The Effect of Releasing Incision on the Postoperative Complications of Mandibular Third Molar Surgery

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ABSTRACT
Surgical extraction of impacted mandibular third molars often result in a wide range of complications such as trismus, pain, swelling and occasionally ecchymosis. The purpose of this study was to assess the effect of two flap designs (triangular and envelope flaps) on such consequences. Twenty healthy patients with similarly positioned bilateral impacted mandibular third molars participated in this randomized clinical trial. Two flap designs were compared in terms of duration of the surgical procedure, postoperative pain, trismus, edema and also ecchymosis. No statistical differences were observed in duration of surgery and postoperative outcomes comparing two flap designs. Regarding to lack of significant differences between the two techniques, the selection of flap design seems to be based on the surgeon's experience and the amount of surgical access that he or she needs.

Keywords: Mandibular third molars, Flap, Complications

INTRODUCTION
One of the most frequent procedures performed by oral and maxillofacial surgeons is the surgical removal of impacted third molars (1-4). Impaction is defined as failure to erupt completely in dental arch within the expected time that caused by various reasons such as lack of space, development in abnormal position, physical barrier in eruption path, high density of overlying bone, size and position of adjacent tooth (5-8). Impaction of mandibular third molars is more prevalent. Wide range of complications is associated with surgical extraction of lower 3rd molar including pain, trismus, swelling and occasionally ecchymosis (1, 3, 9-11). Although the noted complications are regarded as transient outcomes of the third molar surgery, they can cause anxiety and discomfort for the patient (12-14). Surgical techniques especially incisions and flap designs are the crucial factors in producing postoperative complications. Thus, to manage and minimize these, clinicians have sought optimal surgical procedures (2, 9, 10, 15-18). The principles of surgical flaps are to gain sufficient blood supply (broad base), adequate access to the bone and tooth with minimal trauma and less possible soft tissue damage (4, 7, 11, 18-20). Different kinds of mucoperiosteal flap techniques have been developed among which triangular and envelope flaps are more common (4, 7, 16, 17). The envelope flap provides good exposure of the surgical site and its sulcular or crestal incision can be extended as far as needed and because of its broad base, blood supply can be efficiently preserved. The triangular flap is more conservative owing to a lesser amount of tissue reflection needed to keep the flap tension-free during handling (2, 9, 11, 18, 21). The advocators of triangular flap believe that by using it, surgical access is gained adequately without need to extend flap or applying excessive tension as it may occur using
an envelope flap. On the other hand, the opponents of triangular flap claim that the postoperative complications could be aggravated by damaging the integrity of the periosteum while using a releasing incision (7, 11, 15, 17). There are few studies that compare ecchymosis following surgical extraction of mandibular impacted third molars in different flap techniques. The main purpose of this study was to compare two flap designs (triangular and envelope flaps) in terms of severity of pain, trismus, swelling and occurrence of ecchymosis after surgical extraction of impacted mandibular third molars and the duration of doing the procedures were also compared.

