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TO EVALUATE AND COMPARE CRESTAL BONE LOSS IN DENTAL IMPLANTS PLACED VIA FLAP AND FLAPLESS TECHNIQUE: AN IN-VIVO STUDY

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ABSTRACT Dental implants are widely accepted as a reliable solution for tooth replacement, largely due to advancements in materials, design, and surgical techniques. The success of dental implants depends not only on the material properties but also significantly on the surgical technique employed. This study aims to compare crestal bone changes around dental implants placed using flap and flapless techniques.

Twenty patients were randomly divided into two groups: Group I, which used the flap technique, and Group II, which employed the flapless technique. The primary parameter assessed was the change in crestal bone level over nine months, using CBCT at various stages: immediately post-implant placement, three months post-healing, three months post-loading, and six months post-loading.

For Group I, a mid-crestal incision was made, and a mucoperiosteal flap was elevated to expose the bone before placing the implant and suturing the flap back. In Group II, no incision was made; instead, a punch was used to remove a small amount of soft tissue, and the implant was placed directly through the soft tissue.

Post-surgical results showed mean crestal bone levels of 1.74 mm for Group I and 1.78 mm for Group II on the mesial side. At three months post-healing, these levels were 1.89 mm for Group I and 2.02 mm for Group II. Three months post-loading, the levels were 2.01 mm for Group I and 2.29 mm for Group II. Six months post-loading, the levels were 2.23 mm for Group I and 2.70 mm for Group II on the mesial side. Statistically significant differences were observed in crestal bone levels between the two groups at each time interval, with Group II (flapless) demonstrating better maintenance of bone levels.

In conclusion, the flapless technique preserves peri-implant tissues better than the traditional flap technique, resulting in less crestal bone loss. Guided implant surgery can further enhance the accuracy and predictability of flapless procedures, ensuring optimal implant placement and outcomes.

KEYWORDS :

INTRODUCTION

Since the 1960s, when Branemark, proposed osseointegrated implant treatment, the outlook for restoring missing teeth has undergone a significant shift. Given how frequently dental implants are used, it's critical to guarantee both their immediate and long-term success. Maintaining and preserving the soft tissue and crestal bone that surrounds the dental implants plays a crucial role in determining the success of the treatment.[5]

Crestal bone loss around dental implants can have detrimental effects on their stability and long-term success as it plays a crucial role in supporting the implant and its restoration but if it occurs, the implant loses its anchorage and may become unstable, leading to potential failure. Moreover, a reduction in crestal bone level can hinder the proper distribution of occlusal forces, further jeopardizing the implant's stability and longevity; therefore, the current study examines implant placement using flap and flapless procedures to determine which procedure results in least amount of bone loss.[5]

During the flap procedure, the gingival tissue is incised to reach the alveolar bone, allowing for hand instruments to lift the soft tissues for better visibility at the surgical site. Following the osteotomy implant placement is done and the tissue is brought back together and re-approximated with sutures. This approach to placing implants is considered the standard because it offers a clear view of the bone and is a common surgical practice.[8]

Ledermann was the first to introduce the flapless surgical approach in order to prevent bone resorption. In our research, we utilized a minimally invasive flapless implant placement technique described by Campelo & Camara (2002). The procedure involves inserting the implant by drilling through the mucosa into the bone to create the initial osteotomy.[12]

Advanced CAD/CAM technology allows for precise implant placement planning using image data to direct surgical intervention with the help of rapid prototyping technology and a 3-D printed surgical guide for flapless technique.[14]

This method enables accurate assessment of the position of important anatomical structures and lowers the chance of harming them in the surgery.[16]

This study was to compare and evaluate the effects of flap surgical procedure versus flapless surgical (done via 3-D printed surgical guide) over crestal bone levels around a dental implants over a period of 9 months (post operative, 3 months post operative, 3 months post loading and 6 months loadings).

MATERIAL AND METHODOLOGY

All patients were treated at the Department of Prosthodontics and Crown and Bridge at Shree Bankey Bihari Dental College & Research Centre, Masuri, Ghaziabad. After obtaining written informed consent, statistical randomization was used to select the site for either flap or flapless techniques, resulting in the placement of 20 implants in total. Initial radiographic assessment was performed using CBCT.

