FLAP DESIGN MATTERS: A PROSPECTIVE CLINICAL COMPARISON OF MODIFIED SZMYD AND THREE - CORNERED FLAPS IN IMPACTED MANDIBULAR THIRD MOLAR SURGERY

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Abstract

Background: Flap design plays a crucial role in determining postoperative morbidity following surgical removal of impacted mandibular third molars. An ideal flap should provide adequate surgical access while minimizing postoperative pain, swelling, and periodontal complications. The Modified Szmyd flap has been proposed as an alternative to the conventional Three-Cornered flap because of its potential to preserve periodontal tissues and reduce surgical trauma.

Aim: To compare postoperative pain, facial swelling, and periodontal healing following mandibular third molar surgery using the Modified Szmyd flap and the conventional Three-Cornered flap.

Materials and Methods: A prospective comparative clinical study was conducted on 20 patients requiring surgical extraction of impacted mandibular third molars. Patients were randomly allocated into two equal groups. Group A underwent surgery using the Three-Cornered flap, while Group B was treated using the Modified Szmyd flap. Standardized surgical procedures, suturing techniques, and postoperative medications were maintained in both groups. Pain was evaluated using the Visual Analogue Scale (VAS) on postoperative days 1, 3, and 7. Facial swelling was assessed using standardized facial measurements, and periodontal healing was evaluated by measuring probing pocket depth at one month. Statistical analysis was performed using SPSS version 23.0, with $p < 0.05$ considered statistically significant.

Results: Both groups demonstrated progressive reduction in postoperative pain and swelling over time. The Modified Szmyd flap showed significantly lower VAS scores on postoperative Day 3 ($p = 0.002$) and Day 7 ($p = 0.041$). Although early postoperative swelling differed significantly between groups, swelling resolved similarly by Day 7. Periodontal healing was significantly better in the Modified Szmyd group, with lower probing pocket depth at one month ($p = 0.001$).

Conclusion: The Modified Szmyd flap provides superior postoperative outcomes compared with the conventional Three-Cornered flap by significantly reducing postoperative pain and improving periodontal healing while maintaining adequate surgical access. It may therefore be considered the preferred flap design for surgical removal of impacted mandibular third molars.

Keywords: Impacted mandibular third molar; Modified Szmyd flap; Three-Cornered flap; Pain; Swelling; Periodontal healing; Oral surgery.

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INTRODUCTION

Impacted mandibular third molars are among the most common conditions requiring surgical intervention in oral and maxillofacial surgery. Approximately one-third of adults have at least one impacted mandibular third molar, and surgical removal is indicated for recurrent pericoronitis, dental caries, periodontal disease, cystic or neoplastic changes, orthodontic considerations, and prevention of pathology affecting the adjacent second molar. Although extraction of symptomatic impacted third molars is widely accepted, the surgical procedure remains associated with considerable postoperative morbidity, including pain, facial swelling, trismus, wound dehiscence, and periodontal defects distal to the mandibular second molar.

The extent of postoperative complications depends on several factors, including patient age, degree of impaction, surgical difficulty, duration of the procedure, operator experience, and the surgical technique employed. Among these, flap design plays a pivotal role because it determines the amount of tissue reflection, vascular preservation, surgical visibility, wound closure, and postoperative periodontal healing. An ideal flap should provide adequate access to the impacted tooth while minimizing trauma to the surrounding soft tissues and preserving the periodontal attachment of the adjacent second molar.

Various mucoperiosteal flap designs have been described for mandibular third molar surgery, including the envelope flap, triangular (Three-Cornered) flap, Szmyd flap, and several modified flap designs. The conventional Three-Cornered flap remains one of the most frequently used approaches because it provides excellent surgical access through a vertical releasing incision. However, vertical releasing incisions may compromise blood supply, increase tissue tension during closure, and contribute to postoperative pain, swelling, wound dehiscence, and periodontal attachment loss distal to the mandibular second molar. Conversely, the Modified Szmyd flap is designed to preserve the attached gingiva and vascular supply while allowing tension-free primary closure, thereby potentially improving periodontal healing and reducing postoperative morbidity.

