Research Article

“Flapless Implant Surgery: A Clinical Evaluation”

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ARTICLE INFO

Background and objective: The replacement of missing teeth is carried out frequently with the help of implants in surgically indicated cases. The flapless technique of implant placement has numerous advantages such as decreased surgical time and maintenance of both soft and hard tissues, decreased postoperative bleeding and pain, faster recovery, and improved patient’s comfort. In this study, our aim was to evaluate the effect of flapless implant placement on peri-implant and periodontal hard and soft tissues.

Methods: The clinical study was conducted at the Department of Periodontology, Government Dental College and Hospital, Ahmedabad. A total of 30 patients aged >18 years with single/multiple missing teeth were recruited. Flapless surgical implant placement was done in each case. Periodontal parameters were measured at baseline and 6 weeks after implant placement. Papillary presence index (PPI), Marginal level of soft tissue (ML), Gingival index (GI) (Loe and Sillness), Modified bleeding index (mBI) (Mombelli), Probing depth measurement and Patient satisfaction data were measured.

Result: The GI and mBI scores are very less when measured postoperatively. The PPI and ML remained stable from baseline to 6 months, indicating maintenance of soft tissue profile. Radiographic evaluation showed minimal crestal bone loss at follow up and all patients were satisfied with procedure.

Conclusion: Thus flapless implant placement approach can be a highly predictable modality for replacing missing teeth with proper patient selection.

Keywords: Dental Implant, Flapless, Preservation, Surgery

ABSTRACT

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INTRODUCTION:
The replacement of missing teeth is carried out frequently with the help of implants in surgically indicated cases. Dental implants generally present with multiple therapeutic possibilities, high success rate and are considered to be a suitable approach to replace missing teeth.[1] Implant dentistry has evolved from a traditional two stage treatment to a highly esthetic treatment modality. Consequently, there has been increasing implementation of techniques that shorten the treatment with methods such as immediate placement of implants at the time of extraction, immediate loading and flapless surgical procedures. When placing dental implants, a flap is usually elevated to visualize the area properly so that some anatomical landmarks (e.g. foramina, lingual undercuts or maxillary sinuses) are clearly identified and protected.[2] However, when placing dental implants with the above-mentioned open flap technique, there is an associated slight bone loss at the site. To overcome this resulting bone resorption, the flapless surgical approach for implant placement was introduced by Ledermann (1977). This together with other advantages of flapless techniques such as decreased surgical time and maintenance of both soft and hard tissues, decreased postoperative bleeding and pain, faster recovery, and improved patient’s comfort[3,4,5] have made it a technique increasingly demanded and used by clinicians in implantology, both in conventional dental implant surgeries and in implant guided surgery. Hence, the aim of the present study is to evaluate the effect of flapless implant placement on peri implant and periodontal hard and soft tissues.

MATERIALS AND METHODS:
This study is done to evaluate the marginal soft tissue and hard tissue changes after flapless implant placement in partially edentulous jaw. The patients were selected from the Outpatient Department of Periodontology and Implantology, Government Dental College and Hospital, Ahmedabad. The study was approved by the ethical committee. A total of 30 sites were selected to be evaluated by placement of flapless dental implants. The procedure and risks were explained to the subjects and an informed written consent was taken prior to the start of study.

Inclusion Criteria:
All patients included in the study were in the age group of >= 18 years, with partial/complete edentulous jaws with minimum requirement of one implant. Patients selected were systemically healthy with good oral hygiene; and those who were willing and able to provide informed consent

Exclusion Criteria:
Patients with a history of diabetes or any other debilitating systemic disease; or patients requiring ridge augmentation with barrier membrane, sinus grafting procedures following implant placement were excluded from the study. Patients with a history of parafunctional habits (viz. bruxism, clenching), anterior deep bite and unstable occlusion and heavy smokers (more than ten cigarettes/day) were also not included.

Following the initial examination and treatment planning, the selected subjects underwent phase I therapy. Detailed instructions regarding self performed plaque control measures were given. Any restorative corrections if required were completed prior to the surgery. Radiographic examinations were done for each patient by using sectional CBCTs of the area of interest and supplemented, if needed by conventional periapical radiographs and orthopantomographs (OPG). Implant sizes were selected according to those readings. Alginate impressions of the upper and lower arch were made and study casts were prepared for each patient. Customized stents were prepared on the study casts.