The study included participants aged 25-40 years, regardless of

gender, with good periodontal health, oral hygiene, D2 bone density, positive mental attitude, and good systemic health. Participants were non-smokers and non-alcoholic. Exclusion criteria included systemic diseases, heavy smoking, TMJ disorders, bruxism, pregnancy, lactation, arthritis, bone disorders, oral lesions, and those undergoing radiotherapy, chemotherapy, or bisphosphonate therapy.

For the surgical procedure, patients were given antibiotics, starting with AUGMENTIN 625 mg Duo 24 hours before surgery, continuing for 5 days post-surgery. One hour before surgery, a single dose of 1g amoxicillin was administered.

In Group I (flap surgical technique with conventional drills), after administering local anesthesia (2% lidocaine with 1:100,000 adrenaline), a crestal incision was made using a Bard Parker blade no. 15, and a full-thickness mucoperiosteal flap was reflected. The osteotomy was initiated with a pilot drill, followed by sequential drills at a clockwise speed of 800-1500 rpm. The drilling depth was increased by 2mm beyond the implant length to allow for implant submergence, with liberal irrigation throughout. The implant was placed using a torque wrench and implant driver, ensuring primary stability with a torque of 35-40 N cm, followed by the placement of the cover screw and securing the flap with interrupted sutures.

In Group II (flapless surgical procedure using guided implant drilling and placement), digital surgical guides were fabricated using Blue Sky Plan software. DICOM files from CBCT were transferred to the software. Impressions of patient arches were made using a two-step technique, and the final impression was 3-D scanned to obtain a digital 3-D STL model. Implant simulation considered five key points: dimension and cortical plate orientation, implant length and width, implant angulation (not exceeding 15°), spatial position relative to adjacent structures, and the relationship of the restorative/crestal module to the alveolar crest.The printed guide was cured in a UV chamber for 3 minutes and disinfected in isopropyl alcohol and water solution for 24 hours.

For Group II patients, local anesthesia was administered, and the surgical guide was placed over the dentition to guide implant placement. The guide was stabilized, and osteotomy was performed using sequential drills at 800 rpm, with drilling depth 2mm more than the implant length for submergence. Saline irrigation was used throughout. Primary stability was confirmed with a torque of 35-40 N cm upon full insertion, and the cover screw was placed. Radiographs were taken post-procedure to verify implant insertionPost-surgical instructions included prescriptions for five days of chlorhexidine rinses. Patients were called back for follow-up after seven days for suture removal and oral hygiene advice, with subsequent check-ups at three, six, and nine months.

For prosthetic reconstruction, post-healing crestal bone levels were evaluated using CBCT. After three months of healing, all fixtures were examined for stability, and healing abutments were placed under local anesthesia. Patients were recalled after a week for final impressions using the open tray technique. The implant prostheses were fabricated, positioned, and torqued to 25 N/cm. Crestal bone levels were recorded post-functional loading at three and six months using CBCT, with measurements taken on tangential or coronal sections.

Implant site (46) measurements in coronal view

Incision and flap elevation wrt 46

Immediate and 3 months Post-surgical CBCT showing crestal bone loss in mesial and distal aspect wrt 46

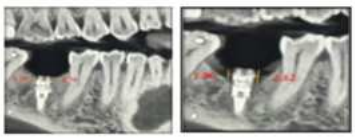
Screw retained crown placed over implant wrt 46

Conventional flap procedure

3D CT of implant site and surgical guide fabrication

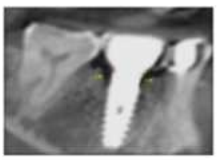
3D printed cylindrical guide sleeve in situ

Surgical guide in situ and Sequential drilling via the guide till desired implant width wrt 46

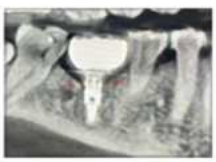


Immediate and 3 months Post-surgical CBCT showing crestal bone loss in mesial and distal

Screw retained crown placed over implant wrt 46



CBCT showing crestal bone loss 6 months post-loading (total duration 9 months) in conventional group



CBCT showing crestal bone loss 6 months post-loading (total duration 9 months) in conventional group

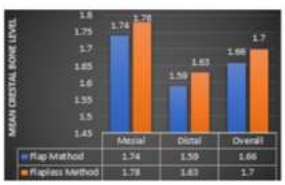
Flapless procedure

RESULT

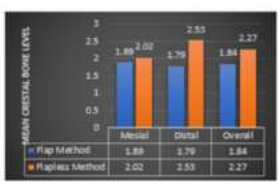
Statistical Analysis

"The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation .The intragroup comparison for the different time intervals was done Repeated Measures ANOVA to find the difference between the individual time intervals The level of the significance for the present study was fixed at 5%."

