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Comparative Evaluation of Soft and Hard Tissue Changes Following Dental Implant Placement with Flap and Flapless Technique – A Clinical and Radiographic Study

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ABSTRACT

Introduction

For placement of a successful dental implant, there should be a good biological connection between implant and the bone. The conventional technique for implant placement includes elevation of mucoperiosteal flap after crestal incision, which facilitated visualization of the anatomical structures that have to be cared during implant placement. In recent years, flapless procedure is gaining attention among clinicians and patients in which dental implant is installed through the mucosal tissue without reflecting a flap. The primary reasons to choose the flapless technique are to minimize the possibility of postoperative peri-implant tissue loss and to overcome the challenge of soft tissue management during or after surgery.

Aim

The aim of this study was to compare and evaluate the soft and hard tissue changes around implants over a period of 6 months in which peri-implant soft tissue changes, crestal bone level changes, patient centered outcomes using VAS were evaluated for both flap and flapless surgical technique used for implant placement.

Material and Methods

A total of 10 systematically healthy patients with a single edentulous site either in maxilla or mandible were randomly selected and categorized into two groups. Group I (flap technique) and Group II (flapless technique) consisting of 5 implants in each group. All the patients were evaluated for soft tissue parameters of bleeding on probing, plaque index, peri-implant probing depth and hard tissue parameters such as crestal bone loss radiographically at baseline, 1, 3 and 6 months. Patients centered outcomes were also assessed by using Visual Analogue Scale (VAS) after 24 hours and 7 days.

Keywords

Dental implants, flapless technique, peri-implant probing depth, crestal bone loss, surgical flap.

INTRODUCTION

The ultimate goal of dentistry is to restore the oral cavity of patient with normal contour, function, comfort, aesthetics, speech and health, whether by removing caries from natural tooth or by replacing the missing tooth. The replacement of lost teeth with dental implant has been in use for more than 50 years and is considered as an effective treatment choice. Initially, dental implants were installed using the surgical protocol, which involves the elevation of a full-thickness mucoperiosteal flap following the placement of implant in bone and flaps are repositioned back using sutures. Flap elevation facilitates visibility and access at operating site which may lead to inter-proximal crestal bone loss and long-term aesthetic complications [1]. Alternative to conventional flap technique, a flapless surgical approach was introduced by Lederman (1997) in which, mucosa is directly punched or a mini-incision technique is used [2]. Flapless procedure has several advantages over conventional flap surgery involving reduced surgical time, less traumatic surgery, no requirement of sutures, accelerated post-surgical healing and better maintenance of the soft tissue profiles.

Now a days, A variety of factors have been associated with Crestal Bone Loss (CBL) around dental implants, including periodontal phenotype, bone density and the formation of biological width, implant placement depth, inter-implant distance, implant micro-design and macro-design, occlusion overloading, and surgical trauma. However, protocols that have been proposed to minimize the loss of crestal bone include the use of platform switched implants, using a flapless surgical technique, and placing dental implants approximately 2 mm below the alveolar crest (submerged/sub-crestal placement)[3,4.] Flapless implant surgical procedure is a predictable procedure with the high success rate if patients are properly selected and appropriate width of bone is available for implant placement aselimination of mucoperiostealflap can prevent potential postoperative bone resorption associated with flap elevation. Also flapless approach has been considered to preserve the vascular supply and existing soft tissue contours.

The choice of surgical procedure according to the literature depends upon its success rate, simplicity and experience of the operator while for the patient comfort is an important criterion. Limited controlled data are available to evaluate the Crestal Bone Height (CBH) after flapless implant surgery. In addition, most crestal bone loss occurs in the early phase after implant placement[5,6]. Therefore, the need of this study was to compare and evaluate the soft and hard tissue changes around implants placed using flap and flapless technique over a period of 6 months.

AIM AND OBJECTIVES

The aim and objective of this study was to compare and evaluate: (i) Peri-implant soft tissue changes around implants placed (ii)Cresal bone level changes around implants placed (iii) Patient centered outcomes using VAS at different time intervals using flap and flapless technique.

