

Comparison of three flap designs on postoperative complication after third molar surgery



CrossMark

Pingky Krisna Arindra,* Adyaputra Indrapradana

ABSTRACT

Introduction: Third molar surgery can cause post-operative complications to the patient due to the presence of wound from the incision. The study aimed to compare modified triangular (triangular reverse) flap with triangular and envelope flap on postoperative complications by the measurements on post-surgical swelling, trismus, pain scale, wound dehiscence and the occurrence of alveolar osteitis.

Methods: Study design using a single-blind randomized clinical trial. Each treatment group consisted of 10 patients. An assessment was performed on day 1, 7 and 14 after surgery. The swelling was measured using different anatomical points, and trismus was measured using the distance of inter-incisal opening. The occurrence of dehiscence was measured from the width of the incision line. Alveolar osteitis and pain scale was observed.

Results: The results of one way ANOVA ($p > 0.05$) shows there was no difference between treatment groups both for swelling and mouth opening, but there was a difference between treatment groups for dehiscence on days 7 and 14. The results of the Post Hoc test show that flap envelope differs from the other flap design, whereas triangular and triangular reverse flap showed no difference. Friedman test results ($p > 0.05$) showed no difference in VAS score. There was no alveolar osteitis occurred in each treatment group during postoperative control. Kruskal Wallis test ($p > 0.05$) showed that there was no difference of VAS score between treatment group during post-operative control.

Conclusion: The triangular reverse flap design may decrease the occurrence of postoperative complication after mandibular third molar surgery.

Keywords: third molar surgery, post-operative complications, reverse triangular flap

Cite This Article: Arindra, P.K., Indrapradana, A. 2018. Comparison of three flap designs on postoperative complication after third molar surgery. *Intisari Sains Medis* 9(2): 89-94. DOI: 10.1556/ism.v9i2.267

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia.

INTRODUCTION

Post third molar surgery discomfort is often felt by patients arising from complications at the time of surgery or after surgery. Patients often experience pain, swelling, trismus, dehiscence, alveolar osteitis, infection, nerve injury and periodontal tissue damage.¹ Complications can be prevented through atraumatic, aseptic, drug administration, and physiotherapy, suturing technique and also flap design. Flap design is intended to achieve good access to the third molar impacted teeth, and facilitate easy suturing, so it is expected to have good post-surgical healing.^{1,2}

During this time, flap design research was done on the condition of fully covered impacted teeth by oral mucosa or alveolar bone.^{1,2,4,5} Daily conditions show that partially impacted dental impaction cases are the most prevalent. Surgical extraction on partially erupted third molar mandible requires a distinct challenge in the flap design to prevent acute postoperative complications.⁶ For that purpose, research on triangular modification (triangular reverse) flap design was compared with conventional and triangular conventional flap envelope design for the occurrence of postoperative complication after third molar surgery. Triangular reverse flap design is a modification of the triangular

incision design by creating a vertical releasing flap on the distal side of the lingual side leading to the lower third molar side of the line past the external oblique linea.

Several studies have reported the effect of flap design on postoperative complications after third molar surgery, but the reverse triangular flap design has not been previously reported.

METHOD

Patient and surgery

The study design used a single-blind randomized clinical trial, patients who fit the inclusion criteria were included as research subjects. The inclusion criteria were patients with partially erupted partial mandibular third molar, aged between 18 to 60 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 Prof. Seodomo Dental Hospital, Faculty of Dentistry Universitas Gadjah Mada.

