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REVIEW ARTICLE

Role of Flap Designs in Successful Surgical Removal of Impacted Third Molar- A Review

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***ABSTRACT*:**
Impaction is one of the most common surgical procedures in Oral and Maxillofacial Surgery. This could be done either for therapeutic or prophylactic reasons. The surgery which exploits both the soft and hard tissues result in the post operative reactions like pain, swelling and trismus. The possible complications are bleeding, dry socket, nerve injury, infection etc. Flap design is one of the factors responsible for the severity of post-operative sequelae. The reduction of post-operative complications leads to the success of surgical outcomes. Several flap designs have been evolved as years passed for reducing the post-operative sequelae. This manuscript reviews various important flap techniques and evaluates its role in the success of third molar impaction.
Key words: Flap design, third molar surgical removal.

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INTRODUCTION

Impaction is one of the most common surgical procedures in Oral and Maxillofacial Surgery. It is a routine event and meant to be the basic procedure of Oral Surgeons. Impaction is probably the result of genetic and environmental factors. In 2004, Farman defined it as those teeth that are prevented from eruption due to a physical barrier in the path of eruption. Third molars generally erupt between the ages of seventeen and twenty-one years (Bouloux et al., 2007)[1],but some of them are impacted due to discrepancy of teeth size along with under development of mandibular arch and 25% might be absent in the arch.The incidence rate of impaction is 9.5%-68%[2].The impaction could be either complete(covered with bone and mucosa) or partial(covered with mucosa).

The impaction surgery can be done either for therapeutic or prophylactic reasons. Nunn et al, who reported a significantly increased risk of a second molar pathology of 4.88-fold with soft tissue impaction of the adjacent third molar and 2.16-fold with bony impaction of the adjacent third molar[3].The most common indication for surgery is infection around the impacted or partially erupted teeth. The other common indications are unrestorable caries, pericoronitis, pulpal and periapical pathology, fracture of tooth and cyst development. Nunn et al described the need for prophylactic extraction to prevent future pathological changes around the impaction.

The surgery exploits both the soft and hard tissues resulting in the post operative reactions like pain, swelling, trismus. This is due to the inflammatory process which deliver the leucocytes to the site of injury, where they help to clear the

invading bacteria and degrade the necrotic tissues resulting from damage. The possible complications are bleeding, dry socket, nerve injury, infection etc. The factors responsible for the severity of post operative sequelae are difficulty of extraction, duration of surgery, surgical techniques including flap designs, bone removal techniques, tooth sectioning methods, placement of drain tubes, suturing techniques.

Flap design is one of the important factor for the success of surgical outcomes. Several flap designs have been evolved as years passed for reducing the post operative sequelae. This article reviews various flap techniques and evaluates its role in the success of third molar impaction.

Principles of surgical flap designs

1) provide accessibility with least damage to soft tissues.
2) provide good and adequate blood supply(broad base).
3)provide adequate vision and space for instrumentation.
4)provide minimal trauma.
5)permit anatomical reposition.
6)provide reflection of soft tissue with full thickness flap.
7)provide a pathway for tooth elevaton and tooth delivery.[4]

VARIOUS FLAP DESIGNS AND ITS CLINICAL SIGNIFICANCE

They are broadly classified into horizontal and vertical incisions and based on reflection, they are of full thickness and partial thickness flaps. Various flap incisions have been designed to fulfill the fundamental principles and to reduce the post operative complications, thereby to achieve the success of third molar impaction.

Wards incision (1946)

It has three parts; anterior, intermediate or gingival and distal. Anteriorly, it extends around the gingival margin of second molar and even the first molar before turning into the sulcus .Over extension of the incision into the sulcus may cause brisk oozing of blood from venous plexus and can be avoided by making the anterior part more oblique. Intermediate is along the gingiva. Distally, the incision must slope outwards as well as backwards, as the ascending ramus lies on the lateral side of the body of mandible[5] (Figure A).

