ORIGINAL ARTICLE

Comparative Evaluation of Peri-Implant Vertical Crestal Bone Changes Following Implant Placement with 'Flapless' and 'With-Flap' Techniques – In Vivo Study

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ABSTRACT

Objective: The aim of the study was to compare Peri-implant vertical crestal bone changes around implants using grid intraoral periapical (IOPA) radiograph with long cone paralleling technique.

Material and Method: The study comprised of 10 patients aged from 20 to 60 years in which 20 implants were placed. Out of 20 Implants, ten were placed using Flap technique and comprised Group 1 while remaining ten implants placed using Flapless technique and comprised Group 2.

Observation: It was observed that from baseline to 3rd and 6th month, the mean crestal bone changes were lower in group II as compared to group I, but the difference was not statistically significant ($p>0.05$).

Conclusion: The results suggest that the implants placed with Flapless technique remain stable and exhibit clinically relevant osseointegration similar to when implants are placed with- Flap procedure.

Keywords: Dental implants, delayed loading, flapless surgery, peri-implant mucosa

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INTRODUCTION

The introduction of implants in dentistry by P.I .Branemark led to more reliable, functional andesthetic alternative to fixed and removable prosthetic appliances.[1]It has been an elusive dream of replacing the missing teeth with an artificial analog part of dentistry for thousands of years. The coincidental discovery by Branemark and his coworkers in 1952, of the tenacious affinity between living bone and titanium oxides termed osseointegration, propelled dentistry into a new age of reconstructive dentistry.[2] According to Branemark protocol, a stress-free healing period is one of the most emphasized requirements for predictable implant integration. According to this protocol, an incision in the mucosa or the mucobuccal fold was made, and then a flap was reflected to expose the underlying bone. The implants were then placed and the flaps repositioned with sutures.[3]

More recently, flap designs for implant surgery have been modified and concept of flapless implant surgery was introduced. In this procedure, a dental implant is installed through the mucosal tissues without reflecting a flap. A motor-driven circular tissue punch or a circumferential incision is used to remove the soft tissue at the site of the dental implant . Drilling with a round bur directly to prepare the implant bed through the soft tissue is another method of flapless implant surgery.

Besides the suggested reduced crestal bone resorption, flapless surgery is associated with several other advantages. These include,(1) a reduced surgical time and less traumatic surgery, which results in minimal

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bleeding and an accelerated post-surgical healing and also allows the patient to resume normal oral hygiene procedures immediately after surgery, and (2) better maintenance of the soft tissue profiles, including the gingival margins of adjacent teeth and the interdental papilla.[4] Despite these evident advantages, the major drawback of flapless implant surgery is that it is a ''blind'' surgical technique. As a consequence, thermal damage can occur due to reduced access for external irrigation during the implant bed preparation.

METHODOLOGY

The present study was conducted in the Department of Periodontology and Implantology at D J College of Dental Sciences & Research, Modinagar, Uttar Pradesh (India). Patients desirous of replacement of missing teeth were selected amongst the outpatient Department of Periodontology and Implantology, D.J College of Dental Sciences & Research, Modinagar. Ethical clearance was obtained from the Ethics Committee of the Institute, before the start of study. All the subjects were explained about the study and written informed consents were obtained.

An attempt was made to evaluate radiographically the "marginal bone level in the peri-implant region of patients treated "with-flap" and "flapless" technique. The study comprised of 10 patients aged from 20 to 60 years.Each patient received two implants one using flap technique that comprised Group 1, while other implant using flapless technique that comprised of Group 2.

INCLUSION CRITERIA

Patients, who were co-operative, motivated and committed; with tooth loss because of trauma, endodontic failure, root resorption after reimplantation; with adequate amount of bone volume and bone density to accommodate an implant of appropriate dimension; with healthy, sufficient and stable soft tissue architecture; edentulous sites free from infection; Adjacent teeth, intact, restored with functionally good restorations, free of calculus and with stable periodontal condition; and willing to follow recommended plaque control and follow-up regimen.

EXCLUSION CRITERIA

Patients, who were unable/unwilling to undergo any surgical procedure; with insufficient bone quality or compromised status of the local site as determined by radiographs and clinical inspection; with history of radiotherapy in the head and neck region; with poor compliance and traumatic oral habits; with poor oral hygiene with no possibility of improvement; with known history of diabetes mellitus or other bone pathologies; with insufficient interarch space to accommodate the adequate prosthetic component; had perforation and /or loss of labial bony plate following tooth removal; with TMJ disorder; with unrealistic expectation and psychological problems and pregnant at the time of consideration.

