



A clinical assessment of periimplant marginal bone loss and soft tissue status in dental implant placed by flapless implant surgery. (A one-year prospective study)

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Abstract

Despite several studies have been conducted to evaluate the clinical outcomes of flapless implant surgery limited information presents regarding the clinical conditions after flapless implant surgery, for this reason this study was carried out to evaluate the peri-implant marginal bone loss and soft tissue status in dental implant placed by flapless implant surgery.

In the present study, 143 implants were placed in 68 patients by using a flapless 1-stage procedure. In these patients, peri-implant soft tissue conditions and radiographic marginal changes were evaluated one year after surgery.

Results: None of the implants was lost during follow-up, giving a success rate of 100%. The mean score of GI was (0.28 mm SD = 0.21), the average BOP index was (0.12, SD= 0.05) and the mean pocket probing depth was (2.7 mm, SD= 1.1).

The mean marginal bone loss (0,4 mm, SD = 0.49) range (0.0 – 1.2 mm). Whereas 34 implants showed no bone loss at all.

The results of this study demonstrate that flapless implant surgery is a predictable procedure. In addition, it is advantageous for preserving crestal bone and mucosal health surrounding dental implants.

Introduction

The concept of replacing missing teeth for esthetics and function has led to evolution of many materials and techniques including complete dentures, removable and fixed partial dentures, dentistry has long sought a superior method of artificial teeth replacement through dental implants with a goal of restoring the normal contour, comfort, esthetics and function⁽¹⁻³⁾

Traditionally, dental implants are

placed by raising of a mucoperiosteal flap and exposure of underlying ridge bone, then placement of dental implant. This treatment modality has disadvantages of invasive characteristic, long time surgical procedure and postoperative pain, bleeding and discomfort⁽⁴⁾.

One of the most important complications in dental implantology are periimplantitis mycosis's which are defined as inflammatory process of

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affecting the tissue around an osseointegrated implant in function, resulting in loss of supporting bone⁽⁵⁾.

Recently flapless surgery as a method for dental implant placement is gaining popularity among implant surgeons. The increased use of this method can be attributed to improvements in radiologic technologies and dental implant treatment planning software, as clinicians can now acquire 3-dimensional images of potential implant sites before surgery⁽⁶⁻⁸⁾.

Flapless dental implant surgery has numerous benefits, including preservation of the vessels around the implant⁽⁹⁾, Maintenance of the original mucosal form around the implant⁽¹⁰⁾ retention of hard tissue volume at the surgical site⁽¹¹⁾, this method also shortens the length of the surgery, improves the patient postoperative comfort and accelerates wound healing and recovery of implanted sites⁽¹²⁾.

In recent years, flapless implant protocol had been widely used in our practice as a tool for performing minimally invasive dentistry, which reported to have predictable outcome from a high success rate, as long as patients are properly selected for the procedure and have appropriate width of bone available for implant placement^(13, 14).

When dental implants are placed by raising a surgical mucoperiosteal flap, there is an associated slight bone loss at the site. Scarring and other complications are of concern. In the esthetic zone, these may lead to an unsatisfactory outcome. Placing implants by using a flapless or envelope incision may eliminate some of these concerns⁽¹⁵⁾. Other researches revealed that exclusion of the mucoperiosteal flap may minimize the potential postoperative marginal bone resorption⁽¹⁶⁻¹⁸⁾, but limited controlled data are available to evaluate the

clinical conditions after flapless implant surgery. In addition, most marginal bone changes occur in the early stages after placement of implant⁽¹⁹⁾. Therefore, the present study was performed to assess the periimplant soft tissue and crestal bone conditions around flapless placed dental implants 1 year after surgical procedure.

Materials and methods

Sixty eight (68) consecutive patients (30 males and 38 females, the range of the age was 21- 65 years with an average of 32 years).