MATERIALS AND METHODOLGY

A single centeredstudy was conducted in the Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi, Punjab. A total of 10 systemically healthy patients in the age group of 20-60 years who were suitable and willing for single implant placement were considered on series on inclusion and exclusion crieteria. The study was divided into two groups – Group I (Conventional Flap technique with implant placement) and Group II (Flapless technique with implant placement), comprising of 5 subjects in each group.

Inclusion criteria included (i) Patients with tooth loss because of trauma, excessive internal tooth resorption, endodontic failure, root resorption after reimplantation or retained primary teeth (in case of agenesis) (ii) Edentulous sites free from periapical pathology adjacent to edentulous site (iii) Adjacent teeth, intact, restored with functionally good restorations, free of calculus and with stable periodontal condition.

Exclusion criteria included (i) Patients with insufficient bone quality or compromised status of the local site (ii) Patients with a history of radiotherapy in the head and neck region (iii) Patients with poor compliance and traumatic oral habits(iv) Patients with Poor oral hygiene with no possibility of improvement (v) Pregnant and lactating women.

Pre-Surgical Protocols and Records

Detailed medical and dental history of the patient was taken along with informed verbal and written consent. Cone beam computed tomography (CBCT) and Periapical radiographs were taken to identify the anatomical landmarks and bone volume at variable sites. Routine blood investigations were done to check the fitness of the patient for dental implant placement. Diagnostic casts, surgical stent (Fig.1) and radiographic stents(Fig.2) were made along with clinical photographs for documentation purposes.

Fig.1 Surgical Stent

Fig.2 Radiographic Stent

Clinical and Radiographic Evaluation

Prior to implant placement, a CBCT scan was performed to confirm adequate bone thickness and implant stability. For each site standardized radiographs (periapical x-rays) were taken at the beginning of implant placement (baseline) as well as at 1, 3, and 6 months.A metal grid was placed between the radiographic film and the surgical site. Plaque Index (PI), bleeding on probing (BOP), mobility, peri-implant probing depth (PPD), marginal bone level (MBL) alterations and the visual analogue scale for pain (VAS) were among the clinical assessments.

Bleeding on probing around the dental implant was evaluated by means of bleeding index of Mombelliet al.[7] Plaque index was evaluated by means of modified plaque index of Mombelli et al.[7]The peri-implant probing depth was measured with a UNC-15 plastic probe at 6 different surfaces around the dental implant at mesio-buccal, mid-buccal, disto-buccal, mesio-ligual, mid-lingual, disto-lingual. For the VAS scale the patient was told to rate the pain from 0 to 10 where 0 being no pain and 10 means maximum pain. For the assessment of marginal bone level changes intraoral periapical radiographs were used.

Surgical Preparation

Complete oral prophylaxis was done prior to dental implant placement. Patient was made to rinse with povidine iodine solution and the outer surface of oral cavity was cleaned with betadine solution. Local anesthesia was then administered at the surgical site using lignocaine with adrenaline in the ratio of 1:80000. After achieving the desired results of the local anesthesia, the procedure was started.

Group I (Conventional Flap Technique with Implant Placement)

To expose the implant site, a crestal incision was made for full thickness flap reflection (Fig. 3). The implant site was then marked by placing a surgical stent over the crest (Fig. 4). The initial osteotomy and bleeding point at the implant site were marked, followed by making an osteotomy site with pilot drill. This was followed by subsequent drills of increasing diameter till a final drill up to the chosen depth. After that, the implants were placed into the osteotomy site (Fig.5). Immediately following implant insertion, cover screws were fastened to the implants to seal the exposed implant site. After placing the cover screws, the surgical site was properly cleaned and the flap was sutured with 3-0 silk sutures (Fig 6). A final IOPAR was taken to ensure the accurate placement of dental implant (Fig.7).

