Original Research Article

ENVELOPE FLAP VERSUS TRIANGULAR FLAP (WARD'S INCISION) DESIGN IN MANDIBULAR THIRD MOLAR DISIMPACTION: A PROSPECTIVE COMPARATIVE CLINICAL STUDY

ABSTRACT

Aim : The aim of study is to assess the influence of Envelope flap and Triangular flap (Ward's incision) on post operative healing after mandibular third molar surgery in relation to pain, swelling, trismus, dry socket and wound gaping.

Methods: 20 patients presenting with symmetrical bilateral impacted mandibular third molars comprising total of 40 surgical extraction sites of which 20 sites were used to study envelope flap and 20 sites were used to study triangular flap (ward's incision). In a single appointment, one flap technique was performed and after about a month, another technique was performed on the contralateral side, data was recorded on 24 hours, 3rd day and 7th day. The statistical analysis was performed using the Chi-square test, in which it was consider as statistically significant if P value will be < 0.005.

Results: Post surgery P value is significant for pain which is p-value 0.009 on 24 hours, p-value 0.006 on 3rd day and p-value 0.03 on 7th day. For swelling also p-value is significant which is p-value 0.01 on 24 hours, p-value 0.001 on 3rd day and p-value 0.027 on 7th day. But the p-value is not significant for trismus, wound gapping and there was no dry socket in any site.

Conclusion: This study shows that Triangular flap for removal of third molar is better choice if we consider pain and post-operative swelling as outcome but there is no significant difference in terms of post-operative wound gaping, trismus and dry socket.

Keywords: Envelope flap, flap design, triangular flap, mandibular third molar disimpaction.

1.INTRODUCTION

The most common operation in oral surgery is surgical removal of impacted third molars. The surgical technique includes variables such as flap design, bone removal, and the tooth sectioning necessary to extract the tooth, and must be performed without damaging the surrounding anatomical structures[1]. Flap design is important for optimal visibility, accessibility, healing of the surgically created defect and damage to the distal periodontal area of the adjacent second molar[2]. The presence of various important anatomical structures in the adjacent area around the surgical site has made many surgeons to design an incision, ranging from Koener's envelope incision, Ward's triangular incision, and its' modification, L shaped incision, bayonet shaped incision, comma incision, and "S" shaped incision[3]. Many studies found a different postoperative course in terms flap design, with the less extended flap generally being the one with fewer complaints[4]. Envelope flap with a distal releasing incision is the most common approach for lower third molar surgery mesioangular impaction is the most prevalent type of impaction in the lower jaw[5]. 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[6].

2.METHODOLOGY

Based on the inclusion criteria, 20 patients aged between 18 to 40 years have been enrolled in the study. That is 20 patients presenting with symmetrical bilateral impacted mandibular third molars comprising total of 40 surgical extraction sites of which 20 sites has been used to study Envelope flap and 20 sites has been used to study Triangular flap (Ward's incision). The demographic data has been recorded, a thorough history has been taken and informed written consent has been obtained from the patients. The patients were assessed clinically and radiographic analysis was performed for all the patients to determine the difficulty index using Pell and Gregory classification. Patient with identical difficulty index bilaterally were selected. Random selection of the quadrant for performing Envelope flap technique on one side of the jaw and Triangular flap (Ward's incision) technique on the other side was

done using flipping the coin. In a single appointment, one flap technique was performed and after about a month, another technique was performed on the contralateral side. All patients were given standard dose of prophylactic antibiotics and anti-inflammatory agents. Drugs started 1 day prior to surgery & continued for 3 days postoperatively. The 40 sites of 20 patients were divided into two i.e. group A (Envelope Flap) & group B (Triangular Flap) by flipping the coin.

2.1 Operative procedure:

All patients underwent bilateral removal of mandibular third molar that were of the same degree of surgical difficulty in two appointments where one month gap was present between two appointments. Both the technique has been performed by the same surgeon in all the patients. Facial skin preparation was done. Mandibular nerve block and buccal block of local anesthesia secured with 2% lignocaine hydrochloride and 1:80,000 epinephrine was given. After effective local anesthesia in patients presenting with bilaterally impacted mandibular third molars, the envelope flap was randomly allotted to one side of the arch and the triangular flap (ward's) to the contralateral side.

