10.5005/jp-journals-10024-2363

ORIGINAL RESEARCH

Crestal Bone Changes around immediately loaded Single-piece Implants using Flap and Flapless Technique: A Radiographic Study

[1]Nancy Singla, [2]Sandeep Kumar, [3]Shashikala Jain, [4]Sunita Choudhary, [5]Navleen Dandiwal, [6]Kulashekar R Nandalur

ABSTRACT

Aim: With the trend shifting toward the minimally invasive surgeries in implant surgery, the flapless technique of implant placement is gaining popularity among the implantologists. This study was done to assess the crestal bone loss level in flap and flapless surgery at follow-up periods of 0, 1, and 3 months.

Materials and methods: Patients presenting with missing teeth requiring dental implants for rehabilitation were included in the study. Implant placement was done in 10 patients with traditional flap technique, while in other 10 patients, flapless technique was performed after determining the availability of sufficient bone width with ridge mapping. Radiographical follow-up was done for 3 months at 0-, 1-, and 3-month intervals.

Results: It was observed that for most of the flapless cases, the bone loss settled at 1st thread or just below the implant collar after 3 months.

Conclusion: It was seen that crestal bone height was reduced in both flap and flapless techniques. On comparing the bone loss, the flapless approach showed statistically significant lesser reduction as determined by radiovisiography.

Clinical significance: The study has been done to evaluate crestal bone level using flap and flapless technique. It was seen that reduction of crestal bone height was seen in both flapless and with flap techniques. However, on comparison, less bone resorption was observed in flapless technique.

Keywords: Bone loss, Dental implant, Flap, Flapless.

How to cite this article: Singla N, Kumar S, Jain S, Choudhary S, Dandiwal N, Nandalur KR. Crestal Bone Changes around immediately loaded Single-piece Implants using Flap and Flapless Technique: A Radiographic Study. J Contemp Dent Pract 2018;19(8):949-954.

Source of support: Nil

Conflict of interest: None

[1-5]Department of Prosthodontics, Surendera Dental College & Research Institute, Sri Ganganagar, Rajasthan, India

[6]Department of Prosthodontics, College of Dentistry, Jazan University, Jazan, Kingdom of Saudi Arabia

Corresponding Author: Sandeep Kumar, Department of Prosthodontics, Surendera Dental College & Research Institute Sri Ganganagar, Rajasthan, India, e-mail: mdssandy07@gmail.com

INTRODUCTION

The introduction of osseointegrated implants in dentistry represented a turning point in the exciting era of revolutionary therapeutic change. The original concept proposed by Branemark et al[1] was a two-stage surgical procedure. Following placement, the implant was covered by the mucosa and the site was left to heal.[2] The two-piece implant (TPI) design has the direct connection of implant and abutment, thus making it weak. In TPI, there can be local inflammation around the implant due to microleakage.[3] The one-piece implant (OPI) design is unique because abutment is attached to the implant which makes it a single unit.[4,5] Thus, this design of OPI eliminates the microgap between abutment and implant. The procedure for placement of OPI can be either flapless or by raising the flap.

In the flapless surgical technique, soft tissue from the implant site is removed with the help of tissue punch,[6-8] or the osteotomy is directly prepared through the soft tissue.[9,10] Gomez-Roman[11] recommended this technique to reduce interproximal bone loss and possible loss of papillae, but Campelo and Camara[12] suggested the raising of flap, when there is need to manipulate the desired soft-tissue position. After one-stage surgery, implant can be loaded with a provisional restoration at the same appointment or shortly thereafter. Depending upon the time interval, loading can be immediate, early, or delayed. Recently, the concept of loading implants immediately after placement has become increasingly popular.

