



Comparison of Three Incision Designs and Influence on Post-Operative Complications in Surgical Removal of Mandibular Third Molars.

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ABSTRACT:

Background: Surgical removal of impacted mandibular third molars is a routine procedure in oral surgery, where flap design plays a key role in surgical access and postoperative recovery.

Objectives: This prospective study compared three mucoperiosteal flap designs: Ward's incision, comma-shaped incision, and Koener's envelope incision focusing on intraoperative visibility, ease of surgery, postoperative pain, swelling, trismus, wound healing, and complications.

Methods: Ninety patients diagnosed with impacted mandibular third molars were randomly divided into three groups of 30, each undergoing surgical extraction with a different flap design. All procedures were performed by experienced surgeons following standardized protocols. Clinical parameters were assessed on the 1st, 3rd, and 7th postoperative days, including pain (VAS score), facial swelling, trismus, wound healing, and complications such as dry socket, infection, dehiscence, paresthesia, and periodontal pocket depth distal to the second molar..

Results: All flaps allowed successful extractions. The comma-shaped incision showed better outcomes in terms of reduced pain, swelling, and faster recovery. Ward's incision gave superior access but caused more tissue trauma. Koener's incision balanced access and healing but was not significantly better than the comma-shaped flap. Complication rates were comparable across groups.

Conclusions: Flap design significantly influences early postoperative symptoms, particularly pain, swelling, and trismus. The comma-shaped incision emerged as the most favorable in terms of patient comfort and recovery. However, since all techniques were effective and complication rates were comparable, flap selection should be guided by clinical judgment, patient anatomy, and individual case requirements.

1. INTRODUCTION

The surgical extraction of an impacted lower wisdom tooth is one of the most common minor oral surgical procedures, requiring a thorough understanding of surgical principles to minimize trauma. Incisions are

made to provide access to the surgical area, ensuring clear visibility and an efficient procedure. Numerous studies have explored the impact of wisdom molar removal and different flap techniques on the periodontal condition of the distal aspect of the second molar, with



varying results.^[1-3] Several researchers have proposed different designs for elevating a mucoperiosteal flap to expose an impacted lower third molar, with the modified triangular flap and envelope flap being the most frequently used.^[4] Due to the proximity of significant anatomical structures to the surgical site, many surgeons opt for various types of incisions, including the envelope (Koener's) incision, triangular (Ward's) incision and its variations, the L-shaped incision, bayonet-shaped incision, comma incision, and "S"-shaped incision. These incisions are designed to provide sufficient access and visibility while protecting critical anatomical structures.^[5] A comparative study was carried out to assess three primary incision types—triangular (Ward's), comma-shaped, and envelope (Koener's)—during the surgical removal of impacted third molars, evaluating factors such as ease of access, surgery duration, dehiscence, infection, dry socket, paresthesia, and postoperative complications like pain, trismus, and swelling.

MATERIALS & METHODS: An in-vivo comparative study was carried out in the Department of Oral and Maxillofacial Surgery, NIMS Dental College and Hospital, Jaipur, after getting Institutional Ethics Committee (IEC) approval. 90 male and female patients aged 18-45 years with impacted mandibular third molars were selected and divided into three groups.

Inclusion criteria consisted of both sexes of age group 20-35 years, partially/ fully impacted mandibular third molars, ASA-1 patients, Non-smoking, non-alcoholic patients, Co-operation of the patients with the study and post-operative follow-up, and patients undergoing impacted third molar removal for the indications of pericoronitis, deep caries with pulpitis and for orthodontic reasons. The class, depth, and position of the involved teeth were evaluated with an OPG.

The participants were randomly assigned to three groups:

- Traditional ward's incision group (Group 1),
- Comma-shaped incision group (Group 2),
- Koener's incision group (Group 3).

Each group comprised 30 patients.

A proforma was created and completed based on the examinations conducted at the following time points:

- Preoperatively
- Immediately postoperatively
- On the First, third, and seventh postoperative days.

