FLAPLESS VERSUS CONVENTIONAL FLAP APPROCH FOR DENTAL IMPLANT PLACEMENT IN THE MAXILLARY ESTHETIC ZONE

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ABSTRACT

INTRODUCTION: Dental implantology, a special field of dentistry dealing with the rehabilitation of the damaged chewing apparatus due to loss of the natural teeth, is currently the most intensively developing field of dentistry. Missing teeth can be replaced using dental implants, which are inserted into root bearing parts of the mandible or maxilla. The success and long-term prognosis of implant prosthetic therapy depend primarily on the anchorage of the implant in the jaw bone

OBJECTIVES: The main objective of this study was to assess clinically and radiographically the flapless versus conventional flap surgical technique in the maxillary esthetic zone.

MATERIALS AND METHODS: This study was a randomized controlled clinical trial. It included 16 dental implants. The patients were divided in to two groups: group A, eight implants were placed in the maxillary aesthetic region using flapless procedure, and group B eight implants were placed in the maxillary esthetic region using flap procedure. All patients followed by clinical and radio-graphical evaluation over a period of 6 months.

RESULTS: The flap technique showed statistically significant higher mean pain severity and duration, plaque index, probing depth, healing score than the flapless technique. The radiographic evaluation of the flapless implant surgery showed marked decrease in the amount of crestal bone loss in comparison to conventional flap. The mean horizontal and Vertical bone loss around implants was significantly less in group A than in group B. There was no difference in bone density between both groups.

CONCLUSIONS: The flapless implant surgery reduces the amount of crestal bone loss, soft tissue inflammation, pain, edema, bleeding and consequently soft tissue recession than the conventional flap technique.

KEYWORDS: Flapless implant techniques, crestal bone loss, esthetic zone, bone density.

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INTRODUCTION

Replacing missing teeth to restore function and aesthetics is one of the main goals of dentistry. For the past years, osseointegrated dental implants have been accepted as one of the major treatment concepts for restoring completely and partially edentulous patients (1). When placing dental implants, a flap is traditionally elevated to better visualize the implant recipient sites and flap elevation also provides that some anatomical landmarks, are clearly identified and protected (2).

If a limited amount of bone is available, flap elevation can help to reduce the risk of bone fenestrations or perforation during implant placement. However, flap elevation needs suturing and is related to some degree of morbidity and discomfort (3). A previous study has also revealed that flap reflection often results in gingival recession and bone resorption around natural teeth (4).

Over the last three decades there have been multiple modifications in treatment modalities (5), including immediate loading and placement without flap elevation to increase patient comfort and acceptance, to minimize the possibility of post- operative peri-implant tissue loss and to overcome the challenge of the soft tissue management during or after surgery (6). The concept of flapless implant surgery has been introduced for patients with sufficient bone volume in implant recipient site (7).

Traditionally, flapless surgery has been regarded as a technique with multiple limitations, such as: poor control of precise drilling depth owing to difficulty of observing the drilling direction of the alveolar bone; inability to preserve keratinized gingiva by a tissue punch perforation; and poor ability to assess the implant point of entry owing to the lack of direct vision of the recipient bone. Therefore, it is very difficult to correct intra operative peri-implant defects. Another concern is that some amount of epithelial tissue could be carried to the osteotomy site. Such situation is highly undesirable because it might affect the complete osseointegration of the implant surface and thereby resulting in implant failure (8).

However, in recent years, it has been reported that flapless implant surgical procedure is a predictable procedure with a high success rate if patients are properly selected and an appropriate width of bone is available for implant placement (7), as well as a sufficient quantity of keratinized gingiva (5).

It has been reported that post-surgical tissue loss from flap reflection may negatively influence implant esthetics especially in the maxillary area (9), while it has been shown that elimination of the mucoperiosteal flap can prevent potential postoperative bone resorption associated with flap elevation (10).

Limited controlled data are available to compare the clinical condition after flapless implant placement with the flap technique with surgical procedure incision, punch or transmucosal (11). Therefore the present study was designed to compare the flapless versus the conventional flap approach for implant placement in the maxillary esthetic zone.

MATERIALS AND METHODS

I- Study design

The sample size was conducted on sixteen implants placed in 12 patients of both genders. The patients were chosen from the Outpatient Clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University.

The patients were divided in to two groups:

Group A (flapless technique)

Eight implants were placed in the maxillary esthetic region using a flapless procedure.