The subjects were 30 patients divided into three study groups and consisted of 10 samples of the conventional flap envelope design group, ten samples of triangular flap design group, ten samples

*Correspondence to:
Pingky Krisna Arindra, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia
krisnarindra@ugm.ac.id

of reverse triangular flap design group (Figure 1). Third molar surgery performed by Oral and Maxillofacial Surgeon. After anamnesis, patient samples signed informed consent and approval as a sample of research before surgery. Third molar surgery was performed with an inferior alveolar nerve block anesthesia and lingual nerve and infiltrating the long buccal nerve using a 2% lidocaine 1: 80.000. Mucoperiosteal flap with envelope flap design, triangular flap design or reverse triangular flap design on mandibular third molars. Osteotomy on the buccal and distal bone of the third molar use Moore and Gilby's guttering technique.⁷ After surgery, the tooth follicle is cleaned. In the tooth socket on the alveolar bone laid gelatin sponge and then performed the primary wound suturing. If there is no history of allergy, the patient is given 500 mg of amoxicillin caplet taken daily 3 times every 8 hours for 5 days, and ibuprofen 400 mg is taken for every 8 hours for 3 days. The suture release was done 7 days post operation. The study received approval from the local ethics committee and in accordance with the Helsinki.

Pre and postoperative assessment

All patients controlled on day 1, 7, and 14 after surgery. Measurements of edema and trismus were performed before surgery and after surgery, consisting of H+0 (immediately after suturing), H + 1 (first day after surgery), H + 7 (the seventh day after surgery) and H + 14 (the fourteenth day after surgery). Measurement of edema by using three facial lines ie the tragus distance (point a) to the corner of the mouth (point b) as line 1, the tragus distance (point a) to pogonion (point c) as line 2 and line 3 is the angular distance (point d) to the lateral angle of the eye (point e). The distance between the three lines is measured in length and the average value is measured (Figure 2). The tool used is soft wire to be sterilized.⁸ Trismus was measured by the subjects opened the mouth wide to the vertical and measured the distance between the incisal edge of the maxillary central incisor to the lower incisor by using the sliding caliper.⁹ (Figure 3)

The dehiscence assessment was done visually and carefully explored with periodontal probes. The distance along the incision line is defined as dehiscence.¹ The occurrence of alveolar osteitis was observed by looking at whether there was an open alveolar bone area and was not filled by granulation tissue and the patient complained of postoperative pain. The postoperative third molar pain was measured by the Visual Analog Scale (VAS) pain scale.^{3,5}

Statistic Analysis

Data were analyzed using SPSS version 20.0 (Statistical Package for Social Science). Test of normality was analyzed with Shapiro-Wilk test. Repeated measure ANOVA test was used to determine the difference of swelling and trismus between control days in each flap group. The paired test was performed to determine the difference of dehiscence on the 7th day and the 14th postoperative day in each group, while the one-way ANOVA test to know the difference between the three groups. If the data is not normally distributed, then nonparametric Friedman test is performed, this test is to know the difference between the control days of each group, and Kruskal Wallis test to evaluate the difference of VAS score in each day of control between each treatment group.

RESULT

Swelling evaluation results measured before surgery and after surgery are shown in table 1. Repeated measure ANOVA (p1) shows a value of $p < 0.05$ which means there is a difference of swelling from day to day in each flap group. This indicates a postoperative inflammatory healing process. The average value of the highest swelling was in the triangular group, and swelling in all groups increased on day 1 postoperatively. The 7th and 14th-day swellings show almost the same value as the preoperative swelling measurements. The one-way ANOVA (p1) result shows $p > 0.05$ in preoperative swelling measurement, one-day and a week postoperative swelling measurement, while $p < 0.05$ on day 14 postoperative swelling measurement. This means that the measurement of preoperative swelling, one-day and a week postoperatively shows no significant difference. While on day 14 preoperative swelling measurements there are differences in swelling measurements between groups. Post hoc test results showed only triangular flap groups whose values differed from those of the envelope and triangular reverse flap groups. Higher mean value results in the triangular flap group compared with the other group could be assumed that the triangular flap group caused swelling compared to the other group, but when compared with the preoperative measurements showed similar results between the preoperative measurements with the day 14 postoperative swelling measurements.