This study's parameters were evaluated using the following criteria:

1. Pain (measured using the Visual Analog Scale by White and Strunin).^[6]
2. Swelling of the face (assessed by the distance between the skin surface's reproducible soft-tissue pogonion and the base of the tragus, as per Schultze-Mosgau et al.).^[7]
3. Trismus (measured as maximal interincisal distance with a divider and ruler, as outlined by Wood and Branco).^[8]
4. Wound healing (established by clinical criteria for acceptable healing, as defined by Holland and Hindle).^[9]

The wisdom molar extraction was done on the patients under local anesthesia. All patients in the current study were anesthetized with a traditional inferior alveolar nerve, lingual nerve, and long buccal nerve block, with 2 ml of 2% lignocaine with adrenaline (1:200,000).

Wards Incision

The incision began just distal to second molar and proceeded along alveolar crest or third molar's buccal gingival sulcus to its distal edge. Over the external oblique ridge, a distal releasing incision was created into the buccal mucosa. An extension of the incision to the first molar's distal, when needed, enhanced visibility, as seen in Fig 1.

Comma Incision

It begins at the vestibular reflection level behind the second molar and curved below the second molar and gradually transitioned to gingival crest at distobuccal line angle. It then proceeded as crevicular incision around the distal side of wisdom molar, as seen in Fig 2.

Koener's Incision

The incision is started alongside the external oblique ridge and descended towards the second molar's distal surface. It was around 0.75 inches in length and proceeded along the second molar's free margin, ending at its mesiobuccal line angle, as seen in Fig 3.



Fig 1: Ward's Incision



Fig 2: Comma shaped Incision



Fig 3: Koener's Incision

A full-thickness mucoperiosteal flap was reflected to expose the crown of the wisdom molar. Bone was excised from mesial, buccal, and distal with copious saline irrigation with a straight handpiece and micromotor and 703 bur. The tooth was luxated and removed; sectioning was required in some instances. The

socket was checked for tissue remnants, and any follicular tissue was curetted out. After carefully irrigating the site with saline and betadine, the site was sutured with 3-0 silk suture, ensuring proper hemostasis. Antibiotics were administered starting one day before surgery and continued for three days post-operatively.

Preoperative clinical examination was performed before the surgery, and at immediately postoperative time and first, third, and seventh postoperative days after wisdom molar removal. Postoperative pain, trismus, swelling, dry socket, wound dehiscence, wound infection, and paresthesia were documented at these periods. Clinical postoperative assessment regarding pain, maximal mouth opening, degree of swelling, and wound healing were then assessed.

OBSERVATION AND RESULTS

This research had 90 patients divided into three groups, who all had their impacted mandibular third molars surgically removed through varying forms of incisions. Thirty patients were in Group 1 who were treated with Ward's incision, Group 2 consisted of 30 patients with a Comma-shaped incision, and 30 patients were in Group 3 who underwent Koener's incision.

Patients were reviewed at 1st day, 3rd day and 7th day post-operatively and the following parameters were evaluated –Ease of access, Time taken for surgery, Mouth opening post-operatively, Swelling post-operatively, Post-operative pain, Dehiscence of the wound, Infection of the wound, Dry socket and Paresthesia.

STATISTICAL ANALYSIS: Software utilized: SPSS, Version 16.0

STATISTICAL TESTS APPLIED:

