ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2018; 4(1): 213-218

www.oraljournal.com
Received: 06-11-2017
Accepted: 07-12-2017

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To compare and evaluate the difference in crestal bone loss after implant placement by conventional flap and flapless technique followed by early loading of implants: An *in vivo* study

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Abstract
Purpose: To evaluate and compare the changes in crestal bone height around implants placed with traditional flap surgery and with-flapless surgery followed by early loading of implants.
Materials and Methods: Twenty implants were placed ten per group-ten using flapless and ten using with-flap techniques in posterior mandibular edentulous region by one-stage approach with early loading protocol. The change in heights of crestal bone was then measured on standardized digital periapical radiographs taken at 0 week, 6weeks, 12 weeks and 6 months.
Results: The present study showed that on both proximal sides, the mean change from 0 months, 6 weeks, 12 weeks and 6 months for flapless method was significantly lower than with traditional flap method (+0,07 against +0.26 mm on mesial side and +0.15 against +0.33mm on distal side at 6 months).
Conclusions: During the six-month period, reduction of crestal bone height around the implants placed with flapless surgery was not statistically significant, while the reduction of crestal bone height around the implants placed using with-flap surgery was statistically significant. Comparitively, flapless approach showed lesser crestal bone height reduction, which was statistically significant.

Keywords: Crestal bone loss, flapless surgery, immediate loading, implants

Introduction
Osseointegration forms the basis of implant success by predictable formation of a direct bone-to-implant interface. Osseointegrated dental implantation is traditionally performed by a flap approach that involves soft tissue flap reflection and necessitates the introduction of sutures after implant placement [1].
When placing dental implants, via conventional flap procedure, a flap is usually elevated to better visualize the area. Flap elevation ensures that anatomical landmarks are clearly identified and the available bone is assessed to facilitate implant placement However, this approach is associated with some degree of morbidity and discomfort, chief among these is a loss of alveolar crest bone due to decreased supraperiosteal blood supply. Additional concerns include postoperative blood loss and hemorrhage, and pain and discomfort for the patient [2, 3].
To address these main concerns, flapless approaches have been developed in which a small amount of tissue over the crest of edentulous ridge is removed that is just sufficient to facilitate implant placement. As a consequence, no suture are required and no soft tissue flap is reflected, decreased surgical time, maintenance of soft and hard tissue and potentially reducing post-operative discomfort and swelling.
Recently, one experimental study on animals showed that the flapless implant placement had positive response on bone height and osseointegration compared to with-flap method [4]. However, there is no documentation on such studies carried out on human subjects. The aim of this study was to evaluate and compare the changes in crestal bone heights around implants placed with flapless and with-flap surgeries. The hypothesis was that flapless surgery results in lesser crestal bone reduction compared to with-flap surgery, and that it is clinically a predictable procedure.

Materials and method

Study included the patients above 18 years of age in which twenty implants were placed in posterior mandibular edentulous region, with sufficient amount of bone width of at least 4.5 mm without undercuts of >15º measured radiographically and keratinized tissue of at least 5 mm measured with the help of William's probe [5].

Presurgical Assessment

Detailed patient history was taken before selecting the patient for procedure. All vital signs were checked and a complete hemogram was done to evaluate the fitness of the patient for implant placement followed by complete oral prophylaxis. Pre‐ operative IOPA and orthopantomogram (OPG) provided the necessary information regarding the available bone and distance of vital structures, i. e. mandibular canal and mental foramen from the implant site.

Surgical preparation:

The patients were pre-medicated with antibiotics (Amclaid 625mg) 1 hour prior to surgery. Local anesthesia was then administered at the surgical site using lignocaine with adrenalin in the ratio of 1:100,000 at the involved site.

