Al-Azhar Journal of Dental Science
Vol. 20 - No. 1 - January 2017

EVALUATION OF EARLY LOADING VERSUS IMMEDIATE LOADING OF DENTAL IMPLANTS AT THE POSTERIOR PARTIALLY EDENTULOUS MANDIBLE

Mahmoud A Mekkey*, Mohammed M El-Hosary**, Tamer A Hamza** *and* Usama Mohammed Fawzy***

ABSTRACT

This study was done to Evaluate the effect of early loading and immediate loading of dental implants on bone and supporting periodontium. The posterior partially edentulous mandible at first molar area was used as implant recipient site. The surgical phase was done with the aid of surgical stent that gave precise results in implant insertion. This stage included fixture insertion in the site of the first molar. The fixture was loaded immediately (immediate loading) or after one month (early loading) with temporary restoration. Then left to heal for four months before final restoration. The follow up of the patients was done after prosthesis cementation as a base line, 3 months, 6 months and 9 months. The radiographic examination included measurement of marginal bone loss on the mesial and distal side and bone density around the fixture. Both the clinical and radiographic assessment revealed that both early loaded dental implants and the immediately loaded implants was in the acceptable range.

INTRODUCTION

One of the most important significant scientific breakthroughs in clinical dentistry was undoubtedly the introduction, of osseointegrated implants for anchorage of fixed bridges 40 years ago. Today this is an established clinical routine with predictable outcomes. Until the advent of implants, the only treatment alternative was to replace missing teeth with tooth supported crowns and bridges, or removable dentures. Although fixed appliances may be well accepted, not all patients can adapt successfully to removable dentures and in many cases experience functional and / or psychological problems [(1)].

Based on the initial concept of osseointegration, many new implant systems have been developed and variations in materials and treatment protocols have been introduced. The original treatment protocol for osseointegrated implants prescribed an unloaded healing period of 3 to 6 months before connection of the prosthetic superstructure and functional loading [(2-4)].

Based on the initial concept of osseointegration, many new implant systems have been developed and variations in materials and treatment protocols have been introduced. The original treatment protocol for osseointegrated implants prescribed an unloaded healing period of 3 to 6 months before connection of the prosthetic superstructure and functional loading [(2-4)].

Although most treatment routines still include a healing period between implant insertion and loading with a prosthetic superstructure, research during the last 10 years has increasingly focused on loading immediately, or very soon after implant placement and before the 3- to 6-month healing period (early). The use of so called immediate/ early loading protocols has obvious advantages for the patients. Only one surgical procedure is required. Both function and aesthetics can be immediately restored with a temporary crown or bridge [(5)].

*Assistant lecturer, Fixed Prosthodontics Department Faculty of Oral and Dental Medicine South Valley University
**Professor of Crowns and Bridges Department Faculty of Dental Medicine Al-Azhar University Cairo -Boys
***Lecturer, Crowns and Bridges Department Faculty of Dental Medicine Al-Azhar University Assuit branch

Immediate loading of endosseous root form implants has been described in the literature for eliminating the 3- to 6-month healing period. However, several authors have reported that micromotion resulting from early implant loading can result in fibrous encapsulation of the implant. Whereas most clinical studies have retrospectively examined implant survival rate after immediate loading, a few initial studies of immediate implant loading have shown clinical results similar to the conventional 2-stage loading protocol. Histologic evaluation from human beings regarding implants that received immediate loading has shown evidence of osseointegration [6-9].

Today, histology from experimental and clinical studies has demonstrated that functional loads do not impair osseointegration. Moreover, with respect to mandibular implants, clinical follow-up studies of one-stage implants have reported similar positive clinical outcomes as for two-stage procedures [7].

The longest follow-up time of early loading and of immediate loading protocols are 5 year. The overall implant survival rate based on available papers ranged from 81%-100% More long-term data are needed before immediate / early loading could be recommended as a standard procedure for single restorations in mandible [8-13].

Computed tomography

Clinicians have been diagnosing, treatment planning, placing and restoring dental implants using periapical and panoramic radiographs to assess bone anatomy for several decades. Two dimensional images have been found to have limitations because of inherent distortion factors and the non-interactive nature of film itself provides. With the advent of technology, CT has led to a new era of implant imaging. CT enables the evaluation of proposed implant sites and provides diagnostic information that other imaging or combinations of imaging techniques cannot provide. CT has several advantages over conventional radiography. First, CT eliminates the superimposition of images of structures outside the area of interest. Second, data from a single CT imaging procedure, consisting of either multiple contiguous or one helical scan, can be viewed as images in the axial, coronal or sagittal planes or in any arbitrary plane depending on the diagnostic task. This is referred to as multiplanar reformatted imaging (Frederiksen, 2009) [16].

