

# The Influence Of Flap Design On Sequelae And Quality Of Life Following Surgical Removal Of Impacted Mandibular Third Molars: A Splitmouth Randomised Clinical Trial

Dr. Tanvi Mahale<sup>1</sup>, Dr. Gokul Venkateshwar<sup>2</sup>, Dr. Mihir Golwala<sup>3</sup>, Dr. Veenita Singh<sup>4</sup>, Dr. Swapna Nayan<sup>5</sup>

<sup>1</sup>Consultant Oral and Maxillofacial Surgeon, Mumbai

<sup>2</sup>Professor, Dept of Oral and Maxillofacial Surgery, DY Patil University School of Dentistry Navi Mumbai (Corresponding author)

<sup>3</sup>Consultant Oral and Maxillofacial Surgeon, Mumbai

<sup>4</sup>Professor Department of Oral and Maxillofacial Surgery, DY Patil University School of Dentistry Navi Mumbai

<sup>5</sup>Professor Department of Oral and Maxillofacial Surgery, DY Patil University School of Dentistry Navi Mumbai

## Abstract

**Background:** This study was conducted to assess the influence of flap design on sequelae and quality of life following surgical removal of impacted mandibular third molars. **Material and methods:** Thirty individuals with the age group of 18-45 years who reported to the Department of Oral and Maxillofacial Surgery, D.Y. Patil University School of Dentistry, Navi Mumbai, with bilateral impacted lower third molars were the study subjects; out of which 18 were male and 12 were female. This was a Split-mouth study where the mesioangular impacted Class IIB lower third molars on either side were divided into two groups: GROUP (A) – Those in which Envelope flap was used. GROUP (B) - Those in which Trapezoidal flap was used. **Results:** This study was conducted to compare the efficacy of envelope flap and trapezoidal flap in mandibular third molar surgery. Thirty patients with bilateral mesioangular impacted mandibular third molar underwent surgical removal under local anaesthesia. **Conclusion:** Third Molar (3M) Removal remains a significant workload on an Oral and Maxillofacial Surgeon. Majority of the 3M removal implies proper tissue handling, adequate bone removal, on other factors. Hence, considering this aspect, flap design remains a vital component in the dynamics of lower 3M removal.

**Keywords:** flap design, impaction, third molar.

## Introduction

The term Impaction is of Latin origin from the word impetus, it means organ/structure has been prevented from assuming its normal position due to an abnormal mechanical condition.<sup>1</sup> Third molars are present in 90% of the population with 33% having at least one impacted third molar. In most of the situations the impacted tooth causes recurrent pericoronitis, caries to adjacent tooth, cyst and other pathologies. Because of these, surgical removal of third molar is one of the most frequently performed procedures in Oral & Maxillofacial surgery.<sup>2,4</sup> Surgical removal of impacted lower third molar (L3M) may be associated with variety of sequelae like pain, swelling, trismus and wound infection. There are different variables in the surgery which influence the postoperative outcome and the quality of life following removal of L3M flap design being one such variable.<sup>2,3</sup> The sequelae following 3M surgery like wound healing, dry socket, pocket formation amongst others behoves an Oral and Maxillofacial Surgeon to consider the ideal flap. Flap design is the mainstay in achieving an ideal removal of 3M followed by an optimal wound healing and avoiding in toward sequelae. Hence, the choice of flap design has to be considered and decided prior to 3M removal and as a part of treatment planning. Envelope flaps have no releasing incision and the ease of access to tooth to be extracted depends on the length of mesial extension of the sulcular incision, which can, if

necessary, extend up to second premolar.<sup>5</sup> Trapezoidal flap is formed by a horizontal incision along the gingivae and two oblique vertical releasing incisions extending to the buccal to the buccal vestibule. Each flap has its own merits and demerits. Though the choice of flap has remained predominantly a surgeon's preference, in order to remove 3M successfully. There are various studies comparing the flaps with conflicting results. Hence, this study was conducted to compare the two commonly used flaps in surgical removal of lower third molar. 3M removal is influenced by 3M position which can be described by angulation and classification. There are two radiographic classifications, the first one introduced in 1926 by Winter, the second one by Pell and Gregory in 1933, they are still the most used to define the grade of inclusion of upper and lower third molars on an Orthopantomograph (OPG). Winter classified the third molar considering its inclination with respect to the long axis of a normally inclined second molar so that the wisdom tooth can be classified as inclined mesial, vertical, distal or horizontal. The Pell and Gregory classification considers class I, II, and III with respect to the anterior aspect of the ascending ramus and A, B, and C based on the position of the lower third molar with respect to the mandibular bone and second molar occlusal plane. Upper molars are classified as belonging to class A, B, or C with respect to second molar occlusal plane.<sup>4,6</sup>