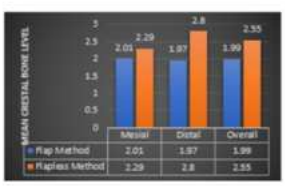
The intergroup comparison for the difference of mean scores between two independent groups was done using the unpaired/independent t test.



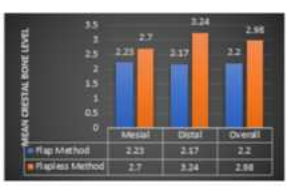
Graph 1 - post-surgical mean crestal bone level



Graph 2 - Three months post-healing



Graph 3 - Three months post-loading



Graph 4 - Six months post-loading

DISCUSSION

Dental implants, which act as artificial root form substitutes, restore functionality similar to natural teeth when implanted in the human jaw. Advances in materials, design sciences, and technology have made dental implants a widely accepted solution for replacing missing teeth. These implants offer high versatility, predictability, and success regardless of the host's systemic conditions or the implantation site, thanks to continuous research and advancements in surgical

techniques.

Researchers and clinicians have worked extensively to develop surgical and prosthetic techniques that maintain aseptic conditions, tissue morphology, and blood supply around dental implants. However, the conventional technique can lead to bone resorption, postsurgical tissue loss, and decreased blood supply due to full-thickness flap reflection. Additional concerns include intra- and post-operative blood loss, edema, aesthetically displeasing soft tissue recession, and patient discomfort.

Minimally invasive procedures became prominent in the early 2000s, with Dr. Marco Degidi advocating for the "flapless" approach for implant placement. This technique, gaining popularity among clinicians, involves minimal removal of soft tissue and is facilitated by advancements in radiologic technologies and dental implant treatment planning software. The flapless method preserves blood vessels, maintains the original mucosal form, and retains hard tissue volume at the peri-implant site, while also shortening surgery length, improving patient comfort, and accelerating recovery.

However, flapless surgery requires greater skill to visualize anatomical landmarks and vital structures, has a risk of thermal damage due to reduced irrigation access, and poses challenges in ensuring accurate implant positioning and optimizing soft tissue contours. These limitations can be mitigated through guided implant surgery, which involves precise digital planning and the use of customized surgical guides to ensure accurate implant placement.

The presence of keratinized gingiva and healthy crestal bone around the implant is crucial for its success, influenced significantly by the blood supply. Poor blood supply leads to soft tissue recession and crestal bone loss.

A study investigated crestal bone changes in dental implants placed with flap and flapless techniques. Patients were divided into two groups and crestal bone levels were measured using CBCT at various stages: immediately post-implant placement (baseline), at 3 months post-healing, 3 months post-loading, and 6 months post-loading where they found that the post-surgical mean crestal bone levels were similar between groups initially. However, over time, Group II (flapless) showed statistically significant differences in crestal bone levels, particularly at the 3 and 6-month intervals. The flapless group demonstrated greater crestal bone level changes, indicating a potential advantage in preserving bone structure.

Our study concluded that while both techniques showed changes in crestal bone levels, the flapless approach might better preserve crestal bone integrity, with statistically significant differences observed in crestal bone levels over the 9-month period. The intragroup changes in bone levels from post-surgical to 9 months were statistically significant for both groups, with the flapless group showing more favorable outcomes in terms of crestal bone preservation.

CONCLUSION

In this study, substantial changes were observed in crestal bone levels over a period of time at mesial and distal aspects after flap and flapless technique for implant placement, while the initial crestal bone levels were non-significant for both flap and the flapless implant placement but eventually increase in crestal bone loss was noticed in mesial and distal aspect of implants over the study duration.

Flapless implant placement showed less crestal bone loss as compared to the flap technique of implant placement.

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