaluated the postoperative results of triangle flap and envelope flaps in paediatric patients, they discovered that there was no statistically significant difference in the groups, which was contradictory to our study results.

When using an envelope flap, the surgical site is sufficiently exposed, allowing for good visualization while the molar is being removed. If necessary, the sulcular incision can be extended mesially at any moment. Following surgery, the osseous defect can be safely covered owing to the well-prepared mucoperiosteal flap. Also, there is sufficient blood supply up to the edges of the wounds [11].

The temporalis tendon's insertion is nearly or completely cut across by the distal extension of the incisions typically performed to access impacted mandibular third molars. It also frequently rests on top of the bone defect created when the tooth was extracted [12]. This may be the cause, at least partially, of the following postoperative trismus, pain, oedema, and periodontal destruction of the preceding second molar [13].

73% of the dehiscence occurred in triangle flaps with primary closure on day 7 post-odontectomy, according to Rakprasitkul and Pairuchvej. However, odontectomy was conducted on all impaction categories and was not compared with a reversed triangular flap design. The lack of mucosa to seal the extraction socket may have caused strain when suturing the buccal flap with the lingual portion of the slightly impacted third molar in all subjects in the triangle flap group who had dehiscence. According to several additional studies, triangle flap designs had less dehiscence than envelope flap designs [14].

Mild pain, swelling, and restricted mouth opening are expected sequelae after impacted mandibular 3rd molar removal. The primary reason behind swelling is the creation of dead space due to a bony defect after the removal of the tooth and bone guttering, which is later occupied by blood and fluid [15]. In the elevation of buccally-based flaps, these blood and fluids expand into the adjacent spaces, such as sub-masseteric space, and create swelling and haematoma. So the reason behind the occurrence of less swelling in triangular flap design than in envelope flap design as described in some studies is that giving an anterior releasing incision in a triangular flap can act as a form of drainage of fluid that prevents a water-tight closure and subsequent swelling in the envelope design group [16]. Also, buccally based flap designs require some dissection through pterygomandibular raphe and elevation of the masseter muscle, which can cause postoperative trismus. The elevation of a lingually-based flap design can avoid these steps, which can potentially lead to lower swelling and trismus. On the contrary, our study found that a lingually-based flap design has the highest amount of pain, swelling, and trismus among all the groups [17].

CONCLUSION:

In impacted mandibular third molar removal The envelope flap design causes lower pain and swelling than the triangular flap and the lingually based flap design. The triangular flap design group had the least intraoperative time among the three groups. Lingually-based flap design caused the highest pain, swelling, and intraoperative time.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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REFERENCE:

