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## To evaluate the clinical outcome of non-occlusal immediate loading versus conventional delayed loading of dental implants in mandibular molar region

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### Abstract

**Background:** Missing teeth have traditionally been replaced with dentures or bridges to restore the ability of patients to eat, speak, and improve appearance. Dental implants are now commonly used for replacing missing teeth in various clinical situations. The present study was conducted to compare the outcome of immediate non-occlusal loading and delayed implant loading in the bilateral replacement of single mandibular molars.

**Material and methods:** A total of 50 patients were enrolled and randomly divided into two groups. In each eligible patient, the mandibular right or left molar was randomly selected to receive either an immediate or delayed provisional crown. The outcome measures i.e. implant survival, Complications, Marginal bone levels; Peri-implant mucosal response was noted. A statistical analysis was performed.

**Results:** In the present study Mean marginal bone levels after 6 months were  $0.67 \pm 0.12$  mm for immediately loaded implants and  $0.70 \pm 0.15$  mm for delayed loaded implants, and no statistically significant differences were observed between the two groups. After 12 months, the mean marginal bone levels were  $0.81 \pm 0.15$  mm for immediately loaded implants and  $0.84 \pm 0.14$  mm for delayed loaded implants, and there was no statistically significant difference between the two groups. The mean PPD values were  $2.73 \pm 0.58$  for immediate loaded implants and  $2.71 \pm 0.53$  mm for delayed loaded implants, and there was no significant difference found between groups.

**Conclusion:** The present study concluded that the outcome of immediately loaded mandibular molar implants was comparable to delayed loading.

**Keywords:** Delayed loading, immediately loaded, osseointegrated implants

### Introduction

The replacement of teeth with osseointegrated implants is one of the significant advances in the field of restorative dentistry [1]. The time interval between tooth extraction and the implant can be very short or long [2]. Initially implant was left to osseointegrate and unloaded after 3 to 4 months in mandibles and 6 to 8 months in the maxillae. Recently immediate loading of implants at the time of placement (or within the first 72h) has become a viable treatment alternative, mainly in the aesthetic zone; approach allows decreasing the patient's discomfort, the treatment's duration and costs. In fact the patient could enter with an edentulism and leave the same day with an aesthetically acceptable implant-supported provisional crown, which makes this approach very attractive [3]. There are various factors which affect the success rate of implant. Occlusal overload is one such key biomechanical factor which influences implant success as it is the primary factor for generation of peri-implant strain and peri-implant bone loss [4]. Since many patients complained of the discomfort of edentulous spaces during the long healing period of the conventional implant protocol, the concept of immediate loading was proposed by some authors in the early 1990s [5-7]. Immediate implant placement is most commonly indicated when tooth extraction is due to trauma, endodontic lesion, root fracture, root resorption, root perforation, unfavourable crown to root ratio (not due to periodontal loss) and bony walls of alveolus are still intact. Contraindications includes presence of active infection, insufficient bone (<3 mm) beyond the tooth socket apex for initial implant stability

and wide and/or long gingival recession [8]. In addition to reducing treatment time, another important advantage of immediate loading of dental implants is the preservation of soft and hard tissue, because the whole surgery and loading process is done in one session [9]. But in the standard method, 2 to 3 sessions of surgery are required, which causes additional trauma to the soft and hard tissues. On the other hand, the implantation of a temporary prosthesis mechanically keeps the gingiva of the buccal surface, and reducing the need for additional soft tissue surgery [10]. The present study was conducted to compare the outcome of immediate non-occlusal loading and that of delayed implant loading in the bilateral replacement of single mandibular molars.

### Material and Methods

The present study was conducted to compare the outcome of immediate non-occlusal loading and that of delayed implant loading in the bilateral replacement of single mandibular molars. Before the commencement of the study ethical clearance was obtained and written consent was obtained from the patient. Patients with missing mandibular molars, stable interocclusal contacts,  $\geq 18$  years of age, residual bone height  $\geq 10$  mm, residual bone thickness  $\geq 6$  mm with at least 5 mm of keratinised gingiva crestally were included in the study. Patients who had general contraindications to implant surgery, lack of occluding dentition in the area intended for immediate loading, periodontitis, bruxism, immunosuppression, previous history of irradiation of the head and neck area, uncontrolled diabetes, heavy smoker, poor oral hygiene, current or past treatment with bisphosphonates, substance abuse, psychiatric disorder, inability to complete follow-up  $\geq 1$  year, requirement for bone augmentation (bone graft and membrane, pregnancy or lactation, implant insertion torque less than 35 Ncm were excluded from the study. A total of 50 patients were enrolled and randomly divided into two groups 25 each. In each eligible patient, the mandibular right or left molar was randomly selected to receive either an immediate or delayed provisional restoration.