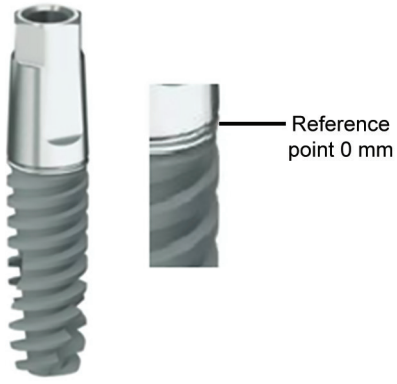


Fig. 1: Reference point used in the study

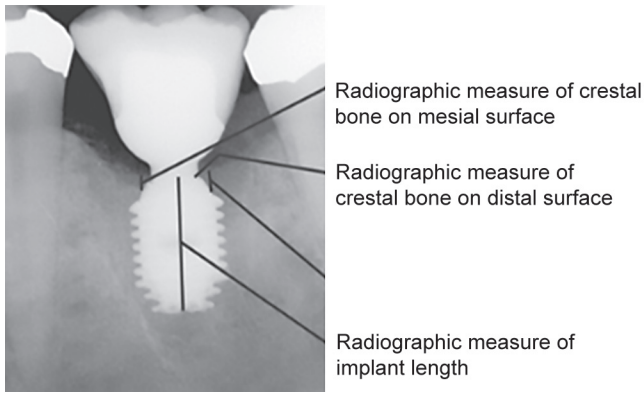


Fig. 2: Radiographic measurements

The aim of the present study was to assess and compare the changes in crestal bone heights around implants which are placed using with flap or flapless technique.

MATERIALS AND METHODS

Patients aged between 30 and 50 years were selected and their informed consents were obtained. A total of 20 implants were placed—10 using flapless and 10 with flap technique. Preoperatively, detailed history was taken and clinical examination had been done along with preoperative radiographical assessment. This evaluation consisted of medical history, clinical examination, radiographic assessment, and study cast. An intraoral periapical radiograph and orthopantomogram (OPG) was done for all patients. Before implant placement, ridge mapping was done using bone gauge to determine the bone width. Preoperative radiograph was taken to determine the length of implant. All procedures were carried out under strict aseptic conditions.

For group I, flapless procedure was followed. Tissue punch was used at the site of implant placement. For group II, flap was raised before placing the implant. Crevicular incision with releasing incision was given at the site of implant placement using 15 no. Bard parker blade. Full-thickness mucoperiosteal flap was raised using mucoperiosteal elevator. Adin's single-piece implants of sizes 3.3 × 13, 3.3 × 11.5, 3.6 × 13, 3.6 × 11.5, 4.2 × 13, and 4.2 × 11.5 mm were used. The osteotomy was prepared to desired width and depth by means of sequential drilling. Implant of selected dimensions was placed at the site. Single-piece implants were inserted into desired position and after 48 hours, provisional restorations were cemented using zinc phosphate cement. Patients were recalled at 1 week, 1 month, and 3 months after surgery.

Radiographic bone-level changes were measured on standardized periapical radiograph/OPG. The lower corner of the straight cylindrical portion of the implant was used as reference point (Fig. 1).[1] Bone levels were measured on the mesial and distal sides of each implant.

To rule out radiographic error, the implant size was taken as reference.

Correction for magnification error[2] (Fig. 2):

Corrected crestal bone level = Measured bone level × (actual implant length/measured implant length)

Data were statistically analyzed.

RESULTS

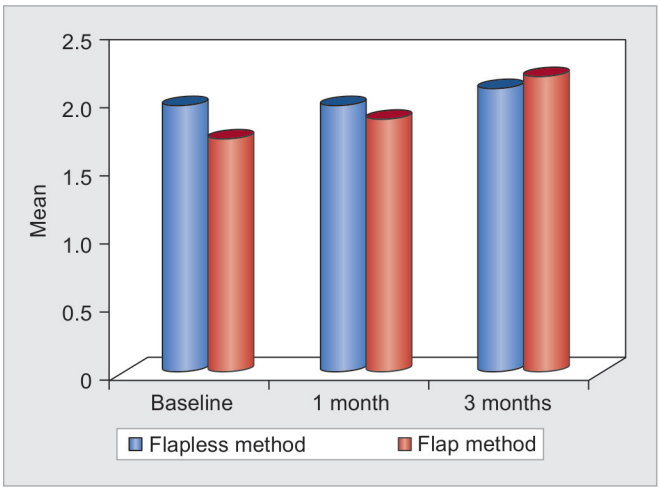
Table 1 and Graph 1 demonstrate comparison of crestal bone loss among different time intervals on mesial side in group I (flapless method); mean loss at 0 month was 1.99 mm, at 1 month, it was 2.02 mm, and at 3 months, it was 2.11 mm. Table 2 and Graph 1 demonstrate comparison among different time intervals on mesial side in group II (with flap method); mean loss from 0 month was 1.74 mm, at 1 month, it was 1.89 mm, and at 3 months, it was 2.19 mm. This means that rate of bone loss using flapless method was not clinically significant.