Those subjects were enrolled in our study and treated at a single clinic of dental implantology at the dental college / Al Mustansiriya University, in addition the patients attending the private center of dental implant of the researchers. All of these patients treated with flapless dental implant / implants. The 143 implants (Xenon system – Germany) were inserted into different areas of the jaw. The subjects underwent partial arch, or single – tooth replacement procedure and inclusion criteria were applied on the study population, which stated that the subject must be systemically healthy, presenting with mild to moderate, and they were able and willing to provide informed consent. Patients requiring ridge augmentation with barrier membranes or bone grafts were excluded from the study.

Surgical procedure:

Under local anesthesia with 2% lidocaine (1: 100,000 epinephrine), the soft tissue of proposed implant site was punched with a soft tissue punch according to the diameter of the implant.

A core of soft tissue was then removed from over the crestal bone, and an implant osteotomy was performed at the core of the exposed

bone. Before drilling, the soft tissue thickness was measured at the implant site using a periodontal probe. Implant osteotomy and placement were performed following the manufactures' instructions. All of the patients received endosseous implants 3.5, 4.0, 4.5, and 5.0 mm in diameter and 8-14 mm in length via flapless implant surgery. After implant placement, the healing abutments 4.5 or 5.5 mm in diameter and 3 or 4 mm in length were connected immediately to the fixtures, such that the coronal portion of the abutments remained exposed to the oral cavity. (Figures 2-17) demonstrate the steps of surgical procedure of a single tooth flapless implant.

Experienced well-trained oral surgeon senior placed all implants. Immediately after implant placement, a program of self plaque control was achieved by the patients daily.

Prosthetic reconstruction:

After 3-4 months of healing, all fixtures were checked for stability using manual tightening torque of 20N. cm. An Experienced senior of conservative dentistry fabricated the final prostheses. He produced a screw – retained metal ceramic or metal – resin reconstructions that then were adapted to the needs or demands of each patient. (Figures 18-21) show the prosthetic part of the flapless implant.

Clinical assessment:

For each implant, a clinical evaluation was done 12 months after implant placement. One experienced periodontics senior performed the clinical evaluation, which involved the measurement of the probing pocket depth (PPD), assessing the gingival index (GI), and recording the presence of bleeding on probing (BOP). Pocket depths were measured using a plastic periodontal probe. The mean PPD for

each implant site was obtained from averaging the measurement taken at 4 different sites around the implant.

For assessment of the postsurgical changes in the crestal bone level, conventional dental radiographs were taken immediately after surgery and 12 months after implant placement.

The images were digitized, and the distance between the fixture shoulder and the apical level of the marginal bone that was in contact with implant was measured at x 8 magnification using implant height (a known measurement) for calibration. Measurements were performed at the mesial and the distal aspects of each fixture and the mean for each case was calculated.

Statistical analysis:

The data were assessed using a statistical software package (SPSS for Windows; SPSS, Chicago, IL) . Descriptive statistics were used to evaluate the soft tissue conditions and any bone changes.

Results

The majority of the patients received **1** dental implant (35 patients), (27 patients) received **2** implants, (10 patients) received **3** implants and (6 patients) received **4** or more (Table 1). The most common region of implant placement was the mandibular molar area (65) implants, followed by maxillary molar region (34) implants, mandibular premolar area, (22) implants, maxillary premolar region (12) implants, mandibular incisor area (7) implants and maxillary premolar region (3) implants. For the whole number of the implanted fixtures, no one of them found to be mobile during the 20 N.cm torque testing conducted 3-4 months after implant placement, additionally, none of the implanted fixtures were lost during follow-up,

giving our study a success rate of 100%. The mean score of GI was (0.28 mm SD = 0.12), the average BOP index was (0.12, SD= 0.15) and the mean pocket probing depth was (2.7 mm, SD= 1.1). (Table 2).

The mean marginal bone loss (0.4 mm, SD = 0.17) range (0.0 – 1.2 mm). The bar chart in (Figure 1) demonstrates the frequencies of bone loss among the implants. No implants showed bone loss > (1.2 mm), 34 implants showed no bone loss. The relationship of the soft tissue thickness to the marginal bone loss was also analyzed (Table 3). The mean bone loss for the thick (3 mm) and thin groups (< 3mm) at 12 months were (0.25mm SD= 0.12) and (0.31mm SD = 0.22 mm), respectively. No significant difference was appeared between the two groups.