## Material and methods

Thirty individuals with the age group of 18-45 years who reported to the Department of Oral and Maxillofacial Surgery, D.Y. Patil University School of Dentistry, Navi Mumbai, with bilateral impacted lower third molars were the study subjects; out of which 18 were male and 12 were female. This was a Split-mouth study where the mesioangular impacted Class IIB lower third molars on either side were divided into two groups: GROUP (A) – Those in which Envelope flap was used. GROUP (B) - Those in which Trapezoidal flap was used.

A standard proforma was used to collect necessary information regarding each case selected for the study. The patients were informed about the study and necessary consent was taken from them. All preoperative, intraoperative and postoperative photographic records and radiographic records were maintained for these patients. And all the patients were treated on an outpatient basis.

### Inclusion criteria:

Age group between 18-45yrs.

Bilateral impacted lower third molars classified as mesioangular (Winter's Classification) Class IIB (Pell and Gregory Classification) with partial bone impaction requiring similar surgical techniques.

Patient should not be on antibiotic therapy at least one month prior to surgery for any reason.

### Exclusion Criteria:

Patients with allergies or contraindications to the anaesthetic employed.

Patients with local inflammation or pathology in the oral cavity.

Pregnant and lactating women.

Women using oral contraceptives.

Patients with inadequate mouth opening.

### Results

This study was conducted to compare the efficacy of envelope flap and trapezoidal flap in mandibular third molar surgery. Thirty patients with bilateral mesioangular impacted mandibular third molar underwent surgical removal under local anaesthesia. This was a Split-mouth study where the impacted lower third molars on either side were divided into two groups:

GROUP (A) – Those in which envelope flap was used. GROUP (B) - Those in which trapezoidal flap was used.

The various parameters were used to evaluate the efficacy of the two flap designs.

Operating time - Time taken from the time of incision till the placement of the final suture.

Post-operatively patients were evaluated for pain, trismus, swelling, and periodontal depth of 2nd molar.

**Table1:OPERATINGTIMEINMINUTES**

	Envelopeflap	Triangularflap
Case1	51	57
Case2	58	54
Case3	43	51
Case4	51	47
Case5	45	50
Case6	47	55
Case7	54	59
Case8	58	52
Case9	51	54
Case10	62	59
Case11	45	46
Case12	42	45
Case13	55	48
Case14	56	59
Case15	52	58
Case24	53	52
Case25	61	55
Case26	44	44
Case27	41	42
Case28	56	45
Case29	58	56
Case30	55	59
Case24	53	52
Case25	61	55
Case26	44	44
Case27	41	42
Case28	56	45