Surgical technique:
Local anaesthesia (2% lignocaine HCl) with adrenaline (1:1,00,000) was given during surgery and the soft tissue at the proposed site of implant was punched using a tissue punch.

All implants were placed equicrestally to prevent formation of the bone during the healing period around the abutment area like in subcrestal placement of implants. Healing abutments were connected immediately to the fixtures, such that the coronal portion of the abutments remained exposed to the oral cavity.
Clinical parameters:
The following clinical parameters were recorded after implant placement:
A) At baseline and at 6 months post-operatively:
1. Papillary presence index (PPI) (Cardaropoli 2004)
2. Marginal level of soft tissue (ML)
B) At 6 months post-operatively:
1. Gingival index (GI) (Loe and Sillness 1963)
2. Modified bleeding index (mBI) (Mombelli et al 1987)
3. Probing depth measurement.
4. Patient satisfaction data

Statistical analysis:
IBM SPSS VERSION 20.0 for Windows (SPSS) was used for the data analysis. Clinical data pertaining to baseline and posttreatment analysis of various parameters were expressed as mean ± standard deviation (SD). Intragroup differences were analyzed using paired t test.

RESULTS:
The study incorporated placement of dental implants by the flapless technique with follow up at 6 months. Two patients in the study were lost to follow-up and finally data on 28 patients was available for analysis. Table 1

Table 1: Demographics Of The Study Population

<table>
<thead>
<tr>
<th>Total No. Of patients</th>
<th>Age group (Years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>18-60</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 2 shows that the gingival index score at 6 months post-operatively is very less, indicating the pivotal role of flapless approach to the maintenance of good soft tissue health.

Table 2: Evaluating The Values For Gingival Index At 6 Months Post Operatively

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI at 6 months</td>
<td>0.79</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Table 3 shows that the modified bleeding index scores at 6 months postoperatively is very less, indicating the absence of inflammation in soft tissues in case of flapless approach of implant placement.

Table 3: Evaluating The Values For Modified Bleeding Index At 6 Months Post Operatively

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>mBI at 6 months</td>
<td>0.94</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Table 4 shows that the papillary presence index scores remain stable from baseline to 6 months postoperative was statistically insignificant, as suggested by the p value, which is greater than 0.05.
Table 4: Paired T Tests For Papillary Presence Index Between Baseline And 6 Weeks Values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Paired Differences</th>
<th></th>
<th></th>
<th></th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. deviation</td>
<td>Std. error of mean</td>
<td>95% confidence interval of the difference</td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td>Baseline PPI</td>
<td>2.17</td>
<td>0.54</td>
<td>0.01</td>
<td>-0.20</td>
<td>0.13</td>
<td>0.4407</td>
</tr>
<tr>
<td>6 months PPI</td>
<td>2.21</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 shows that the marginal soft tissue level scores remain stable from baseline to 6 months, indicating that there was no significant marginal tissue recession through the follow up period. The difference in the mean ML scores from baseline to 6 months postoperative was statistically insignificant, as suggested by the p value, which is greater than 0.05.

Table 5: Paired T Tests For Marginal Soft Tissue Level Between Baseline And 6 Weeks Values

<table>
<thead>
<tr>
<th>Variable</th>
<th>PAIRED DIFFERENCES</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. deviation</td>
<td>Std. error of mean</td>
</tr>
<tr>
<td>Baseline ML</td>
<td>0.06</td>
<td>0.52</td>
<td>0.03</td>
</tr>
<tr>
<td>6 months ML</td>
<td>0.13</td>
<td>0.36</td>
<td></td>
</tr>
</tbody>
</table>

Radiographic evaluations showed a small amount of bone loss during the healing process. The average bone loss was 1.01 mm 6 months after surgery. (Table 6)

Table 6: Mean probing depth and bone loss at each site

<table>
<thead>
<tr>
<th>Sites</th>
<th>Mean Probing Depth (mm)</th>
<th>Bone Loss (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Site 2</td>
<td>1.25</td>
<td>1.2</td>
</tr>
<tr>
<td>Site 3</td>
<td>1.25</td>
<td>1.2</td>
</tr>
<tr>
<td>Site 4</td>
<td>1.75</td>
<td>1.2</td>
</tr>
<tr>
<td>Site 5</td>
<td>1.25</td>
<td>0.8</td>
</tr>
<tr>
<td>Site 6</td>
<td>1.5</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Patient satisfaction data collected at 6 months (Table 7) showed that all patients were generally satisfied with the procedure. (mean value of 1.10)