Patients and methods
Forty mandibular impacted third molars were removed surgically in this randomized, double blind clinical trial. The study population consisted of patients referred to the Department of Oral and Maxillofacial Surgery of Babol Dental School (Babol, Iran) from June 2014 to November 2015 for surgical removal of mandibular impacted third molars. Using a simple sampling, 20 patients aged from 15 to 35 whose right and left mandibular third molars were indicated to be removed surgically, participated in this study. The impactions were of grades 1, 2, A or B, according to Pell and Gregory classification (11). Excluding criteria comprised taking some drugs such as Corticosteroids, immunosuppressive drugs or bisphosphonates, presence of systemic diseases like anaemia, diabetes, ischemic heart disease, hyperthyroidism and autoimmune diseases. Patients were also excluded if they had pericoronitis or pre-existing pathologic conditions associated with their third molars. In addition, heavy smokers and patients who were suffering from hemorrhagic disorders or taking anticoagulants or MAO inhibitors were not included in the survey as those who had been given radiotherapy or those whose surgeries lasted more than 30 minutes. All the surgical procedures were carried out by an experienced surgeon. Clinical evaluation of the patients was done before and after surgery by a trained dental graduate who was unaware of the flap types on both sides of each patient. Preoperatively, panoramic radiographs were taken and written consents which was approved by Ethics Committee of Babol University of Medical Science (with number 4834 at November 2014) were obtained. Also this clinical investigation was registered in Iranian Registry of Clinical Trials (IRCT) with number: 201506191760N42. The dependant variables supposed to be investigated were trismus, swelling, pain, ecchymosis and duration of surgery. The maximum interincisal opening taken as the maximum distance between the upper and lower central incisors and facial measurements for evaluating the amount of postoperative swelling were measured in millimetres using a dental floss and a 20 centimetres rigid plastic ruler. The horizontal facial measurement was taken as the distance between the corner of the mouth and the attachment of the earlobe. The vertical component was measured as the length of a straight virtual line drawn from lateral canthus of the eye to the angle of the mandible after marking the inferior border. All the procedures were done under local anaesthesia after blocking the inferior alveolar, long buccal and lingual nerves, together with local infiltration using 2% lidocaine plus 1:80000 epinephrine. Three cartridges were maximally used in each procedure. In every patient, a conventional triangular flap and an envelope flap were both used. The side of surgery was randomly selected for each flap design in all the patients and the examiner was unaware of it. The time interval between the two surgeries was at least 4 weeks for each participant. The envelope flaps were extended from the anterior border of mandibular ramus, about one centimetre posterior to the 2nd molar tooth to the mesiobuccal line-angle of the 2nd premolar. The starting point of the triangular flaps was similar to the envelope one, the releasing incision of which with at least 1 centimetre length started from the mesiobuccal line angle of the 2nd molar apically. After reflecting the mucoperiosteal flap, bone removal and sectioning of the third molar (if required) were done using surgical burs under copious irrigation with saline. The possible remnants of the associated dental follicles were also removed. After irrigating the surgical sites...
with sterile saline solution, the flaps were repositioned and wound closure was carried out using silk thread (4-0) in all the cases. The duration of each procedure was recorded per side from starting of the incision until the last suture was placed using a stopwatch. Medicines prescribed to all the patients postoperatively, were Amoxicillin 500mg capsules to take every 8 hours for 3 days; Gelofen (Ibuprofen) 400 mg tablets and Acetaminophen Codeine tablets to take every 6 hours for 1 day and also Chlorhexidine mouthwash 0.2% to rinse twice a day for 7 days. Facial swelling was measured as:

\[ \text{Horizontal measurement} + \text{vertical measurement} \]

\[ \text{Postoperative measurement} - \text{preoperative measurement} \]

\[ \text{Preoperative measurement} - \text{postoperative measurement} \]

Trismus was measured as:

\[ \text{Preoperative measurement} - \text{postoperative measurement} \]

The patients were informed to refer on 3rd and 7th days, 2nd weeks and finally 4 weeks after the surgery for evaluation of trismus, swelling and ecchymosis. Pain was daily recorded by patients using a Visual Analogue Scale (VAS) calibrated from 0-10 until they were pain free. To determine the pain severity after surgery the patients were asked to explain their pain with 0 as no pain, 1-3 as mild pain, 4-6 as moderate pain, 7-9 as severe pain and 10 as the worst pain.

**Statistical analysis**

The duration of surgery was assessed using Independent Samples T-test in two different flap groups. Paired Samples T-test and Repeated Measure ANOVA were applied to compare the pain, trismus and swelling in two groups. \( \chi^2 \) test was used to evaluate the occurrence of ecchymosis in both groups. The P-value<0.05 was considered statistically significant.

**RESULT**

**Table 1.** Comparison of mean duration

<table>
<thead>
<tr>
<th>Total number of patients</th>
<th>Envelope flap mean duration of surgery(min)</th>
<th>Triangular flap mean duration of surgery(min)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>24.50± 5.09</td>
<td>23.05± 4.46</td>
<td>0.26</td>
</tr>
</tbody>
</table>

The VAS pain scores reported by patients showed a higher pain severity in envelope flap group 7 days after surgery. However, the difference between 2 groups was not statistically significant (p>0.05). After 7th postoperative day, minimal pain was recorded in both techniques which continued in envelope flap group more than the other, but the difference was also insignificant (p>0.05) (table 2)

**Table 2.** Comparison of pain scores based on VAS

<table>
<thead>
<tr>
<th>Post op. days</th>
<th>Envelope flap</th>
<th>Triangular flap</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.6</td>
<td>2.9</td>
<td>0.39</td>
</tr>
</tbody>
</table>
A higher incidence of trismus was observed in envelope flap on 3rd postoperative day after which a considerable decrease was seen from 3rd to 7th day. On 7th day, measurements revealed more trismus in triangular flap group and about two weeks after surgery, higher trismus was again recorded in envelope flap group. Comparison of trismus between two flap designs did not reveal any statistical significant difference (table 3).

