

## The flap design of third molar surgery: An overview

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### Abstract

**Purpose of the study:-** Purpose of present study is to review the update in various flap designs and their influence on outcome in third molar surgery.

**Material and Methods:-** Literature was selected through a search of electronic databases. The keywords used for search were mandibular third molar, impacted mandibular third molar, mandibular third molar flap design, mandibular third molar incision. The search was restricted to English language articles. Additionally, a manual search in the major oral surgery journals and books was performed.

**Results:-** In total 29 literature sources were obtained and reviewed.

**Conclusion:-** Review states that considering various flaps, triangular flap and envelop flap were mainstay for third molar surgery, triangular flaps have significance over envelop flap in term of wound healing, postoperative pain, trismus and swelling but not significant statistically. These two flaps do not seem to have a long lasting difference in term of primary wound healing and status of periodontium.

**Keywords:** Third molar, flap design, incision, impacted tooth.

### Introduction

It is theoretically possible for any tooth to follow an aborted eruption path and become impacted within the dentoalveolar process or in remote heterotrophic anatomic sites [1,3].

At the recent National institute of health consensus development conference on removal of third molar, it was agreed that impaction or malposition of third molar was an abnormal state and might justify its removal; such treatment was not considered to be prophylactic. And thus removal of impacted third molars is the most frequently performed surgical procedure in many oral and maxillofacial surgical practices [1, 4, 8].

Accessibility significantly influences the degree of difficulty of removal of a third molar. The ease with which the tooth can be removed is also influenced by the degree of surgical exposure, the ability to create a pathway for tooth delivery and ability to gain purchase (natural or surgically prepared) on the tooth [4].

Surgical removal of lower third molar is a common procedure and is associated with potential postoperative complication which includes pain, swelling, trismus, and alveolar osteitis. To minimize these complications clinicians have sought an optimal surgical approach and have investigated the use of various flaps [2, 12, 17].

Principle of surgical flap design is to provide access with the least possible ensuring soft tissue damage. Incisions should be designed so as to provide good and adequate blood supply (broad base), good access to allow adequate vision and space for instrumentation, protect the soft tissue in term of influencing minimal trauma, and permitting anatomical repositioning and reattachment of the flap. The incision must permit elevation and reflection of soft tissue without damaging the adjacent structure and it must be a full thickness flap (overlying gingival, mucosa, submucosa, periosteum) [2, 6, 14]

Outcome of third molar surgery is influenced by variety of factors, including mucoperiosteal flap design.

Purpose of present study is to review the update in various flap designs and their influence on outcome in third molar surgery

### Sequencing and comparison of flap design techniques-

Mucoperiosteal access flaps used for removing third molar are broadly grouped under triangular (vertical flap) and envelop flap and few other variables.

In 1932 Thoma<sup>19</sup> described the vertical flap for removal of third molar surgery [5, 8].

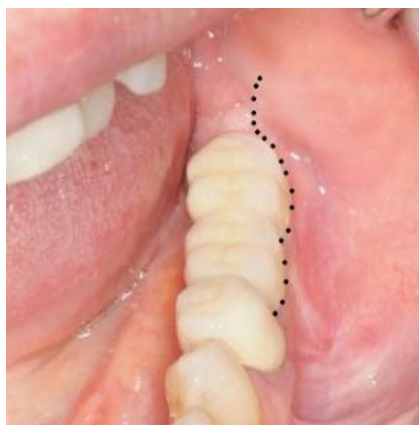
Howe described a mucoperiosteal flap in which the anterior incision curved forward from distobuccal corner of crown of second molar and ended along side of mesiobuccal cusp of that tooth. The distal incision was then extended along the buccal gingival to external oblique ridge [1, 16]. Ward (Fig 1) recommended a larger but similar mucoperiosteal flap for improved access in 1956 [1, 23]



Fig 1: Ward Incision

In 1959 Kruger<sup>[20]</sup> (Fig 2) described envelop flap (a variation of Thomas vertical flap) in which first part of incision was

similar to vertical incision i.e begins medial to external oblique ridge and extending to distal lower angle of second molar followed by sulcular incision which was made from distofacial angle of second molar to mesiofacial angle of first molar [8].