Table 2, shows the results of a trismus evaluation of the width of the interincisal opening of the maxilla and the lower jaw. The result of repeated

Table 1 Statistical analysis of postoperative swelling after third molar surgery with different flap designs

Research groups Mean	Swelling Pre Surgery		Swelling Post Surgery H+0		Swelling Post Surgery H+1		Swelling Post Surgery H+7		Swelling Post Surgery H+14		p1
	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Envelope	120.29	6.56	120.88	7.07	130.05	6.44	120.79	6.37	115.36	0.83	0.000
Triangular	124.07	8.82	124.76	7.80	131.50	8.06	125.89	8.76	124.10*	8.88	0.000
Reverse Triangular	119.28	3.58	119.69	3.62	128.29	4.13	120.35	4.08	119.17	3.66	0.000
p2	0.257		0.202		0.541		0.140		0.006		

p1) Repeated measure; p2) One-way ANOVA;*) p<0.05 post hoc ANOVA Flap Triangular vs. Flap Envelope

Table 2. Statistical analysis of postoperative trismus after third molar surgery with different flap designs

Research groups Mean	Trismus Pre Surgery		Trismus Post Surgery H+0		Trismus Post Surgery H+1		Trismus Post Surgery H+7		Trismus Post Surgery H+14		p1
	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Envelope	39.17	2.34	36.73	2.22	31.43	3.31	38.04	2.32	38.85	1.95	0.008
Triangular	41.60	2.77	36.13	3.76	28.90	1.75	40.89	2.54	41.60*	2.55	0.000
Reverse Triangular	40.62	2.34	34.31	4.08	29.30	4.99	39.48	3.09	40.26	2.50	0.002
p2	0.109		0.280		0.258		0.076		0.047		

p1) Repeated measure; p2) One-way ANOVA;*) p<0.05 post hoc ANOVA Flap Triangular vs. Flap Envelope

Table 3 Statistical analysis of postoperative dehiscence after third molar surgery with different flap designs

Research groups	Dehiscence H+7		Dehiscence H+14		p1
	Mean	SD	Mean	SD	
Envelope	5.83	1.54	2.87	0.67	0.000
Triangular	3.65*	1.14	1.45*	0.71	0.000
Reverse Triangular	3.03*	0.97	0.90*	0.50	0.000
p2	0,000		0,000		

p1) Paired T test; p2) One-way ANOVA;*) p<0.05 post hoc ANOVA Flap Triangular vs. Flap Envelope, Flap Reverse Triangular vs. Flap Envelope

Table 4 Statistical analysis of postoperative pain after third molar surgery with different flap designs

Research groups Mean	VAS Pre Surgery		VAS Post Surgery H+0		VAS Post Surgery a H+1		VAS Post Surgery H+7		VAS Post Surgery H+14		p1
	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Envelope	0.2	0.4	0.0	0.0	1.5	1.2	0.2	0.4	0.0	0.0	0.000
Triangular	0.4	0.5	0.7	1.1	1.6	0.7	0.4	0.5	0.0	0.0	0.000
Reverse Triangular	0.4	0.5	0.5	0.7	1.5	0.7	0.2	0.4	0.0	0.0	0.000
p2	0.560		0.075		0.951		0.517		1.000		

p1) Friedman test; p2) Kruskal Wallis test

measure ANOVA (p1) shows p-value <0.05 meaning that there is a difference in trismus measurement between measurement before surgery and measurement after surgery at each treatment group. The results of the average postoperative score indicate values that approximate the measurements before the surgical operation on the 7th and 14th-day measurements. This means that the control of days

7 and 14 occurs inflammatory healing involving mastication muscles. At the moment the surgery is completed and at one day after surgery shows a decrease in interincisal opening width.

