ORIGINAL RESEARCH

Loss of Interdental Crestal Bone Comparison Following Immediate and Delayed Loading after Delayed Placement of Dental Implants in Mandible - A Clinical Study

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ABSTRACT

Introduction: Implant placement in the posterior mandible is associated with many problems because of insufficient bone quality. Immediate loading of implants placed in the posterior mandible may be a high-risk clinical situation. One of the most important criteria for evaluating implant success is determining crestal bone levels surrounding an implant. The present was undertaken to compare the loss of interdental crestal bone in between immediate loading and delayed loading of prosthesis after delayed implant placement.

Material and methods: Patients were divided in to two groups, Immediate loading group and Delayed loading group. Parameters like Plaque index, gingival index, Implant mobility and width of keratinized gingiva were recorded clinically at baseline, 3 months, 6 months and 9 months and subjected to statistical analysis.

Results: Results showed that all the implants were osseointegrated based on implant mobility parameter (100%) irrespective of immediate or delayed loading of implants.

Conclusion: The present study results concluded that there was no comparable statistical difference between both the groups at baseline, 3 months, 6 months and 9 months.

Key words: Osseointegration, Immediate loading, Delayed loading, Delayed Placement

INTRODUCTION

Osseointegrated titanium dental implants have been successfully used to restore completely and partially edentulous patients. The original surgical protocol proposed by Adell and associates and Brånemark and coworkers considered a healing period of 3 to 6 months free from functional loading as optimal to obtain osseointegration of titanium dental implants.[1]

The rationale behind this approach is that implant micro movement caused by functional force around the bone–implant interface during wound healing may induce fibrous tissue formation rather than bone contact, leading to clinical failure (Adell et al. 1981).[1] In addition, coverage of an implant has also been thought to prevent infection and epithelial downgrowth (Brånemark et al. 1977).[2]

Implant placement in the posterior mandible is associated with many problems because of insufficient bone quality. Moreover, anatomic limitations, which restrict the amount of bone available for implant placement in posterior locations, often mean that only shorter implants can be placed. Immediate loading of implants placed in the posterior mandible may be a high-risk clinical situation because loading immediately after surgery may result in micromotions at the interface, thus interfering with the healing process.[3-6]

The aim of the present prospective clinical study was to evaluate and compare clinical and radiological parameters of sand blasted, acid etched dental implants placed in the posterior mandible in which immediate and delayed loading was done.

MATERIAL AND METHODS

A total of fourteen male and female subjects of 25 to 55 years were recruited from Department of Periodontics, Government Dental College and Hospital, Hyderabad and with at least one mandibular molar or premolars extracted at least 4 months back. Total 16 Sand blasted, acid etched implants were placed. Two among these patients had

single implants placed bilaterally; all other subjects had single implants placed unilaterally. The study protocol was approved by the ethical committee. The study was carried out for a period of 12 months. The subjects were selected for the study based on the following inclusion and exclusion criteria. Patients with presence of at least 10mm height and 6mm width of alveolar bone, absence of acute signs of infection, systemic pathologies, absence of pathology in adjacent teeth were included in the study. Patients who were on drugs effecting bone metabolism, with periodontal infections in adjacent teeth, close proximity to anatomical structures were excluded for the study.

Initial therapy consisted of oral hygiene instructions and thorough full mouth scaling. Patients were advised to use chlorhexidine mouth wash, twice daily for a period of 15 days. Periapical and panoramic radiographs were obtained. A total of sixteen implants were placed of which eight implants were loaded immediately after surgery by means of a provisional restoration within 48 hours and were included under the immediate loading group.

The other eight implants were left to heal for 3 months before a permanent restoration is given after second stage of surgery and were included in delayed loading group.

Presurgical clinical measurements

The following parameters were measured at base line (before surgery).

Simplified Oral hygiene index (Greene and Vermillion 1964)[4]:

The OHI-S, like the OHI, has two components, the Debris Index and the Calculus Index. The six surfaces examined for the OHI-S are selected from four posterior and two anterior teeth.

Patients with oral hygiene index scores less than 1 were only included for this study.

Surgical procedure:

The surgical procedure was performed under local anaesthesia using 2% lignocaine containing adrenaline. Crestal incision was given and a full thickness periosteal flap was raised and the underlying bone was assessed for the width of available bone. Drilling of the osteotomy site was done according to the manufacturer's instructions, starting from the smallest drill of 2mm, which is a pilot drill. The pilot drill was extended to the desired length. A sequential drilling was carried out with drill sequences of 2.2, 2.8, 3.2, 3.65, 4.3 and 5mm with a speed ranging from 500-1200 rpm under copious irrigation, taking care of the anatomical boundaries.

Implants were placed at the buccal- lingual level of the bone crest. The buccal and lingual flaps were sutured using 3-0 silk sutures to enable maximum approximation and to ensure soft tissue coverage to protect the implant sites. Amoxicillin 500mg thrice daily for 5 days and Ibuprofen 400 mg thrice daily were prescribed for all patients for 5 days. Intraoral radiographs were taken using the long cone paralleling technique.For Delayed loading, the patients were given instructions about post-operative care and reviewed the next day followed by suture removal after 7 days.