Case29	58	56
Case30	55	59

**Table2: Post-Operative pain (Visual analogue score)**

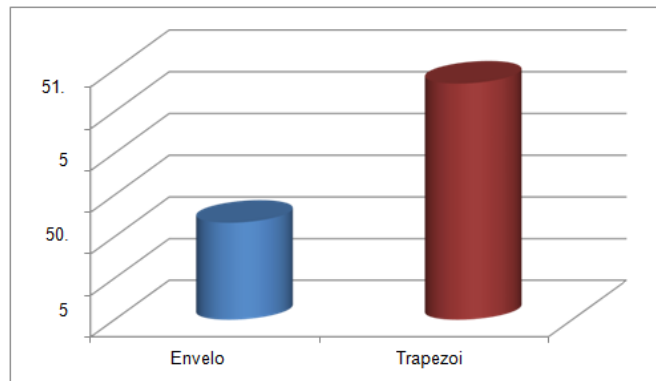
Pain score	Envelope flap				Trapezoidal flap			
	Day1	Day3	Day7	Day15	Day1	Day3	Day7	Day15
Case1	7	5	2	0	8	5	1	0
Case2	7	5	2	0	8	6	1	0
Case3	6	4	1	0	7	5	0	0
Case4	7	4	2	0	7	5	2	0
Case5	8	6	2	0	6	4	1	0
Case6	6	4	1	0	7	5	0	0
Case7	7	4	2	0	6	4	1	0
Case8	6	3	1	0	7	4	1	0
Case9	7	4	2	0	7	4	2	0
Case10	6	4	1	0	6	4	1	0
Case11	5	3	1	0	6	4	1	0
Case12	7	4	1	0	7	4	1	0
Case13	6	3	1	0	7	5	1	0
Case14	7	3	0	1	7	5	0	0
Case15	7	3	0	0	6	4	1	0
Case16	6	4	1	0	7	6	0	0
Case17	7	4	1	0	7	5	1	0
Case18	7	4	2	0	6	6	1	0
Case19	8	3	1	0	6	5	1	0
Case20	6	6	2	0	7	4	2	0
Case21	7	5	1	0	8	5	1	0
Case22	7	5	1	0	6	5	0	0
Case23	8	3	2	1	7	5	2	0
Case24	7	4	2	0	8	4	1	0
Case25	8	4	0	0	7	5	0	0
Case26	6	4	2	0	6	4	1	0
Case27	5	5	0	0	6	5	1	0
Case28	5	3	1	0	8	4	1	0
Case29	6	4	2	0	6	4	1	0
Case30	7	4	1	0	7	5	1	0

**TABLE3: POST-OPERATIVE TRISMUS (Interincisal opening in Mm)**

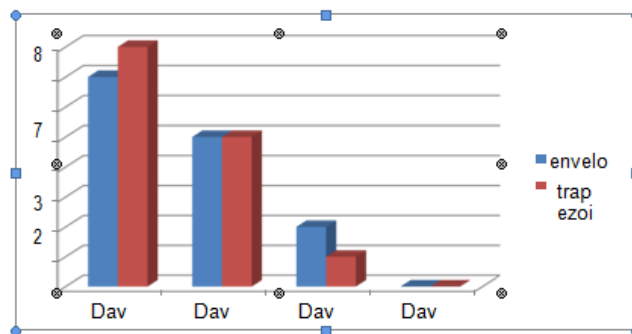
Interincisal opening	Envelope flap					Trapezoidal flap				
	Preop	Day1	Day3	Day7	Day15	Preop	Day1	Day3	Day7	Day15
Case1	41	39	36	40	41	41	39	36	40	41
Case2	40	38	35	40	41	40	38	36	39	40
Case3	41	39	37	40	41	41	39	36	40	41
Case4	39	38	36	38	39	39	38	35	39	40
Case5	40	39	37	39	40	40	38	36	38	40
Case6	41	40	38	40	41	41	39	37	39	40
Case7	42	41	39	40	41	42	40	36	40	41
Case8	36	35	31	35	36	36	35	34	35	36
Case9	41	39	37	40	41	41	40	37	39	40
Case10	37	36	34	35	37	37	36	34	36	37
Case11	39	38	36	37	39	39	37	35	39	39
Case12	40	38	36	38	40	40	38	36	39	40
Case13	43	41	40	42	43	43	41	39	43	43
Case14	41	39	38	39	41	41	40	38	40	41
Case15	42	40	38	41	41	42	40	38	41	42

Case 16	42	38	37	38	40	40	38	37	38	40
Case 17	41	40	36	40	43	41	38	34	40	41
Case 18	39	38	38	40	41	39	39	36	40	41
Case 19	41	39	36	40	36	41	39	36	38	41
Case 20	42	40	37	38	41	40	38	36	38	40
Case 21	41	38	35	40	41	41	39	36	40	40
Case 22	42	35	34	35	41	41	35	36	35	36
Case 23	36	41	37	40	39	36	40	37	40	40
Case 24	40	36	31	36	40	40	41	37	36	37
Case 25	38	39	31	40	37	39	37	36	39	40
Case 26	40	37	40	42	36	36	35	35	39	36
Case 27	44	42	38	39	41	40	37	39	39	43
Case 28	42	36	38	41	43	41	40	35	40	43
Case 29	40	36	40	36	40	40	41	35	41	42
Case 30	41	42	35	40	43	42	41	36	43	41

