

# The Impact of Different Flap Designs on Periodontal Outcomes in Alveolar Bone Cleft Surgery for Orthodontic Patients. A Randomized Control Trial

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## ABSTRACT

**Background:** Alveolar bone grafting (ABG) is a critical surgical intervention in patients with a cleft of the alveolus, aimed at reconstructing the alveolar ridge to facilitate proper eruption, periodontal support, and alignment of adjacent permanent teeth.

**Objective:** The aim of this study is to determine the impact of different flap designs on periodontal outcomes in alveolar bone cleft surgery for orthodontic patients.

**Methods:** This research comprised 86 individuals who underwent M3 extraction for either acute or chronic periodontal issues and pericoronitis. Patients were divided in two groups. Group I received envelope flap and group II received triangular flap. Outcomes were examined in terms of gingival recession (REC) reported at six locations and pain score

**Results:** In group I mean age was 35.47±20.62 years and in group II mean age was 36.51±14.74 years. 26 cases in group I and 27 in group II were males. In group I 10 (23.3%) cases had history of smoking and in group II 8 (18.6%) cases had history. There was statistical difference observed between both groups in terms of pain score and gingival recession (REC).

**Conclusion:** We concluded that envelope flap presented better outcomes as compared to triangular flap in terms of wound healing, gingival recession and pain score.

**Keywords:** Bone cleft, PPD, CAL, Flap Designs

## INTRODUCTION

A complete cleft lip and palate is associated with an alveolar cleft in almost all cases. Patients with cleft palates may have their maxillary arch function and structure restored using alveolar bone grafting (ABG)<sup>1,2</sup>. The third layer of bone graft can help close an oronasal fistula and improve oral hygiene<sup>3</sup>. Secondary alveolar bone grafting (SABG) is the standard method for treating alveolar cleft in many regions. It encourages facial growth to a larger extent than primary gingivoperiosteoplasty (GPP). Although SABG is considered the best method for repairing alveolar clefts, there are some potential side effects of the procedure, such as pain, bleeding, and a long scar at the donor site. However, these issues are extremely rare. Resorption or infection at the transplant site is another potential outcome.

Alveolar bone grafting provides the necessary bone for the erupting canine and lateral incisor. Secondary alveolar bone grafting (SABG) has been the surgical treatment of choice for restoring alveolar bone since its initial description by Boyne and Sands in 1972.<sup>1</sup> This bone grafting procedure aims to stabilize the maxillary arch and construct a uniform alveolar arch. Improving the aesthetic result, easing the process of tooth eruption, and eliminating oronasal fistulas are additional objectives<sup>4</sup>. The age at which SABG is conducted is typically determined by the eruption state of the canine or lateral incisor<sup>5</sup>, however it usually falls anywhere between 7 and 11 years old. Bone grafting will not significantly affect future growth of the maxilla because much of its transverse and vertical development has already occurred by this age.

Age, cleft type, dentition development, oral hygiene practices, tooth extraction, and other factors have been identified as potential drivers of surgical result and reoperation probability<sup>6</sup>. Better outcomes with less surgery can be achieved by identifying factors that increase the risk of failure prior to surgery.

Several periodontal operations have proposed treatments for periodontal tissue disorders<sup>7</sup>. For instance, periodontally accelerated osteogenic orthodontics (PAOO) is a very new method that has shown promise in enhancing alveolar

bone volume, treatment scope, stability after treatment, treatment duration, root resorption, and treatment scope<sup>8</sup>. Traditional PAOO that used a collagen barrier membrane, in contrast, failed to increase GT. Gingival recession is more common in people with a thin gingival phenotype after surgery.

The standard surgical procedure for gum thickening involves a combination of a connective tissue graft (CTG) and a coronally advanced flap (CAF). Previous research suggests that GT could be improved by combining PAOO with CTG or acellular dermal matrix<sup>9</sup>. When combined with PAOO, CTG has significant downsides, such as increasing postoperative morbidity, requiring two surgical sites, and reducing donor tissue availability<sup>10</sup>. It is not possible to enhance the volume of alveolar bone with CTG and CAF in patients who have skeletal problems. Further, surgery will take longer with CTG and PAOO therapy, which raises the risk of postoperative pain, hemorrhage, and problems<sup>11</sup>. Thin gingival phenotype is a potential side effect of PAOO for patients with dentoskeletal disorders; hence, other therapeutic options should be considered.