It shows the presence of inflammation involving mastication muscles. The result of one way ANOVA (p2) shows the value of p > 0.05 before the operation, shortly after surgery, one day after



Figure 1 Design of envelope flap (A), triangular (B), reverse triangular (C) on partial eruption lower third molar

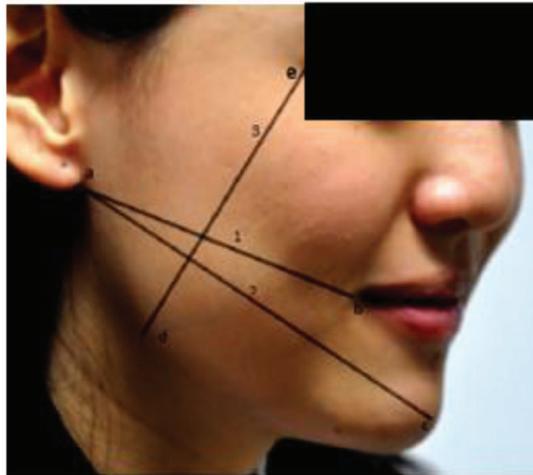


Figure 2 The points of edema measurement on the face

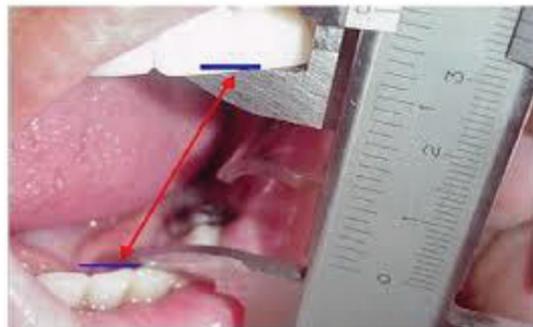


Figure 3 Measurement of interincisal opening with sliding caliper

surgery, and one week after surgery. These results mean that there is no difference in interincisal width measurements between flap design groups on pre-operative measurements up to one week postoperatively. While 14 days after surgery shows p -value $< 0,05$, it means there is a difference of interincisal width measurement between flap design group on day 14. Post hoc test show only different triangular flap design compared to design group of flap envelope and reverse triangular with most interincisal opening value wide. This shows that the triangular flap design is a flap design capable of reducing the occurrence of trismus postoperative third molar surgery.

Table 3, shows the dehiscence measurements between day 7 and day 14, based on the results of paired t-test (p_1), there is a difference between dehiscence on day 7 and day 14 in each flap design group. This shows that there is healing on day 14. The result of one way ANOVA (p_2) test shows the significance of $p < 0.05$ on day 7 and day 14, meaning that there is a difference between treatment group on day 7 and day 14. Result of the Post Hoc test shows that the flap envelope differs from the triangular and reverse triangular flap, whereas the reverse triangular and triangular flap do not show any difference.

The occurrence of alveolar osteitis is supported by the presence of postoperative pain. Visual Analog Scale pain scale measurements were measured at day 1, 7 and 14 postoperative controls. The control results did not show the occurrence of postoperative alveolar osteitis in each treatment group. Shapiro Wilk test results obtained $p < 0.05$ which means the data is not normally distributed. Furthermore, nonparametric analysis with Friedman test was used to know the difference between the control days of each group, and Kruskal Wallis test to know the difference of VAS score in each day of control between each treatment group. The results of the analysis are presented in table 4. There is no difference in VAS score from time to time in each treatment group. These results showed no Alveolar Osteitis in each treatment group at the time of postoperative control. While the result of Kruskal Wallis test shows p value > 0.05 meaning there is no difference of VAS score between treatment group at the time of post-operation control.

