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Evaluation of Crestal Bone Loss in Flapped vs Flapless Implant Placement Technique: A Randomized controlled trial

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ABSTRACT

Aim To evaluate the flapless and flap techniques in terms of crestal bone level. Materials and methods This prospective randomized clinical trial was conducted involving a total of 60 patients aged 18–55 years, who required replacement of a single missing tooth in the posterior mandibular region. Participants were randomly divided into two equal groups (n = 30 each), Group A (Flapless technique) wherein Implant placement was done using a soft tissue punch Group B (Flapped technique) wherein Implant placement was done following full-thickness mucoperiosteal flap elevation Results All 60 patients completed the 6-month follow-up period without any reported complications. The implant survival rate was 100% in both groups. Group A showed a statistically significant increase in crestal bone loss between 3 and 6 months (P = 0.011). Group B also demonstrated significant bone loss from 3 to 6 months (P = 0.001). Conclusion Flapless technique of dental implant placement has significantly less crestal bone loss compared to the flap technique. Therefore, flapless implant surgery can be considered as a promising alternative to conventional flap.

KEYWORDS: *Osseointegration, Crestal Bone Loss, Flapless and Flap*

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1. INTRODUCTION

Dental implants facilitate mastication, phonation, and esthetics and are one of the most common treatment modalities used for the rehabilitation of missing teeth. To provide support for the dental prosthesis, implants form a direct connection with the surrounding bone known as "osseointegration.".[1] It is a biological consequence of a well-performed surgical procedure, which in some instances is not achieved and can lead to implant failure.[2]

Osseointegration in dental implantation is typically done by using a flap-based approach that involves reflection of soft tissue flap and also necessitates suturing following the placement of dental implants. Another technique wherein a flapless approach has been developed wherein a smaller bit of soft tissue overlying the edentulous crestal ridge undergoes surgical removal which is sufficient for the placement of an implant. There is no requirement for sutures.[2,3,4,5]

No real conclusion has been reached to date which would clearly state the benefit of one approach over the other.[1] This study was thereby designed to evaluate the flapless and flapped techniques in terms of crestal bone level.

2. MATERIALS AND METHODOLOGY

Study Design and Population
This prospective randomized clinical trial was conducted in the Department of Periodontology and Implantology at Pacific dental college and Research centre, involving a total of 60 patients aged 18–55 years, who required replacement of a single missing tooth in the posterior mandibular region.

Inclusion Criteria
- Healthy individuals
- Adequate bone volume confirmed on cone beam computed tomography (CBCT), with a minimum width of 6 mm and height of 10 mm
- Good oral hygiene status (plaque index <20%)
- Non-smokers

Exclusion Criteria
- Systemic diseases
- History of radiotherapy or chemotherapy
- Poor oral hygiene or periodontal diseases
- Requirement for simultaneous bone augmentation

Participants were randomly divided into two equal groups (n = 30 each)
Group A (Flapless technique): Implant placement using a soft tissue punch
Group B (Flapped technique): Implant placement following full-thickness mucoperiosteal flap elevation

Surgical Protocol
All surgical procedures were performed under local anesthesia. In Group A, a circular soft tissue punch was used to access the underlying alveolar bone, after which osteotomy preparation and implant placement were performed. In Group B, a mid-crestal incision was made, and a full-thickness mucoperiosteal flap was elevated to expose the bone prior to osteotomy and implant placement.

Implants of uniform dimensions (4.0 mm diameter, 10 mm length) were placed in both groups. Healing abutments were connected immediately, and sutures were applied only in the flapped group.

Postoperative care, including medications and oral hygiene instructions, was standardized for all participants. Follow-up evaluations were conducted at 7 days, 3 months, and 6 months post-surgery.

Radiographic Evaluation
Standardized periapical radiographs were obtained at baseline (immediately after implant placement), 3 months, and 6 months using a customized film holder to ensure reproducibility of angulation and positioning.

Digital measurements were taken from the implant–abutment junction to the first bone-to-implant contact at both mesial and distal aspects. Crestal bone loss was calculated as the difference between baseline and follow-up measurements.

Statistical Analysis
Data were analyzed using SPSS version 21 using paired t-tests and unpaired t-tests. Descriptive statistics were expressed as mean ± standard deviation (SD).A P-value < 0.05 was considered statistically significant.

3. RESULTS

All 60 patients completed the 6-month follow-up period without any reported complications. The implant survival rate was 100% in both groups. The summarized results are presented in Table 1.

Intragroup Analysis
Group A (Flapless): Showed a statistically significant increase in crestal bone loss between 3 and 6 months (P = 0.011).

Group B (Flapped): Also demonstrated significant bone loss from 3 to 6 months (P = 0.001).

4. DISCUSSION

The present study demonstrated that Flapless technique of dental implant placement has significantly less crestal bone loss compared to the flap technique at 3 and 6-month period, emphasizing that preservation of periosteal blood supply and minimal trauma to the surrounding tissues contribute to improved bone stability. Loss of alveolar crestal bone is more in flapped technique, due to a decrease in supra-periosteal vascular supply. In addition, other related changes may include postoperative loss of blood and/or hemorrhage, and pain alongside discomfort for a patient. [2]

Similar findings of reduced bone loss with flapless technique were noted by You et al.[6] and Gupta et al.[7] who observed a greater reduction in crestal bone height in implants placed when the mucoperiosteal flap was raised. The flapless surgical technique is performed by either reaching the alveolar bone by punching out a minor amount of soft tissue that may be required for preparing an osteotomy site or performing the osteotomy procedure directly via overlying soft tissue. It has been suggested that the surgical technique without raising a mucoperiosteal flap helps in minimizing inter-proximal loss of crestal bone.[1,8]

Marginal bone loss is determined by measuring the interproximal height of bone which is defined as the distance between the apical ends of the first thread of the implant and the most coronal point of the interproximal crestal bone . In a flapless technique, the intact blood supplies from soft tissue assist in the maintenance of nutrition, which is a critical factor in preventing initial bone loss around an implant. This results in the maintenance of soft tissue contours mainly for esthetics due to better quality of osseointegration.[1,8]

A study by Mishra et al[9] concluded that there are not any significant differences in the crestal bone with both flap and flapless techniques. Comparatively, the flapless approach showed a lesser crestal bone height reduction, which was statistically significant. Lin et al.[10] and Lemos et al.[11] could not establish a significant difference in the survival rate or crestal bone loss between the two techniques which was not in accordance to that reported in our study.

Hence, to conclude, Flapless placement of implant can positively influence crestal bone loss in comparison with conventional flap technique.

5. CONCLUSION

Flapless technique of dental implant placement has significantly less crestal bone loss compared to the flap technique. Therefore, flapless implant surgery can be considered as a promising alternative to conventional flap

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Conflicts of interest
There are no conflicts of interest.

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Table 1. Showing Crestal Bone Loss in mm using Flapless and Flapped Implant placement Technique

	3 Months	6 Months	P value
Group A Flapless	**0.35 ± 0.21**	**0.49 ±0.36**	**<0.001**
Group B Flapped	**0.54 ± 0.12**	**0.70 ± 0.24**	**<0.001**