Several investigators have evaluated the influence of flap design on postoperative outcomes following third molar surgery. Previous studies have reported conflicting findings regarding postoperative pain, swelling, trismus, wound healing, and periodontal status. While some authors observed no significant differences between flap designs, others demonstrated improved periodontal healing and reduced probing pocket depth with the Modified Szmyd or other paramarginal flap designs. These inconsistencies may be attributed to differences in study design, sample size, surgical technique, follow-up duration, and methods of clinical assessment. Consequently, the optimal flap design for minimizing postoperative morbidity while maintaining adequate surgical access remains controversial. Preservation of periodontal health distal to the mandibular second molar has become an important objective in contemporary third molar surgery because postoperative periodontal defects may predispose patients to plaque accumulation, chronic inflammation, attachment loss, and long-term periodontal breakdown. Therefore, surgical approaches that minimize soft tissue trauma while maintaining adequate visibility are of considerable clinical interest.

In view of the conflicting evidence available in the literature and the limited number of prospective studies directly comparing the Modified Szmyd flap with the conventional Three-Cornered flap, the present study was undertaken to evaluate the influence of these two flap designs on postoperative pain, facial swelling, and periodontal healing following surgical removal of impacted mandibular third molars. It was hypothesized that the Modified Szmyd flap would provide superior postoperative outcomes by reducing surgical trauma, preserving periodontal tissues, and improving wound healing without compromising surgical access.

Materials and Methods

Study Design and Participants

A prospective comparative clinical study was conducted in the Department of Oral and Maxillofacial Surgery at Teerthanker Mahaveer Dental College and Research Centre (TMDC&RC), Moradabad, India. Twenty patients requiring surgical removal of impacted mandibular third molars were recruited after obtaining informed written consent and institutional ethical approval. Eligible participants were between 18 and 50 years of age, belonged to American Society of Anesthesiologists (ASA) physical status I or II, and had partially erupted or completely impacted mandibular third molars requiring surgical extraction.

Patients with severe systemic illness, pregnancy or lactation, Pederson difficulty scores of 7–10, mental disability, long-term use of medications affecting bone healing (e.g., bisphosphonates, chemotherapy, or phenytoin),

or those unwilling to participate in follow-up were excluded from the study.

Group Allocation

Patients were randomly allocated into two equal groups (n = 10 each):

 Group A: Surgical extraction using the conventional Three-Cornered flap.

 Group B: Surgical extraction using the Modified Szmyd flap.

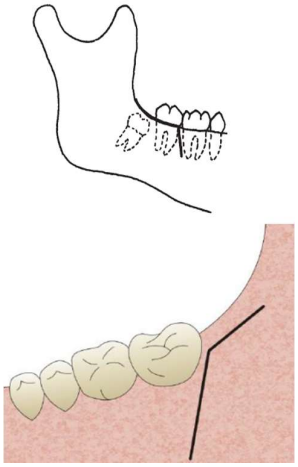


Fig.A Modified Szmyd Flap
Fig.B Three Corner Flap

The same surgeon performed all procedures using a standardized surgical protocol to minimize operator-related variability.

Surgical Procedure

All patients were instructed to rinse with 0.2% chlorhexidine gluconate before surgery, and the operative field was disinfected using 5% povidone-iodine solution. Local anaesthesia consisting of 2% lignocaine with 1:80,000 adrenaline was administered using standard inferior alveolar, lingual, and long buccal nerve block techniques.

After flap reflection according to the assigned study group, bone removal was performed using a surgical handpiece and carbide bur under continuous sterile saline irrigation. Tooth sectioning was carried out whenever necessary to facilitate atraumatic removal. Following extraction, the socket was thoroughly irrigated with sterile saline, and primary wound closure was achieved using 3-0 black silk sutures placed with a vertical mattress technique. Sutures
were removed on the seventh postoperative day. All patients received identical postoperative medications and standardized postoperative instructions.