Figure 3 Figure 4 Figure 5 Figure 6 Figure 7

Group II (Flapless Technique with Implant Placement)

All the pre-surgical protocols were followed and there was no reflection of flap in this technique. The surgical stent was placed at the desired site and the site was marked for implant placement, a soft tissue punch (Fig.8) of known diameter was used to expose the underlying bone at the marked site (Fig.9). The initial drill (Fig.10) was used to produce the osteotomy site following the subsequent drills of the increasing diameters till the desired length and width for dental implant is achieved(Fig.11). Dental implant of desired size was then placed and a cover screw was tightened (Fig.12). After placing the dental implant post-operative instructions were given also the patients along with antibiotics and analgesics for one week post-operatively. After 7 days the patients from Group I (conventional flap technique) were recalled for suture removal and patients from Group II (flapless technique) were recalled for re-evaluation of the treatment only.

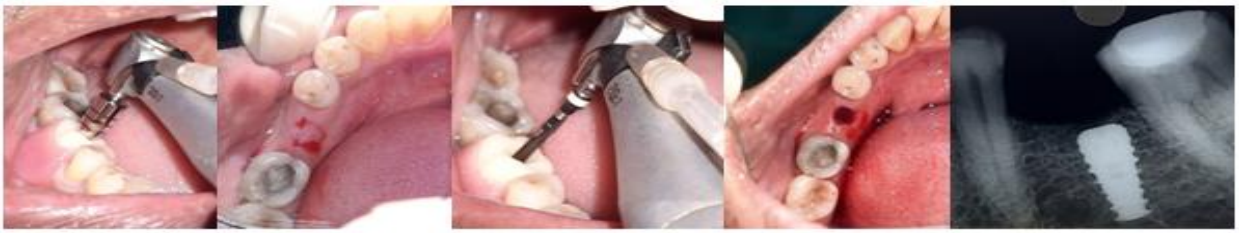


Fig.8 Fig.9 Fig.10 Fig.11 Fig.12

Three months after the surgery the patients from both the groups were recalled for stage II surgery, in which healing screw was placed. After 1 week of placement of healing screw final abutment was placed and abutment level impression was made with C-Silicone putty material followed by fabrication of the cast. Shade selection and metal try-in was done, final prosthesis wasfabricated and a trial and occlusal adjustments were made in patient's mouth . After final trial, polishing was done and the prosthesis was cemented with the help of luting type I Glass ionomer Cement (GIC).

RESULTS

The success rate of implant placement was 100% with no failure of any implant. Soft tissue parameters were evaluated at baseline, 1 month, 3 months and 6 months. Hard tissue parameters were evaluated at 1 month, 3 months and 6 months and the pain index was recorded with visual analogue scale (VAS) was recorded at 24 hrs and 7 days.

STATISTICAL ANALYSIS

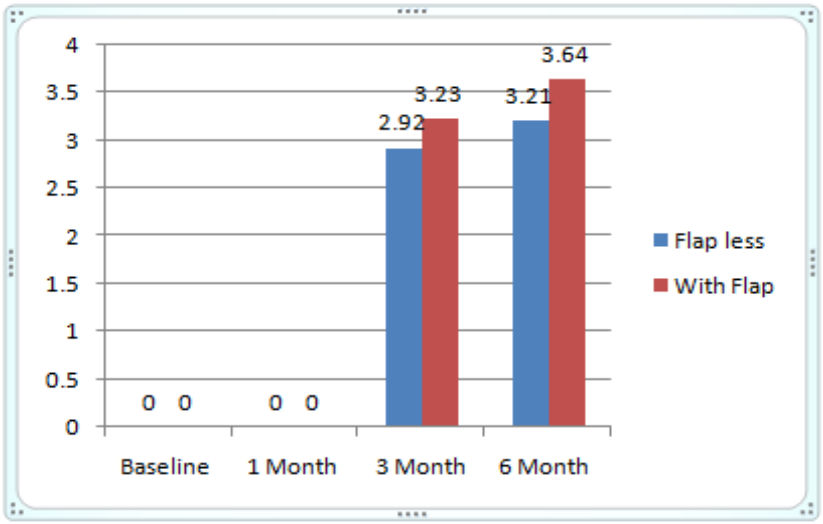
The data for the present study was entered in the Microsoft Excel 2013 and analyzed using the SPSS statistical software 23.0 Version. The level of the significance for the present study was fixed at 5%.The intergroup comparison for the difference of mean scores between two independent groups was done using the unpaired/independent t test.