Group B (Conventional flap technique)

Eight implants were placed in the maxillary esthetic region using the conventional flap procedure.

The sample was selected conveniently to fulfil a list of inclusion and exclusion criteria.

The inclusion criteria of this study were; patients of age 20-40 years, patients with missing teeth in the maxillary aesthetic zone and presence of adequate bone and healthy gingival tissue of surrounding dentition.

Exclusion criteria were; patients with acute infection or with relevant systemic diseases or local factors which contraindicate implant placement, also patients with para-functional habits as bruxism, clenching……etc , patients with poor oral hygiene , heavy smokers.

The study was approved by the ethical committee at the Faculty of Dentistry, Alexandria University. All patients received both oral and written information about the study protocol and signed their informed consent before agreeing to participate in the study.

II - Materials

1) **Dentium Super Line Implant System** (Super line; dentinum company, Seoul, Korea)

The implants were available in different diameters ranging from 3.6 mm to 7.0mm and lengths ranging from 7mm to 14mm. It is known for its tapered body design and SLA (Sandblasting with Large grit and Acid etching) surface treatment that facilitates the osseointegration process (Figure 1).

Figure 1: A photograph showing Dentium implant system and tissue punch.

2) **Tissue punch** size 4.5mm with a speed not exceeding 35 rpm (Figure 1).

III - Methods

A-Pre-surgical phase

Every patient was assessed and evaluated by proper history taking and thorough clinical and radiographic examination as follows:

1- History

The preoperative data was collected and recorded in full details including demographic data.

2- Clinical Examination

Local visual examination and palpation of the entire oral and para- oral tissues to ensure right selection of the patient and evaluate the site of implant placement, Initial periodontal therapy including scaling and oral hygiene instructions were achieved.

3- Radiographical examination

a. Panoramic radiography

Panoramic radiographs were obtained for preliminary examination of the implant recipient site and to detect the presence of any pathology.

b. Cone beam computed tomography (CBCT)

CBCT was done to evaluate the quantity and the quality of bone present and to detect any hidden bony abnormalities and for planification of length and diameter of implant.

4- Fabrication of the surgical guide stent

Primary alginate impression was taken for both arches and diagnostic study models were casted, the surgical guide stent was fabricated and a hole was drilled in the stent opposite to the missing tooth indicating the position of the implant.

B-Surgical Procedures

All patients were operated under local anesthesia, using infiltration technique (Articaine HCL 4% with vasoconstrictors (1; 200. 000) (Septodent, Articaine HCL with vasoconstrictors), Novocol Pharmacutical, Canada).

All patients were instructed to rinse with 0.12% chlorhexidine gluconate (Hexitol; the Arab Drug Company, Cairo, AR.E) mouth wash immediately before operation for 30 seconds.

Group A (flapless technique)

A rotary tissue punch with a speed not exceeding 35 rpm was used to make a circular cut in the soft tissue at the crest of the alveolar bone at the site of the implant placement, the circular soft tissue cut was removed using tissue forceps, the steps of implant placement were carried out according to the instructions of implant manufacturer, the electric motor was used together with a low speed high torque externally irrigated hand piece to prepare the implant site, sterile saline was used for external irrigation while preparing the implant site, The bone site preparation was initiated using the 2 mm initial drill to the predetermined length, the depth gauge and the direction indicator were used for measuring the depth of the osteotomy site, and check the parallelism of the implant, sequential drilling up to the final drill was achieved, the implant was inserted manually under slight apical pressure in a clock-wise direction to its bed till it stopped. Then a ratchet wrench was used to insert the implant to the final insertion depth and the cover screw was inserted into the occlusal opening in the implant and tightened (Figure 2).

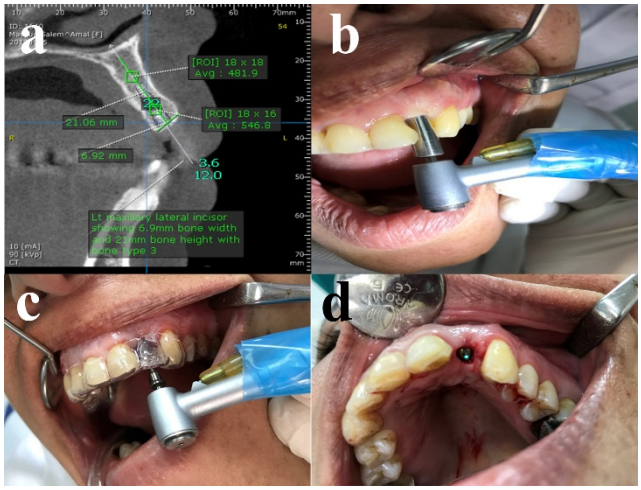

Figure 2: Preoperative photograph of group A. **(a)** A photograph showing preoperative x-ray CBCT. **(b)** A photograph showing rotary tissue punch. **(c)** A photograph showing initial drilling of bone sequential final drill. **(d)** A photograph showing the implant with cover screw.