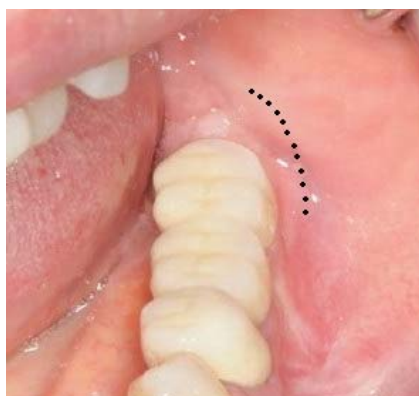
**Fig 2:** Kruger Envelop Flap

In 1966 Berwick [21] (Fig 3) described vestibular tongue shaped flap. This tongue shaped flap extended on to the buccal shelves of mandible with an incision line that did not lie over bony defect, created by removal of impacted tooth, and had its base at the distolingual aspect of second molar to spare the periodontal ligament of adjacent tooth [5, 8, 15]



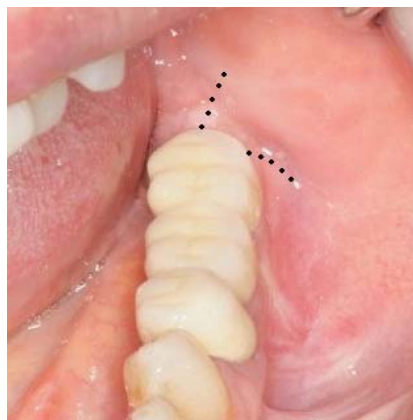
**Fig 3:** Berwick Tougue Shape Flap

In 1969 Henry [22] (Fig 4) described lateral trepanation technique for excision of developing mandibular third molar and was reported by Kaj and Klamfeldt as having no late postoperative complications. This technique is based on the assumption after evaluation, that the third molar would be impacted. This technique does not appear to be popular [1].



**Fig 4:** Henry Incision

In 1979 Killy and Kay [24] (Fig 5) advocatd flaps starting along the gingival crevices of second molar tooth. Healing of gingival crevices from incision has been unsatisfactory and now rarely used [1, 24].



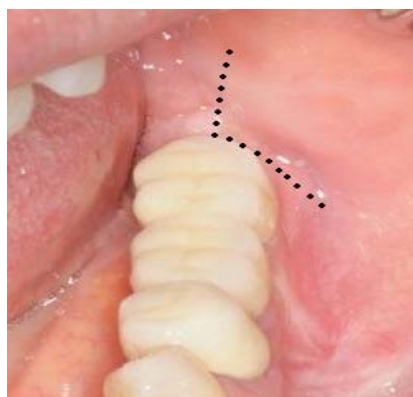
**Fig 5:** Killy and Kay Incision

In 2002 Nageshwar [15] (Fig 6) gave the comma shaped flap for impacted mandibular third molar surgery. The incision is made to a point below second molar from where it is smoothly curved up to meet the gingival crest at the distobuccal line angle of second molar. The incision is continued as a crevicular incision around the distal aspect of second molar. The incision is designed to overcome the problem with conventional incisions as cut across the insertion of temporalis tendon and flap commonly lie over the bone defect formed after removal of impacted tooth [2, 14, 15].



**Fig 6:** Nageshwar Comma Shaped Flap

Though variable flap techniques are designed to overcome the shortcoming of triangular (Fig 7) and envelop flaps but in our review we found the later flaps (triangular flap and envelop flap) as mainstay for third molar surgery [2, 12, 3, 4, 9, 10, 11].



**Fig 7:** Triangular Flap

Pain, trismus, and facial swelling after a surgical removal of third molar tooth are routine sequel due to inflammation as a result of surgery. A major cause of third molar surgical trauma occurs when raising a mucoperiosteal flap to gain access to the tooth [2, 3, 6].

Envelop flap allows good exposure of surgical site, incision can be extended anteriorly if required. Owing to broad base, blood supply is excellent, and the design facilitates easy closure and reapproximation. Potential problem of envelop flap have been discussed in the literature and include damage to the periodontal ligaments when creating sulcular incision around a tooth, increased osteoclastic activity when raising mucoperiosteal flap with potential local bone loss and a higher risk of wound dehiscence in postoperative period compared with modified triangular flap [2]. Modified triangular flap is regarded as more conservative owing to a lesser degree of tissue reflection because it avoids the raising of soft tissue from the buccal aspect of second molar. It is simple to close and allows for relatively tension free closure. However unlike the envelop flap, it cannot be readily extended [2, 3, 8, 9-11].