Outcome Measures

Postoperative evaluation was performed on Days 1, 3, and 7 after surgery.

Pain intensity was assessed using the Visual Analogue Scale (VAS).

Facial swelling was evaluated using standardized linear facial measurements between the lateral canthus and gonion, tragus and commissure of the mouth, and tragus and soft tissue pogonion.

Periodontal healing was assessed by measuring probing pocket depth on the distal surface of the mandibular second molar using a UNC-15 periodontal probe before surgery, on postoperative Day 7, and at one month.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 23.0. Continuous variables were expressed as mean ± standard deviation. Normality was assessed using the Shapiro–Wilk test, while homogeneity of variance was evaluated using Levene's test. Independent sample t-tests or Mann–Whitney U tests were used for intergroup comparisons, whereas paired t-tests or Wilcoxon signed-rank tests were used for intragroup comparisons where appropriate. Statistical significance was established at $p < 0.05$.

Results

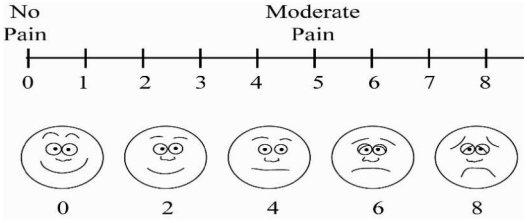
Twenty patients completed the study without any loss to follow-up.

Pain Assessment

Both groups demonstrated a progressive reduction in postoperative pain throughout the observation period. On postoperative Day 1, mean VAS scores were comparable between Group A (7.10 ± 1.79) and Group B (6.80 ± 1.23), with no statistically significant difference ($p = 0.639$).

By Day 3, Group B demonstrated significantly lower pain scores (3.30 ± 0.48) than Group A (4.80 ± 1.23) ($p = 0.002$). A similar trend was observed on Day 7, when Group B recorded significantly lower pain scores (1.40 ± 0.52) than Group A (2.00 ± 0.82) ($p = 0.041$).

Intragroup analysis demonstrated a highly significant reduction in pain from Day 1 to Day 3, Day 1 to Day 7, and Day 3 to Day 7 in both groups ($p < 0.001$).



VISUAL ANALOGUE SCALE (VAS)

Facial Swelling

Both groups exhibited the expected postoperative inflammatory response characterized by increased facial swelling during the early postoperative period followed by gradual resolution.

Intergroup comparison demonstrated significantly greater swelling in Group B on Day 1 ($p = 0.045$) and Day 3 ($p = 0.032$). However, by Day 7, swelling had substantially resolved in both groups, and no statistically significant difference was observed ($p = 0.835$).

Within-group analysis demonstrated significant increases in swelling during the early postoperative period, followed by significant reduction by the seventh postoperative day ($p = 0.001$).