Surgical flap techniques – Envelope flap - An incision was made beginning medial to the external oblique ridge and was extend up to the middle of the distal line angle of the second molar. Further, a sulcular incision was made from the distofacial line angle of the second molar to the mesiofacial line angle of the first molar (figure 1).

Triangular flap (Ward's incision) Incision begins at anterior border of ramus (external oblique ridge) and extends as far as the distal aspect of second molar, and vertical releasing incision is made obliquely downward and forward ending in the vestibular fold (figure 2). Following the incisions placement in both the techniques, the mucoperiosteal flap was reflected and the impacted molar was expose. ostectomy was performed following incision placement and in required cases, odontosection was done aiding in the removal of the impacted molar. After the surgical extraction and cavity treatment with saline solution, closure was done using 3-0 mersilk suture. Following surgery all patients were on similar antibiotic and analgesic regime and patient were recalled after 24 hours ,3rd day and 7^{day} to evaluate post-operative healing.

Figure.1-Envelope flap

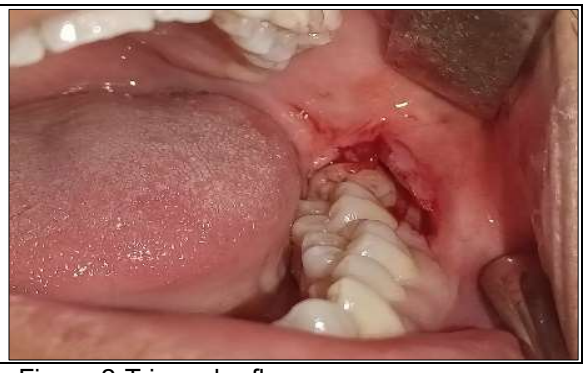


Figure.2-Triangular flap

2.2 Assessment criteria

1.Pain assessment was done using Visual Analogue Scale (VAS) scale ranging from 0 to 10.

2. Assessment of swelling was done using a thread to measure the extent of swelling with following control points: a-b : Lateral canthus of eye to the angle of mandible, c-d: Tragus of ear to the corner of mouth which was later measured on scale.

$$\text{Facial Swelling} = \frac{\text{Horizontal + Vertical measure}}{2}$$

3. Assessment of trismus by measuring the distance between the incisal edges of upper and lower central incisors using measuring scale.

4. Incidence of dry socket will be noted based on the clinical presentation and symptomatic history by patient.

5. Incidence of wound gaping will be noted.

3.RESULT

Table 1 and graph 1 represent the results for comparison of study groups based on post-surgical pain at 24 hours. It was found that in group A there were 20%, 30%, 15%, 20% and 15% of the study participants who experienced pain of score 3, 4, 5, 6, and 7 respectively after 24 hours of the surgery. On the other hand, in group B 50% participants had pain score of 3 and other 50% had score 4 after 24 hours. On applying Chi-square test, the difference in pain score between groups A and B at 24 hours was statistically significant with P-value 0.009. Thus 24 hours after the surgery, the participants in Group A experienced significantly more pain as compared to those in group B.

Table 2 and graph 2 shows the comparison of study groups based on post-surgical pain after 3 days of the surgery. The results show that 25% and 35% of the participants in Group A experienced pain of score 1 and 2 respectively; whereas, 35% and 5% had score of 3 and 4 respectively. In case of Group B 70% participants had score 1 and 30% had score 2 for pain after 3 days of surgery. On comparison of these values with Chi square test, the difference in pain score in Group A and B after 3 days of surgery was statistically significant with P-value 0.006. This shows that Group B experienced significantly less pain as compared to Group A after 3 days of the surgery.

Table 3 and graph 3 shows the comparison of study groups based on post-surgical pain after 7 days. The result showed that score 0 was seen in 40% of group A and 75% of group B participants. Further in group A 45%, 10% and 5% had score 1, score 2 and score 3 respectively; however, in Group B 25% had score 1 and none of the participants had score 2 and 3. The difference in pain score between Group A and Group B after 7 days of surgery was statistically significant. Thus the participants in group A experienced more pain as compared to those of group B at 7 days after the surgery.