SURGICAL PROCEDURE

Flap Technique: After achieving adequate local anesthesia, crestal incisions were placed on the edentulous site with no. 15 B.P. blade. The crestal incisions were extended to the mid-buccal and mid lingual crevices of the adjacent tooth. Full-thickness flaps were elevated using the periosteal elevator.

Stage I surgery: Drilling of the osteotomy site was done according to the manufacturer instructions. The apical area was prepared for the placement of the implant. Bone drilling was performed at revolutionary rates recommended by Branemark i.e. 1000-1500 rpm. To minimize trauma to the bone, drilling was performed at low speeds, the area was profusely irrigated with the chilled saline solution, to avoid overheating and thus necrosis of alveolar bone and drills were used in progressively increasingly diameters.

Implant placement: Implants of decided dimension were placed at a speed of 20-30 rpm. During implant placement care was taken for angulation of placement. After completion of implant site preparation, Titanium implants were placed with the collar of the implant at the level of the bone crest on the labial aspect. All implants were placed with primary stability and were completely housed within the implant osteotomy.

Suturing of the flap over osteotomy site: The flap margins were then repositioned and sutured tension free by applying simple interrupted with a 3- 0 braided silk suture. After about 7-10 days, sutures were removed.

The patient was then advised to follow standard post-operative instructions, which include ice packs, soft

high nutrient diet, post-operative medications which consisted of appropriate antibiotic (amoxicillin 500 mg, 4 times a day), analgesic (ibuprofen 400 mg 4 to 6 hours as needed for pain). Patients were instructed not to brush the surgical site, but rather to rinse with 0.2% chlorhexidine gluconate twice daily for 15 days.

Flapless Technique: Before surgery, alginate impression and cast fabrications were carried out for all patients. A surgical stent was fabricated using soft cure acrylic resin and placed in patient's mouth. Then drilling with a round bur directly to prepare the implant bed through the soft tissue was done, which was followed by sequential drilling to get a final osteotomy to accommodate the implant. A periapical radiograph was taken during the osteotomy to ensure proper angulation and length of the proposed implant site. All patients received a root-form endosseous implant via flapless surgery.

Post-surgical Follow up: the patients were called up for the post-operative checkup after 24hrs. In the case of patients done under Flap technique, sutures were removed seven days after surgery. Regular follow-up of all patients was done at 1st day, one week, 15 days, 1month, 3rd month and 6th month and the required investigations were done whenever needed.

Second Stage Surgery: Three-four months after implant placement second stage surgery was done. In the case of Flap group, mid crestal incision was placed, and the flap was reflected. In the Flapless group, a circumferential incision utilizing a surgical blade was used to remove the soft tissue at the site of the dental implant with no surgical flap elevation. Cover screw was removed, and gingival former was placed for 15 days. This resulted in the formation of the gingival cuff or gingival collar.

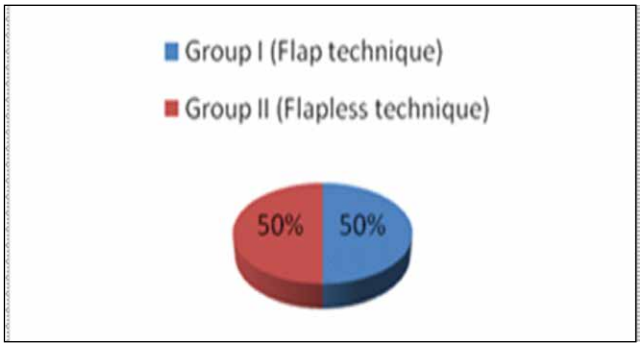
Gingival former was removed with the help of 0.50 hex driver, and abutment was placed over implant and screw was tightened. Impressions were made using addition silicone impression material with a closed tray technique. The dental laboratory fabricated porcelain fused to metal prosthesis. The milled abutment was placed on the dental implant, and abutment screw of the prosthesis screw was tightened. The cement retained prosthesis was luted with zinc polycarboxylate cement. Patients were reviewed at the 1st month, 3rd month and 6th month with evaluation of radiographic parameters.

RESULTS

The study comprised of 10 patients aged from 20 to 60 years in which 20 implants were placed. (Table 1, Graph 1).