Graph 2 and Table 3 demonstrate comparison at different time intervals on distal side in group I (flapless method); mean loss at 0, 1, and 3 months was 2.5, 2.53, and 2.6 mm respectively. This means that rate of loss of bone around implants using flapless method was not statistically significant. Table 4 and Graph 2 demonstrate comparison of crestal bone loss at different time

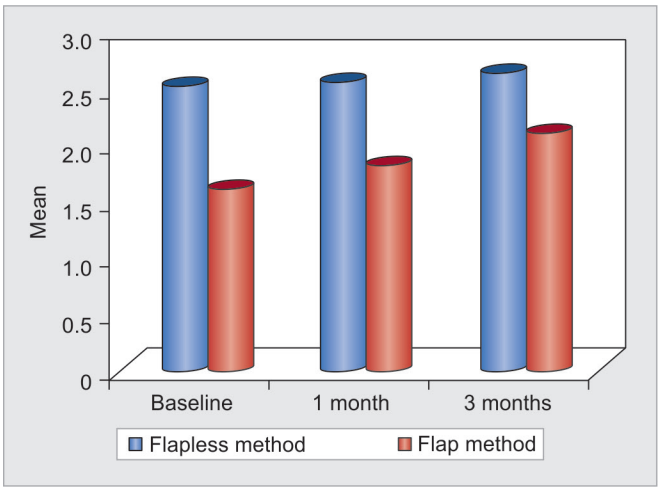
Table 1: Comparison of mean bone loss between different time intervals for flapless method on mesial side

Time intervals	*Mean ± SD (mm)*	*Change mean ± SD (mm)*	*t-test*	*p-value*
Month 0	1.99 ± 0.36	0.03 ± 0.01	0.19	0.85
Month 1	2.02 ± 0.34			
Month 1	2.02 ± 0.34	0.09 ± 0.03	0.62	0.54
Month 3	2.11 ± 0.31			
Month 0	1.99 ± 0.36	0.12 ± 0.04	0.79	0.44
Month 3	2.11 ± 0.31			

SD: Standard deviation



Graph 1: Mean bone loss of groups I and II on mesial side



Graph 2: Mean bone loss of groups I and II on distal side

Table 2: Comparison of mean bone loss between different time intervals for the flap method on mesial side

Time intervals	*Mean ± SD (mm)*	*Change mean ± SD (mm)*	*t-test*	*p-value*
Month 0	1.74 ± 1.02	0.15 ± 0.08	0.32	0.75
Month 1	1.89 ± 1.26			
Month 1	1.89 ± 1.26	0.3 ± 0.19	0.59	0.56
Month 3	2.19 ± 1.01			
Month 0	1.74 ± 1.02	0.45 ± 0.22	0.99	0.33
Month 3	2.19 ± 1.01			

SD: Standard deviation

Table 3: Comparison of mean bone loss between different time intervals for the flapless method on distal side

Time intervals	*Mean ± SD (mm)*	*Change mean ± SD (mm)*	*t-test*	*p-value*
Month 0	2.5 ± 0.99	0.03 ± 0.01	0.07	0.94
Month 1	2.53 ± 0.97			
Month 1	2.53 ± 0.97	0.07 ± 0.03	0.17	0.87
Month 3	2.6 ± 0.91			
Month 0	2.5 ± 0.99	0.1 ± 0.02	0.24	0.82
Month 3	2.6 ± 0.91			

SD: Standard deviation

Table 4: Comparison of mean bone loss between different time intervals of the flap method on distal side

Time intervals	*Mean ± SD (mm)*	*Change mean ± SD (mm)*	*t-test*	*p-value*
Month 0	1.59 ± 0.89	0.2 ± 0.11	0.49	0.63
Month 1	1.79 ± 0.92			
Month 1	1.79 ± 0.92	0.28 ± 0.16	0.69	0.5
Month 3	2.07 ± 0.9			
Month 0	1.59 ± 0.89	0.48 ± 0.26	1.2	0.25
Month 3	2.07 ± 0.9			