The promise of growth factor therapy to improve periodontal surgery outcomes has piqued interest in the treatment since its beginnings<sup>12</sup>. Reconstructive procedures such as fat transplantation, sinus augmentation, and intra-bony defect repair have all made use of concentrated growth factor (CGF) as a promoter of tissue regeneration. Prior studies have shown that CGF and CAF can heighten gingival recession by increasing KTW and GT. Furthermore, our previous studies demonstrated that CGF promotes gingival regeneration through the AKT/Wnt/ $\beta$ -catenin and YAP signaling pathways. Despite the promising clinical and experimental outcomes of CGF-based tissue regeneration, no research has investigated the impact of combining CGF with PAOO on the GT in patients with skeletal defects.

## MATERIALS AND METHODS

This comparative study was conducted at CMH institute of Medical Sciences / CIMS Dental College Multan/ Nishtar Institute of Dentistry Multan from February 2023 to August 2023 and comprised of 86 patients. After getting informed written consent detailed demographics were recorded. Considering 95% confidence level, power 80%, wound healing with envelop flap

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technique as 90% and 43% in triangular flap group, a minimum sample size of 86 cases (43 in each group) was calculated.

Participants could be male or female and aged 20–50 if they required surgical removal of IMTM. Orthopantomogram (OPG) measurements taken at different depths in the alveolar bone and third molar crown measurements taken on the occlusal plain were used to corroborate the diagnosis of IMTM. No patient could take part if they had a history of blood disorders, diabetes, other systemic conditions, or chronic liver disease. Prior to surgery, the orthopantomogram (OPG) radiographs of every patient were examined. Each patient's medical history was meticulously documented, and comprehensive physical exams were performed. Using a lottery procedure, the two groups were assigned at random. Patients in the envelope flap group underwent sulcular incisions covering the first two molars and a distal relieving incision all the way to the mandibular ramus. A shallow cut was made into the buccal bone at the level of the first molar. Once the mucoperiosteal flap was fully elevated, it was possible to access the buccal surface. A superficial retraction of the lingual tissues was noted. For the triangle flap group, the procedure involved making a sequence of forward-curving anterior incisions that extended from the distobuccal corner of the second molar crown all the way to the mesiobuccal cusp. Prolonged distally along the buccal side was the horizontal incision that led to the external oblique ridge. Based on the incision margin, bleeding response to palpitation, presence of granulation tissue, and tissue color, the wound's healing was deemed excellent or poor using the Landry RG criteria. A wound was considered good or great if it healed well, and bad if it didn't. We used a visual analog scale (VAS) that categorizes pain as "no pain," "mild pain," "moderate pain," or "severe pain" to measure the intensity of the discomfort. On the seventh day, pain and wound healing were observed in all cases that finished the last follow-up. Patients were asked to return for a follow-up appointment on days three and seven. An study of statistical significance was carried out using SPSS version 24.0. For qualitative data, we used percentages and frequencies, while for quantitative data, we calculated means and standard deviations (SD). A p-value of less than 0.05 was deemed significant when comparing the data from both research groups using chi-square.

**RESULTS**

In group I mean age was 35.47±20.62 years and in group II mean age was 36.51±14.74 years. 26 cases in group I and 27 in group II were males. In group I 10 (23.3%) cases had history of smoking and in group II 8 (18.6%) cases had history.(table 1)

Table-1: Demographics of the presented cases

Variables	Group I (43)	Group II (43)
Age (years)	35.47±20.62	36.51±14.74
Gender		
Male	26 (60.5%)	27 (62.8%)
Female	17 (39.5%)	16 (37.2%)
Smoking History		
Yes	10 (23.3%)	8 (18.6%)
No	33 (76.7%)	35 (81.4%)