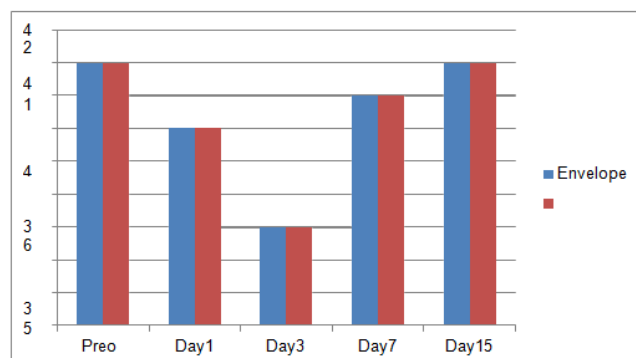
**Graph 1: Operating Time For Envelop Flap & Triangular Flap.**



**GRAPH 2: POST-OPERATIVE PAIN EVALUATION AT DIFFERENT TIME INTERVALS.**



**GRAPH 3: TRISMUS EVALUATION AT DIFFERENT POST-OPERATIVE DAYS.**



## Discussion

The lower third molar (3M) removal, particularly hinges on its position and angulation in the oral cavity. The difficulty indices precede the technique and the treatment plan, used in the effortless removal of a lower 3M with optimum outcome. Amongst the various variables, flap design is an important and significant factor in gaining access to the lower 3M. Wound healing, periodontal health (pocket distal to the 3M), possible sequelae like trismus, pain, edema and Quality of Life (QOL) are also dictated by the flap utilized in lower 3M removal. The Oral and Maxillofacial (OMF) surgeon has an option to use various flaps in order to remove a 3M. Envelope flaps, Triangular flaps, Trapezoidal flap are some of the commonly used flaps in 3M surgery. In this study, the lower 3M chosen fit into our protocol. Comprehensive history and detailed examination of the lower 3M region and oral cavity was done prior to removal. The envelope flap and the trapezoidal flap were used in this split mouth study. Envelope flap involves a linear incision without any angles. The extension of the sulcular incision can be up to the second premolar. In our study it was extended to the distobuccal aspect of the first molar.

Intra-operatively both flaps were checked for accessibility of tooth and ease of suturing. It was found that envelope flap is easier to suture than the trapezoidal flap. The approximation of the trapezoidal flap as per its anatomical alignment can be tedious and at times repetitive. It has been reported that flap designing influences the postoperative complications in third molar surgery.<sup>8,9</sup> In our study, visual analogue scale was used for the assessment of pain. There were no significant difference present between pain scores of envelope flap and trapezoidal flap at different postoperative days. The pain score was gradually decreasing from 1<sup>st</sup> post-operative day to 15<sup>th</sup> postoperative day. The study by **Gool AV, Bosch JJ and Boering G. (1977)**<sup>20</sup> also concluded that incision and reflection of mucoperiosteum was responsible for pain. They reported that the type of flap design had no influence on the degree of pain.

While in study conducted by **A. Sandhu, S. Sandhu, T. Kaur (2012)**<sup>11</sup> reported an increase in pain scores with envelope flap group than triangular flap. This was attributed to more operating time taken by envelope flap than triangular flap. In our study, the mean operating time for Envelope flap (49.6min.) was less than the mean operating time required for trapezoidal flap (51.3min.) But this difference was not statistically significant. (p value-0.368) When mean trismus scores were compared between two incisions, it was observed that there was no significant difference present between two flaps

on day 1, day 7 and 15<sup>th</sup> post-operative day. But there was statistically significant difference present on 3<sup>rd</sup> post-operative day. The mean interincisal opening on 3<sup>rd</sup> postoperative day for envelope flap group was 39.53mm while for trapezoidal flap group was 36.2mm. The difference was 3.33mm which indicates that trapezoidal flap group has more trismus on 3<sup>rd</sup> post-operative day. It has been suggested that trapezoidal mucoperiosteal flaps induce inflammation in the muscles of mastication and it is possible that muscle irritation induced by hematoma formation when the periosteum is incised for the anterior releasing incision, is more likely with this design.<sup>12</sup>