Table 4 and graph 4 show the comparison of study groups based on post-surgery swelling seen at different time intervals. The results show that mean swelling after 24 hours of surgery was 17.55 in Group A and 14.20 in Group B and this difference was statistically significant with p-value 0.01, analysed by Students T-test. Further the mean swelling recorded after 3 days of surgery was 14.10 and 11.45 in Group A and Group B respectively. When the difference in swelling between Groups A and B was analysed using Students-T test, it was found to be statistically significant with P-value 0.001. Finally, after 7 days of surgery the mean swelling in Group A was 11.70 and in Group B it was 10.05 units. On analysis with Students-T test the difference in swelling in the study Groups A and B 7 days post-surgery was statistically significant with P-value 0.027. Therefore, the results of this can be summarized by stating that Group B showed significantly less post-surgery swelling as compared to Group A at 24 hours, after 3 days as well as after 7 days.

Table 5 and graph 5 show the comparison of study groups based on post-surgery trismus seen at 24 hours, 3 days and 7 days. It was found that the mean trismus (mouth opening) in group A was 25.10 mm, 36.50 mm and 48.40 mm at 24 hours, 3 days and 7 days post-surgery respectively. Whereas, in Group B the post-surgery trismus (mouth opening) was 25 mm, 36.15 mm and 48.15 mm at 24 hours, 3 days and 7 days respectively. When the difference in trismus (mouth opening) was analyzed using Students-T test it was found statistically not significant at all 3-time intervals. Thus, the results showed that there was no significant difference in trismus (mouth opening) between Groups A and B at 24 hours, 3 days and 7 days after the surgery.

Table 6 and graph 6 shows the Comparison of study groups based on post-surgery wound gapping at different time intervals. The study showed that, at 24 hours post-surgery, wound gapping was absent in all study subjects in Group A as well as Group B. At 3 days post-surgery, wound gapping was absent in Group A; however, it was seen in 5% of the participants of Group B. But the difference was statistically not significant when analyzed by Chi-square test. Finally, after 7 days of surgery wound gapping was seen in 5% of the participant in both groups A as well as group B and there was no statistical significance.

Table 7 show the comparison of study groups based on dry socket seen at 24 hours, 3 days and 7 days post-surgery. It was found that there was no dry socket seen in group A or group B 24 hours, 3 days and 7 days after the surgery.

Table 1: Comparison of study groups based on post-surgical pain at 24 hours

Study group	Post-surgical pain at 24 hours (based on VAS Score)					P-value
	Score 3	Score 4	Score 5	Score 6	Score 7	
Group A	20.0%	30.0%	15.0%	20.0%	15.0%	0.009*
Group B	50.0%	50.0%	0.0%	0.0%	0.0%	

*Statistically significant value

Table 2: Comparison of study groups based on post-surgical pain at 3 days

Study group	Post-surgical pain at 3 days (based on VAS Score)				P-value
	Score 1	Score 2	Score 3	Score 4	
Group A	25.0%	35.0%	35.0%	5.0%	0.006*
Group B	70.0%	30.0%	0.0%	0.0%	

*Statistically significant value

Table 3: Comparison of study groups based on post-surgical pain at 7 days

Study group	Post-surgical pain at 7 days (based on VAS Score)				P-value
	Score 0	Score 1	Score 2	Score 3	
Group A	40.0%	45.0%	10.0%	5.0%	0.03*
Group B	75.0%	25.0%	0.0%	0.0%	

*Statistically significant value

Table 4: Comparison of study groups based on post-surgery swelling seen at different time intervals

Study Group	Swelling after 24 hours		Swelling seen after 3 days		Swelling seen after 7 days	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Group A	17.55	2.416	14.10	1.618	11.70	2.154
Group B	14.20	3.155	11.45	2.187	10.05	2.372
P-value (Students T-test)	0.01*		0.001*		0.027*	

*Statistically Significant value

Table 5: Comparison of study groups based on post-surgery trismus seen at different time intervals

Study Group	Trismus after 24 hours		Trismus seen after 3 days		Trismus seen after 7 days	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Group A	25.10	6.568	36.50	5.226	48.40	3.118
Group B	25.00	5.399	36.15	5.450	48.15	5.039
P-value (Students T-test)	0.958		0.849		0.831	

