*Section A -Research paper*

# Assessment of Immediately Loaded Basal Implants in Partially/Completely Edentulous Ridges: A Clinico-Radiographic Study

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**Abstract**

**Background:** The purpose of the study was to check the clinical application of a smooth surface single piece Bi-cortical implant with immediate loading in partially/completely edentulous ridges. **Materials & methods:** 10 Patients with missing teeth was selected from the outpatient department (O.P.D) of Oral and Maxillofacial surgery GNDDC, SUNAM and 25 implants was placed in maxilla and mandible with 14 in healed sockets and 11 in fresh extraction socket. . In all the patients loading was done immediately within 72 hours of implant placement. All patients was evaluated for primary stability, pain, peri-implant bone levels using IOPA, bleeding, sulcular bleeding index, at specified time intervals. **Results:** All the patients were evaluated and showed nil mobility and no significant difference was found between bleeding index and sulcular bleeding index with minimum bone loss. Post operative pain was checked at specified intervals (1st day, 3rd day, 7th day, 4weeks and 3 months) and found, a significant difference was present in reduction of pain at .time interval – b/w 1 day and 3 days; b/w 1 day and 7 days. There was non- significant difference in pain at time interval - b/w 1 month and 3 month. **Conclusion:** Hence, according to our study, that Basal implants can play a vital role in rehabilitation of patients, where compromised quality and/or quantity of bone is present and additional augmentation procedures would be required for placement of conventional root form implants.

**Keywords:** Bicortical implant, Peri-implant bone, Primary stability

## Introduction

Dental Implant is a device designed to be placed surgically within or on the mandibular or maxillary bone to provide resistance to displacement of a dental prosthesis. Basal implants can be used as an alternate in such cases as they do not require any bone augmentation or grafting and can be immediately loaded also, this will avoid second surgery, long span of edentulous phase and overall reduces the expenses. Basal implantology also known as bicortical implantology or just cortical implantology is a modern implantology system which utilizes the basal cortical portion of the jaw bones for retention of the dental implants which are uniquely designed to be accommodated in the basal cortical bone areas. For retention of these unique and highly advanced implants, basal bone provides excellent quality cortical

bone. The basal implants are also called as "orthopaedic implant" as basal implantology includes the application of the rules of orthopaedic surgery to mark a clear distinction between them and the well known term "dental implant".[1- 3] Basal bone is defined as the osseous tissue of the mandible and maxilla underlying the alveolar processes. It is relatively fixed and unchangeable framework of the mandible and maxilla which is very strong and forms the stress bearing part of our skeleton. Teeth can also be loaded immediately when dental implants are placed in this bone. Placing the traditional implants in the sites where the basal bone is utilized is not possible. The conventional Implants utilises the alveolar bone - that resorbs after teeth are lost and as function reduces, it decreases throughout life.[4- 6] The Basal or the strategic implants are anchored cortically by the surgeon and the process of creating this anchorage has been referred as "osseo-fixation. Secondary osseo-integration into spongious bone areas through which endosseous parts of the implants are projecting is expected to happen in any case later. The primary stability, that decides the success of the treatment, depends on the macro-mechanic anchorage (osseo-fixation) in the2nd or 3rd cortical. A thorough understanding of maxillofacial anatomy is recommended so that bi-cortical engagement is achieved with respect to the accepted principle (primum nihil nocere) i.e; limiting treatment .Basal implants are the devices of first choice whenever augmentation are part of alternative treatment plan and act as a patient oriented therapy , which meets their demand ideally.[6- 8] Hence the study was to evaluate clinical application of smooth surface, single piece, bi-cortical implant with immediate loading.

**Materials & methods**

Patient's written informed consent shall be taken prior to surgical procedure. Emphasis is based on strict asepsis and infection control. All implants will be placed under local anesthesia using maxillary nerve blocks and infiltrations for maxilla while inferior, lingual and mental nerve blocks for mandibular implants. Osteotomy will be prepared according to standard recommended protocol from the manufacturer. Drilling will be continued till the basal cortex (nasal floor/ sinus floor/lingual cortex/ pterygoid bone) is engaged. Implant will be inserted and threaded till it engages the basal bone (second cortex). Pertinent prosthetic protocol will be followed according to which befitting prosthesis will be delivered within 3 to 6 days and occlusal adjustments will be done, if any. Post-operative instructions will be given and patients will be prescribed antibiotics, analgesics, and saline gargles for 5 days. Patients will be recalled to follow up at 4 weeks and 3 months, postoperatively .10 Patients with missing teeth was selected from the outpatient department (O.P.D) of Oral and Maxillofacial surgery and 25 implants was placed in maxilla and mandible with 14 in healed sockets and 11 in fresh extraction socket. In all the patients loading was done immediately within 72 hours of implant placement. All patients was evaluated for primary stability, pain, peri-implant bone levels using IOPA, bleeding, sulcular bleeding index, at specified time intervals. protocol to restore edentulous jaws, with appropriate surgical technique and prosthetic rehabilitation.