Soft Tissue Parameters

Peri -Implant Probing Depth

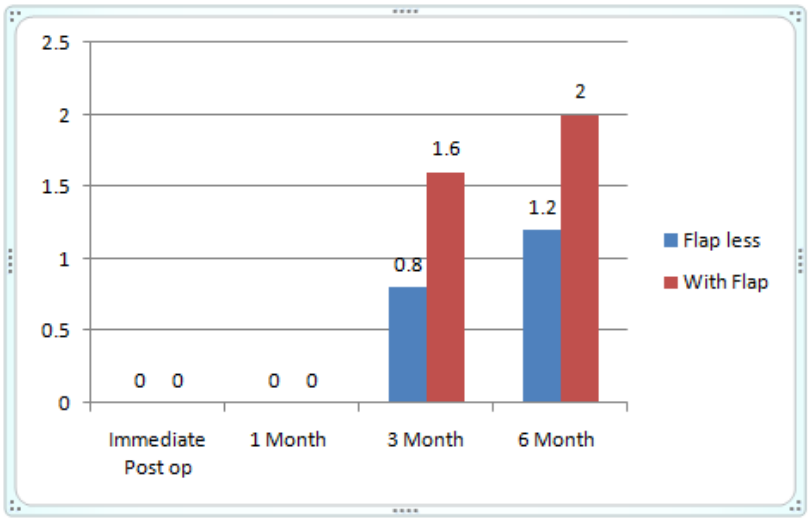
The inter group difference in Probing Depth between the groups at baseline and 1st month was statistically

non-significant (p value-1.00) whereas at the 3rd and 6th month time interval it was statistically significant p value-0.036 and p value-0.001 respectively.



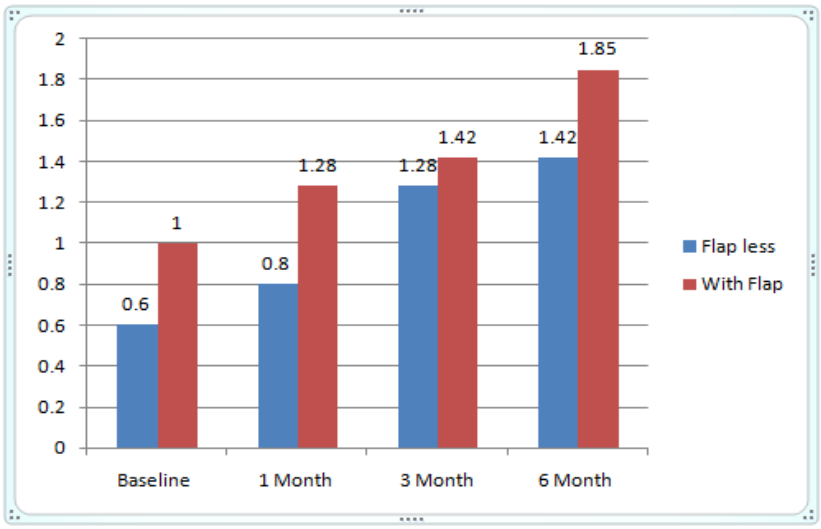
Assessment of Bleeding Index

The inter group difference in Bleeding Score at baseline and 1st month was statistically non-significant (p value-1.000) whereas at the 3rd Month and 6th month time interval it was statistically significant with p value-0.001



Assessment of Plaque Index

At baseline and 1st month the differences in Plaque Score between the groups was statistically significant with p value-0.001 and p value-0.043 respectively also it was statistically significant with p value-0.031 and p value-0.001 respectively for 3rd and 6th month time interval.