Figure A

It has advantage of (1) good adaptation of gingival margins, (2) no pocket formation distal to mandibular second molar, (3) avoidance of difficult suturing in vestibule, (4) no chances of injury to facial artery and vein, (5) no food lodgment and thus chances of infection are reduced. Ward's incision enjoys advantages like better accessibly and visibility especially in deep seated impactions. It is easy to retract flap margins away from surgical area.

Three cornered flap- Modified Wards Incision

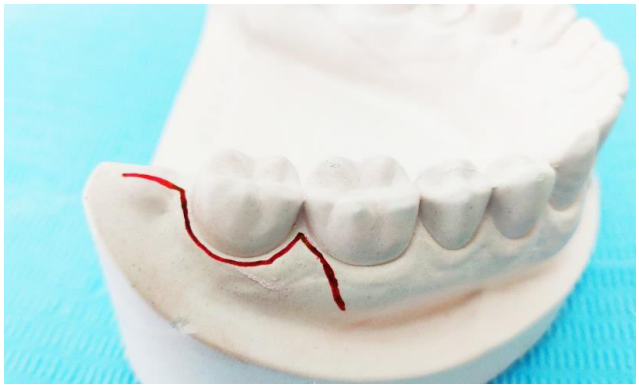

Figure B

Anterior incision curves forward from the distobuccal corner of the crown of the first molar and it ends alongside the mesiobuccal cusp of that tooth. A vertical or crevicular incision should be made through the buccal gingival crevice of the second molar.Distally it is similar to wards incision[6] (Figure B). Modified triangular flap consisted of an incision that begins from the ramus and continues up to 2 mm distal to the second molar and it continues downward ending in buccal vestibule. *Modified triangular flap* induces less tissue reaction and provides tension-free stitches.

Envelope flap (Kruger 1959)

It begins medial to external oblique ridge and extending to distal lower angle of second molarfollowed by sulcular incision which is made from distofacial angle of second molar to mesiofacial angle of first molar[7](Figure C).

Figure C

This flap allows good exposure of surgical site with minimal soft tissue trauma. It facilitates easy closure and reapproximation, good blood supply, easier to perform and suture.

Modification of envelope flap

Figure D

It involves the extension of the sulcular incision with a direct horizontal cut through the papillae between the first and second molars.[8] It is best for linguoangular impactions as it provides better visibility(Figure D)[9].

Vestibular tongue shaped flap- Berwick (1966)

Figure E

This flap extends to the buccal shelf of the mandible. The incision line does not lie over the bony defect created by the removal of the impacted tooth and its base at the distolingual aspect of the second molar[10] (Figure E).

Szymd flap(1971)

Figure F

Szmyd flap[11] preserves a strip of mucoperiosteum on the buccal surface of second molar, thus minimizing bone resorption leading to pocket formation distal to second molar. Thus this modification in flap design precludes the need for detachment of the buccal gingival fibers around the first and second molars, the amount of periosteum to be reflected is there by reduced markedly and also achieves adequate accessibility. It leaves an intact gingiva which will provide a better primary periodontal healing, minimal reflected periosteum, adequate exposure, visibility and blood supply (Figure F).

L-shaped flap or Modified Szymd flap

Figure G

It kept the attached gingiva in the distobuccal region of second molar, with an extension of the incision made straight down to the buccal vestibule.[12]

Comma shaped flap (Nageshwar 2002)

Figure H

Starting from a point which is at the depth of stretched vestibular reflection which is posterior to the distal aspect of the preceding second molar, the incision is made in an anterior direction. Incision is made to a point below the second molar, from where it is smoothly curved up to meet the gingival crest at the distobuccal line angle of the second molar. The incision is continued as a crevicular incision around the distal aspect of the second molar[13] (a distolingually based flap) (Figure H).
It provides larger accessibility and it is indicated in case deep horizontal impactions.