Discussion

Minimally invasive flapless dental implant surgery offers the possibility of high implant predictability with clinical insignificant marginal bone loss for up to 4 years. Proper diagnosis and treatment planning are key factors in achieving predictable outcomes.

Flapless dental implant placement is possible in selected patients but limited to those sites with adequate or augmentable attached gingiva and available bone volume and density⁽²⁰⁾ According to Alberktsson's success criteria ⁽²¹⁾, the average marginal bone loss should be <1.5 mm during the first year of functional use of an implant. The marginal bone loss is reported to range from 0.0 to 1.1 mm 1 year after flap implant surgery⁽²²⁾.

The results of the present study showed that the mean value of bone loss was 0.4 mm one year after flapless implant surgery and this result is appeared to be highly lower than the

values of bone loss associated with flap reflected dental implant procedures.

The findings of the current study demonstrate that the mean bone loss was 0.4 mm 1 year after flapless implant surgery and no implant failed to osseointegrate, and no implants exhibited bone loss > 1.1 mm. these low frequencies of both implant failure and progressive marginal bone loss agree with the results of earlier studies ^(23,24), which found that flapless implant surgery is predictable procedure with a high success rate. A possible explanation for the high success rate may be that when flaps are not reflected, the periosteum is preserved, which may help to optimize the healing of the peri-implant tissue.

Seuing-Mi Jeong et al (2007) and Velde et al (2010) also found similar promising results when they demonstrated that the flapless implant surgical procedure for single tooth in anterior region was achieved with a great success in providing a magnificent function, esthetics and increased patient's comfort and satisfaction⁽²⁵⁻²⁷⁾.

Merli et al (2008) concluded that the use of flapless implants placement in conjunction with occlusal immediate loading in selective patients can provide excellent clinical outcomes, these predictable results provide the flapless implant technique another advantage⁽²⁸⁾.

Flapless implant was also found to be requested by the patients because of reducing their anxiety and thus this treatment modality had a high treatment acceptance rate⁽²⁹⁾

Tae-Min You et al 2008 conducted a study which was a comparison between flap and flapless procedures in the canine mandible The results indicated that gingival inflammation, the height of junctional epithelium, and bone loss around flapless implants can

be reduced when implants are placed without flap elevation⁽³⁰⁾.

The amount of bone loss in the present study is encouraging, even when compared with the results of earlier studies that measured bone loss after flapless surgery^(31, 32).

The lower rate of crestal bone loss in the present study may be due to our use of a tissue punch narrower than the implant itself some earlier studies used a tissue punch wider than the selected implant. The gap between the implants and the peri-implant mucosa was determined based on the size of the soft tissue punch and the size of the implant. In patients in whom a wider tissue punch was used, a wide gap was created between the implants and the surrounding mucosa. However, when the mucosa is punched with a narrow tissue punch, the peri-implant mucosa is in direct contact with the implants, and no gap is produced. Small, clean, closed wounds are known to heal quickly and with little scar formation. In contrast, large open wounds heal slowly and with significant scarring⁽³³⁾. This principle can also be applied to wounds around flapless implant. The flapless procedure, which uses a narrower tissue punch, produces a surrounding mucosa that has smaller, cleaner, and more closed wounds compared with those produced by a wider tissue punch. The smaller wounds may improve the ability of the peri-implant mucosa to quickly attach to the surface of the implant after the operation, which could lead to a lower rate of crestal bone loss.

Effective plaque control after flapless surgery could be another factor involved in lower rate of crestal bone loss in the present study. Implants can be easily cleaned immediately after flapless procedure, because the implant surface is in close contact with the surrounding mucosa. Early plaque control plays an important role in

promoting the health of the peri-implant mucosa and preventing peri-implant bone loss⁽³⁴⁾. We observed excellent peri-implant mucosal health in the present sample after flapless procedure, as confirmed by low GI and BOP index scores.

The maintenance of healthy mucosa adjacent flapless implant may also lead to the minimal bone loss in this study.

Resulting from the small access punch technique used in this study, the implant surface may be contaminated by soft tissue contact during the flapless implant procedure.