**Table 3.** Comparison of mean trismus (%) in envelope and triangular flaps on different postoperative days

<table>
<thead>
<tr>
<th>Post op. day</th>
<th>Envelope flap</th>
<th>Triangular flap</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>32.94 ± 15.03</td>
<td>29.28 ± 20.57</td>
<td>0.34</td>
</tr>
<tr>
<td>7</td>
<td>12.98 ± 12.28</td>
<td>13.08 ± 15.98</td>
<td>0.87</td>
</tr>
<tr>
<td>14</td>
<td>1.58 ± 5.19</td>
<td>0.53 ± 2.37</td>
<td>0.43</td>
</tr>
</tbody>
</table>

As with mouth opening, no significant differences were seen in postoperative swelling on 3rd, 7th and 14th days after surgery comparing two groups (table 4).

**Table 4.** Comparison of mean swelling (%) in envelope and triangular flaps on different postoperative days

<table>
<thead>
<tr>
<th>Post op. day</th>
<th>Envelope flap</th>
<th>Triangular flap</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4.95 ± 1.81</td>
<td>5.1 ± 2.15</td>
<td>0.80</td>
</tr>
<tr>
<td>7</td>
<td>1.39 ± 1.19</td>
<td>1.42 ± 1.5</td>
<td>0.94</td>
</tr>
<tr>
<td>14</td>
<td>0.15 ± 0.49</td>
<td>0.04 ± 0.21</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Ecchymosis was observed in 6 cases out of forty surgeries (30%), i.e. in four patients of triangular flap group. All the ecchymosis occurred in females. Neither the two groups did not demonstrate significant differences in incidence of ecchymosis after surgery (table 5).