1. Mansuri, D. S., & Ahmed, D. M. S. (2011, October 1). Mandibular Third Molar Impaction : Effect of Age on Post Operative Pain and Trismus. *Indian Journal of Applied Research*, 3(9), 15–19. <https://doi.org/10.15373/2249555x/sept2013/180>
2. Comparative Evaluation of the Post-operative Complication following Mandibular Third Molar Surgery when using Chlorhexidine vs. Ozonated Water as an Intra-operative Irrigant: A Double-blinded Randomised Controlled Trial. (2023, January 1). *Journal of Population Therapeutics and Clinical Pharmacology*, 30(10). <https://doi.org/10.47750/jptcp.2023.30.10.042>
3. Sisk, A. L., Hammer, W. B., Shelton, D. W., & Joy, E. D. (1986, November). Complications following removal of impacted third molars: The role of the experience of the surgeon. *Journal of Oral and Maxillofacial Surgery*, 44(11), 855–859. [https://doi.org/10.1016/0278-2391\(86\)90221-1](https://doi.org/10.1016/0278-2391(86)90221-1)
4. Chiapasco, M., Crescentini, M., & Romanoni, G. (1995, April). Gernectomy or delayed removal of mandibular impacted third molars. *Journal of Oral and Maxillofacial Surgery*, 53(4), 418–422. [https://doi.org/10.1016/0278-2391\(95\)90715-7](https://doi.org/10.1016/0278-2391(95)90715-7)
5. López, J. L. (2018, December 10). The Importance of Flap Design in Third Molar Surgery: A systematic Review. *Biomedical Journal of Scientific & Technical Research*, 11(5). <https://doi.org/10.26717/bjstr.2018.11.002164>
6. Blanco, G., Lora, D., & Marzola, C. (2017). The Different Types of Flaps in the Surgical Relations of the Third Impacted Molars–Literature Review. *Dentistry*, 07(04). <https://doi.org/10.4172/2161-1122.1000425>
7. Lopes da Silva, B., Machado, G., Primo Miranda, E., Galvão, E., & Falci, S. (2020, August). Envelope or triangular flap for surgical removal of third molars? A systematic review and meta-analysis. *International Journal of Oral and Maxillofacial Surgery*, 49(8), 1073–1086. <https://doi.org/10.1016/j.ijom.2020.01.001>
8. Baqain ZH, Al-Shafii A, Hamdan AA, Sawair FA. Flap design and mandibular third molar surgery: a split mouth randomized clinical study. *International journal of oral and maxillofacial surgery*. 2012 Aug 1;41(8):1020-4. <https://doi.org/10.1016/j.ijom.2012.02.011>
9. Mohan, J., Loganathan, K., Kamaraj, B., Jaganathan, S., Sengodan, S., & Varghese, A. (2019). Comparison of New Flap Design with Conventional Flap Designs on Postoperative Pain and Swelling Following Mandibular Third Molar Removal. *World Journal of Dentistry*, 10(6), 422–427. <https://doi.org/10.5005/jp-journals-10015-1680>
10. Flap design affects recovery from wisdom tooth surgery. (2012, July 31). *Springer Healthcare News*, 1(1). <https://doi.org/10.1007/s40014-012-0768-x>
11. Jeffrey Stephens, R., App, G. R., & Foreman, D. W. (1983, November). Periodontal evaluation of two mucoperiosteal flaps used in removing impacted mandibular third molars. *Journal of Oral and Maxillofacial Surgery*, 41(11), 719–724. [https://doi.org/10.1016/0278-2391\(83\)90188-x](https://doi.org/10.1016/0278-2391(83)90188-x)
12. Jakse, N., Bankaoglu, V., Wimmer, G., Eskici, A., & Pertl, C. (2002, January). Primary wound healing after lower third molar surgery: Evaluation of 2 different flap designs. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 93(1), 7–12. <https://doi.org/10.1067/moe.2002.119519>
13. Elo, J. A., Sun, H. H. B., Dong, F., Tandon, R., & Singh, H. M. (2016, August). Novel incision design and primary flap closure reduces the incidence of alveolar osteitis and infection in impacted mandibular third molar surgery. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 122(2), 124–133. <https://doi.org/10.1016/j.oooo.2016.01.024>
14. Kim, J. C., Choi, S. S., Wang, S. J., & Kim, S. G. (2006, August). Minor complications after mandibular third molar surgery: type, incidence, and possible prevention. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 102(2), e4–e11. <https://doi.org/10.1016/j.tripleo.2005.10.050>

15. Rahpeyma, A., Khajehahmadi, S., & Ilkhani, S. (2015, September 16). *Wound Dehiscence after Wisdom Tooth Removal in Mandibular Mesioangular Class IB Impactions: Triangular Transposition Flap versus Envelope Flap*. Journal of Dental Research, Dental Clinics, Dental Prospects; Tabriz University of Medical Sciences. <https://doi.org/10.15171/joddd.2015.032>
 16. Alqahtani, N. A., Khaleelahmed, S., & Desai, F. (2017, January 1). *Evaluation of two flap designs on the mandibular second molar after third molar extractions*. Journal of Oral and Maxillofacial Pathology; Medknow. https://doi.org/10.4103/jomfp.jomfp_75_17
- Kirk, D. G., Liston, P. N., Tong, D. C., & Love, R. M. (2007, July). Influence of two different flap designs on incidence of pain, swelling, trismus, and alveolar osteitis in the week following third molar surgery. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 104(1), e1–e6. <https://doi.org/10.1016/j.tripleo.2007.01.032>