In immediate loading patients addition silicone impressions were taken using impression transfer copings and sent to the laboratory for fabrication of an acrylic provisional restoration. Prosthesis was cemented within 48 hours.

In the delayed loading group the second stage surgical procedures were performed 3 months after the first procedure. A crestal incision was made and the implants were exposed, the cover screws were removed and healing cap or gingival formers were placed and suturing done. Healing caps were left insitu for 7 days, during which time soft tissues were allowed to mature to form a tight cuff. After 7 days, the gingival formers were removed and impressions were made

In the immediate loading group the impressions were recorded without the need for second stage surgery. The superstructure was then cemented using IRM cement. Recall appointments were made 1 week and 3 months and 6 months post insertion. At 3 months, 6 months and 9 months post implant placement, patients were recalled and the necessary clinical and radiological measurements were made.

Clinical parameters[5, 6] measured at the time of implant placement were implant mobility, width of keratinized mucosa, which measured in millimeters at the mid-buccal aspects; At 3, 6 and 9 months post-placement, all the patients underwent clinical and radiographic examinations, which included evaluation of the following parameters:

- Modified Plaque Index on the mesial, distal, buccal, and lingual-palatal surfaces of the implants
- Modified Bleeding Index (Sulcus Bleeding Index (mBI) (26) on the mesial, distal, buccal and lingual-palatal surfaces of the implants by a modified
- Implant mobility
- Width of keratinized mucosa, which measured in millimeters at the mid-buccal aspects

Implant mobility evaluation

All the implants were checked for mobility with the two blunt ends of the instrument to see for any perceivable mobility.

Width of keratinized gingiva was measured with a University of North Carolina Probe (UNC-15) as the distance from the gingival margin to the mucogingival junction (includes both marginal gingiva and attached gingiva).

STATISTICAL ANALYSIS

The data were subjected to ANOVA and Students t test for paired comparisions through Statistical software namely SPSS 15.0.

RESULTS

A total of 16 implants were placed in 14 patients, which included 7 male and 7 female patients with age range of 25 – 55 years. Out of the 16 implants, 16 implants were successful. Overall, the success rate of implants in this study was 100%.

The following clinical and radiological parameters were recorded in all the cases at 3months, 6 months and 9 months.

Clinical parameters

The study consisted of 7 male and 7 female patients with one female and one male patient treated bilaterally.

Modified plaque index (mPI)

All the patients were regularly monitored for oral hygiene and instructions in plaque control were emphasized at every visit. The mean modified Plaque index which was 0.19±0.18 at 3 months decreased to 0.09±0.13 at 6 months and it was the same for 9 months too for the Delayed loading group. For the Immediate loading group the mean modified Plaque index was 0.5±0.19 at 3 months which decreased to 0.19±0.12 at 6 months and there was a further decrease to 0.16±0.13 at 9 months. The difference between the two groups was significant at 3 months only. P value < 0.01.

Modified bleeding index (mBI)

The mean modified Bleeding index at 3 months was 0.37 ± 0.27 showing an improvement at 6 months with a mean of 0.06 ± 0.12 and at 9 months with a mean of 0.03 ± 0.01 for the delayed loading group. For the immediate loading group the mean bleeding index was 0.41 ± 0.23 at 3months which further improved to 0.06 ± 0.12 at 6 months and stayed the same at 9 months. Overall there was an improvement in gingival index from 3months to 9 months. The comparison between the two groups was not significant.

The following clinical and radiological parameters were recorded in all the cases at baseline, 3months, 6 months and 9 months.

Implant mobility

The implant mobility was assessed clinically by using two blunt ends of the instrument. At baseline, 3months, 6months and 9 months all the 16 implants were clinically stable and asymptomatic (100%). (Table 1, Graph 1). All the successfully treated implants achieved good osseointegration.

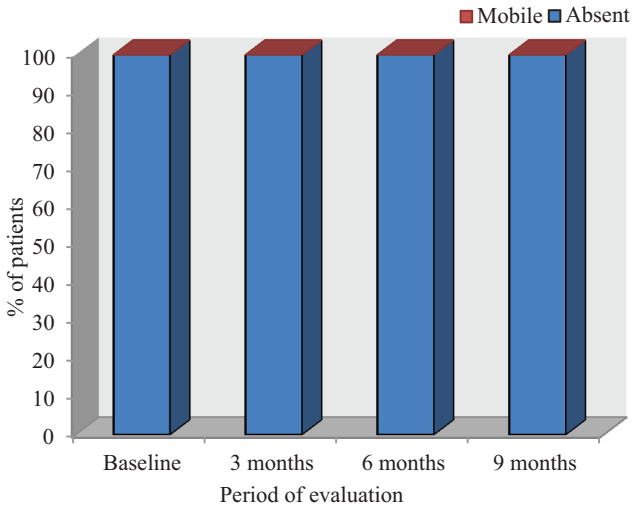
Width of keratinized gingiva

The mean width of keratinized gingiva was 3.12± 0.76 mm at baseline and had remained at the same level for 9 months in the delayed loading group. In the immediate loading group the mean width of keratinized gingiva at baseline was 3.75±1.16 mm which also did not change for the whole 9 months. The comparison between groups was not significant.