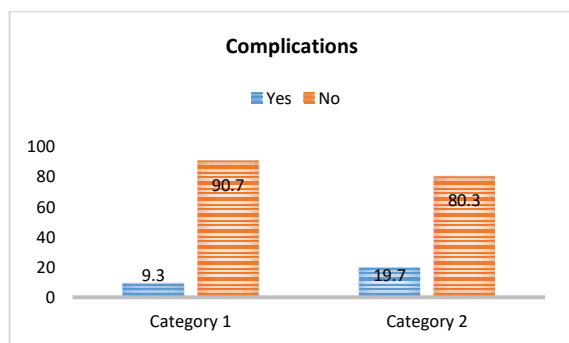


Figure-1: Comparison of complications post-operatively

There were statistical difference was observed between both groups in terms of pain score and gingival recession (REC). (table 2)

Post-operative frequency of complication in group II was higher as compared to group I with p value <0.01.(figure 1)

Table-2: Post-operative comparison of outcomes

Variables	Group I (43)	Group II (43)	P value
Pain (VAS)	1.4±2.13	3.5±2.15	<0.04
Wound healing	40 (93.02%)	35 (81.4%)	<0.05
gingival recession	8 (18.6%)	14 (32.6%)	<0.02

**DISCUSSION**

Surgical removal of an impacted third molar is one of the most common procedures performed by oral surgeons. Teeth that have impacted are often a result of an underdeveloped mandibular arch and abnormally big or tiny dental arches. After having third molars surgically removed, patients often experience inflammation-induced facial puffiness, trismus, and pain<sup>10</sup> Various flap methods have been developed and tested with the aim of improving surgical access and reducing complications. Their primary classifications are eleventh-century envelope flaps and triangle (vertical) flaps. Comparing the postoperative results of two different flap design procedures for removing an impacted third tooth from the jaw was the primary goal of this study.

The fact that this study found a strong correlation between patient satisfaction and both the triangle flap and envelope flap groups suggests that factors other than flap type are likely to influence patient satisfaction. Patient satisfaction was significantly influenced by the surgeon's effectiveness and the clarity of the provided clinical information about the treatment, according to Balaguer-Martí et al.<sup>12</sup>. There was a statistically significant difference in VAS scores by the end of day 7, while subjects who had surgery utilizing a triangular flap reported less discomfort on days 4, 5, and 6. Consistent with this finding, Kirk et al.<sup>13</sup> determined that the two flap designs resulted in significantly different levels of postoperative pain.

According to earlier accounts, the envelope flap has several advantages: it allows for better adaptation of the gingival edge, prevents pockets from forming distal to the mandibular second tooth, eliminates the possibility of damaging facial arteries or veins, and reduces the risk of infection by not storing food. There was talk of using it to sidestep suturing problems in the vestibule as well. And yet, the triangular flap provides better access and visibility for deeply imbedded impaction. It is also believed that a triangle flap is simpler to retract from the surgical site.<sup>11</sup> Consistent with our results, Desai A. and colleagues found no statistically significant difference in wound healing between patients with IMTM who had surgical removal using triangle or envelope flap designs. Better postoperative outcomes, such as less facial swelling and better opening of the mouth, were observed with a triangle flap design, according to Baqain et al.<sup>14,15</sup> An Iranian study found that the envelope flap approach led to a significantly greater rate of healing compared to the triangle flap (p=0.005)<sup>6</sup>

Every flap design has its own set of pros and cons. The group that received an envelope flap had lower VAS scores, according to Erdogan et al.<sup>16</sup> Patients reported less discomfort with the envelope flap design as compared to the triangle flap. This occurred because the flap did not extend all the way to the back of the first tooth, reducing the amount of skin exposed at the surgery site. Since both the standard and modified triangle flaps extend incisions to the sulcus, McCagie argued that this results in increased edema. The new flap design lowered edema compared to the bayonet flap because it did not extend into the sulcus. It is believed that this issue can be circumvented by utilizing an envelope incision, which only extends anteriorly to the gingival trough. Koyuncu showed that after four days, the modified triangle group had less swelling and pain than the envelope group, however this goes against what we see here<sup>18</sup> Compared to other

designs, the envelope flap performs better on days 1, 3, and 7 following surgery.

## CONCLUSION

We concluded that envelope flap presented better outcomes as compared to triangular flap in terms of wound healing, gingival recession and pain score.

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