Group B (Conventional flap technique)

A pyramidal mucoperiosteal incision was prepared using blade no. 15, including either side of the proposed implant site, reflection of the mucoperiosteal flap from the bone surface as accurate possible to avoid damaging the periosteium., the implant site was prepared as previously mentioned in the flapless technique, the implant was inserted with the cover screw and the mucoperiosteal flap was repositioned and sutured using 3/0 black silk suture material (Figure 3).

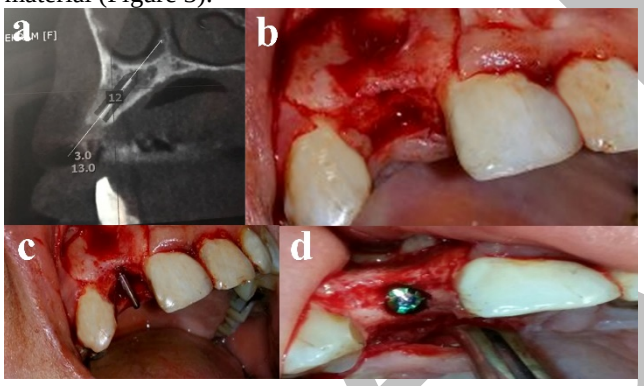

Figure 3: Preoperative photograph of group B. **(a)** A photograph showing preoperative x-ray CBCT. **(b)** A photograph showing Elevation of flap. **(c)** A photograph showing guide pins parallelism. **(d)** A photograph showing the implant with cover screw in place.

C-Post-surgical phase

Postoperative instructions were given to the patients including application of cold packs extra-orally intermittently every 10 minute for 2 hours on the first day and oral hygiene instructions. Postoperative medications including: Antibiotics 1 gm (Amoxicillin 875mg clavulanic acid 125mg) (Augmentin®, GlaxoStmith Kline, UK) tablets, 1 tablet every 12 hours for 5 days postoperatively. Non-steroidal anti-inflammatory drugs Diclofenac potassium 50 mg (Cataflam (50mg), Novartis, Swiss multinational pharmaceutical company, Novartis, New Jersey) tablets every 8 hours for 5 days. Warm mouth wash using chlorhexidine HCL (0,12%) (Hexitol, the Arab Drug Company, Cairo, ARE), Three times daily for 2 weeks. Sutures were removed one week post surgically.

D-Follow up phase

- At one week, all subjects were recalled to check for the presence of any infection, and to evaluate the oral hygiene of the subjects and for suture removal.
- Patients were also recalled after 4 months and 6 months duration for clinical and radiographic assessment (Figure 4 , 5).

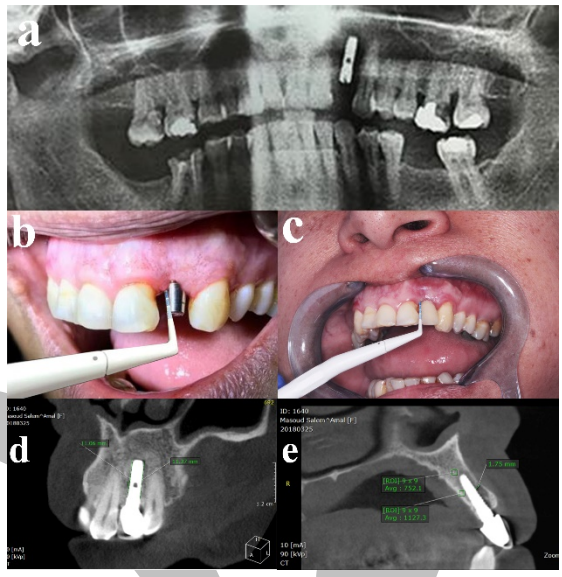

Figure 4: Postoperative photograph of group A. **(a)** OPG photograph showing immediate postoperative panoramic x-ray. **(b)** A photograph after 4months showing probing depth mesial to implant. **(c)** A photograph after 6months showing probing depth mesial to the implant. **(d)** CBCT showing marginal bone loss and vertical bone level after 6 months. **(e)** CBCT showing horizontal bone thickness and bone density after 6 months.