DISCUSSION

This study aimed to evaluate whether reverse triangular flap design was able to prevent postoperative complications of swelling, trismus, dehiscence, alveolar osteitis and pain after surgery of the partial eruption mandibular third molars compared with triangular and envelope flap design. The results show that the triangular flap design tends to cause swelling when compared with other flap designs. Factors that affect the occurrence of swelling due to the addition of releasing incision so that it is assumed to produce edema due to an inflammatory process.^{10,11} Similar results were also found by Mobilio et al. (2017) comparing envelope incisions and conventional triangular incisions.¹³ The mucosa will respond to tissue trauma by releasing antibodies and leukocytes present in the bloodstream, plasma exudation, protein, and neutrophils in the injury area resulting in inflammatory clinical symptoms of swelling.¹²

The occurrence of facial swelling in the first postoperative day in all treatment groups showed an increase in extracellular fluid and extravascular fluid accompanied by abnormal fluid accumulation in between tissue and facial serous cavity after third molar surgery.^{10,11} Edema that occurs is an inflammatory process for healing and reaches its peak at 24-48 hours and will be reduced and lost on the third and fourth days after lower third molar surgery.¹³ This is in accordance with the results of studies showing a decrease in facial swelling of seven and fourteen days postoperatively.

Trismus measurements showed that triangular flap groups resulted in better interincisal opening compared to the flap envelope and reverse triangular design groups. Trismus is a spasm of the muscles of mastication caused by trauma to the musculus and blood vessels in the infratemporal space that leads to open mouth disorders, trigeminal nerve motor disorders due to nervous structures that are suppressed due to the edema that occurs. The cause of trauma to the muscle is the recurrent needle insertion in the inferior alveolar nerve anesthetic block, particularly in the medial pterygoid cavity, infection, haemorrhage or hematoma irritating tissue and impairing the function of muscle, mouth rinse containing alcohol or substances that irritate, third molar surgery and direct trauma to the temporomandibular joint.^{3,5} In this study the occurrence of trismus after third molar surgery caused by inflammation of the muscles of mastication leading to spasm secondary to the raising of a mucoperiosteal flap.

Postoperative dehiscence appears on the envelope flap design, and it is reported that dehiscence is more common in envelope flap than in bayonet flap or triangular flap.^{6,7} The advantage of the flap envelope is being able to provide sufficient viewing space on the surgical side and allow the elongation of the incision to the anterior if necessary, good for blood supply and facilitate easy suturing. The disadvantage is the breakdown of the periodontal ligament when making a sulcular incision around the tooth, this damage will increase osteoclast activity when opening the mucoperiosteal flap and increase the risk of wound dehiscence. Dehiscence may occur in the envelope flap due to a tense flap on the anterior side with intersulcular suture, tension in soft tissue will result in postoperative hematoma and mastication movement will increase the incidence of wound dehiscence.^{10,11}

The advantage of modified triangular flap design is more conservative because it prevents the trauma of the buccal side tissue of the second molars. Triangular flap design is a flap design that

supports tension free tension making it possible to close primarily, while the envelope flap is not possible to close primarily.¹² Triangular flap produces a better viewing field and is wider than the flap envelope, due to a vertical releasing incision but will result in swelling and other signs of postoperative complications.¹⁰⁻¹²

The reverse triangular flap is a triangular flap by creating a vertical releasing flap on the distal side that leads from the lingual side to the buccal side through the external oblique line in the retromolar area of the mandibular third molar and adds a sulcular horizontal incision on the distobuccal side of the mandibular second molar.

This flap is a modification of the conventional triangular flap and this flap can be transposed as a short triangular flap design, supporting primary sewing, and allowing to add a visible field on the distal side of a buried third molar tooth. There is the flexibility to increase the length of the sulcular incision in the buccal second molar. The deficiency of this flap is to increase the risk of bleeding and lingual nerve injury especially if the trigonum retromolar is thin and the incision line is not directly above the bone in the area of the trigonum retromolar.

The results of this study indicate that flap design choices determine the occurrence of postoperative complications. The risk of alveolar osteitis is caused by a lack of postoperative oral hygiene and immunocompromised patients.¹⁴ Need to educate the patient to be careful when performing oral cleansing cavity either rinsing or brushing teeth because if too often or gargle too hard will release the blood formed so as to cause a dry socket or alveolar osteitis after the third mandibular molar surgery.