SD: Standard deviation

Table 5: Comparison of mean change between two methods on mesial side

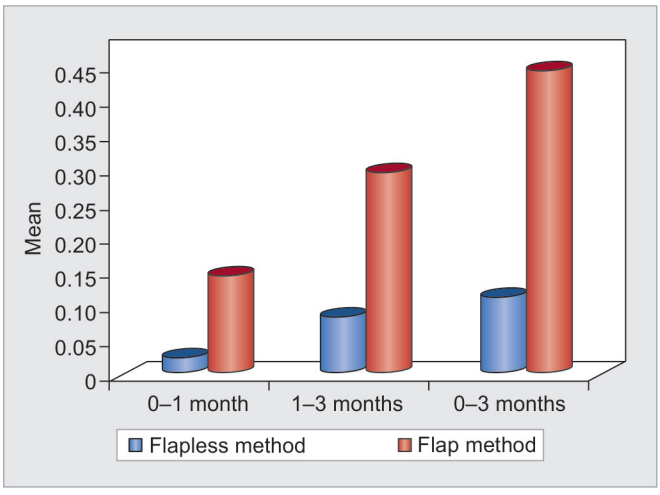
Time intervals	*Flapless method mean ± SD (mm)*	*With flap mean ± SD (mm)*	*t-test*	*p-value*
Months 0–1	0.03 ± 0.01	0.15 ± 0.08	2.96	0.008*
Months 1–3	0.09 ± 0.03	0.3 ± 0.19	3.45	0.003*
Months 0–3	0.12 ± 0.04	0.45 ± 0.22	4.67	0.0002*

SD: Standard deviation; *p < 0.05

intervals on distal side in group II (with flap method); mean loss at 0, 1, and 3 months was 1.59, 1.79, and 2.07 mm respectively. This shows that results were statistically nonsignificant.

Table 5 and Graph 3 show mean change in the crestal bone height on mesial side between groups I and II at different time intervals from 0 to 1 month, 1 to 3 months, and 0 to 3 months. As $p < 0.05$, results were statistically significant. Table 6 and Graph 4 show mean change in the crestal bone height on the distal side between groups I and II at different time intervals from 0 to 1 month, 1 to 3 months and 0 to 3 months. Results were statistically significant.

It was concluded that reduction of crestal bone height was seen in both flapless and with flap techniques.

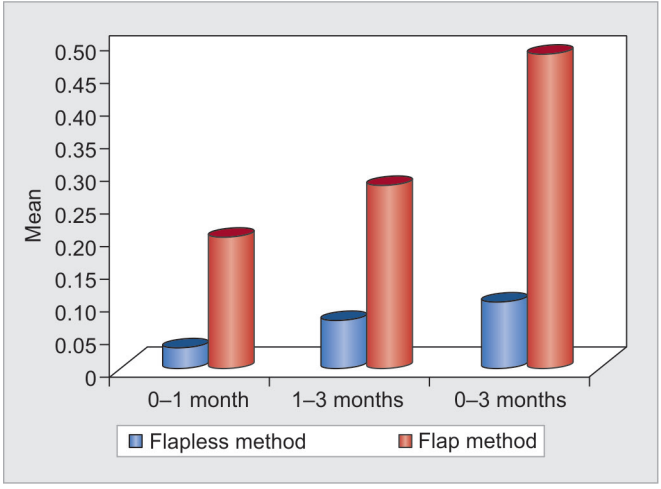


Graph 3: Difference in the crestal bone height of both groups on mesial side at different time intervals

Table 6: Comparison of mean change between two methods on distal side

Time intervals	Flapless method mean ± SD (mm)	With flap mean ± SD (mm)	t-test	p-value
Months 0–1	0.03 ± 0.01	0.2 ± 0.11	4.89	<0.01*
Months 1–3	0.07 ± 0.03	0.28 ± 0.16	4.08	0.0007*
Months 0–3	0.1 ± 0.02	0.48 ± 0.26	4.61	0.0002*

SD: Standard deviation; *p < 0.05



Graph 4: Difference in the crestal bone height of both groups on distal side at different time intervals

However, on comparison, less bone resorption was observed in the flapless technique.

DISCUSSION

Since the beginning of modern dentistry in the late 1700s, much has changed and with respect to modern implant dentistry, rapid change has occurred since its beginning around three decades ago. The first root form endosseous implants which were constructed required two-stage surgery, but recently, single-piece implants have been developed which do not require second-stage surgery; instead, abutment is directly attached with implant. With the focus to decrease the amount of time in completing the implant therapy, three approaches have been developed: immediate, early, and delayed loading.[13] Immediate loading shortens the overall treatment time and provides the patient with provisional prosthesis immediately after implant placement. A successful outcome of implant therapy requires osseointegration, a histologic term defining the direct contact of implant with bone without intervening fibrous connective tissue. According to Wolffe's law, bone remodeling occurs in response to implant placement.[14] Implant can be placed either by raising the flap or by flapless method and so, this study was carried out with an aim to evaluate radiographically crestal bone loss around immediately loaded single-piece implant using flap and flapless method.