The individual element of the CT image is called a voxel, which has a value, referred to in Hounsfield units (HU), that describes the density of the CT image at that point. HU also known CT numbers, range from -1000 (air) to +3000 (enamel), each corresponding to a different level of beam attenuation (Benson & Shetty, 2009; Frederiksen, 2009; Resnik et al., 2008) [16-21].

The density of structures within the image is absolute and quantitative and can be used to differentiate tissues in the region (i.e., muscle, 35–70 HU; fibrous tissue, 60–90 HU, cartilage, 80–130 HU; bone 150–1800 HU) and characterize bone quality (D1 bone, >1250 HU; D2 bone, 750–1250 HU; D3 bone, 375–750 HU; D4 bone, <375 HU) (Misch, 2008)[20,21].

PATIENTS AND METHODS

Patients selection

Initial selection of the patients that requiring single implant replacement to first mandibular molar teeth. Final selection was done after thorough diagnosis

Patients grouping;

The selected patients will be divided randomly into two main groups according to type of implant loading protocol table (1):

TABLE (1)

	Loading protocol	No. of the patient
Group I (E)	Early loading	8 patient
Group II (I)	immediate loading	8 patient

1. Group I; ***immediate loading protocol,*** this group includes eight patients, their implants restored by temporary crowns placed in normal occlusion within 48 hours of implant placement then after four months, permanent restorations are fabricated.
2. Group E; ***early loading protocol,*** this group includes eight patients. Their Implants restored by fabricated temporary crowns at one month after implant placement then after four months, permanent restorations were fabricated table (1).

CT scan was done to detect the quality of bone and its suitability for implant placement.

Study cast analysis:

Primary impressions of the upper and lower arch were used for fabrication of the study model. Face bow[1] and interocclusal records were used to mount the study model on a semi adjustable articulator[2].

Dentium implant[3] Dental Implants was used in this study. Lengths (10-12 mm) and diameters (3.5 to 4 mm) according to the mesio-distal and bucc-lingual dimension at the area of implant placement.

This implant system has abutment portion of post type that is designed to receive a fixed crown.

Surgical armamentarium:

For each patient, the following surgical set up was prepared:

Surgical motor[4] with irrigation flow (20-60ml/min).

Reduction contrangle handpiece (20:1)[5] with drilling speed 850 R.P.M.

Osteotomy preparation:

Placement of the sterilized surgical stent to detect the site and the direction of drilling. Circumferential blade is used to perform mid-crestal incision (enveloped flab) followed by elevation of a mucoperiosteal flap, at the mesial and distal side of the adjacent teeth, maintained the volume and position of papillae.

Round bur is used for implant site marking and cortical perforation with external copious irrigation

Drilling is started using pilot drill (initiator) to the desired depth; the drills are driven by low speed handpiece attached to surgical motor under normal saline cooling irrigation. Finishing drills is used to finish the preparation.

The implant is fixed to the prepared osteotomy and fastened by fingers till it stable in the bone.

Finger driver and manual wrench are then used to complete the insertion of the implant until the implant body is flushed with bone.

The titanium cover screw was inserted into the occlusal opening of the implant.

Finally, the flap was repositioned and secured by interrupted suture using 3/0 black silk suture[6] mounted on a cutting needle**.**

The patient was subjected to CT to check direction and position of the implant, Fig. (1)

Prosthetic phase

1- for group I, in group I, Provisional prosthesis (prefabricated temporary acrylic resin relined with

1. Standered Face-Bow, Bio-Art Equipamentos Odontologicos Ltda.Sao Carlos, SP, Brasil
2. A7 plus Articulator, Bio-Art Equipamentos Odontologicos Ltda.Sao Carlos, SP, Brasil
3. Dentium Co,Ltd. 201,202 1-Vally, 14-1 Dang-Dong, Gunposi, Gyeoggido, Korea
4. X-CUBE IMPLANT ENGINE, Saeshin, Korea.
5. NSK reduction contra-angle hand piece 20:1, Nakanishi Inc., Kanuma, Tochigi, Japan.
6. Surgical black suture, Shandong, Sinorgmed Co. L TD., China