Some authors have argued that it is important to avoid contamination of the implant surface by bacteria and biologic molecules (including saliva and foreign bodies) during the surgical insertion of implants into the jaws⁽³⁵⁾. In contrast, Ivanoff et al.⁽³⁶⁾ reported that preoperative soft tissue contamination of titanium implants did not prevent osseointegration, after examining the differences in bony contact between biologically contaminated implants and standard control implants. There were no major morphologic differences between control and test sites regarding their bone or marrow structures and bone – to implant contacts. Esposito et al.⁽³⁷⁾ reported that clinical observation and experimental evidence failed to indicate any soft tissue contact-related causes for implant failures.

Our study produced similar results to those of Ivanoff et al.⁽³⁶⁾ and Esposito et al.⁽³⁷⁾ in that osseointegration occurred in all of the present cases despite potential contamination caused by the small punch. Nevertheless, we recommend that flapless implants surgeries include meticulous preoperative disinfection, especially in the area of the mucosa through which the implants pass. In conclusion, the present results indicate

that the flapless procedure is advantageous for preserving crestal bone and periimplant mucosal health. Our findings support the clinical use of flapless implant surgery to increase the success rate of the implant procedure.

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Table (1): Distribution of implants according to the number of patients

Number of patients	Number of implants received	%
35 patients	1 implant	
27 patients	2 implants	
10 patients	3 implants	
6 patients	4 implants	

Table (2): Clinical parameters values after one year of placement of flapless implants.

Study parameters	One year	
Mean probing pocket depth	2.7 mm	SD= 1.10
Mean Bleeding on Probing	0.12	SD=0.05
Mean Gingival index	0.28	SD=0.21
Mean Crestal bone loss(mm)	0.4	SD=0.49

Table (3): Soft tissue thickness and crestal bone loss.

Soft tissue thickness	No.of implants	Crestal bone loss (mm)
<3.0 mm	112	0.29
> 3.0 mm	31	0.31

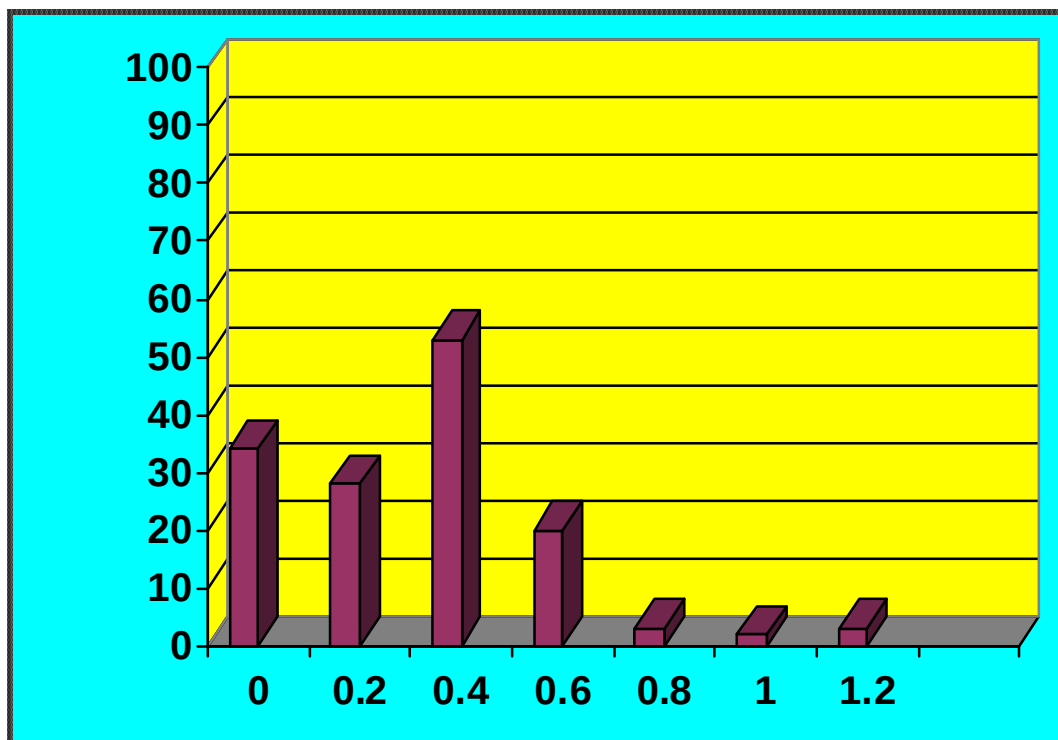


Figure (1): Frequencies of implants that showed varying amounts of bone loss during the healing period from the time of implant placement to the 12 months follow-up.