In the present study, immediate loading protocol with provisional restoration was chosen as it provide esthetics, function, space maintenance, and soft-tissue healing. An acrylic tooth was used to make a provisional restoration. When using an immediate function protocol, it is important that initial implant stability is achieved which is more crucial when OPI is used, as it does not allow the clinician to submerge the implant below the gingival. In the current report, initially, all the implants were stable and acrylic tooth was used for provisional restoration. Acrylic has shock-absorbing nature, which reduces stresses over bone, which in turn reduces the bone resorption.

Maintaining the interdental papilla and bone height following implant placement has been a challenge for the restorative dentist. With the conventional flap elevation technique, an extended flap is needed to visualize the bone sufficiently in order to avoid perforation of critical anatomical structures.

For implant placement, various flap designs have been reported earlier. Han et al[15] described two types of incisions—crestal and remote. Sclar[16] advocated three designs, such as resective contouring, papilla regeneration, and lateral flap advancement. Gomez-Roman[11] compared the crestal bone loss by using two flap designs, namely widely mobilized flap and limited flap design.

In the present study, single tooth implants were placed using limited flap design that protected interdental papillae. The goal of this surgical technique was less traumatic preparation of the soft tissues. This approach conserves the papillae during single tooth implant placement. The limited flap design is also advantageous because two mucosal wound edges are brought together, hence providing better seal.

Flapless implant surgery is thought to be a procedure with many limitations, including the inability to save the keratinized mucosa because a tissue punch removes some of this tissue; a lack of proper drilling depth assessment, as it is difficult to see lines on the drill at the bone crest; an inability to assess the location of the implant because there is no direct visualization of the bone; and an inability to correct peri-implant defects, as they are not exposed during surgery. As a result, guidelines on the flapless procedure were that it should be used only when the bone has abundant width and when the soft tissue has sufficient amounts of keratinized mucosa. Following the above-mentioned guidelines, the flapless technique can be used.

Three-month bone level was taken as baseline and bone resorption was measured subsequently. It was also observed that the pain felt by patient postoperatively when measured on visual analog scale was lesser for

those placed through the flapless as compared with those which were placed by flap technique.

In this technique, there was minimal surgical trauma, and thus, discomfort is greatly reduced. The study by Fortin et al[8] showed that less pain was reported in the flapless procedure. Furthermore, the entire periosteum maintains a better blood supply which reduces the chance of early bone resorption.

Tissue punch that was used for the flapless technique had a diameter slightly bigger than the size of the implant selected for the placement. Flapless technique was used only for those cases where sufficient bone width was present as determined by ridge mapping along with substantial quantity of keratinized gingiva.

The present study evaluated 20 patients at different time intervals of 0, 1, and 3 months in which implants were placed using flapless and with flap technique. Results showed that mean crestal bone loss on the mesial side was 0.12 ± 0.04 (group I) and 0.45 ± 0.22 (group II). Mean bone loss evaluated on the distal side was 0.1 ± 0.02 (group I) and 0.48 ± 0.26 (group II). This depicts that there is less bone resorption in flapless technique as compared with that of the traditional flap method. These results are in accordance with Rousseau, who studied and concluded that patients eligible for flapless surgery can benefit from less straining procedure without affecting the success rate of dental implant surgery.

In dentulous mouth, blood supply comes from periodontal ligament, connective tissue above the periosteum, and from within the bone. Periodontal supply disappears when there is tooth loss so blood comes only from soft tissue and bone. When flaps are raised, supply from the soft tissue is removed, leaving poorly vascularized cortical bone, resulting in bone resorption. This may lead to long-term esthetic compromise by the effect of the distance from the contact point to the crest of the bone in the absence of interdental papillae.[17] When interdental papillae are lost, the root surface adjacent to implant may get exposed, leading to sensitivity and also the implant threads can be exposed. This indicates the significance of maintenance of the soft-tissue configuration around the implants.

Definitive restorations were placed after 6 months of implant placement. However, in two cases, implant was removed due to failure of osseointegration which occurred due to unknown reason which belonged to group I. Traditional treatment was planned in such cases.