Implant placement using conventional flap surgeries

Crestal incision was given for full thickness flap reflection, to expose the implant site. Surgical stent was then placed over the crest to mark the implant site. Implant site was marked to create bleeding point and initial osteotomy. After marking the implant site pilot drill was used, followed by subsequent drills of increasing diameter, and final drill up to the decided depth in order to create an osteotomy site of required dimensions for each patient. The implants were then inserted into this osteotomy site. Healing abutments were then screwed to the implants immediately after implant placement to close the opened implant site. Once the healing abutments were placed the surgical site was thoroughly irrigated and flap was closed with tight non-resorbable 3-0 silk sutures and the patients were prescribed with antibiotics and analgesics for 1 week, post‐operatively.

Implant placement using flapless surgeries

Routine pre-surgical protocol was followed for each patient as with traditional flap technique. For the patients in this group, no flap elevation was performed. All implants in this technique were placed after the osteotomy sites were created using surgical stents and soft tissue punch. The surgical stent was first placed in patient's mouth and the implant site was marked with the help of soft tissue punch for each patient. After marking the implant site the surgical stent was then removed and soft tissue punch of similar size was then used to remove the soft tissue at the implant site, once the tissue was removed pilot drill was used, followed by subsequent drills of increasing diameter, and final drill up to decided depth to create an osteotomy site, implants were then placed at this osteotomy site. The implants were placed slightly below the level of alveolar crest. Healing abutments were then screwed to the implants immediately after implant placement.

Post-operative instructions were given to the patients regarding diet, oral hygiene maintenance. Patients were recalled after 24 hours for review and then after one week for assessment of post-operative recovery and suture removal in case of conventional flap surgeries.

After implant placement by both the techniques implants were left for osseointegration following early loading protocols that is 2 months for mandible and 3 months for maxilla [16] and abutments were placed thereafter.

After abutment placement the impression was made by polyvinylsiloxane material using direct impression technique. Impression was then poured in die stone to fabricate the cast. After cast fabrication die cutting was done and wax pattern fabricated, metal casting was then fabricated from investing and casting of this wax pattern.

Metal try in was then made followed by shade selection. Final prosthesis was fabricated and then tried in patient's mouth and occlusion adjusted, after final trial the prosthesis was cemented with the help of Type I Glass Ionomer Cement (Luting).

Follow up

The patient was then recalled for follow up for radiographic evaluation which was made at 6, 12 weeks and 6 months of implant placement for evaluation of crestal bone changes with help of radiographs.

The standardized periapical radiographs were obtained at immediate post-operative, 6, 12 weeks and at 6 months were digitized using Digimizer Image analysis, Med Calc Software version 4. 3. 5. 0. The known implant length was used to calibrate the images in the computer software.

The results obtained were subjected to statistical analysis using Paired T-test.

Results and discussion

The standard protocol for placing dental implants has been a two-stage flap approach that involves soft tissue flap reflection, a protocol with very good long term results. However, despite the long standing and successful use of flap approach for the surgical placement of dental implants, this approach is associated with several drawbacks. Chief among these is a loss of alveolar crest bone [2].

The factors that affect crestal bone may vary and can include the implant design, surgical technique, prosthetic design, and loading factor [6]. Chief cause for crestal bone loss after surgical procedure is a result of the alteration in the vascularization of the bone periosteum after flap reflection. Several experimental studies verified that avoiding flap reflection on the insertion of dental implants prevents the alteration of the vascularization resulting in less crestal bone resorption [7, 8].

In the past, several studies indicating resorption of bone following elevation of mucoperiosteal flap have been done. But literature lacks studies comparing the crestal bone height using flapless and with-flap surgical techniques. As the amount and quality of bone are critical for osseointegration, it was appropriate to study the change in crestal bone height with these techniques. Hence, this study was designed to evaluate whether implants placed without flap elevation followed by early loading in partially edentulous patients showed lesser amount of crestal bone loss when compared with the implants placed by traditional flap procedures followed by early loading.

The aim of the present study was to compare and evaluate crestal bone loss for fter implant placement by two surgical techniques: conventional flap and flapless technique followed by early loading of implants.