### Clinical procedures

All patients were clinically evaluated and complete history was recorded. Intraoral and panoramic radiographs were taken as shown in figures 1 and 2 to evaluate potential patients' eligibility.



**Fig 1 and 2:** Preoperative intraoral and radiographic photograph

Patients received oral hygiene instructions and debridement if required, after which bone volumes were analysed using cone-beam computed tomography (CBCT). All patients received amoxicillin + clavulanic acid (1 g twice daily from 1 hour before implant placement to 6 days post-surgery). Prior to implant placement, patients rinsed for 1 min with 0.2% chlorhexidine mouthwash and local anaesthesia was induced using Lidocaine with adrenaline (1:100,000). Implants were placed using a conventional approach: an intrasulcular and crestal incision was performed and a mucoperiosteal flap was

elevated as shown in figure 3. Drills were used to prepare the recipient bed and all implants were installed with an insertion torque  $>35$  Ncm and 4.3 or 5.0 mm and lengths of 10 or 8 mm (figure 4). Flaps were sutured with Vicryl 4.0 sutures.



**Fig 3:** Incision given and flap raised



**Fig 4:** Implant placed in delayed loading site

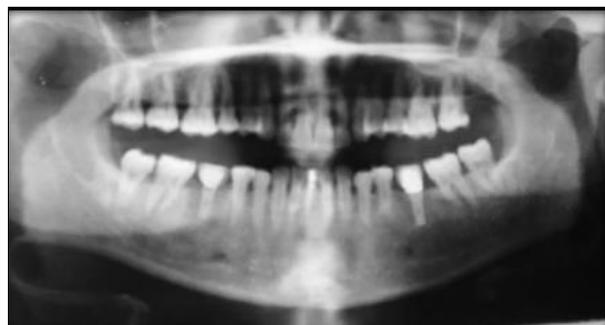
In case of immediate loading site implants were inserted (fig. no 5) and a silicone impression was then taken, followed by acrylic crown fabrication on the temporary titanium abutment. Temporary crown was placed on the day after surgery in the immediate loading site as shown in figure 6. In case of delayed loading site implants were placed and flap was sutured back and left for secondary healing (for osseointegration).



**Fig 5:** Implant placed in immediate loading site



**Fig 6:** Temporary crown placed



**Fig 7:** Post-operative OPG at the time of definitive crown delivery

Care was taken that provisional crowns did not have any static or dynamic occlusion contacts. Baseline intraoral radiographs were taken of both sides at the time of surgery. A total of 80 mg of ketoprofen (2 to 3 times daily) was prescribed for as long as required. Patients were instructed to rinse with 0.2% chlorhexidine for 2 weeks and to stay on a soft diet regimen for 10 days. Sutures were removed after 1 week. After 3 to 4 months, implants were radio logically and manually checked for stability and silicone impressions were taken bilaterally. Customized cast models were then produced. After 3 to 4 weeks, definitive zirconia-ceramic or metal-ceramic crowns were cemented on individualized titanium-zirconia abutments. Intraoral and panoramic radiographs of the study implants were taken at the time of definitive crown delivery and after 6 and 12 months (fig. no 7).

The outcome measures i.e. implant survival, Complications, Marginal bone levels; Peri-implant mucosal response was noted. Statistical analyses were conducted using QI Macros SPC software (ver. 2010, Know Ware International, Denver, CO, USA) for Microsoft Office Excel. Statistical significance was tested at the 0.05 probability level, and all values were presented as mean ± standard deviation.

**Results**

In the present study 50 patients were included. Data were collected at baseline, 6 and 12 months after initial implant loading.

**Table 1:** Implant survival (N=50)

Implant survival	Baseline N (%)	6 months N (%)	12 months N (%)
Implant mobility	0(0%)	0(0%)	0(0%)
Infection	0(0%)	0(0%)	0(0%)
Implant fracture	0(0%)	0(0%)	0(0%)

No implant mobility, infection or implant fracture was occurred and all implants were stable at the end of the study. Only 3 provisional acrylic crowns were fractured after 2 months in case of immediate loading and 3 zirconia-ceramic crowns of the delayed loading group were chipped off at 10 and 11 months after loading. No biological complications were recorded in both the groups.