- Qualitative data - Chi-Square Test
- Quantitative data – ANOVA

DISCUSSION

The design of the flap is a key factor that affects the severity of postoperative complications.^[10,11-14] Incisions that expose impacted wisdom molars are usually classified into triangular and envelope types. All incisions continue posteriorly from the distal edge of the second molar towards the ascending ramus. A number of surgeons have created modifications of the usual



incisions, and Nageshwar's comma-shaped incision is superior to the classical incision. Postoperative pain after wisdom molar surgery usually occurs as localized inflammation with differing intensities of pain. Removal of the impacted wisdom molar results in tissue and cellular injury, which causes release and synthesis of a number of biochemical mediators of the pain process, mainly histamine, bradykinin, and prostaglandins.^[15] Moderate to severe pain usually starts within the first twelve hours, with its intensity peaking at about six hours following the administration of a standard local anesthetic. The pain then slowly diminishes over the next few days, provided the wound heals normally.^[16] Postoperative pain was measured on the first, third, and seventh post-operative days by a Visual Analogue Scale (VAS) of 0 to 10, with higher values representing more pain. This was used because it is easy to describe to patients and they quickly understand it. Lower pain scores on the sides where the comma incision was performed were noted in comparison to those with the traditional wards and Koener's incision, which is in accordance with the observation of Nageshwar's study.^[17] This finding was contrary to the observation of Gool et al., who had concluded that the severity of pain after third molar removal was not related to the type of incision made.^[18] The two main reasons of postoperative swelling are trauma and infection. Trauma to the gingiva and bone during oral surgery usually causes early postoperative swelling. This swelling is greatest 19–24 hours following surgery and will resolve over the course of the following seven days.^[19] The parameters that control the development of pain and swelling are the skill of the surgeon, surgical trauma, suturing method, age, gender, medication, time of day, and the design of the local flap.^[20-22] There was less swelling in the region where the comma incision was made compared to where the conventional incision was made. Nageshwar's findings were consistent with these results. The comma-shaped incision was also accompanied by fewer instances of limited mouth opening than the control incision side, in accordance with Nageshwar's study. The correlation between trismus and pain has been reported in various studies, and this hypothesis was corroborated by an electromyographic study, concluding that limited mouth opening is a voluntary response to pain avoidance.^[23] In the current study, ease of access was determined in terms of visibility and accessibility. The findings

indicated that access was excellent for all surgeries with Ward's incision. With the comma-shaped incision in surgeries, access was excellent in 50% and moderate in the remaining 50%. For Koener's incision, access was excellent in 70% and moderate in 30%. The outcomes showed that Ward's incision offered greater access to the operative field than the Koener's and comma-shaped incisions, with the comma-shaped incision recording the lowest access among the three designs. The findings are consistent with the research by Monaco et al.^[24] who discovered that triangular flaps are easier to access. The findings showed a large variation in the duration of surgery. The mean duration of surgery when Ward's incision was used was 20.75 minutes, when the comma-shaped incision was used it was 13 minutes, and when Koener's incision was used it was 17.75 minutes. The shortest time was required for operations with the comma incision, and Ward's incision took the longest time, with Koener's incision being in between. These results contradict the research conducted by Giuseppe Monaco et al who had stated that operations with Koener's incision were longer than operations involving Ward's incision. The difference can be explained by parameters like the experience of the surgeon, tooth depth and location, and flap reflection.

The inter-incisal distance was employed as an indicator of trismus in some earlier studies, though most of them failed to mention the instruments used to record it. During the present study, a scale and divider were used to assess the inter-incisal distance. The percentage difference between the reduction of mouth opening was measured on the first, third, and seventh post-operative days. The mean percentage difference was subsequently calculated. The findings were considerable, as they showed that Ward's incision had the greatest impact on post-operative mouth opening, as opposed to the comma and Koener's incisions, which produced similar effects. These findings concur with Saravana Kumar et al.'s study.^[25] They are, however, different from Nageshwar's study, which did not find any difference in mouth opening post-operatively irrespective of the type of incision. This may be attributed to other causes such as the length of the surgery and the extended reflection of the flap.

In a clinical study by Nageshwar et al. and Desai et al.^[26], swelling was noted to be more associated with the incision, reflection of the mucoperiosteal flap, and length



of procedure. This trend could be attributed to the extensive handling of the open wound. The current study substantiates this. In the present study, percentage increase in facial measurements was found on the first, third, and seventh post-operative days, and mean was calculated. The findings showed that post-operative swelling was higher after surgeries involving Ward's incision than those involving comma or Koener's incisions. The comma incision had the lowest increase in facial measurements among the three incision patterns. These are inconsistent with the findings of Saravana Kumar et al.