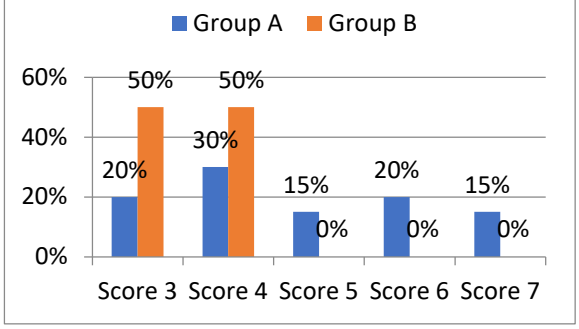
Table 6: Comparison of study groups based on post-surgery wound gapping at different time intervals

Study Group	Wound gapping after 24 hours		Wound gapping after 3 days		Wound gapping after 7 days	
	Present	Absent	Present	Absent	Present	Absent
Group A	0%	100%	0%	100%	5%	95%
Group B	0%	100%	5%	95%	5%	95%
P-value (Chi-square test)	-		0.547		-	

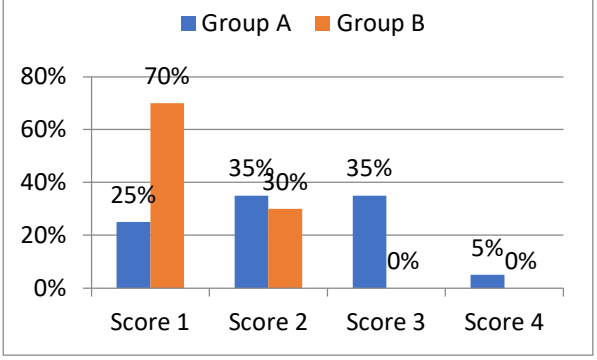
Table 7: Comparison of study groups based on dry socket seen at different time intervals

Study Group	Wound gapping after 24 hours		Wound gapping after 3 days		Wound gapping after 7 days	
	Present	Absent	Present	Absent	Present	Absent
Group A	0%	100%	0%	100%	0%	100%
Group B	0%	100%	0%	100%	0%	100%
P-value	-		-		-	

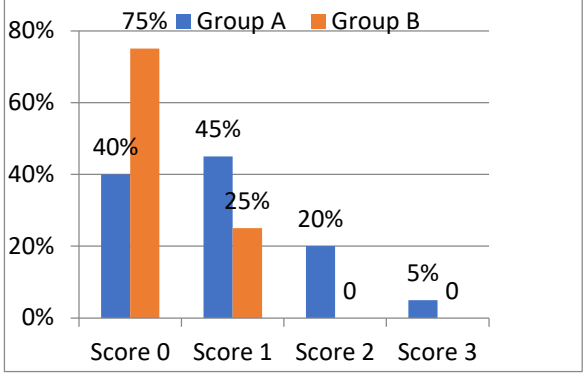
Graph 1: Comparison of study groups based on post-surgical pain at 24 hours



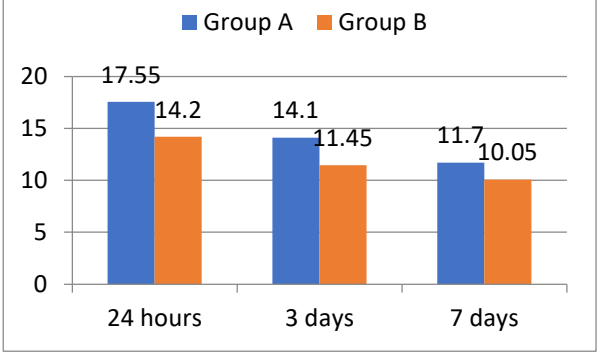
Graph 2: Comparison of study groups based on post-surgical pain at 3 days



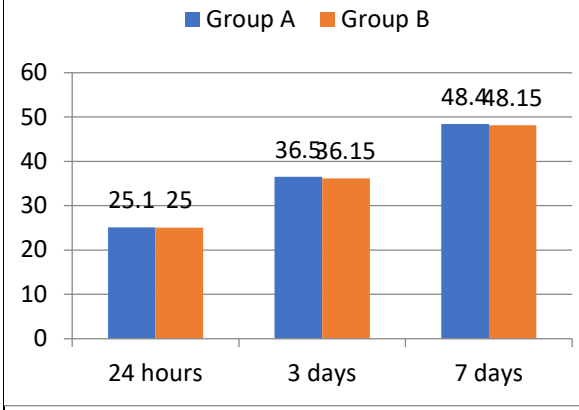
Graph 3: Comparison of study groups based on post-surgical pain at 7 days



