

A 4 years follow-up study of immediate and delayed loading of small-diameter dental implants

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Abstract

Background: Mandibular overdenture Supported by tow Dental implants have been approved to have good success rates with implants placed in different procedures. The aim of this study is to evaluate 12 consecutive cases of immediately and delayed loading of Small-diameter implants (SDIs) as support of mandibular overdenture (one implant was immediate loaded, and one was delayed loaded for every case) and report mesial and distal marginal bone resorption rate.

Materials and Methods: First SDI for every patient was placed with flapless surgical technique in the anterior aria of the mandible and was submerged. After 3 months, the second SDI for every patient was placed in the other side of the mouth with the same surgical technique. In the day of second SDI placement, the tow ball attachments were placed on the tow SDIs; the attachment housing was placed to the denture base with self-curing lining resin, and attachments were activated. In this technique, the first SDI was delayed loaded and the second was immediately loaded. The SDIs were then observed, and the marginal bone level was evaluated by periapical radiographs for 4 years.

Results: Overall, marginal bone resorption rate after 6 months of loading was 0.79 mm around immediately loaded SDIs and 0.71 mm around delayed loaded SDIs. After 4 years of loading, marginal bone resorption rate was 1.3 mm around immediately loaded SDIs and 1.2 mm around delayed loaded SDIs.

Conclusion: In the limitations and conditions of this study, complete mandibular dentures supported by two SDIs with immediate and delayed occlusal loading had a high survival rate. Alveolar bone resorption rate after 4 years was 1.3 mm for immediate loaded SDIs and 1.2 mm for delayed loaded SDIs.

Introduction

Severely atrophic mandibles restored by conventional dentures has often many complications such as retention, phonetic, functional, and instability.^[1] The use of dental implants has been suggested as a successful treatment to restore edentulous jaws with fixed partial dentures, hybrid prosthetics, and removable overdentures.^[2] Many studies have shown the effectivity of osseointegrated dental implants in the treatment of edentulous patients.^[2-4] The majority of these studies have used a standard diameter implants (3.75 or 4.50 mm). The placement of a standard diameter implant requires a minimum volume of bone. It has been suggested to have a minimum of 1 mm of bone around the implant surface. The optimal anatomic situation is required to place a standard diameter implant to decrease the risk of complications.^[5] Small-diameter implants (SDIs)

(3.0-3.4 mm) is a good treatment choice where the residual alveolar bone is narrow or where the available space is <7 mm. The use of SDIs could prevent the need for additional surgical procedures and bone reconstruction (bone grafts techniques, guided bone regeneration, crest expansion) or orthodontic treatment to enlarge the mesiodistal spaces.^[6]

Materials and Methods

Edentulous patient's clinical data were obtained at Department of Removable Prosthodontics, Faculty of Dentistry, University of Aleppo. Patients were chosen in this study were edentulous for at least 1 year, had well fit complete denture, not suffering from any disease can effect on dental implant success. In total, 12 patients (i.e., nine male, three female), the main age of 53.5

(i.e., range 42-63), received a total of 24 SDIs (11.5 mm length, 3.2 mm diameter, Antic Ball, Implasa Höchests, Germany) [Figure 1].

Panoramic radiographs were obtained for every case, and one small-diameter, tow-pieces dental implant was placed in the mandibular anterior aria (i.e., on the left side for six patients and the right side for the others) with a flapless surgical procedure. After implant placement, the cover screw was placed, and the implant was submerged. The patient's pre-existing denture was partially relined with a temporary resilient material (Soft liner Tough Soft, Tokuyama, Japan) to reduce forces that could effect of implant. After 3 months, the second implant was placed on the other side with the same surgical procedure, and the ball attachment was placed immediately. The cover screw of the first implant was replaced, and the ball attachment was placed instead, [Figure 2]. A sufficient amount of mandibular denture base was removed, and attachment housing was fixed to the denture base with a hard acrylic lining



Figure 1: Antic Ball, Implasa Höchests small-diameter implants



Figure 2: Placing the ball attachments to the small-diameter implants on the day of second implant placing

material (Rebase II, Tokuyama, Japan) to activate the tow ball attachments. After the acrylic lining material was set, denture was removed, finished, and reinserted [Figure 3]. Patients were then asked to eat just soft food, replace the overdenture just for cleaning in the next 2 weeks and undertake of oral health instructions. In this technique, the first SDI was delayed loaded and the second was immediately loaded for every case.

Periapical radiographs of implants were taken immediately (T0), after 3 months (T1), and after 6 months (T2), and after 4 years (T3) of loading. These radiographs were taken with Periapical films holder (View Plus, China). A sufficient amount of high viscosity C-silicon impression material (Zeta Plus, Zhermak, Italy) was applied to the inter-occlusal base of the periapical film holder. Patients then were asked to bite on this occlusal base to make a silicon bite of every implant which could save the radiographic position for every recall [Figure 4].

Mesial and distal bone resorption around the implants was measured with Schei ruler,^[7] and the marginal bone resorption was the average of mesial and distal bone resorption for every time of recall [Figure 5].