Figure 2.

Site has adequate width and zone of keratinized tissue for a flapless surgical procedure.

**Figure 3.**

Radiograph of site measures approximately 14 mm of bone height from the crest of the ridge to the mandibular canal.

**Figure 4.**

Initial entry is made through tissue and 2 mm into bone.

**Figure 5.**

Parallel pin/depth gauge placed into initial osteotomy confirms proper angulation between adjacent teeth.



Figure 6.

Radiograph of parallel/pin depth gauge into initial osteotomy confirms depth and angulation between a teeth.

**Figure 7.**

A 3-mm rotary tissue punch is placed on the tissue, confirming proper location.

**Figure 8.**

Tissue plug is removed revealing 2 mm diameter osteotomy in the middle of the site.

**Figure 9.**

Implant burs with depth stops are used to deepen and widen osteotomy.

**Figure 10.**

A 5-mm implant bur taken to the depth stop against the crest of the ridge.



Figure 11.

A 5-mm in diameter by 10-mm long threaded implant is ready for placement in the ost



Figure 12.

Position of the implant fixture mount confirms the depth of the implant. The implant is



Figure 13.

Implant platform is 2 mm below the surface of the tissue.

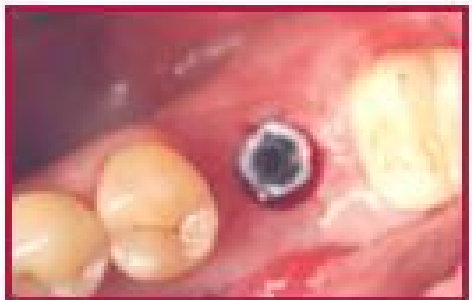


Figure 14.

A 5-mm in diameter by 3-mm length tapered healing abutment is attached to the implant.



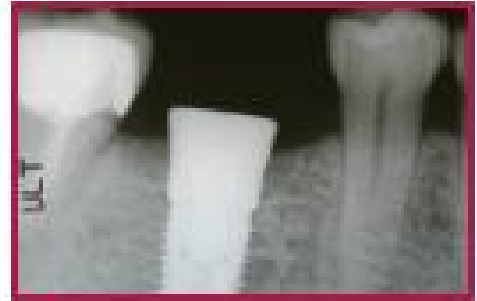
Figure 15.

Facial view of healing abutment shows topography of the ridge is lower on the facial aspect of the ridge.

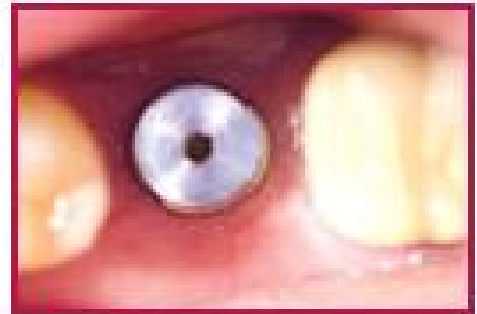


Figure 16.

Postoperative periapical radiograph of the implant in place.

**Figure 17.**

A one-week postoperative view of healing abutment shows proper tissue healing and excellent oral hygiene.

**Figure 18.**

Abutment is attached to the implant. Cotton is placed over hex screw and temporary cement is placed over the cotton.

**Figure 19.**

Occlusal view of implant supported porcelain fused to metal crown. Note reduced occlusal surface.



Figure 20.
Facial view of properly contoured
crown.



Figure 21.
Periapical radiograph of implant with seated
crown.