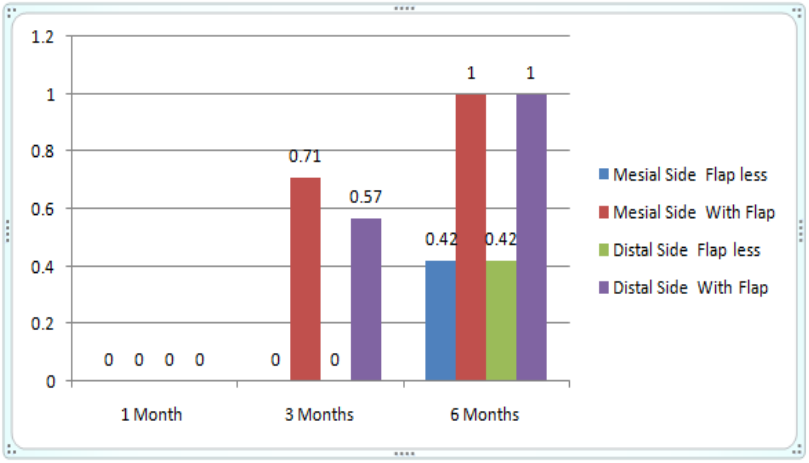


Hard Tissue Parameters

Assessment of Marginal Bone Level Changes

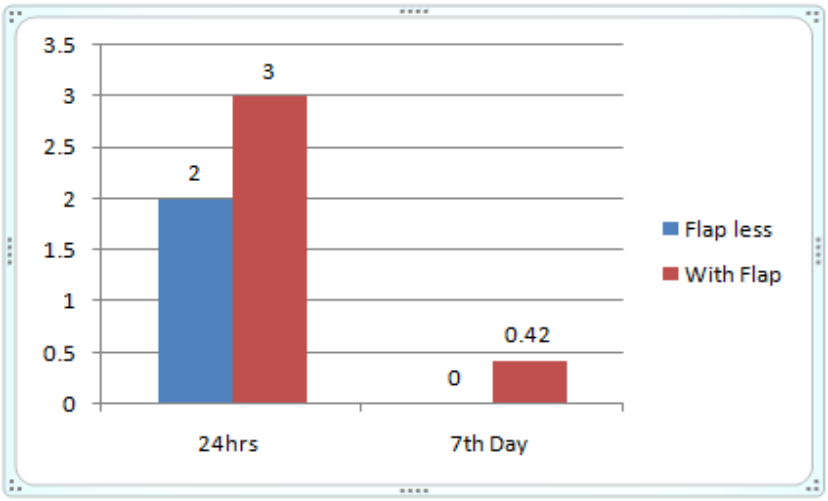
The marginal bone level changes were assessed both at the mesial and distal sides at 1 month, 3 months and 6 months. At 1 month the difference in mean bone depth (Mesial Side) between the groups was statistically non-significant (p value-1.000) and it was seen statisticallysignificant with p value-0.001 and 0.013 respectively for 3rd and 6th month time interval when analysed using the independent t test.

At 1 month,the difference in mean bone depth (distal side) between the groups was statistically non-significant (p value-1.000) and it was statistically significant with the p values 0.014 and 0.013 respectively for 3rd and 6th month.



Assessment of Pain Using VAS

After 24 hours the difference in the painscores between the groups was statistically significant (p value-0.049) whereas it was statistically non-significant (p value-0.066) at 7days.



DISCUSSION

Implant dentistry has an experience of unbelievable changes in the last many decades. Previously, in the conventional two-stage surgical approach, incisions around dental implant sites were designed to provide access to the underlying residual crest under direct visualization. In recent years, there has been scientific evidence in the literature that flapless implant surgery is a contemplated procedure with an expectation of high success rates if patients are selected with an appropriate width of bone for implant placement. This technique is one of the newer and efficient technique with lower patient morbidity.