Table 7: Table For Patient Satisfaction At 6 Months Postoperatively

<table>
<thead>
<tr>
<th>Variable</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient satisfaction data</td>
<td>1.10</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Table 8 describes the overall clinical characteristics and soft and hard tissue conditions of implant and related mucosa 6 months after surgery. The mean probing depth was 1.01 mm. The mean GI score was 0.79. The mean mBI score was 0.94. The average difference in PPI scores was 0.04. The average difference in ML score was 0.07.

Table 8: Overall Clinical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>6 Months (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probing depth (mm)</td>
<td>1.31</td>
</tr>
<tr>
<td>Gingival index</td>
<td>1.06</td>
</tr>
<tr>
<td>Modified bleeding index</td>
<td>1.08</td>
</tr>
</tbody>
</table>
Papillary presence index 0.04
Marginal soft tissue level 0.07
Crestal bone loss (mm) 1.01
Patient Satisfaction 1.10

Graph 1 comparing the Papillary Presence Index (PPI) at baseline and 6 months postoperative

Graph 2 comparing the Marginal Soft Tissue Levels (ML) at baseline and 6 months postoperative.

Graph 3 shows the variables such as Gingival Index (GI) and bleeding index (mBI) measured at 6 months postoperatively.
Graph 4 shows the variables such as probing depth and crestal bone loss as measured at 6 months postoperatively.

Fig 1: Preoperative Buccal View

Fig 2: Preoperative Occlusal View
Fig 3: Sectional CBCT Showing Adequate Width And Height

Fig 4: Marking At The Proposed Site Of Implant Placement

Fig 5: Tissue Punching Done

Fig 6: Implant Placed By Flapless Technique
Fig 7: Healing Cap In Place

Fig 8: Immediate Post Operative Radiograph

Fig 9: Healing Cap In Place At Follow Up

Fig 10: Abutment In Place
DISCUSSION:
The use of dental implants has added to the range of treatments available for different types of tooth loss. Many studies have confirmed an excellent long-term prognosis (success rates of 78% to 100% Adell R, Lekholm U et al 1981)[6] Previously, teeth with a poor prognosis were preserved to postpone the inevitable removable prosthesis. Nowadays, with the advent of implant surgery, that option is practically eliminated. Before formulating a treatment plan, the practitioner must establish the diagnosis and its etiology, determine the prognosis of the remaining teeth, and predict the final functional and esthetic result. Equally, the prognosis of the different therapeutic options must be fully analyzed.

Implant placement can be done by the conventional technique by raising of a mucoperiosteal flap and placing the implant. However this technique has
several disadvantages such as increased bone resorption during the initial healing phase (Misch et al[1]), post operative scarring, etc. In contrast to this, flapless implant surgery has numerous advantages, such as preservation of blood circulation (because in flapless implant placement, elevation of the flap is not done), maintenance of soft tissue architecture (because only a small tissue punch is done to access alveolar bone), maintenance of hard tissue volume at the site (because flap is not elevated, blood supply to the underlying alveolar bone is not hampered), decreased surgical time for procedure and no requirement of sutures- these will ultimately lead to improved patient comfort and accelerated recuperation and allow the patient to resume normal oral hygiene procedures immediately after the implant placement. (Sclar AG et al 2003)[7]

A soft tissue punch, the size of implants was used to create punch at the site of operation before implant placement. It provided proper soft tissue margin and marginal seal around implants. Becker et al.2005[5] made a hole in the gingival tissue using drills instead of a tissue punch which was smaller than implant size. Drilling through the mucosa without removing a core of soft tissue may simultaneously cut the gingival tissue and the bone. This method could result in large ragged wounds. 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 tissue punch which is the size of the implant itself, the peri-implant mucosa is in direct contact with the implants, and no gap is produced (Lee, Choi et al 2010)[8].

Papillary presence index and marginal soft tissue level were measured at baseline and 6 months after implant placement; and Gingival index, modified bleeding index and probing depth at 6 months after implant placement to check the soft tissue health around dental implants. These indices would give accurate results to decide the soft tissue healing around dental implants. (Pippi et al 2017)[9].