In contrary to our results **Kirk DG, Liston PN, Tong DC (2007)** and **Nageshwar (2002)** found no significant difference in mouth opening between the two flap designs explaining their findings on the grounds that the distal incision, which follows the same course in both flap designs, is similar.<sup>13</sup> Post-operative swelling was also observed; there was no significant difference present between the two incisions on 1<sup>st</sup>, 7<sup>th</sup> and 15<sup>th</sup> postoperative day. But there was statistically significant difference present on 3<sup>rd</sup> postoperative day. The mean swelling measurement on 3<sup>rd</sup> postoperative day for envelope flap group was 21.57mm while for the trapezoidal flap group was 22.13mm. The difference was 0.56mm which indicates that trapezoidal flap group has more swelling on 3<sup>rd</sup> post-operative day.

Triangular flaps were associated with significantly greater measures of facial swelling after the 3<sup>rd</sup> post-operative day, but the difference lost statistical significance when measured on 7<sup>th</sup> post-operative day. This finding is in accordance with the outcome of **Kirk DG, Liston PN, Tong DC (2007)** and **Z.H. Baqain et al (2012)** but contrary to those of **Sandhu et al (2012)** who reported that post-operative swelling is related to operating time and not because of flap design.<sup>12,13</sup> But in our study, there was no statistically significant correlation between duration of surgery and post-operative swelling ( $p > 0.05$ ). It is likely that the anterior releasing incision of trapezoidal flap induced a greater inflammatory response and subsequent edema in the buccal tissues. The periodontal health of second molar was evaluated with William's periodontal probe, around second molar. It was compared with preoperative pocket depth. Post-operatively it was evaluated on day one, three and seven. When mean periodontal pocket depth was compared, it was observed that there were no significant difference present between two flaps on day 1, day 3, day 15<sup>th</sup>, 1 month and 3 months post-operative period. But there was statistically significant difference present on 7<sup>th</sup> post-operative day. The mean pocket depth on 7<sup>th</sup> postoperative day for envelope flap group was 4.54 mm while

for trapezoidal flap group was 4.24mm. The difference was 0.3mm which indicates that envelope flap group had more pocket depth on 7<sup>th</sup> postoperative day. On the first post-operative day, both the flaps showed increase in pocket depth around the second molar compared to their pre-operative pocket depth, indicating that third molar surgery compromise periodontal health of second molar. But on the later post-operative visits there was reduction in pocket depth indicating recovery of periodontal health around the second molar. On the 7<sup>th</sup> post-operative day there was statistically significant difference present between the two flaps. Envelope flap group has more pocket depth than trapezoidal flap, indicating that trapezoidal flap allows earlier return to the pre-operative pocket depth. But in both flaps, the probing depth tended to return to the preoperative value in 3 months after the extraction with no statistically significant difference. Our findings are in accordance with the outcome of **Giuseppe Monaco et al(2009)**.<sup>7</sup> Contrary to our results in a study conducted by **Adalberto Luiz Rosa et al(2002)** concluded that independent of the type of flap used, the periodontal health of second molars worsened in early postoperative period and it recovered in a post-operative period of 36 months.<sup>14</sup> In our study, all operations were performed by a single surgeon, under similar operating conditions. Therefore, patient's compliance bias was eliminated and all other possible factors and surgical procedures were kept as constant as possible, presenting flap design as the sole independent factor to determine the severity of outcomes of variables. The results of our study suggested that flap design has an influence on accessibility and ease of suturing during mandibular third molar removal and it also influences postoperative complications of third molar surgery. Envelope flaps had a better outcome in terms of ease of suturing and on post-operative swelling and trismus, while trapezoidal flaps allowed for an early return to pre-operative probing depth around second molar. However, there were no differences in the long term (1 month and more) in both the flaps with respect to periodontal health of 2<sup>nd</sup> Molar