The present study showed that on both proximal sides, the mean change from 0months, 6 weeks, 12 weeks and 6 months for flapless method was significantly lower than with traditional flap method (+0,07 against +0.26 mm on mesial side and +0.15 against +0.33mm on distal side at 6 months)

This indicates that the loss of bone during the six-month period was significantly lower with flapless method compared to with-flap method. Therefore, the results of the present study confirms the hypothesis that flapless surgical procedures followed by early loading result in lesser crestal bone reduction compared to surgeries where mucoperiosteal flap is elevated followed by early loading.

The flapless procedure involves either accessing the bone by punching out a small amount of soft tissue required for osteotomy preparation or preparing the osteotomy directly through soft tissue. It was suggested that this technique helps to minimize interproximal crestal bone loss and possible loss of papillae, but on the other hand elevation of a flap was also advocated, when the esthetic appearance of the soft tissue is critical, since it can be manipulated to its final desirable position. However, it has been found that implants placed with flap reflection, often lead to bone resorption [5-13].

We must be fully aware of the resorption that crestal bone experiences after surgical procedures involving incision with flap elevation. This occurs unpredictably, as a result of the alteration in the vascularization of the bone periosteum after flap reflection. The flap reflection entails a loss of the blood supply of the supraperiosteum vessels, so the bone vascularization depends upon its own vessels, which is a poor blood source in the case of cortical bone. This will imply a certain level of bone resorption during healing in cases that occur with a mucoperiosteum flap reflection

In a flapless technique, the intact blood supply from soft tissue facilitates maintenance of nutrition, which is a critical factor in preventing initial bone loss around the implant. This helps in maintaining the soft tissue contour for esthetic emergence profile because of better osseointegration and decreased bone loss due to decreased blood supply [6-9].

Early loading was followed after single stage implant placement by traditional flap and flapless surgery. Early loading has been widely used in implant therapies, particularly in mandibles with good bone quality. The protocols provide good esthetics, enhanced function, and almost immediate comfort, and have a favorable implant survival rate due to continuous improvements in implant materials, designs and surface treatment techniques, early loading has been defined as the loading of the implants after a 6-week to 2-month healing period [14].

Despite of various advantages of flapless procedure there are several drawbacks which include the surgeon's inability to visualize anatomic landmarks and vital structures and the increased risk of malposed angle or depth of implant placement.

Even though the flapless technique is a blind procedure, accurate implant placement and angulations could be achieved with the help of sound knowledge of the anatomy of the site, meticulous diagnostic procedures, and a diligent surgical technique [4]. Overall, to accurately assess the merits of the flapless technique, more studies with similar loading protocols that objectively compare conventional surgery with a flapless approach are needed.

Under the guidelines of the present study, the results suggest that flapless surgical approach followed by early loading is a good option for implant placement with less crestal bone resorption when compared with traditional flap procedure followed by early loading.

Conclusions

Within the limitations of the study, it can be concluded that reduction of crestal bone height was seen in both flapless and with-flap techniques followed by early loading. The change in crestal bone height observed in flapless group was not statistically significant, while the reduction in crestal bone height found in with-flap group was statistically significant; and when the change in crestal bone height was compared, the flapless approach showed statistically significant lesser reduction.

Photographs

Traditional flap procedure

Fig 1, 2, 3: Preoperative view

Fig 4: Mid crestal incision

Fig 5: Healing abutment placement followed by flap closure

fig 6: Immidiate Postperative IOPA

fig 7: One week after implant placement

Fig 8: Abutment placement

Fig 9: Final prosthesis cemented

Flapless procedure

Fig 10, 11, 12: Preoperative view

Fig 13: Soft tissue punch for marking implant site

Fig 14: soft tissue removal followed by implant placement

Fig 15: Healing screw in place after implant placement

Fig 16: Immidiate Postperative IOPA view

fig 17: Abutment placed

Fig 18: Final prosthesis cemented

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