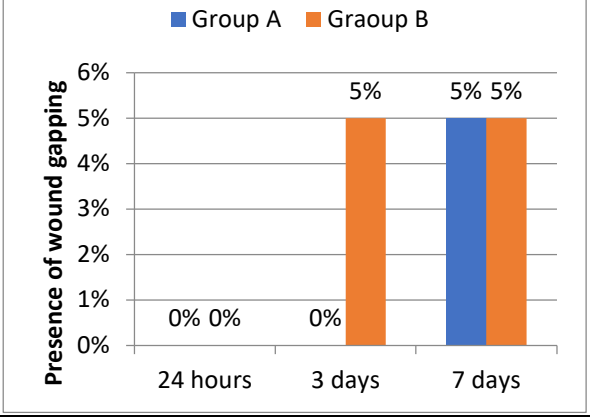
Graph 4: Comparison of study groups based on post-surgery swelling at different time intervals



Graph 5: Comparison of study groups based on post-surgery trismus seen at different time intervals



Graph 6: Comparison of study groups based on presence post-surgery wound gapping at different time intervals



5.DISCUSSION

The removal of third molars is the most frequently performed surgical procedure in many oral and maxillofacial surgical practices, because third molars are the teeth that are most commonly impacted. The epidemiological incidence of their impaction ranges from 17%- 32%.

After the third molar surgery discomfort is most commonly felt by patients arising from complications at the time of surgery or after surgery. Patients commonly experience pain, swelling, trismus, dehiscence, alveolar osteitis, infection and nerve injury[30]. These complications can be prevented through atraumatic procedure, aseptic conditions, drug administration, and physiotherapy, proper wound closure using fine suturing technique and also flap design. Various flap designs are studies as it 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 and least discomfort to the patient[7,8].

The removal of impacted third molars is often advised for a various reason; however, absolute indications and contraindications for the removal of these teeth have not been established, while there is little controversy over removal of the impacted third molars associated with pathologic lesions, but a question still remains about the prophylactic removal of these teeth. At the recent national institute of health consensus development conference on removal of third molars it was agreed that impaction or malposition of a third molar which has potential to damage the surrounding hard and soft structure might justify its removal.

Surgical removal of the mandibular third molar requires that a flap be created and osteotomy be performed, Flap design is important not only to allow optimal visibility and access to the impacted tooth, but also for subsequent healing of the surgically created defect.

This study was conducted to compared two flap design for surgical removal of impacted third molars, that are envelope flap versus triangular flap. We have compared postoperative effect of two flap design on post-operative pain, swelling, trismus, wound gaping and dry socket in twenty patients with forty extraction site at twenty-four hours, third day and on seventh day. Which are symmetrical bilateral impacted third molar in the age group of 18 to 40 years. of which twenty sites has been used to study envelope flap which are mentioned as group-A and 20 sites has been used to study triangular flap (ward's incision) which are mentioned as group-B, data of both the group has been collected and compared.

Pain:

In our study we have evaluated the postoperative pain after 24 hours, on3rd day and on 7th day postoperatively on Visual Analogue Scale (VAS) with score ranging from 0- equals to no pain, 5- equals to moderate pain, 10- equals to worst pain.

Value in all group were compared.

This study found that in group-A (Envelop flap) there were 20% patient experience pain of 3 on VAS scale, 30% patients experience of 4, while 15% patient experience score 5, 20% patient experience score 6 and 15% patients experienced score of 7, after 24 hours of the surgery. On the other hand, in group-B (Triangular flap) 50% of participants had pain score of 3 and other 50% had score 4 after 24 hours. On applying Chi-square test, the difference in pain score between two groups at 24 hours was statistically significant with p-value 0.009. Thus 24 hours after the surgery, the group-A (Envelope flap) experienced significantly more pain as compared to those in group- (Triangular flap).

On 3rd post-operative day the results showed that 25% and 35% of the participants in group-A (Envelop flap) experienced pain of score 1 and 2 respectively; whereas, 35% and 5% had score of 3 and 4 respectively. In case of group-B (triangular flap) 70% participants had score 1 and 30% patients had score 2 for pain after 3 days of surgery, which was statistically significant This shows that group-B (Triangular flap) experienced significantly less pain as compared to group-A (envelope flap) after 3 days of the surgery.