**Results**

Table 1: Age-wise distribution

| **Age Group (in years)** | **N** | **%** |
|---|---|---|
| 21-30 | 3 | 30.0s |
| 31-40 | 2 | 20.0 |

| | | |
|---|---|---|
| 41-50 | 2 | 20.0 |
| >50 | 3 | 30.0 |
| Total | 10 | 100.0 |

Table 2: Mobility at different intervals

| **Intervals** | **Score** | | | | | | **Fisher Exact** | **p value** |
|---|---|---|---|---|---|---|---|---|
| | **0** | | **1** | | **2** | | | |
| | **N** | **%** | **N** | **%** | **N** | **%** | | |
| 1st Day | 10 | 100 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 Month | 10 | 100 | 0 | 0 | 0 | 0 | | |
| 3 Month | 10 | 100 | 0 | 0 | 0 | 0 | | |

**Table 3: Pain At Different Intervals**

| Intervals | Mean | SD | ANOVA test | p-value |
|---|---|---|---|---|
| 1st day | 5.70 | 0.48 | 19.43 | <0.01* |
| 3rd day | 3.80 | 0.92 | | |
| 7th day | 1.30 | 0.95 | | |
| 1 month | 0.00 | 0.000 | | |
| 3 months | 0.00 | 0.000 | | |

***: Significant**

**Table 4: Peri Implant Bone Level By Iopa(From Abutment To Bone Level) At Different Intervals**

| Interval | | Mean | SD | ANOVA test | p-value |
|---|---|---|---|---|---|
| Mesial | Baseline | 4.20 | 2.45 | 0.08 | 0.92 |
| | 1 month | 4.25 | 2.44 | | |
| | 3 months | 4.60 | 2.45 | | |
| Distal | Baseline | 4.05 | 2.36 | 0.099 | 0.91 |
| | 1 month | 3.95 | 2.47 | | |
| | 3 months | 3.60 | 2.29 | | |

**Table 5: Bleeding At Different Intervals**

| Intervals | N | % | Chi-square | p-value |
|---|---|---|---|---|
| 1st day | 0 | 0 | 0 | 1 |
| 3rd day | 0 | 0 | | |
| 7th day | 0 | 0 | | |
| 1 month | 0 | 0 | | |
| 3 months | 0 | 0 | | |

Total 10 patients were selected with compromised bone with poor quantity or quality out of which 3 patients were male and 7 were female and maximum age distribution with 30% each

(21-30, >50years) and 20% each with age group are from (31-40, 41-50) was showed in Tab 1. There was 1 patients in which single implants was placed and in rest of the 8 patients multiple implants was placed. Total 25 implants were placed in maxilla and mandible with 14 in healed sockets and 11 in fresh extraction socket. In all the patients loading was done immediately within 72 hours of implant placement. All patients were evaluated for primary stability, pain, peri-implant bone levels using IOPA, bleeding, sulcular bleeding index, at specified time intervals. To evaluate stability of the implant, primary stability was evaluated by checking the implant mobility at the time of implant placement follow up of 1 months and 3 months. It was observed that all the implants placed had 0 mobility at the time of implant placement along with patient comfort, pain was measured by visual analogue scale at specified time periods (Table 3). It was observed that pain was maximum on day 1(mean = 5.7) and decreased by 3rd day to a mean of 3.8. It further decreased on day 7th with a mean value of 1.3 and finally no pain was present at 1 month, 3 months follow-up. It was observed that pain rapidly reduced from 1st day to 7th day. Level of the peri-implant bone was evaluated radiographically by measuring the distance from base of the abutment till the peri-implant bone using caliper method.

- IOPA (mesial and distal side) at time intervals of 1st day, 1 month and 3 months.