Table 1: Group wise distribution of Cases

S. No.	Group	Description	No. of Implants	Percn-age
1.	I	Flap technique	10	50
2.	II	Flapless technique	10	50



Graph 1: Group-wise distribution of Cases

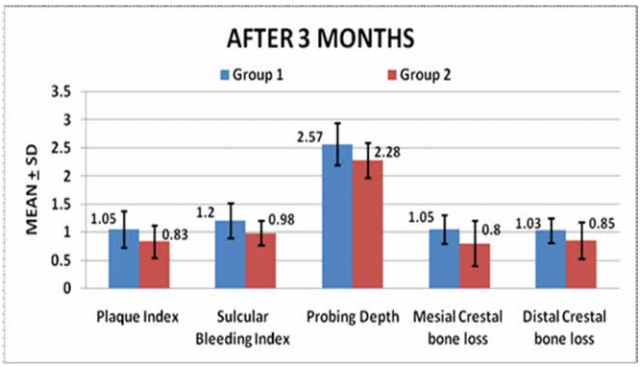
After 3 months, crestal bone loss on mesial side was found to be slightly more in Group 1 compared to Group 2, but difference in crestal bone loss on mesial side was statistically.

Table 2: Comparison of two Groups for 3rd Month

Groups		Crestal Bone Loss [Mean ±Sd]	
		Mesial	Distal
Group 1	3rd Month	1.05 ± 0.26	1.03 ± 0.22
Group 2	3rd Month	0.80 ±0.40	0.85 ± 0.33
Independent t – test	t	1.646	1.434
	p – value	0.117	0.169

not significant (p>0.05). After 3 months, crestal bone loss on distal side was found to be more in Group 1 compared to Group 2, but difference in crestal bone loss on distal side was statistically not significant (p>0.05) (Table 2, Graph 2)

Graph2: Comparison of two Groups for 3rd month

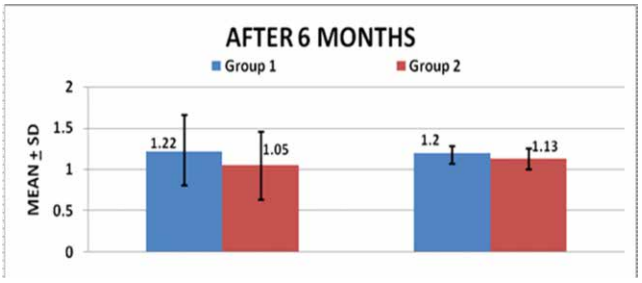


After 6 months, crestal bone loss on mesial side was found to be slightly more in Group 1 compared to Group 2, but difference in crestal bone loss on mesial side was statistically not significant (p>0.05).After 6 months, crestal bone loss on distal side was found to be more in Group 1 compared to Group 2, but difference in crestal bone loss on distal side was statistically not significant (p>0.05) (Table 3, Graph 3).

Table 3: Comparison of two Groups for 6th Month

Groups		Crestal Bone Loss [Mean ±Sd]	
		Mesial	Distal
Group 1	6th Month	1.22 ± 0.25	1.20 ± 0.16
Group 2	6th Month	1.05 ± 0.40	1.13 ± 0.34
Independent t – Test	t	1.170	.593
	p – Value	0.257	0.560

Graph3: Comparison of two Groups for 6th Month

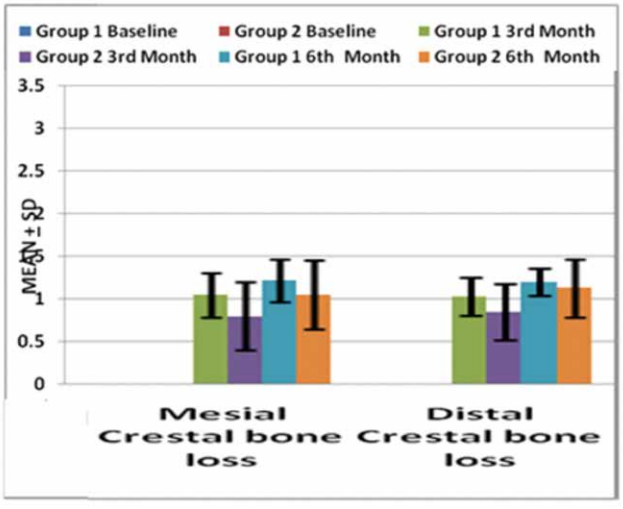


The mean crestal bone levels around implants was evaluated and compared at different time points that is, baseline, 3 and 6 month after implant placement on both the proximal aspects (mesial and distal) for both techniques separately (Table 4, Graph 4).