**Table 5.** Comparison of the incidence of ecchymosis in envelope and triangular flaps

<table>
<thead>
<tr>
<th>ECC. envelope</th>
<th>ECC. triangular</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>14 (70%)</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>YES</td>
<td>2 (10%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Pain, trismus, facial swelling and ecchymosis after surgical extraction of mandibular 3rd molars are usual consequences affected by various factors such as flap designs (1, 20, 22, 23). The two mucoperiosteal flap designs used in the present study are both common and widely used by their proponents (1, 18, 20, 24, 25). The preliminary hypothesis of this study was being of an insignificant difference in postoperative side effects between the two flap designs. The results of our study demonstrated similar incidence of ecchymosis, severity of pain level of trismus, swelling and duration of surgery in both groups, therefore, the hypothesis was proved. There was no significant difference in duration of surgery between the flap designs in this study. This finding is in line with the results of Kirk et al (9), Erdogan et al (22) and Koyuncu et al (25). According to some studies (26, 27), duration of surgery is related to some factors such as severity of impaction, tooth position and experience of the surgeon. So the similar impacted teeth (based on Pell and Gregory classification) in each patient and only one surgeon for all surgeries, could be a reason of this result. This survey, shows no statistically significant difference in the pain scores between 2 different flaps. Both groups showed a decrease in the severity of pain over time. This finding is in accordance with the results of Kirk et al (9), Baqain et al (15), Dolanmaz et al (27) Briguglio
et al (28) and Sulieman (29). Pain is physiologically attributed to the tissue injury and inflammation that cause the releasing of endogenous mediators such as bradykinin, serotonin and is not closely related to the incision itself (6, 19, 30). Some researchers have explained that the postoperative pain is affected by the incision, reflection of mucoperiosteum and osteotomy rather than the flap design (1, 9, 22, 24, 31, 32). Also, prioritizing a certain type of flap could be based on the surgeon's ability and experience. We selected patients with bilateral impacted mandibular third molars who were scheduled to undergo both flap designs. Accordingly, comparison of all variables seemed to be more accurate and reliable compared to the study of Koyuncu et al (25), in which every participant received only one flap design. Koyuncu showed that severity of pain in envelope group was greater than modified triangular group in the first 4 days. However Sandhu et al (23), found a significant difference only on the 2nd postoperative day, which is contrary to Erdogan et al (22) who had reported reduced VAS scores in the envelope flap group. As the postoperative pain is moderate to severe following mandibular third molar surgery, Ibuprofen and Paracetamol plus codein were described to the patients to take during the first postoperative day if they experienced annoying pain. Accordingly the present study is contrary to Erdogan’s study (22) who considered the number of analgesics taken as a determinant of pain. Statistical analysis, revealed no significant difference in trismus on days 3, 7 and 14 between the two study groups. Therefore, the flap design did not seem to have any considerable effect on the severity of postoperative trismus. This is in agreement with the finding of Kirk et al (9), Koyuncu et al (25), Sandhu et al (23), Erdogan et al (22) and Sulieman (29). Trismus following the mandibular third molar surgery is usually caused by the inflammation extending to the nearby masticatory muscles. Other possible causes compromises TMJ trauma, needle trauma to the medial pterygoid muscle during injection to block the inferior alveolar nerve and, scarcely, infection (6, 18, 22, 24, 33). Negashewar (34) and Kirk et al (9) have proposed that the similar severity of trismus in these 2 flap designs may be due to similar distal path of incision in commonly used flaps. There are few researches in which comparing the flaps with different distal incision paths has been noted, so it would appear reasonable that similar paths could have same effect on trismus severity. Baqain et al (15), compared the influence of triangular and envelope flaps on complications of mandibular 3rd molar surgery on 2nd, 7th and 14th postoperative days and concluded that the envelope flap yielded less trismus than triangular flap on 7th and 14th postoperative days. They explained that the releasing component of triangular flaps creates an inflammation in masticatory muscles and it is possible that the resulted inflammation is more likely with this type of flap. In Baqain's study (15) the time interval between two surgeries of each patient was at least 2 weeks. Although, a great reduction in trismus was postoperatively observed at the end of two weeks, the remaining trismus could affect the trismus caused by the second surgery. Perhaps this is the cause of the difference between Baqain et al (15) and our survey in the comparison of trismus in two study groups. In the present study, the severity of swelling in the envelope flap group was not significantly different from that in the other group during follow-up sessions. Similar to the findings of other literatures and regardless of flap design, the swelling after the mandibular third molar surgeries usually reached a peak level 2 or 3 days postoperatively, subsiding in severity in most patients afterwards and reached zero by day 14 (6, 23, 25, 35, 36). This result is supported by Sandhu et al (23), Dolanmaz et al (27), Briguglio et al (28) and Sulieman (29). They have mentioned that postoperative swelling is mainly due to local edema caused by the accumulation of fluid exudates in the interstitial tissue. Also the researchers have insisted that edema is caused by reflection of the periosteum and not by making a releasing incision (19, 37, 38). Koyuncu et al (25), reported that only on the second postoperative day, a greater amount of swelling was observed with the use of envelope flap compared to a
triangular flap. In contrast, Kirk et al (9), Erdogan et al (22) and Baqain et al (15) demonstrated a significant association between flap designs and swelling after the surgery. According to those results, the envelope flaps caused swelling less than the triangular flaps. The variety of these findings could be due to the different methods used to measure postoperative swelling. Various methods have been utilized to assess facial swelling after an operation including computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography, photometry, and physical measurements of the given points on the face, preoperative and postoperative dental impressions. In this study, measurement of the defined distances on the face was used. This way is not as accurate as CT or MRI, but it is a non-invasive, simple, cost effective and time saving method to determine facial changes (1, 17, 25, 39). In addition, comparing the postoperative ecchymosis between the two flaps, there was no significant difference between the two groups. To us, evaluating the postoperative ecchymosis is a dominant feature of this survey which gives some novelty to it. The predominant features of this study worthy to be mentioned is that, the whole procedures were performed under similar operating conditions using the same instruments. Of course, we encountered some limitations in our study including small number of participants and also the method of facial swelling measurement which is not so accurate to investigate the swelling in three plans. All of these may result in no significant differences between two types of surgical flap in short out coming complications.

As we concluded no significant difference between the two flaps and according to all the previously mentioned results of this survey, the selection of flap design seems basically to be based on the surgeon’s preference and the surgical access that he or she needs.

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REFERENCES


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