It was observed that using IOPA (Table5) on the mesial side of the implant, the mean distance from abutment base till peri-implant bone was observed to be 4.2 which further increased to 4.25 at the time interval of 1 month and at 3 month of follow up mean distance increased to 4.60. Whereas, on the distal side the mean distance from abutment base till peri-implant bone was 4.05 at the time of implant placement which reduced at one month with mean value of 3.95 and at 3 months follow-up it further decreased to 3.60. When peri-implant bone levels were compared between different time points (Table 5) (using paired “t” test) it was observed that at all the time points there was no significant difference-between 1st day and 1 month; between 1 month and 3 months and 1st day and 3 months. The soft tissue health modified sulcular bleeding index was used at specified time intervals (Table 7). At the time of implant placement mean value of SBI was observed to be 1.5 and it reduced to 0.6 at 1 months. After 3 months follow-up, further reduction was seen with mean of 0. It was observed that there was significant reduction seen from baseline to 1 months in SBI. Sulcular bleeding index was compared b/w different time intervals (Table 7) (using paired “t” test). It was observed that there was significant difference in mean values of SBI at all the time points- b/w baseline and 1 months; b/w 1months and 3 months. Evaluation of bleeding was done at 1st day, 2nd day, 3rd day and the 7th day of follow-up (Table 6). Bleeding was not seen in any of the patient.

**Discussion**

A good bone quality and quantity is criterion for accomplishment of root form implants. Rocci et al. performed a randomized clinical trial (RCT) to evaluate two implant systems (TiUnite and machine surfaced Branemark systems) & he also observed patients with compromised bone were greater than five times more likely to experience an implant failure than patients with acceptable bone. In various studies, success rates of dental implants are reported to be 75-90%, when placed along with bone grafting.Blomqvist et al. identified 11 patients (n=74 implants) with severely atrophied maxillary alveolar processes who received implants and sinus floor bone grafting by a one-stage procedure and followed them for a

mean period of 30 months. He observed that patients with compromised bone quality were nearly eight times more likely to experience an implant failure.Because of the poor quality and quantity of the implant bed, placement of implants in patients with compromised jaws is especially challenging. Broader crestal bone is vital which is resorbed in such cases to lodge the neck of conventional implants. These cases are indicated for various procedures such as displacement of the mental nerve and procedures involving sinus lifting, bone augmentation, ridge splitting to overcome the initially unfavourable anatomical and mechanical conditions. Further these procedures upsurges the cost of treatment, total number of surgeries and length of treatment. With these approaches at the donor and/or recipient sites, unpredictable degrees of morbidity are involved despite acceptable success rates.In cases with chronic periodontitis, the remaining infection with multiple endo□periodontal lesions often prevents simultaneous tooth extractions and bone grafting or immediate placement of implants. Furthermore, patients are sometimes reluctant to undergo such extensive procedures. There is a growing need of patients to be rehabilitated with a fixed, implant□supported prosthesis immediately after surgery, not only to minimize patient discomfort but also to restore functionality and esthetics quickly so that patients can return to their normal routine within a short period of time.Taking into consideration, the failure rates associated with placement of root-form implants in compromised ridges and additional procedures associated with it, basal implants were developed for use in atrophied jaw bones. “Basal Implant” is a term used in reference to the principles of utilizing basal bone areas which is free of infection and resorption. The load bearing tolerance of the cortical bone is many times higher than that of the spongious bone. Basal bone is comparatively static, not subject to any alteration in the morphology of the framework and relatively resistant to bone resorption and infection due to its dense structure.

Basal Implant Types Based on Morphology

There are four basic types of basal implants available-

i. Screw Form.
ii. Disk Form.
iii. Plate Form.
iv. Other Forms.
    a. TPG Implant (Tuberopterygoid).
    b. ZSI Implant (Zygoma Screw).

In this study Basal Screw implants (BCS) or Bi-cortical Screw implants were placed in all the 10 cases. BCS implant has wide diameter cutting screws which helps in engaging the buccal and palatal/lingual cortical plates and initially provide primary stability and load bearing capacity to the implant and later on act as a load bearing and distribution component.Two different approaches for immediate loading of dental implants are currently known. Both have in common the implicational concept that splinting/stabilization .The first approach relies on the compression screw principle. Screw implants of this type can result in lateral condensation of spongy areas. Implant stability is greatly increased by a mechanism that could be regarded as “corticalization” of the spongy bone. The second approach is to establish cortical anchorage of thin screw or basal implants. Excellent primary stability can be obtained along the vertical surfaces of these implants with no need for corticalization. Implants of this type are, therefore, well suited not only for immediate loading but also for immediate placement. These implants may be used both in extraction sockets and in healed