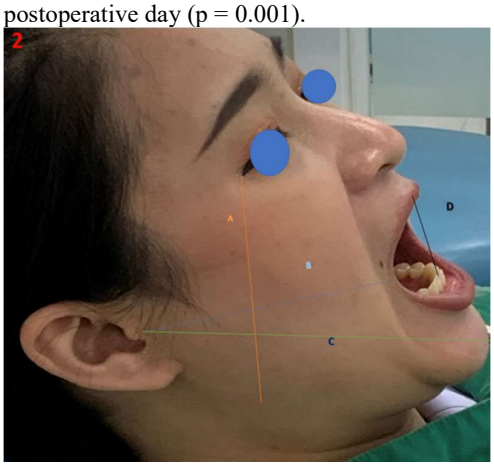


Figure: -showing different measurement described above

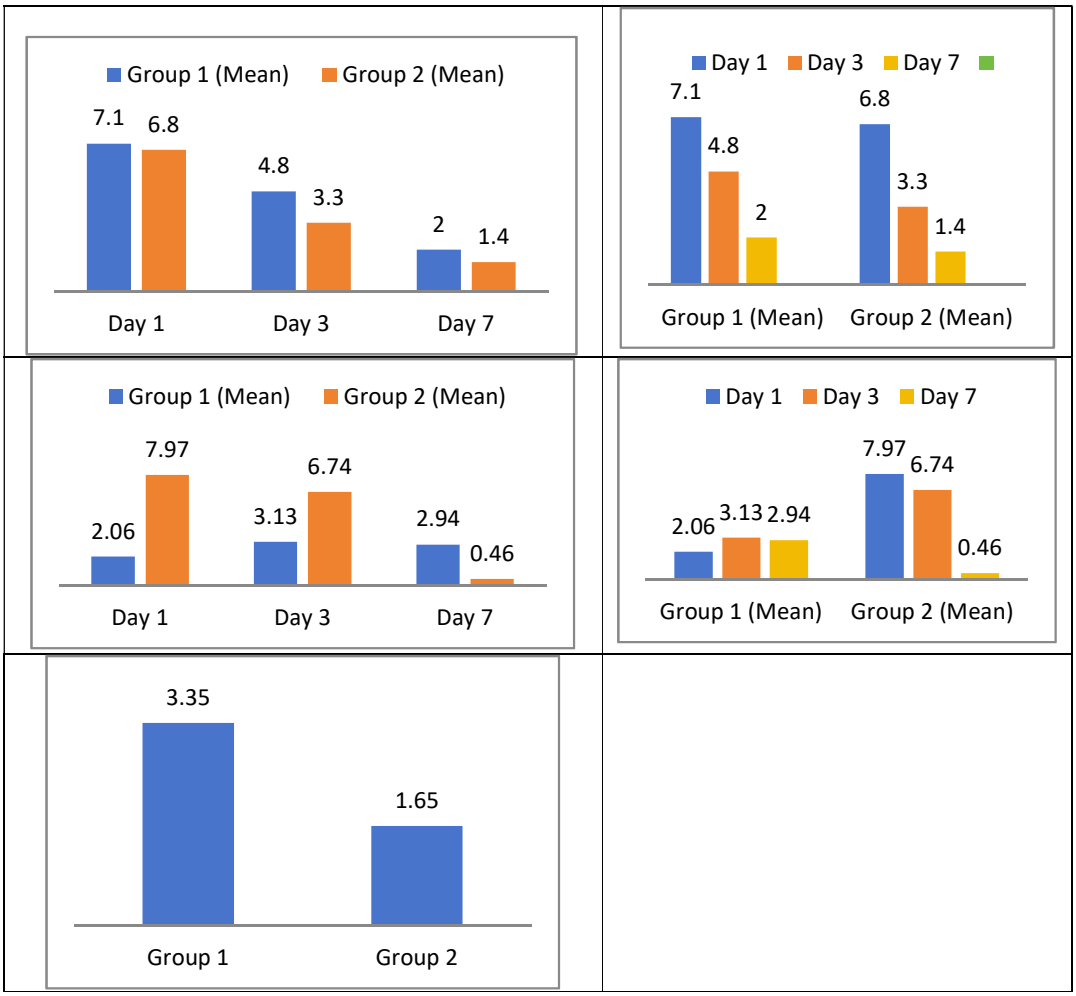
- **Gn-Lc line**: A line drawn from the lateral canthus of eye to the gonion; is marked and measured both by preop and post-operatively . The differences in the readings are compared and conclusion on the extend of swelling and its regression timing is measured.
- **Tr-Com line**: A line drawn from the Tragus of the ear to the commissure of the mouth; is marked and measured both by preop and postoperatively . The differences in the reading are compared and the conclusion on the extend of the swelling and it's regression timing is measured.
- **Tr-Pog line**: A line drawn from the Tragus of the ear to the soft tissue pogonion; is marked and measured both by preop and postoperatively. The differences in the reading are compared and the conclusion on the extend of the swelling and its regression timing is measured.