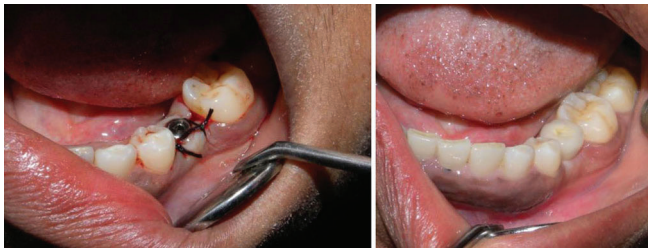
The mean width of keratinized gingiva which was 3.12 mm at baseline remained the same at 3months, 6 months and 9 months even when one of the patients didn't have any keratinized gingiva. The mean width of keratinized gingiva which was 3.75 mm at baseline remained the same at 3months, 6 months and 9 months.

Period of evaluation	Number of implants	Presence of Implant mobility	
		Absent	Mobile
Baseline	16	16 (100.0%)	0
3 months	16	16 (100.0%)	0
6 months	16	16(100.0%)	0
9 months	16	16(100.0%)	0

Table-1: Presence of Implant mobility



Graph–1: Presence of implant mobility



Delayed loading of Implant Group;
Figure–1: Gingival former placed in second stage surgery;
Figure–2: Delayed loading done. (Prosthesis)

Immediate loading of Implant Group
Figure–3: Delayed implant placed;
Figure–4: Immediate loading by prosthesis

DISCUSSION

Osseointegration represents a direct connection between bone and implant without soft tissue layer. Researchers have demonstrated that, during the first few weeks after implant insertion there were no signs of proper osseointegration. Three months after implant insertion there was relatively higher proportion of bone to implant direct contact and a clearly increased resistance to torque removal. This indicates osseointegration may be a time related phenomenon[7].

In this study, contrary to concerns that immediate full occlusal loading of restorations would generate excessive stress that would compromise implant survival, the clinical results obtained with the microtextured-surface implant comparable between the test and control groups.

Cortical bone adaptation occurs within the first 6 months following implant placement, with no additional significant adaptation for up to 2 years of follow-up[8]. The possible loss of up to 2 mm of bone in the adaptation phase, followed by additional bone loss in the first year after loading, can limit the ability to maintain interdental papillae[9]. A key to maintaining the interproximal papillae and gingival margin is the use of a provisional crown. Peri-implant mucosal adaptation to an anatomic form and the support of the papilla at each time of treatment usually results in a natural esthetic outcome. The esthetic value of implant-supported single-tooth restorations is dependent on soft tissue responses to therapy. Wider implants can be used when possible for improved strength within the implant pillar for a single-molar restoration[10].

Bleeding index and plaque index did not show any significant differences when immediately loaded and conventionally loaded implants were compared[11, 12].

The width of keratinized gingiva and level of mucogingival junction were all constant throughout the study. All the above findings are in confirmation with that of the previously reported studies[13]. None of the successfully placed 16 implants in both the groups showed implant mobility at the end of 9 months, thereby achieving good osseointegration which was confirmed by radiographs. This is in accordance with results obtained by Ericsson et al. 2000; Chiapasco et al. 2001; Romeo et al. 2002; Cannizzaro and Leone 2003; Cornelini et al. (2004)[1,14,15,16]. From the data available in the current literature, no conclusions can be drawn concerning relevant exclusion and inclusion criteria for immediate loading of oral implants, and controlled studies are needed to address this problem. In most of the studies on immediate loading, good bone quality has been mentioned as an important prognostic factor for the success of the procedure[15]. Although this conclusion seems reasonable, the level of evidence that supports the assumption is low. There are no controlled studies that have been especially designed to compare immediate loading of oral implants in bone of different qualities. The same is true for the implant lengths and diameters that should be used for immediate loading. In a controlled study, rough implant surfaces improved the survival rate of immediately loaded implants however; the influence of the rough as opposed to machined surfaces was not significant[11]. Successful immediate loading of an implant with an insertion torque of 15N cm has been shown under some conditions (Calandriello et al. 2003)[17]. However until now, there has been no reported controlled study that has compared the relationship of different implant stability levels with the implant survival rate. Consequently, there is currently no proven threshold value that indicates that immediate loading will be successful.

CONCLUSION

The clinical and radiological parameters were recorded in all the cases at baseline, 3 months, 6 months and 9 months. There was a no significant change in modified plaque index and modified bleeding index between 3 months, 6 months and 9 months. There was excellent soft tissue stability as the width of keratinized gingiva and the level of mucogingival junction remained stable throughout the study. Radiographic evaluation of intraoral periapical radiographs of the implants revealed that there was a negligible decrease in bone height which had no clinical significance. Therefore it can be concluded from the present study that immediate loading of Sand blasted acid etched surface implants for replacement of single posterior teeth represents a viable therapy. With the trend of shortening treatment time and reducing patient discomfort/inconvenience, immediate loading of implants has re-emerged as an alternate approach.

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