**Table 2:** Mean marginal bone levels in mm

Mean marginal bone levels in mm	Immediate loading group (N=25)	delayed loading group (N=25)	p-value
Baseline	0.46 ± 0.18	0.40 ± 0.14	0.109
6 months	0.67 ± 0.12	0.70 ± 0.15	0.329
12 months	0.81 ± 0.15	0.84 ± 0.14	0.524

Mean marginal bone levels after 6 months were 0.67± 0.12 mm for immediately loaded implants and 0.70 ± 0.15 mm for delayed loaded implants, and no statistically significant differences were observed between the two groups. After 12

months, the mean marginal bone levels were 0.81 ± 0.15 mm for immediately loaded implants and 0.84 ± 0.14 mm for delayed loaded implants, and there were no statistically significant differences between the two groups.

**Table 3:** Peri-implant mucosal response

Peri-implant mucosal response	Immediate loading group (N=25)	delayed loading group (N=25)	p-value
6 months	2.73± 0.58	2.71 ± 0.53	0.924
12 months	2.74 ± 0.45	2.69 ± 0.36	0.649

The mean PPD values were 2.73 ± 0.58 for immediate loaded implants and 2.71 ± 0.53 mm for delayed loaded implants, and there was no significant difference was found between groups.

**Discussion**

In The Fourth ITI Consensus Conference (November 2009), the advantages and drawbacks of the various points in time

for implant placement after tooth extraction were reported. They concluded that immediate implant placement is a more difficult technique than delayed implant placement to allow initial stability and a good prosthetic position. There is also an in-cresed risk of mucosal recession. Nonetheless, based on the aesthetic index, 80% of immediate implant sites show satisfactory outcomes. The survival rates for immediate implants are high and comparable to those of implants placed

in healing sites <sup>[11]</sup>. Over time; clinical experience has provided the criteria for immediate implant treatment success: atraumatic tooth extraction, minimal invasive surgical approach, as well as implant primary stability <sup>[12]</sup>.

In the present study no implant mobility, infection or implant fracture occurred and all implants were stable at the end of the study. Only 3 provisional acrylic crowns were fractured after 2 months in case of immediate loading and 3 zirconia-ceramic crowns of the delayed loading group were chipped off at 10 and 11 months after loading. No biological complications were recorded in both the groups. Mean marginal bone levels after 6 months were  $0.67 \pm 0.12$  mm for immediately loaded implants and  $0.70 \pm 0.15$  mm for delayed loaded implants, and no statistically significant differences were observed between the two groups. After 12 months, the mean marginal bone levels were  $0.81 \pm 0.15$  mm for immediately loaded implants and  $0.84 \pm 0.14$  mm for delayed loaded implants, and there were no statistically significant differences between the two groups. The mean PPD values were  $2.73 \pm 0.58$  for immediate loaded implants and  $2.71 \pm 0.53$  mm for delayed loaded implants, and there was no significant difference was found between groups.

In 2007, Rao and Benzi published a study on single, mandibular first-molar implants (Replace Select Tapered Ti Unite) placed with flapless guided surgery and immediately loaded with pre-manufactured individualized abutments and crowns. All 51 tapered implants placed were stable and successful in function after 1 year, providing a 100% survival rate <sup>[13]</sup>.

Meloni SM *et al.*, compare the outcome of immediate non-occlusal loading and that of delayed implant loading in the bilateral replacement of single mandibular molars. The results showed that no patients dropped out and no implant failed. Only minor prosthetic complications were observed (2 provisional acrylic crown fractures in the immediate loading group and 2 ceramic chipping in the delayed loading group). Mean marginal bone loss was  $0.83 \pm 0.16$  mm (95% CI 0.75 to 0.91) in the immediate loading group and  $0.86 \pm 0.16$  mm (95% CI 0.78 to 0.94) in the conventional loading group and no statistically significant differences between the two groups were observed ( $P = 0.530$ ). Mean PPD and BOP values were, respectively,  $2.76 \pm 0.48$  (95% CI 2.55 to 2.97) and  $1.30 \pm 0.73$  (95% CI 0.98 to 1.62) in the immediate loading group, and  $2.70 \pm 0.37$  (95% CI 2.54 to 2.86) and  $1.40 \pm 0.75$  (95% CI 1.07 to 1.73) in the conventional loading group. Also, a statistical comparison of BOP and PPD did not show any significant difference ( $P = 0.163$  and  $P = 0.652$ , respectively) <sup>[14]</sup>.

## Conclusion

The present study concluded that the outcome of immediately loaded mandibular molar implants was comparable to delayed loading.

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