Every preparation of a mucoperiosteal flap leads to a growing activity of osteoclasts in the area of the alveolar process, inducing loss of alveolar bone [25]. Every sulcular incision is an intervention to the periodontal ligament and may lead to periodontal damage. Alternatively, paragingival and vestibular tongue-shaped [21] flap designs, which aim at sparing the periodontal ligament of the adjacent molar, have been described. Especially in cases of thin keratinized gingiva in the area of the second molar, the conventional flap design may lead to a total loss of the attached gingiva in this area after the operation. This again can cause pocket formation and loss of attachment in the area of the second molar [26]. The frequent occurrence of dehiscences distofacial to the second molar seems to be another disadvantage of the envelope-flap design. These gaping are usually located at the distobuccal gingival rim of the adjacent second molar, where the distal relieving incision leads into the sulcular incision. In this area, soft tissue tensions resulting from postoperative hematoma and masticatory movements may induce a rupture of the wound margins during the first few postoperative days. This is particularly true for the envelope flap because it is fixed anteriorly with intersulcular sutures. Such dehiscence can take place inconspicuously and unnoticed by the patient and may heal secondarily. Thus, secondary wound healing can cause wedge-shaped defects of the gingiva distal to the second molar, or it can favor a loss of attachment distal to the second molar. The triangular flap allows easy relief of the hematoma during the first postoperative day. A dehiscence does make hygiene more difficult and requires intense follow-up treatment (ie, frequent irrigation and possible local medication). There is also a chance for longer-lasting discomfort caused by hypersensitivity in the area of the distally exposed root surface of the second molar. Alveolar osteitis and soft tissue abscess are more severe complications that are possible. Jakse *et al* in his comparison study found that, 56% of the patients develop a disorder in primary wound healing, when conventional sulcular flap design was used. With the modified triangular flap design, primary wound healing was significantly improved, dehiscence occurred only in 10% of cases. He suggests that this was because of a tension decrease in the area of the distal wound closure compared with the situation of the envelope flap technique. The vestibular triangular flap can be easily moved to

lingual, ensuring a wound closure that is almost tension-free. The mesial vestibular relieving incision, which is only adapted coronally by a single suture, allows depletion of the postoperative hematoma during masticatory movements. On the very first postoperative day, hematoma is easy to relieve by spreading and compression. Also the release area has bone support. This study has shown that the conventional sulcular flap design has a nearly 6-times-higher risk of rupture of the primary wound closure than the modified triangular flap. The modified triangular flap design, when compared with the conventional sulcular incision, definitely makes primary wound healing easier. Factors such as the degree of impaction, the duration of the surgery, and nicotine habits have less influence on primary wound healing [12].

Trismus after third molar surgery is usually caused by inflammation of the muscles of mastication leading to spasm secondary to the raising of a mucoperiosteal flap. There is no advantage in choosing either of these flap designs over the other to reduce the severity of trismus. Nageshewar [15] has proposed that this may be due to the distal incision path of all commonly used flap designs being the same. There is insufficient research comparing flap designs with different distal incision courses to objectively evaluate this statement, but it would appear reasonable to attribute to the same distal incision path the similarity of trismus severity in the 2 flap designs. Postoperative pain on the other hand is not directly influenced by flap design. However VAS score was found elevated in patients who developed alveolar osteitis. Difference may have been seen owing to the increased incidence of alveolar osteitis associated with the use of the envelope flap, but the difference in incidence of alveolar osteitis between this two flaps was not statistically significant [2, 6, 10].

The periodontal status of second molar is another area of interest. Schofield *et al* reported that flap design was not important on periodontal health of second molar, and when bone was not removed distal to second molar, flap design did not have permanent effect. Thus the effect of flap design have more relevance to the immediate postsurgical period rather than as a long term concern [3].

The envelope flap is easier to perform and suture than the triangular flap, but it does not facilitate access to the surrounding structures, making osteotomy more difficult, and more distal dehiscence of sutured incision. Whereas the triangular flap allows easier access to the surrounding structures, facilitating the osteotomy needed to extract the tooth. Conversely, suturing is more involved, and the exposure of a larger bone area tends to activate osteoclastic bone resorption [28, 29]. At the postoperative examination after 7 days, the probing depth was statistically greater in the first and second molars on the side on which an envelope flap was used. These findings could be related to the deficient initial regeneration of the connective-tissue attachment, which was formed perfectly 3 months postoperatively, as demonstrated on postextraction probing [5, 8, 9, 11].

## Conclusion

Review states that considering various flaps, triangular flap and envelop flap were mainstay for third molar surgery, triangular flaps have significance over envelop flap in term of wound healing, postoperative pain, trismus and swelling but not significant statistically. These two flaps do not seem to have a

long lasting difference in term of primary wound healing and status of periodontium.

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