Table 4: Overall Assessment of Group 1 and Group 2 from baseline to 6 months

Groups		Crestal Bone Loss [Mean ±Sd]	
		Mesial	Distal
Group 1	Baseline	0.00 ± 0.00	0.00 ± 0.00
Group 2	Baseline	0.00 ± 0.00	0.00 ± 0.00
Group 1	3rd Month	1.05 ± 0.26	1.03 ± 0.22
Group 2	3rd Month	0.80 ± 0.40	0.85 ± 0.33
Group 1	6th Month	1.22 ± 0.25	1.20 ± 0.16
Group 2	6th Month	1.05 ± 0.40	1.13 ± 0.34

Graph 4: Overall Assessment of Group 1 and Group 2 from baseline to 6 months



DISCUSSION

Dental implant treatment has recently become popular for the oral rehabilitation, replacing conventional dental treatments. Originally, to minimize the risk of implant failures, the two-stage surgical approach using submerged implants was suggested with the concept of a load-free healing period of at least 3–4 months in the mandible and 6–8 months in the maxilla. When placing dental implants, a flap is reflected to provide better visualization of implant recipient sites, and protection of some anatomical landmarks (i.e., foramina, maxillary sinuses).[5] It also helps in reducing risk of bone fenestration or perforation when a limited amount of bone is available, the increased amount of surgical morbidity due to an increased amount of surgical access, increased trauma, and increased tissue and bone loss.

However, flap elevation is related to some degree of morbidity and discomfort due to an increased amount of surgical access and increased trauma to the tissues. Ultimately, flap procedures have the potential for increased postoperative morbidity, such as swelling and hemorrhage, need for sutures and suture removal.

Previous studies have also revealed that flap reflection often results in gingival recession and bone resorption around natural teeth. To minimize the possibility of post-operative peri-implant tissue loss and to overcome the challenge of soft tissue management during or after surgery, the concept of flapless implant surgery has been introduced for the patients with the sufficient bone volume in the implant recipient site.

Flapless implant surgery is becoming an alternative protocol for dental implant placement. Flapless implant surgical procedures are typically performed through the mucosal tissue without reflection of the soft tissue covering the alveolar bone.The benefits of this approach are largely due to the reduced amount of tissue trauma necessary to place the dental implant. Flapless procedures, however, also tend to be more difficult due to the inability of the surgeon to directly visualize anatomical landmarks and vital structures. Advantages of the procedure include decreased surgical time, less trauma, improved esthetics and increased patient comfort. It prevents the potential post-operative bone resorption which is associated with flap procedures.[5] A mean crestal bone loss < 1.5 mm during the first year after loading and < 0.2 mm/year after that has been proposed as one of the major success criteria according to Albrektsson.[6]

The flapless approach requires the use of a surgical guide and osteotomy preparation. Concerns are that tissues might be forced into the osteotomies potentially compromising osseointegration. The results of this study suggest that flapless implant placement is as successful as the placement of the implants following mucoperiosteal flap reflection. Patients treated with this approach must be carefully treatment planned and have sufficient bone volume for implant placement.[7] Radiographic evaluation of Intraoral Periapical Radiograph of the implant at mesial and distal sites revealed that there was the decrease in bone height indicating bone remodeling around the implants. Early plaque control plays an important role in promoting the health of the peri-implant mucosa and in preventing peri-implant bone loss.[8,9] The maintenance of healthy soft tissue adjacent to flapless implants may also contribute to the minimal bone loss in this study.

The results of our study clearly show that there was an increase in marginal mean bone level at distal and mesial location at 3rd and 6th months in both the groups. From the baseline to 3rd and 6th-month distal location had a higher bone loss in group I as compared to group II. When comparing both the groups, mean crestal bone changes were lower in group II as compared to group I, but the difference was not statistically significant ($p>0.05$) which were similar to early studies conducted by Malo *et al*.,[10] Caneva *et al*.,[11] and Nickenig *et al*.[12]

The presence of small sample size of 20 implant insertion only; short span of follow-up visits i.e., baseline, 3rd month and 6th month; and absence of histological studies to ascertain its advantages over the conventional approach were limitations of the present study. A long-term study with more sample size, use of periotest, resonance frequency analysis or ostell mentor devices are certainly better methods to assess implant stability and outcome and use of advanced radiographic techniques like CBCT and MRI for pretreatment implant site evaluation.

CONCLUSION

Within the limitations of the present study, the data obtained by periodic assessment of the parameters indicates that all the implants osseointegrated

successfully as indicated by the described success criteria. There was 100% success rate of implants at six months follow-up. It can be concluded that, in both with-flap and flapless technique during the six months follow-up, changes in hard tissues were not statistically significant, thus implants placed with flapless technique remain stable and exhibit clinically relevant osseointegration similar to when implants are placed with-flap procedure.

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