DISCUSSION

Impaction is a most common procedure in which flap design is one of the important factors in reducing the severity of complications. Various flap designs have been executed for the success of third molar impaction. Conservative tissue handling is an important aspect and if the extension and duration of injury increases, longer the inflammation and the resultant post operative complications.
The most commonly used flap designs are triangular flaps and envelope flaps .Various studies have been conducted to find out the flap design that has fulfilled the requirement of an ideal flap for the third molar surgery in order to overcome the post operative complications.
Complication of wound dehiscence is seen with routinely used flap design, the Ward‘s incision. Because incision is given at the site of bone removal, the incidence of wound dehiscence is more and thus chances of infection are increased.[14] In the study conducted by Desai et al, Ward’s incision was compared with envelope flap for visibility, accessibility, healing and pre-and post-operative complications. No statistical differences were noted between the groups in terms of visibility, accessibility, excessive bleeding during surgery, healing of flap, sensitivity of adjacent teeth, and dry socket. A statistically significant difference was observed in post-operative hematoma, wound gaping, and distal pocket in adjacent tooth, which was significant in Ward's triangular incision group in comparison to envelope incision group.[15]
Mohajerani et al compared both modified triangular flap (MTF) compared with the envelope flap (EF) on the incidence of dry socket and healing degree after lower-impacted third molar surgery and found out that the application of MTF may lead to a reduction in dry socket incidence and an increase of healing after 7 days since lower-impacted third molar surgeries.[16] But there was no significant difference between the envelope and modified triangular flap regarding postoperative pain and swelling after impacted third molar surgery in another study conducted by Dolanmaz D et al.[17]
Alqahtani et al revealed that the modified triangular flap had lesser postoperative PPDs and dehiscence.[18] The envelope flap was better when swelling was analyzed. But Stephens et al compared the periodontal status of second molars after third molar surgery using either the envelope flap design or the triangular flap design and concluded that, flap design did not influence the health of the second molar periodontium, and therefore flap design becomes a matter of individual preference.[19]
Erdogan et al compared the influence of triangular and envelope flaps on trismus, pain, and facial swelling after mandibular third molar surgery. Envelope flap yields to less facial swelling and reduced VAS scores in comparison to triangular flap.[20] Baqain et al showed that the probing depth was significantly greater with envelope flaps in the early postoperative period.[21]
Chiramel et al found that the Szmyd flap design makes primary wound healing easier, less wound dehiscence and periodontal complication than envelop flap design[22]. Kirtiloğlu et al demonstrated that Szmyd flap can leaves an intact gingiva around the second molar which will provide a better primary periodontal healing.[23]
Kumar et al[24] evaluated the effect of a comma shaped flap design and wards incision on pain, swelling and trismus after impacted third molar surgery. They observed that the comma shaped flap was associated with lesser facial swelling, lower pain scores and a lower incidence of trismus. Similarly, comma shaped incision has shown less post operative complication in compare to standard incision in a study conducted by Pasha et al.[25]
In the study conducted by Agarwal et al, the result showed that the post surgical swelling, pain and trismus were less in comma shaped incision but were not statistically significant due to smaller sample size.[26]
In 2018, Gomez et al reviewed and found that the duration of surgery, and not the flap design, affected the acute postoperative symptoms and signs after lower third molar extraction.[27] Blanco et al[28] mentioned that all procedures always report complications, trismus, pain, swelling, difficulty opening the mouth, and do not take into account other factors such as the quality of due patients, which was significantly affected.
Each technique has its own merits and demerits in one way or in other way. The surgeons must be skilled enough to fulfill the demands of patients. Careful diagnosis, pre surgical planning, good surgical execution and adequate post operative care are benchmarks for acceptable treatment.

CONCLUSION

Flap design has its own role in the success of third molar impaction. They are paramount, and the selection of flap design is fully dependent on the choice of surgeon.
The successful surgical removal of impacted third molar depends on ideal flap designs. Various flap designs have been executed for the reduction of postoperative sequelae. But none of them fulfills the whole principles of an ideal flap. Though each has its own advantages and disadvantages, the increased accessibility of the surgical site and decreased post-operative complications might

influence patient satisfaction. Flap designs with proper accessibility and less complications are more preferred for the success of surgery and more over these important principles with proper planning on execution leads to the success of surgery.

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