Figure 3: Attachments housing fixed to the denture



Figure 4: Film holder and occlusal bite

Results

A total of 24 small-diameter dental implants were placed in 12 patients. One of the immediately loaded implants was failed within 1 week of loading. This represents an overall implant survival rate of 94% for immediately loaded implants and 100% of delayed loaded implants. Marginal bone resorption rate after 3 months was 0.55 mm for immediately loaded SDIs and 0.45 mm for delayed loaded SDIs, and ($P = 0.037 < 0.05$). Therefore, there were no significant differences between this to groups. Marginal bone resorption after 6 months was 0.79 mm for immediate loaded SDIs and 0.71 mm for delayed loaded SDIs, and ($P = 0.079 > 0.05$). After 4 years, marginal bone resorption was 1.3 mm for immediate loaded SDIs and 1.2 mm for delayed loaded ones, and ($P = 0.03 < 0.05$). Therefore, marginal bone resorption around immediate loaded SDIs after 6 months was statistically greater than that around delayed loaded ones, but there was no significant difference between the two loading protocol after 4 years of loading [Table 1].

Discussion

One immediate loaded SDI was failed in one patient after 1 week of loading. It may have been the result of excessive forces during the initial healing phase. 2 months following the removal of the failed SDI, it was replaced by an SDI of similar size and surgical procedure and immediate loaded.

This study presents results of using two small-diameter dental implants to support mandibular overdenture by ball attachments and shows a difference between marginal bone resorption rate

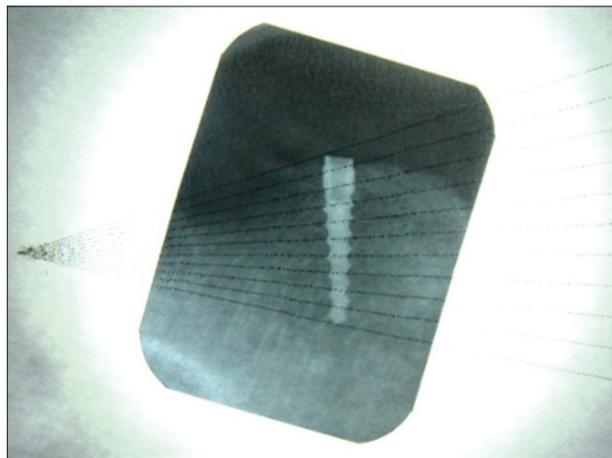


Figure 5: Using of Schei ruler to measure the mesial and distal bone resorption around small-diameter implants

Table 1: Marginal bone resorption rate (mm)

Follow-up time	After 3 months	After 6 months	After 4 years
Immediate loading	0.55 mm	0.79 mm	1.3 mm
Delayed loading	0.47 mm	0.71 mm	1.2 mm

around immediately loaded implants (1.2 mm) and delayed loaded ones (1.3 mm) after 4 years of occlusal loading.

Ericsson *et al.* evaluated the treatment results and outcomes of single tooth fixed prostheses retained to narrow-diameter implants placed in a 1-stage surgical procedure and immediately loaded. The marginal bone resorption was 0.79 mm around immediately loaded implants after 18 months of loading and 0.36 mm around delayed loaded implants.^[8] Ostman *et al.* evaluated the Nobel Perfect and Nobel Direct one-piece implants (OPIs, 3.0 mm in diameter) when used for immediate function and reported that marginal bone resorption rate was 1.3 mm after 1 year.^[9] Turkyilmaz *et al.* studied the outcomes of mandibular overdentures supported by two unsplinted early loaded implants (3.75 mm in diameter) and showed that no implants were lost, and 0.93±0.3 mm marginal bone resorption was noted for the implants after 5 years.^[10] Heschl *et al.* evaluated the outcomes of (XiVE plus) implants after overdenture rehabilitation with bar attachment in the edentulous mandible and reported that the marginal bone resorption around implants with 3.8 mm in diameter was 0.81 mm after 1 year.^[11] Elsyad *et al.* evaluated the outcomes of mini dental implants (MDIs) that support a mandibular overdenture and presented results of 0.71 mm of marginal bone loss after 1 year of immediate loading.^[12]

The two-piece SDIs are more likely to be used in this study to reduce excessive forces during the healing and osseointegration phases of delayed loading SDIs.

Several studies have evaluate the small surface dental implant (Short or small-diameter) and concluded that they help to avoid additional surgical procedure and have a good success rate.^[13]

Oral rehabilitation of severely absorbed mandible with standard or wide diameter dental implant may require surgical procedures such as bone grafting or distraction osteogenesis to enhance the ability implant placement and an increase of success rate. In this study, SDIs placed with flapless surgery in severely absorbed mandibles resulted in limited surgical complications and minimal postoperative discomfort and swelling.

Conclusion

In this study, complete mandibular dentures supported by two non-splinted, SDIs provided immediate and delayed occlusal loading and function with a high survival rate of the both immediate loading (94%) and delayed loading (100%). Alveolar bone resorption rate after 4 years was 1.3 mm for immediate loaded small-diameter dental implants, and 1.2 mm for delayed loaded ones. Further studies are required to determine long-term success rate and predictability of this treatment modality and possible applicability for SDIs supported maxillary dentures.

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