On 7th post-operative day the result showed that score 0 was seen in 40% patients of group-A and 75% of group-B participants. Further in group-A 45%, 10% and 5% patients had score 1, score 2 and score 3 respectively; however, in group-B 25% patient had score 1 and none of the participants had score 2 and 3. The difference in pain score between both after 7 days of surgery was statistically significant. Thus the participants in group-A experienced more pain as compared to those of group-B at 7 days

after the surgery. This study tilted in favour of group-B (Triangular flap) compared to group-A (envelop flap) as it has better pain score. Our study results are comparable to study conducted by Erdogan et at[17] which talk about less inflammation and pain after surgery than envelop flap.

Post-operative swelling:

Assessment of soft tissue healing in our study was done at 24 hours, on 3rd day and on 7th day post operatively. The soft tissue healing or swelling was measured extraorally using thread as horizontally it is measured from corner of mouth to tragus of ear and vertically its measured from lateral canthus of eye to angle of mandible in mm. Then the both horizontal and vertical values were added and then its divided by 2 the final value which came given for statistical analysis.

Regarding post-operative swelling which was measured in mm our study observed that mean swelling after twenty-four hours of surgery was 17.55 mm in group-A and 14.20 mm in group-B and this difference was statistically significant with p- value 0.01, analysed by Students T-test. Further the mean swelling recorded after three days of surgery was 14.10 mm and 11.45 mm in group-A and group-B respectively. Difference in swelling between two groups was analysed using Students-T test, it was found to be statistically significant with p-value 0.001. Finally, after seven days of surgery the mean swelling in group-A was 11.70 mm and in group-B it was 10.05 mm. Which was statistically significant. We can say that in our study group-B was better in compared to group-A in terms of post-operative swelling. Our study results were comparable to study by Koyuncu et al[9]which reported greater inflammation in envelop flap.

Trismus:

Assessment of trismus in our study done by measuring the distance between the incisal edges of upper and lower central incisors using measuring scale at twenty-four hours, on third day and on seventh day postoperatively.

It was found that the mean trismus (mouth opening) in group A was 25.10 mm, 36.50 mm and 48.40 mm at twenty-four hours, on third day and on seventh day post surgery respectively. Whereas, in Group B the post-surgery trismus (mouth opening) was 25 mm, 36.15 mm and 48.15 mm at twenty-four hours, on third day and on seventh day postoperatively. respectively. When the difference in trismus (mouth opening) was analyzed using Students-T test it was found statistically not significant at all three time intervals. Thus, the results showed that there was no significant difference in trismus (mouth opening) between Groups A and B at twenty-four hours, on third day and on seventh day after the surgery.

Wound gaping:

Wound gaping in our study was assessed using clinical presence or absent of the gap at the surgical site.

Regarding wound gaping our study showed that after twentyfour hour post-surgery, there was no wound gaping. At day three post-surgery, wound gapping was absent in envelop flap group; however, it was seen in five percent of the participants of triangular flap group. But the difference was statistically not significant when analysed by Chi-square test. Finally, after seventh days of surgery wound gapping was seen in five percent of the participant in both groups but without statistical significance.

Dry socket:

Dry socket in our study was assessed using its presence or absence clinically and from complain of pain from three to five days post extraction by patients.

Our study showed that there was no incidence of dry sockets in both group after twenty-four hours, third day and seventh day post operatively.

From our study we found that in regards to pain and post-operative swelling triangular flap can be preferred over envelop flap as this group has statistically significant less incidences of pain and swelling however both flaps are equal in regards to wound gapping, trismus and dry socket. Our results regarding trismus, wound gap and dry socket were comparable to many study like study by Sean Dolan[10], Viral Pate[11], Anil Managutti, Arvind Agrawal, Shailesh Menat, Khyati Mahida, Dr. Jigar Patel, Dr. Sunita Managutti[37].

6.CONCLUSION.

As most common operation in oral surgery is surgical removal of impacted third molars. Because third molar are the teeth that are most commonly impacted.

There are many ways to do it and generally decided by operating surgeon on the basis of his prior experience and literature available regarding same, this particular area has lot of scope for research.