bone areas.In a randomised clinical study done by TommasoGrandi et al it was concluded that, if adequate primary stability is achieved, immediate loading of dental implants can provide similar success rates with early or delayed loading. Primary stability was evaluated by checking mobility (criteria by Misch) of implant at the time of implant placement. It was observed that in all the cases there was no mobility at all the specified time intervals. In one female patient 3 conventional implant was already placed in anterior mandible region out of 3 one get failed and we decided to placed basal implant and splinted with other on 3rd day. At the end of the study period none of the 27 basal implants placed had any mobility, which is similar to the study of Palka L. et al in which BCS implants were placed in severely resorbed maxilla and had no mobility after 2 years follow up.Patient comfort was evaluated by measuring pain by visual analogue scale at specified time periods. It was observed that pain was maximum on day 1(mean= 5.7) and decreased significantly on day 7th with a mean value of 1.3 and finally no pain was present at 1 month, 3 months follow-up.Same trends in pain reduction were seen in a study done by Ritesh Garg et al in which immediate loading was done of basal implants within 72 hours. It was observed that the mean pain value at 1 week was 4 and there was no pain at time intervals of 1 month, 3 months, 6 months and 12 months respectively.In the same study conventional implants were placed in which delayed loading was done. It was observed that mean pain score at 1st week there was no pain. Further at 3 months follow-up there was mean pain score of 4 because of second stage surgery and then there was no pain in subsequent follow-ups. Therefore the amount of patient discomfort is less and number of procedures are also decreased with basal implants.Various authors have discussed the success criteria of dental implants on the basis of crestal bone loss. P. Papaspyridakos et al in 2011 examined most frequently used criteria to define treatment successin implant dentistry. It was reported that bone loss at 1st year < 1.5 mm and annual bone loss <0.2 mm thereafter was considered to be most acceptable criteria for success of dental implants. In a case study done by Singh M. et al in 2016, BCS implant was immediately loaded in fresh extraction socket and the mean crestal bone loss evaluated was0.57mm and 0.75 mm at 6 months and 1 year follow-up, respectively. Garuti G. et al performed randomised clinical study, in which it was reported that marginal bone loss was in the range of 0.42– 0.46 mm and was identical for both immediately loaded as well as delayed loaded conventional implants. In another study done by sunyong et al, it was observed that, for conventional two-stage and one-stage loading protocols, the range of marginal bone loss seen in the first year was 0.2 to 0.7 mm and 0.0 to 2.0 mm, respectively. For early loading protocols, the range was 0.0 to 0.2 mm; immediate loading protocols saw a marginal bone loss of around 0.7 mm in the first year. In the present study the mean peri-implant bone loss measured at 3 months (mean = 4.6) on mesial side while on distal side (mean =3.6). There was bone gain on mesial side of 0.40 and bone loss on distal side of 0.45 therefore we observed nil to minimal peri- implant bone loss in the study. Soft tissue health was evaluated by using modified sulcular bleeding index given by mombelli et al at specified time intervals. It was observed that there was significant difference in values of SBI at specified time intervals. Statistically there was significant reduction in the SBI at 3 months when compared to earlier time intervals.In a study in which soft tissue health was compared of immediately. It was observed that SBI at 1st day was 1.5, 0.5 at 4 weeks, 0.0 at 3 months.Bleeding was evaluated at specified time intervals as while engaging any of the 2nd or 3rd cortex there is

always a risk of injuring any vessels near the surgical site. In this study, no bleeding was observed in any of the case. José-Carlos Balaguer-Martídid review on bleeding complications in immediate implantology and concluded that the area with the largest number of bleeding complications corresponded to the mandibular canine. The cause of bleeding was lingual cortical bone perforation during implant placement, with damage to the sublingual artery. However in basal implants there are much more chances of bleeding, if anatomical variations of various vessels, or plexuses are not known. Like while placing pterygoid implants, anatomical variations should be in knowledge of operator to minimize the risk of bleeding.[8-14]

## Conclusion

It can be concluded from the present study, that Basal implants can play a vital role in rehabilitation of patients, where compromised quality and/or quantity of bone is present and additional augmentation procedures would be required for placement of conventional root form implants. Basal implant also provide immediate replacement of aesthetics and function without much expenditure and complications.

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