CONCLUSION

The reverse triangular flap design can reduce the occurrence of postoperative third molar complications. Reverse triangular flap design can be an alternative to flap design options because it gives the same results as triangular flap design.

REFERENCES

1. Rahpeyma A, Khajehahmadi S, Ilkhani S. Wound Dehiscence after Wisdom Tooth Removal in Mandibular Mesioangular Class II Impactions: Triangular Transposition Flap versus Envelope Flap. *Journal of Dental Research, Dental Clinics, Dental Prospects*. 2015;9(3):175-180. doi:10.15171/joddd.2015.032.
2. Aydintug, YS, Bayar GR, Gulses A, Misir AF, Ogretir O, Dogan N, Sencimen M, Acikel CH. Clinical study on the closure of extraction wounds of partially soft tissue-impacted mandibular third molars. *Quintessence International*. 2012;43:863-870.

3. Borgonovo AE, Giussani A, Grossi GB, Maiorana CM. Evaluation of postoperative discomfort after impacted mandibular third molar surgery using three different types of flap. *Quintessence International*. 2012;22(1):1-12.
4. Jeffrey A, Elo HH, Dong F, Tandon R, Singh HM. Novel incision design and primary flap closure reduces the incidence of alveolar osteitis and infection in impacted mandibular third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2016;122(3):124-133
5. Kirk DG, Tong DC, Love RM., Influence of two different flap design on incidence of pain, swelling, trismus, and alveolar osteitis in the week following third molar surgery. *Oral surg Oral med Oral pathol Oral radiol Endod*. 2007;104:e1-e6
6. Sandhu A, Sandhu S, Kaur T. Comparison of two different flap designs in the surgical removal of bilateral impacted mandibular third molars. *Int. J. Oral Maxillofac. Surg*. 2010;39(1):1091-1096
7. Jackse N, Bankaoglu V, Wimmer G. Primary wound healing after third molar surgery: Evaluation of two different flap design. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2002;93(4):7-12.
8. Klongnoi B, Kaewpradub, Boonsiriseth K, Wongsirichat N. Effect of single dose preoperative intramuscular dexamethasone injection on lower impacted third molar surgery. *Int. J. Oral Maxillofacial Surg*. 2012;41(2):376-379.
9. Agrawal J, Shenai PK, Chatra L, Kumar PY. Evaluation of normal range of mouth opening using three finger index : south India perspective study. *Indian J Dent Res*. 2015;26(4):361-365.
10. Santosh BS, Shivamurthy DM, Shilpa IG, Thippeswamy SH, Singh JR, Mangalekar SB. Comparison of pain, swelling, and trismus in the surgical removal of impacted mandibular third molars by following two different flap techniques. *Journal of Advanced Medical and Dental Sciences Research*. 2016;4(1):139-142.
11. Bodh R, Jain A. The flap design of third molar surgery : An Overview. *International Journal of Medical and Health Research*. 2015;1(3):32-35.
12. Yolcu AH. Comparison of a new flap design with the routinely used triangular flap design in third molar surgery. *Int. J. Oral Maxillofac. Surg*. 2015;44(2):1390-1397.
13. Mobilio N, Vecchiatini R, Vasquez M, Calura G, Catapano S. Effect of flap design and duration of surgery on acute post-operative symptoms and signs after extraction of lower third molars: A randomized prospective study. *Journal of Dental Research, Dental Clinics, Dental Prospects*. 2017;11(3):156-160 doi:10.15171/joddd.2017.028.
14. Refo'a Y, Ouatik N, Golchin F, Mahboodi N, Comparing primary and secondary wound healing discomfort after mandibular third molar surgery: a randomized, double-blind clinical trial. *Gen Dent*. 2011;59(4):310-313.



This work is licensed under a Creative Commons Attribution