This study has compared the two different designs of flap used of surgical removal of third molars like Envelop flap and Triangular flap methods. As both methods were done in same patients who were having symmetrical bilateral impacted third molars, so result can be compared nicely as it has eliminated patient bias. This study has shown us that Triangular flap for removal of third molar is better choice if we consider pain and post-operative swelling as outcome but same time it has emphasised that both methods are equal in terms of post-operative wound gaping, trismus and dry socket and it will surgeon's prerogative to choose either of them.

To make this observation as general rule we need larger sample size and multicentric study but this study has shown us that further research will be helpful for both patient community and doctors before choosing right approach.

10.CONSENT:

All authors declare that 'written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

11.ETHICAL APPROVAL:

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

12.REFERENCE:

1.Giuseppe Monaco, DMD,* Giuseppe Daprile, DMD,† Loredana Tavernese, DMD,‡ Giuseppe Corinaldesi, MD, DMD,§ and Claudio Marchetti, MD, DDS. Mandibular Third Molar Removal in Young Patients: An Evaluation of 2 Different Flap Designs2009 American Association of Oral and Maxillofacial Surgeons J Oral Maxillofac Surg 67:15-21, 2009

2. FarheenUstad, SatyajitDandagi, Fareedi Mukram Ali, Zaheer Kota, Prasant MC, Vinit Aher Comparative Evaluation of Envelope and Triangular Flaps in Inferior Third Molar Surgery. Indian J Stomatol 2013;4(3):66-70.

3.Adarsh Desai1, Rushit Patel2, Kiran Desai2, Nirav Bharatbhai Vachhani2, Kruti A Shah2, Raj Sureja2. Comparison of two incision designs for surgical removal of impacted mandibular third molar: A randomized comparative clinical study. Contemporary Clinical Dentistry | Apr-Jun 2014 | Vol 5 | Issue2

4.Nicola Mobilio1* • Renata Vecchiatini1 • Michele Vasquez1 • Giorgio Calura1 • Santo Catapano1. Effect of flap design and duration of surgery on acute postoperative symptoms and signs after extraction

of lower third molars: A randomized prospective study. J Dent Res Dent Clin Dent Prospect 2017; 11(3):156-160 |.

5.Abbas Karimi 1, Mehrnaz Karimi Afshar 2, Delaram Banesh Marvasti 3, Zeinab Manafi 4, Naghmeh Bahrami 5*.Comparison of postoperative complications of envelope flap and triangular flap in surgical removal of mandibular third molar teeth, a double blind split-mouth study. J Craniomax Res 2017; 4(4) : 435-439.

6.Pingky Krisna Arindra,* Adyaputra Indrapradana. Comparison of three flap designs on postoperative complication after third molar surgery. Intisari Sains Medis 2018, Volume 9, Number 2: 89-94 P-ISSN: 2503-3638, E-ISSN: 2089-9084.

7. Kamaraj Loganathan1, Jayashree Mohan2 , Bindu Kamaraj3 , Sabarinathan Jaganathan4 , Sabitha Sengodan5 , Abin Varghese. Comparison of New Flap Design with Conventional Flap Designs on Postoperative Pain and Swelling Following Mandibular Third Molar Removal. World J Dent 2019;10(6):422–427.

8. Gupta S, Khan TA, Attarde H and Narula J. Surgical Anatomy of Mandibular Third Molar. Austin J Surg. 2019; 6(13): 1194.

9. Koyuncu BÖ, Çetingül E. Short-term clinical outcomes of two different flap techniques in impacted mandibular third molar surgery. Oral surgery, oral medicine, oral pathology and oral radiology. 2013 Sep 1;116(3):e179-84.

10. Dolan S, Rae E. What are the implications of flap design on post-operative complications when carrying out third molar surgery?. Evidence-Based Dentistry. 2021 Sep;22(3):104-5.

11. Viral Patel1, Anil Managutti2* , Arvind Agrawal3 , Shailesh Menat4 , Khyati Mahida5 , Dr. Jigar Patel6 , Dr. Sunita Managutti7.Comparison of the Effect of Modified Ward's and Triangular Flap Design on Periodontium of the Second Molar after Surgical Removal of Mandibular Impacted Third Molar. Arch Clin Med Case Rep 2020; 4 (3): 459-470.

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