Single-piece implants which were used had certain disadvantages:

- Abutments cannot be customized.
- After the implant placement, the abutment milling has to be done directly in the mouth itself.
- Screw retained option is not possible.
- OPIs cannot be used in cases of limited interarch space.
- There are chances of fracture of implant mount if the osteotomy is not sufficiently prepared.
- Abutment of these implants projects from mucosa after implant placement which becomes the source of irritation for the patient.

However, single-piece implant had certain disadvantages, but its advantages cannot be overlooked. Because of the solid structure, OPI has greater mechanical strength. It reduces the surgical procedures. Also, it can be placed in area where angulation is not of much concern like molars and premolars. The OPI shows reduced marginal bone loss, as there is no interface gap between implant and abutment. The present study revealed that single-piece implant placed using flapless technique was more comfortable to the patient, as it reduced the crestal bone level and pain felt by the patient postoperatively as compared with implant placed with the conventional method.

CONCLUSION

At the end of 3 months, crestal bone loss was found comparatively less in the case of flapless as compared with the traditional flap technique. This was because on raising the flap, the only source of blood supply is bone as compared with those implants placed without raising the flap, which have blood supply from bone as well as soft tissue. Pain experienced by patient was also less in flapless as compared with the traditional flap technique.

REFERENCES

1. Branemark, PI.; Zarb, GA.; Albrektsson, T. Tissue-integrated prostheses: osseointegration in clinical dentistry. Chicago (I) L: Quintessence Publishing Company, Inc; 1985.
2. Albrektsson T, Branemark PI, Hansson HA, Lundstrom J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand 1981;52(2):155-170.
3. Quirynen M, van Steenberghe D: Bacterial colonization of the internal part of two-stage implants. Clin Oral Implants Res 1993 Sep;4(3):158-161.
4. Hahn JA. Clinical and radiographic evaluation of one-piece implants used for immediate function. J Oral Implantol 2007;33(3):152-155.
5. Hahn J. One-piece root-form implants: a return to simplicity. J Oral Implantol 2005;31(2):77-84.
6. Hahn J. Single-stage, immediate loading, and flapless surgery. J Oral Implantol 2000;26(3):193-198.
7. Casap N, Tarazi E, Wexler A, Sonnenfield U, Lustmann J. Intraoperative computerized navigation for flapless implant surgery and immediate loading in the edentulous mandible. Int J Oral Maxillofac Implants 2005 Jan-Feb;20(1):92-98.
8. Fortin T, Bosson JL, Isidori M, Blanchet E. Effect of flapless surgery on pain experienced in implant placement using an

image guided system. Int J Oral Maxillofac Implants 2006 Mar-Apr;21(2):298-304.
9. al-Ansari BH, Morris RR. Placement of dental implants without flap surgery: a clinical report. Int J Oral Maxillofac Implants 1998 Nov-Dec;13(6):861-865.
10. Becker W, Wikesjo UM, Qahash M, Hujoel P, Goldstein M, Turkyilmaz I. Histologic evaluation of implants following flapless and flapped surgery: a study in canines. J Periodontol 2006 Oct;77(10):17-22.
11. Gomez-Roman G. Influence of flap design on peri-implant interproximal crestal bone loss around single tooth implants. Int J Oral Maxillofac Implants 2001 Jan-Feb;16(1):61-67.
12. Campelo LD, Camara JR. Flapless implant surgery: a 10-year clinical retrospective analysis. Int J Oral Maxillofac Implants 2002 Mar-Apr;17(2):271-276.
13. Yoo RH, Chuang SK, Erakat MS, Weed M, Dodson TB. Changes in crestal bone levels for immediately loaded implants. Int J Oral Maxillofac Implants 2006 Mar-Apr;21(2):253-261.
14. Lian Z, Guan H, Ivanovski S, Loo YC, Johnson NW, Zhang H. Effect of bone to implant contact percentage on bone remodeling surrounding a dental implant. Int J Oral Maxillofac Surg 2010 Jul;39(7):690-698.
15. Han TJ, Park KB, Klokkevold PR. Standard implant surgical procedures. In:Carranza's clinical periodontology, 10th ed. St. Louis: Saunders;2006. pp. 1120-1132.
16. Sclar AG. Guidelines for flapless surgery. J Oral Maxillofac Surg 2007 Jul;65(7 Suppl 1):20-32.
17. Bryant SR, Zarb GA. Crestal bone loss proximal to oral implants in older and younger adults. J Prosthet Dent 2003 Jun;89(6):589-597.