This study showed that when implants were placed without flap elevation, the crestal bone levels decreases from the time of placement till 6 months. The difference of Marginal bone loss (mesial & distal aspect) was statistically significant but was lesser as compared to the marginal bone loss seen with conventional flap technique of implant placement. According to Albrektsson's criteriafor a successful implant, the crestal bone loss should be lower than 1.5mm during the first year after loading and 0.2 mm annually thereafter[8]. From the present study, it is inferred that though both groups showed minimal bone loss during the study period, all the implants were osseointegrated and functionally stable after loading. Therefore, the change in marginal bone height is inevitable in both conventional flap and flapless techniques. This may be due to the preservation of bone vascularization in flapless technique which may help to optimize bone regeneration around implants, as suggested by the improved osseointegration observed after flapless surgery.

Tsoukaki et al. in their study reported that flapless approach resulted in decreased pain, swelling and inflammation and have a higher patient acceptance than flap technique[9]. VAS is considered as a valid parameter for assessing dental perception of pain, inflammation, bleeding and swelling. Our results were also in accordance with the study in which, within 24 hours after implant placement, the mean VAS was below 2-3 in both conventional flap technique and flapless technique. Patients experienced mild pain and discomfort in the flapless technique after 24 hours. However, flapless and conventional flap technique

resulted in comparable pain and discomfort after 24 hours to 7 days.

In terms of dental implants, the diagnostic accuracy of bleeding on probing (BOP) appears to be a better predictor. The absence of bleeding on probing around peri-implant sites is considered healthy and stable. Therefore, in the present study bleeding on probing was measured using Mombelli et al. 1987 index[7]. On intergroup comparison bleeding on probing at baseline and 1st month was found to be statistically non-significant and at 3rd and 6th month was found to be statistically significant. The change in the bleeding index at different time period can be attributed to the fact that oral hygiene instructions were given for the maintenance of the success of implant therapy and constantly reinforced to the patient so that the inflammation subsides. The results of the present study were in accordance with the earlier studies conducted by Becker et al.[10],Camelo LD and Camara JRD[11].

Plaque is considered one of the primary etiologic factors for the initiation of periodontal diseases. The significant relationship has been shown in between modified plaque index and microbiological aspects of subgingival plaque on implants. In the present study it was shown that mean plaque index from baseline to 6 months was found to be statistically significant. . The mean change in the plaque index is due to the oral hygiene maintenance by the patient throughout the follow up time period. These results of our study were in accordance with the Oh et al.[12],sunitharv et al.[13.] Oh et al.evaluated all the clinical parameters including PPI, PPD, modified bleeding index in flap versus flapless technique and concluded that flapless implant provide better soft tissue results as compared to the conventional flap surgery[12].

Peri-implant probing provides an assessment of different parameters such as bleeding on probing and suppuration from the sulcus and peri-implant tissues. Clinical probing depth is more around implants versus natural teeth, because the probe tip may ends apically from the junctional epithelium into the connective tissue which is more close to the alveolar bone crest. Generally successful implants allow the probe to penetrate approximately 3mm. In the present study, on intergroup comparison of peri implant probing depth at baseline and 1st month was found to be non-significant and at 3rd and 6th month was found to be statistically significant. These results comply with the finding that the initial maturation and stabilization of the peri-implant mucosa occurs within the first 6 weeks after implantation. There by the flapless technique showed more stable peri-implant probing depth over the time period and it was also less when compared to the conventional flap technique. The results of this study were found to be consistent with that of authors such as Tsoukakiet al.[7]and You et al.[14]andSclar AG[15].

SUMMARY AND CONCLUSION

From our study, we concluded that the Dental implants that were placed using flapless technique, as in Group II, showed better results than those placed using conventional flap technique (Group I) when parameters like marginal bone loss, bleeding on probing, plaque index and peri-implant probing depth were assessed. However, there was no significant difference in pain after 7 days of implant placement, among the two groups.

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