Periodontal Healing

At one month, the mean probing pocket depth was significantly lower in Group B (1.65 ± 0.87 mm) than in Group A (3.35 ± 1.05 mm), demonstrating superior periodontal healing associated with the Modified Szmyd flap ($p = 0.001$).

Overall, both flap designs produced satisfactory postoperative healing. However, the Modified Szmyd flap was associated with significantly less postoperative pain and improved periodontal outcomes compared with the conventional Three-Cornered flap.

UNC 15 Probe



Discussion

The present prospective clinical study compared postoperative outcomes following surgical removal of impacted mandibular third molars using the conventional Three-Cornered flap and the Modified Szmyd flap. The primary outcome variables included postoperative pain, facial swelling, and periodontal healing. The findings demonstrated that although both flap designs resulted in satisfactory healing, the Modified Szmyd flap produced superior postoperative outcomes with respect to pain reduction and periodontal health.

Pain is one of the most common postoperative complications following third molar surgery and is directly influenced by the extent of surgical trauma and tissue manipulation. In the present study, pain decreased progressively in both groups throughout the postoperative period. However, patients treated with the Modified Szmyd flap experienced significantly lower pain scores on postoperative Days 3 and 7. These findings suggest that preservation of soft tissue integrity and reduced flap tension associated with the Modified Szmyd design may contribute to decreased inflammatory response and improved patient comfort. Similar observations have been reported by Bello et al. and Baqain et al., who demonstrated that atraumatic surgical techniques and careful tissue handling significantly reduce postoperative pain.

Postoperative swelling represents the normal inflammatory response to surgical trauma and generally reaches its maximum within 48–72 hours before gradually subsiding. In the present study, both groups exhibited increased facial swelling during the early postoperative period, followed by marked resolution by Day 7. Although statistically significant differences were observed between groups during the initial postoperative period, swelling became comparable by the seventh postoperative day. These findings are consistent with previous studies by Ustun et al. and Laureano Filho et al., who reported that flap design primarily influences early postoperative

oedema without significantly affecting long-term resolution.

Preservation of periodontal health distal to the mandibular second molar is an important objective during impacted third molar surgery. The present study demonstrated significantly lower probing pocket depth in the Modified Szmyd flap group at the one-month follow-up, indicating superior periodontal healing. The improved periodontal outcomes may be attributed to preservation of marginal gingival attachment, reduced soft tissue trauma, improved flap adaptation, and decreased plaque accumulation during healing. These observations are in agreement with previous reports suggesting that flap design plays a critical role in maintaining periodontal integrity adjacent to the second molar following third molar surgery.

Overall, both flap designs were clinically effective and produced satisfactory postoperative recovery. Nevertheless, the Modified Szmyd flap demonstrated significant advantages in reducing postoperative pain and improving periodontal healing while providing adequate surgical access. These findings support the use of the Modified Szmyd flap as a preferable alternative to the conventional Three-Cornered flap, particularly when preservation of periodontal tissues and reduction of postoperative morbidity are important clinical considerations.

The principal limitations of the present study include the relatively small sample size and the short follow-up period of one month. Future randomized controlled trials with larger sample sizes and longer follow-up periods are recommended to validate these findings and evaluate the long-term periodontal outcomes associated with different flap designs.

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Conflict of Interest

The authors declare that they have no conflicts of interest regarding the publication of this article.

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Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of Teerthanker Mahaveer Dental College and Research Centre, Moradabad, Uttar Pradesh, India. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments.

Informed Consent

Written informed consent was obtained from all participants prior to their inclusion in the study. All participants were informed about the nature and purpose of the study, and confidentiality of patient information was maintained throughout the research.

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