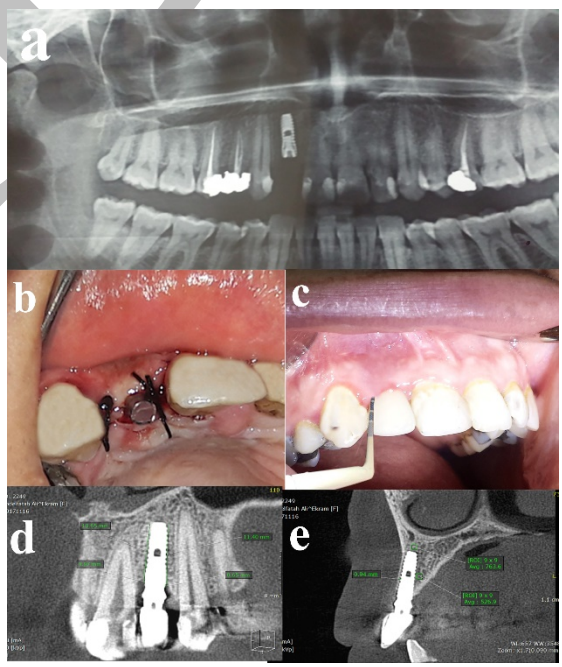

Figure 5: Postoperative photograph of group B. **(a)** OPG photograph showing immediate postoperative x-ray. **(b)** A photograph showing after 4 month after loading of implant. **(c)** A photograph showing probing depth after 6 months at distal site of implant. **(d)** CBCT showing marginal bone loss and vertical bone level after 6 months. **(e)** CBCT showing horizontal thickness and bone density after 6 months.

Clinical Assessment

The following clinical parameters were recorded at each interval.

1. Presence or absence of pain or sensitivity (12)

Pain was evaluated using the Visual Analogue Scale which was used in questionnaires as responding to a VAS item, respondents specify their level of agreement to a statement by indicating a position along a continuous line between two end-points. A score of 0 was defined as no pain, and 10 points was defined as the most severe intolerable pain. Scale 0: no pain: VAS= 0 - Scale 1: mild pain: O < VAS ≤ 3.5 - Scale 2: moderate pain; 3.5 < VAS ≤ 7 - Scale 3: sever pain; VAS > 7.

2. Post-operative complications

The presence of pain, tenderness, infection or swelling may indicate the presence of peri-implant disease and possible accelerated bone loss. Any post-operative complications were recorded.

3. Probing depth (PD)

The probing pocket depth around the implant at the 4 aspects of the implant facial, palatal and proximal surfaces was measured, using a graduated periodontal probe, according to Harvard conference (13), in 1978, by introducing the periodontal probe parallel to the long axis of the implant, with very slight pressure, until the probe is stopped.

Radiographic Evaluation

- Postoperative immediate panoramic radiographs were taken to ensure proper implant placement and the relationship of implant to opposing landmarks or surrounding structures.
- Cone Beam Computed Tomography (CBCT) was taken after six months for both groups to measure:

1. The crestal bone loss around the implants.
2. The bone density around the implants.

E-Prosthetic phase

After 4 months of implant placement, the patients for both groups were recalled for delivery of PFM definitive restoration.

Statistical Analysis

Data were fed to the computer and analysed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using number and present. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level (14,15).

RESULTS

The present study was conducted on sixteen implants placed in 12 patients (3 males, 9 females). Six patients were assigned to the group A, while the other six patients assigned to the group B. The implants were placed in the maxillary esthetic zone (six implants in the central incisors area, seven implants in the lateral incisors area, three implants in the canine area). The implant sizes used in both groups were 3.6 – 4 mm in diameter and 10-14mm in length, patients were selected from the Outpatient Clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University. All patients were free from any systemic or local health conditions that can comprise implant success. All patients were followed up for six months and the results were registered as regards to clinical and radiographic evaluations.