In the current research, out of the 30 operations conducted with Ward's incision, two cases underwent wound dehiscence during the post-operative course. In the same manner, out of the 30 operations conducted with Koener's incision, one case also underwent wound dehiscence. However, no cases of wound dehiscence were observed in the 30 surgeries performed with the comma incision. The difference in wound dehiscence rates between the three incision groups was not statistically significant. These findings are consistent with the findings of Monaco et al.

In the current research, among the 30 operations conducted with Ward's incision, two cases developed a wound infection during the post-operative period. Similarly, one case of wound infection was observed among the 30 surgeries performed using Koener's incision. However, no cases of wound infection occurred in the 30 surgeries performed with the comma incision. The difference in wound infection rates between the three incision groups was not statistically significant. These findings consistent with the findings of Monaco et al.

In the current research, among the 30 operations conducted with Ward's incision, one patient developed a dry socket during the post-operative period. No cases of dry socket were observed in the 30 surgeries performed with either the comma or Koener's incision. The difference in the incidence of dry socket among the three incision groups was not statistically significant. These results contradict the findings of Kirk et al. [27], stating increased occurrence of alveolar osteitis associated with envelope flaps.

In the current research, among the 30 operations conducted with Ward's incision, one patient developed

paresthesia during the post-operative period. Similarly, one case of paresthesia was observed in the 30 surgeries performed using the comma incision, while two cases of paresthesia were noted in the 30 surgeries using Koener's incision. The paresthesia was temporary and resolved within two months. The difference in the occurrence of paresthesia among the three incision groups was not statistically significant. This parameter has not been previously assessed in comparison across these three incision types.

This research firmly shows that the selection of incision design strongly affects the postoperative results after surgical extraction of impacted lower wisdom molars. Although Ward's incision provided outstanding access and visibility to the operative area, it had a negative effect on post-operative mouth opening, swelling, and pain. Surgery time for the comma incision was shorter than for Ward's and Koener's incisions. Even though it offered less exposure, the incision that was comma-shaped had the smallest adverse effect on post-operative mouth opening, swelling, and pain. Koener's incision had a moderate adverse effect on these parameters. No comparison was found between the three incision groups wound dehiscence, wound infection, dry socket, or paresthesia in the postoperative time.

SUMMARY AND CONCLUSION:

A comparative research was done to evaluate the outcomes of three different incision techniques used for surgically extracting impacted lower wisdom molars. This study involved a total of 90 patients, who were evenly divided into three groups.

Group 1 underwent extraction with the traditional Ward's incision, Group 2 had a comma-shaped incision, and Group 3 received the Koener's incision. Post-operative effects were evaluated on the first, third, and seventh days after surgery for all participants. The main aim of the study was to assess the advantages and drawbacks of each incision technique.

The results revealed differences in factors such as surgical site access, procedure duration, and post-operative complications, including restricted mouth opening, swelling, and pain. However, there were no significant differences between the groups regarding, wound dehiscence, infection, alveolar osteitis, or paresthesia.



This research presents the following important conclusions:

1. Ward's incision provided superior visibility to the operation area than both the comma-shaped and Koener's incisions.
2. The comma-shaped incision was the quickest to perform, while Ward's incision took the most time.
3. Patients who underwent surgery with Ward's incision experienced more significant post-operative issues like restricted mouth opening, swelling, and pain. In contrast, the comma-shaped incision had the least negative effects, with Koener's incision showing moderate results.

These results are in agreement with earlier research by Nageshwar et al., Saravana Kumar et al., and Adarsh Desai et al. The conclusion of this study is that the comma-shaped incision is the most preferable among Ward's and Koener's incisions. Nevertheless, it might need some practice at first, and a greater study group for each type of incision is advisable for stronger conclusions.

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