### Conclusion

Third Molar Removal remains a significant work load on an Oral and Maxillofacial Surgeon. Majority of the 3M removal implies proper tissue handling, adequate bone removal, among other factors. Hence, considering this aspect, flap design remains a vital component in the dynamics of lower 3M removal. In this split mouth study, trapezoidal and envelope flaps were used and the parameters were statistically analyzed. Though the overall quality of life was satisfactory in both

flaps, the following parameters like swelling and partial trismus were seen more in trapezoidal flap on the 3<sup>rd</sup> post operative day, better periodontal health was seen in envelope flap as possibly the distal aspect of the 2<sup>nd</sup> molar was more accessible in envelope flap as compared to a trapezoidal flap. Suturing was found more easier in envelope flaps compared to trapezoidal flap, other parameters like post operative pain was equal in both the flaps. The overall assessment found envelope flap better except for unsatisfactory pocket depth. Though the choice of flap lies with the operator, consideration of various parameters can lead to an ideal outcome following removal of lower 3M and enhancing the quality of life offered to the patient.

### References

1. O.D. Osunde. A comparative study of the effect of suture-less and multiple suture techniques on inflammatory complications following third molar surgery. *International Journal of Oral and Maxillofacial Surgery* 2012; 41:1275-1279
2. Stephen RJ, George R, Foreman DW. Periodontal evaluation of two mucoperiosteal flaps in removing impacted mandibular third molars. *J Oral Max. Surg.* 1983;4:719-724.
3. Carolyn Dicus, George H. Blakey, Jan Faulk-Eggleston, Eric Hoverstad, Steven Offenbacher, Ceib Phillips, Raymond P. White Jr. Second Molar Periodontal Inflammatory Disease After Third Molar Removal in Young Adults. *Journal of Oral and Maxillofacial Surgery* 2010; 68:3000-3006.
4. Kevin L. Moss, Sally Mauriello, Andrew T. Ruvo, Steven Offenbacher, Raymond P. White Jr, James D. Beck. Reliability of Third Molar Probing Measures and the Systemic Impact of Third Molar Periodontal Pathology. *Journal of Oral and Maxillofacial Surgery* 2006;64:652-658.
5. Burcu Ozkan Cetinkaya, Mahmut Sumer, Ferda Tutkun, Elif Ozen Sandikci, Ferhat Misir. Influence of different suturing techniques on periodontal health of the adjacent second molars after extraction of impacted mandibular third molars. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology* 2009;108:156-161.
6. Banu Özveri Koyuncu and Erdoğan Çetingül. Short-term clinical outcomes of two different flap techniques in impacted mandibular third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012;13:565-569.
7. Giuseppe Monaco Giuseppe Daprile, Loredana Tavernese, Giuseppe Corinaldesi, and Claudio Marchetti. Mandibular Third Molar Removal in Young Patients: An Evaluation of 2 Different Flap Designs. *J Oral Maxillofacial Surgery* 2009; 67:15-21.
8. Pasqualini, N. Cocero, A. Castella, L. Mela, P. Bracco. Primary and secondary closure of the surgical wound after removal of impacted mandibular third molars: a comparative study. *Int. J. Oral Maxillofac. Surg* 2005;34:52-57.

9. Yakup Ustun, Ozgur Erdogan, Emin Esen and Ebru Deniz Karsli. Comparison of the effects of 2 doses of methyl prednisolone on pain, swelling, and trismus after third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:535-9.
10. Gool AV, Bosch JJ and Boering G. Clinical consequences of complaints and complications after third molar removal. *Int J Oral Surg* 1977;6:29.
11. A. Sandhu, S. Sandhu and T. Kaur. Comparison of two different flap designs in the surgical removal of bilateral impacted mandibular third molars. Department of Oral and Maxillofacial Surgery, SGRD Institute of Dental Sciences and Research, Mall Mandi, G.T. Road, Amritsar, Punjab – 143006, India.
12. Z.H. Baqain, A. Al-Shafii, A.A. Hamdan and F.A. Sawair. Flap design and mandibular third molar surgery: a split mouth randomized clinical study. Faculty of Dentistry, University of Jordan, Amman, Jordan.
13. Kirk DG, Liston PN, Tong DC influence of two different flap designs 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;10:e1-e6.
14. Adalberto Luiz Rosa Marilia Gomes Carneiro, Marco Antonio Lavrador, Arthur Belém Novaes Jr and São Paulo. Influence of flap design on periodontal healing of second molars after extraction of impacted mandibular third molars. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002;93:404-7.