I. Clinical evaluation

1- Presence or absence of pain and infections

After the procedure, all patients of the group A experienced mild to moderate pain at the surgical sites which disappeared completely after the 2nd and 3rd days. While in group B most patients experienced moderate to severe pain at the surgical sites which disappeared completely after the 5th and 7th days. Three had worst pain which subsided totally by the 4th post-operative day. There was statistically significant higher mean pain severity and duration score in group B than in group A.

Three implants were lost from two patients, one with flapless procedure and another with conventional flap lost 3 months after placement in the same patient due to infection from an endodontic treatment done to the teeth adjacent to the implant site. Also another implant with flapless procedure was lost 3 weeks after placement due to immediate infection.

***2*- Probing depth (PD)**

The probing depth was measured for all surfaces of all implants. Statistical analysis of probing depth scores was done for all patients. (Table 1)

Table (1): Comparison between the two studied groups according to probing depth.

Probing depth	Group A	Group B	Test of Sig.	P
After 4th months	**(n = 6)**	**(n = 7)**		
Min. – Max.	1.40 – 2.50	1.75 – 3.50	t= 3.123 *	0.010 *
Mean ± SD.	1.90 ± 0.43	2.76 ± 0.54		
Median	1.88	2.80		
After 6th months	**(n = 6)**	**(n = 7)**		
Min. – Max.	0.75 – 2.0	1.0 – 2.70	t= 1.971	0.074
Mean ± SD.	1.33 ± 0.58	1.96 ± 0.56		
Median	1.25	2.0		
Change from 4th months to 6th months	**(n = 6)**	**(n = 7)**		
Min. – Max.	0.25 – 1.0	0.50 – 1.25	U = 9.50	0.093
Mean ± SD.	0.57 ± 0.27	0.80 ± 0.22		
Median	0.50	0.75		
% of Change from 4th months to 6th months	**(n = 6)**	**(n = 7)**		
Min. – Max.	11.11 – 57.14	16.67 – 42.86	U= 20.50	0.943
Mean ± SD.	31.97 ± 17.87	29.98 ± 9.48		
Median	26.79	28.57		

t, p: t and p values for **Student t-test** for comparing between the two groups

U, p: U and p values for **Mann Whitney test** for comparing between the two groups

*: Statistically significant at p ≤ 0.05

Group A: Flapless technique

Group B: Conventional Flap technique

At 4 months

The mean probing depth for group A was 1.90± 0.43 mm, while the mean probing depth for group B was 2.76±0.54 mm. There was group B showed statistically significantly higher mean PD than group A at 6 months postoperative (p-value= 0.010*).

At 6 months

The mean probing depth for group A was 0.57±0.27mm, while the mean probing depth for group B was 0.80±0.22 mm. There was no statistically significant difference between the 2 groups regarding the mean probing depth at 4months postoperative P-value= 0.074).

Percentage change in probing depth

The mean percentage change in probing depth for group A was 31.97±17.87%, while the mean percentage change in probing depth for group B was 29.98±9.48%. There was no statistically significant difference between the 2 groups regarding the men percentage change in PD scores of the both groups at 4 months and 6 months. (P- value = 0.943).

II. Radiographic evaluation

1- Assessment of crestal bone loss around the implants

Using On Demand 3D software, crestal bone loss was measured at the mesial and distal aspects of all implants for all surfaces of all implants. Statistical analysis of crestal bone loss scores was done for all patients. (Table 2, Figure 6)

At 6 months

The mean crestal bone loss for group A was 0.45±0.22mm, while the mean crestal bone loss for group B was 0.82±0.09mm. Group B showed statistically significantly higher mean crestal bone loss than group A at 6months postoperative (p-value= 0.003*).

Table (2): Comparison between the two studied groups according to marginal bone loss (mm).

After 6th month	Group A (n = 6)	Group B (n = 7)	U	P
Marginal bone loss (mm)				
Min. – Max.	0.0 – 0.60	0.72 – 0.98		
Mean ± SD.	0.45 ± 0.22	0.82 ± 0.09	0.0*	0.003*
Median	0.52	0.78		

U, p: U and p values for **Mann Whitney test** for comparing between the two groups

*: Statistically significant at p ≤ 0.05

Group A: Flapless technique

Group B: Conventional Flap technique

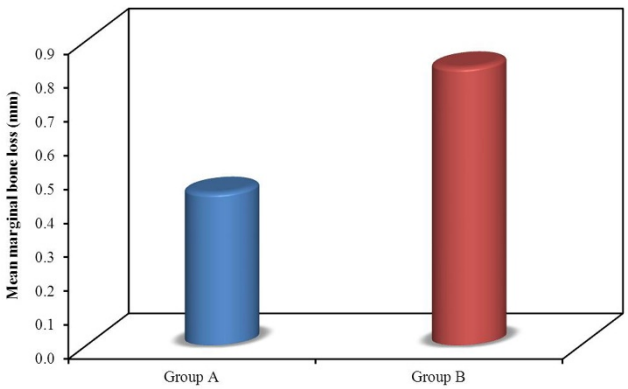

Figure 6: Comparison between the two studied groups according to marginal bone loss (mm).