One of the important clinical signs of gingival inflammation, besides the exudation of gingival fluid, is the redness of the gingival margin. It arises partly from the aggregation and enlargement of blood vessels in the immediate subepithelial connective tissue and the loss of keratinization of gingiva.

In the present study, the gingival index at 6 months was 0.79 +/- 0.21 (Table 2). The modified bleeding index at 6 months was 0.94 +/- 0.15 (Table 3). This may be explained on the basis of maintenance of good healing conditions in soft tissue adjacent to flapless implants and maintenance of proper oral hygiene by the patients, contributing to the resulting stable soft tissue profiles. Similar results were found by Seung-Mi Jeong et al(2011)[10] and Tae-Ju Oh, Shotwell et al 2006[11] in their studies.

In the present study, the papillary presence index at baseline was 2.17 +/- 0.54 and at 6 months it was 2.21 +/- 0.56. The change in values from baseline to 6 months showed no statistical significant difference (p value > 0.05).

These similar results were obtained by Jill, Bashutski et al 2013[12] and Tae-Ju Oh, Shotwell et al 2006[11] who, in their studies showed that the soft tissue profiles around implants remained stable in terms of PPI upto 6 months.

A previous study has documented that gingival recession is a common outcome following flapped implant surgery (Van der Zee E, Oosterveld P et al 2004)[13]. Most gingival recession occurs 3 months after implant placement. In the present study, patients experienced no gingival recession after implant using a flapless implant procedure. This suggests that flapless procedures are advantageous for maintaining the original mucosal form surrounding dental implants.

According to the results of present study, flapless implant surgery yields reduced sulcus depth around implants, with a mean pocket probing depth of 1.31mm +/- 0.21, 6 months after flapless implant surgery in contrast to pocket depths around flapped implants ranging from 2 to 2.6 mm at postoperative weeks 12-24 according to DeAngelo SJ et al 2007[14]. Small, clean, closed wounds heal quickly with little scar formation, whereas large, open wounds heal slowly and with significant scarring. This principle also holds for wounds around the implants. Following flapless procedures, the surrounding mucosa has smaller, cleaner, less open wounds than following flapped procedure, which, in turn, may improve peri-
implant mucosal healing (Pippi et al 2017)[9]. In the present study, the results follow a similar trend as mentioned above.

In the present study, in the 6 months observation period, no implant failure, no implant mobility, no peri-implant inflammation or pain has been reported. The result of the present study is in accordance with the study done by Nadine Brodala et al 2009,[15] wherein the 14 studies that evaluated long-term outcome included a total of 778 patients and 2,040 dental implants over a mean observational period of 19 months.

The stability of soft tissue profiles observed at flapless implant sites in the present study likely results from minimal peri-implant bone loss. Several authors have reported that flapless implant surgery minimizes bone resorption (Becker W, Goldstein M 2005[5]; Jeong SM 2007[16]). The results of the present study indicate an average bone loss of 1.01 +/- 0.35 mm 6 months after implant placement. The stability of soft tissue profiles may also reflect a lower degree of soft tissue injury than that incurred after flapped implant surgery. The degree of soft tissue injury is known to influence the speed and quality of healing.

According to Albrektsson's success criteria, 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 0.4 to 1.2 mm 1 year after flapless implant surgery. (Buser DA, Schroeder A et al 1988)[17]. The findings of the present study demonstrate that the mean bone loss was 1.01 +/- 0.35 mm 6 months after flapless implant surgery; all implants were successfully osseointegrated, and no implants exhibited bone loss >1.2 mm, except one site where the crestal bone loss at 6 months follow up was 2.3 mm. These low frequencies of both implant failures and progressive bone loss agree with findings from earlier studies of Campelo LD 2002[18] and Goldstein M 2005[8].

Effective plaque control after flapless implant surgery could be another factor involved in the lower rate of crestal bone loss in the present study. Implants can easily be cleaned immediately after the flapless implant procedure, because the implant surface is in close contact with the surrounding mucosa.[11] Early plaque control plays an important role in promoting the health of the peri-implant mucosa and in preventing peri-implant bone loss.

**CONCLUSION:**
An analysis of the data obtained in this study, compared with data obtained while reviewing literature, leads to the conclusion that flapless implant placement approach is a highly predictable modality for replacing missing teeth. It must however be noted that patient selection plays a pivotal role in the success of flapless implant placement.

**REFERENCES:**


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