2- Bone density

CBCT was used to assess the bone density of the implants site, and the standard value of jaw bone density varies from one individual to other.

The operator used the spatial coordinate tool (x, y) to determine the region of interest (ROI). The y-coordinate, which could vary vertically, was held constant, and the x-coordinate, which could vary horizontally. Then the mean densities and standard deviations, as well as the square area of the ROI (mm2) in the trabecular bone, were automatically calculated by the software. The average of bone density was taken for all patients.(Table 3)

At 6 months

The mean Bone density for group A was 967.13±240.40 HU, while the mean Bone density for group B was 775.84±115.50HU. There was no statistically significant difference between the 2 groups regarding the mean Bone density at 6months postoperative (P-value= 0.087).

Table (3): Comparison between the two studied groups according to bone density (average).

After 6th month	Group A (n = 6)	Group B (n = 7)	T	P
Bone density (average)				
Min. – Max.	797.3 – 1329.4	594.6 – 1196.9		
Mean ± SD.	1035.48±226.60	871.40±222.69	1.314	0.216
Median	1008.70	786.10		

t, p: t and p values for **Student t-test** for comparing between the two groups

Group A: Flapless technique

Group B: Conventional Flap technique

DISCUSSION

Implant placement can be done by either flapless approach or using by elevating of a flap. Flapless implant placement has been gaining popularity among surgeons.

The patient comfort and satisfaction are critical aspects of implant therapeutics thus the present study evaluated questionnaires in patients, regarding pain severity and duration of the pain. The patients in group B reported more pain severity and duration following surgery. The difference between the 2 groups was statistically significant.

In the year 2006 Fortin et al (8) stated that pain decreased faster with flapless procedure and the number of patients who felt no pain was higher with the same procedure. They stated that one objective of the flapless procedure is to reduce the invasiveness of surgery and thus reduce surgical outcomes such as pain, edema and hematoma. This generally agrees with results reported by Chang et al (16).

In the present study there was the difference in mean probing depth was only statistically significant at 4 months.

In the year 2006 Oh et al (17) stated that the study reported mean probing depth between the flapless versus conventional only statistically significant at 4 months.

In the current study, cone beam CT was done at 6 months to compare the marginal bone loss and bone density around dental implants placed using flapless and flapped surgical techniques.

From the results of this study, the patients in group B reported more marginal bone loss round dental implants. The difference between the 2 groups was statistically significant.

In the year 2001Gomez and Roman (18) supported the results of the present study by reporting that whenever it comes to marginal bone, higher bone loss rates usually occur with widely mobilized surgical flap sites where the interdental bone in the proximity to the implant is denuded from the periosteum thus affecting the nutrition of the bone and papillae, thus resulting in unpredictable degree of resorption of the interproximal marginal bone.

This study revealed that the density of the bone around dental implant increased with osseointegration, with the both groups. The difference between the two groups was not statistically significant. In the year 2011 Barunawarty (19) approved that bone density increased around dental implant after placement of dental implants with conventional flap and flapless procedures.

From these results, it could be postulated that the flapless implant surgery had an advantage over the conventional flap technique regarding the preservation of the soft tissue profile, a by the elimination of the need for incision and flap reflection together with the preservation of the blood supply to the underling bone and reduction of the surgical edema with its' inflammatory mediators results in reduced crestal bone loss and more stable soft tissue profile after implant placement with a more preferable esthetic outcome.

CONCLUSION

Currently the 1st option of treatment plan is the quality and accuracy with a little time as possible. Also the time of the surgery should be short to improve patient, comfort and satisfactory outcome. Flapless implant surgery has all of these advantages for both surgeon or dentist and the patient himself. In addition the flapless implant surgery reduces the amount of crestal bone loss, soft tissue inflammation, pain, edema, bleeding and it gives fast healing more than the conventional flap technique.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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