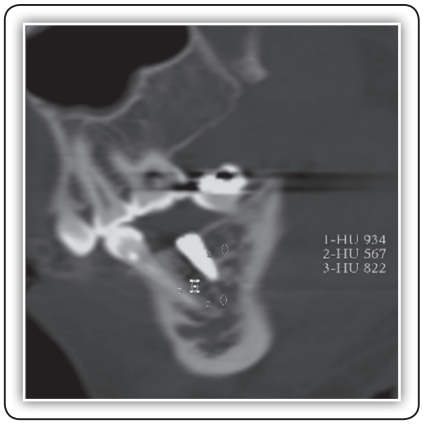

FIG (1)

FIG (2)

an autopolymerizing acrylic resin[1] placed in normal occlusion to distribute the force of mastication and provide support contact in maximum intercuspation and cemented using temporary cement[2] for four months. While the patient was applying maximum biting force, it was not possible to pull a piece of articulating paper through the occlusal contact. The occlusal contacts were axially directed and the patient was on a regular diet.

2- For Group E, after implant placement, the healing screw attached to it and the flap repositioned for healing, after one month the implant was restored with the resin provisional crown. The provisional restoration was adjusted into full occlusion. While the patient was applying maximum biting force, it was not possible to pull a piece of articulating paper through the occlusal contact. The occlusal contacts were axially directed and the patient was on a regular diet.

After 4 months (in both groups E and I), the abutment returned to its implant and attached to it by screw driver, then the final restoration was done and cemented with permanent cement. Figure (2).

Follow-up:

A) Clinical evaluation

1- *Bleeding on probing:*

Bleeding on probing was evaluated using Mühlemann Papillary Bleeding Index (PBI). Bleeding was provoked by sweeping the sulcus using a periodontal probe under light finger pressure from the base of the papilla to its tip along the distal and mesial aspects of the implant and waiting for 20 seconds.

Criteria of papillary bleeding index:

1. A single bleeding point was observed.

2. A fine line of blood or several bleeding points became visible at the gingival margin.

3 The interdental triangle became more or less filled with blood.

4. Profuse bleeding immediately after probing, blood flew into the interdental area to cover portions of implant or gingiva.

1. Protemp™II Composite for temporarycrowns and bridges 3M Deutschland G mbH 41453 Neuss Germany.
2. Provilat, PROMEDICA, Dental Material, GmbH, Germany.

2- Probing periodontal pocket depth

It was measured on all axial surfaces of all implants according to a standard procedure described by Glavind and Löe to measure pocket depth that refers to the distance from the gingival margin to the bottom of the clinical pocket.

The measurement were carried out using a 0.8 mm. thick periodontal probe with Williams' calibrations marked from 1-10 mm. Pocket depths of 1 mm. or less were recorded as "1 mm.", measurements exceeding 1 mm., but less than 2 mm., was recorded as "2 mm.", etc.

Measurements were taken all around the implant; mesially, buccally, distally, and lingually. The probing depth of the implants were obtained by totaling the four probing depth scores per implant. The sum of these scores was divided by four; the probing depth score for the implant was, thus, obtained.

PI = Total scores / No. of surfaces examined.

B) Radiographic Evaluation:

Each patient was subjected to CT scan on time of prosthesis loading as the baseline and intervals of 3, 6 and 9 months post-operatively to detect marginal bone level and bone density.

RESULTS

Data analysis was performed in several steps for the results of each group.

Gingival index

The results showed that there are no statistically significant difference between mean gingival index of early loading in relation to immediate loading dental implants at all intervals of the follow-up period.

Periodontal index

There was no statistically significant difference between mean periodontal index of the early loading in relation to immediate loading dental implants at all intervals of the follow-up period.

Marginal bone loss

There was no statistically significant difference between mean marginal bone loss of the early loading in relation to immediate loading dental implants at all intervals of the follow-up period.

Bone density

The early loaded dental implants had a higher statistically significant effect ($p<0.05$) on mean bone density than the immediately loaded implants at the intervals 6M, and 9M as indicated by Student t test table (2) and figure (3).

TABLE (2) Bone density of early loaded and immediately loaded implants

		no.	mean	SD	t	p	sign.
0M.Bone.Density	Immediate	4	835.5	27.012			
	Early	4	861.75	30.783	-1.282	0.248	NS
3M.Bone.Density	Immediate	4	835.5	27.012			
	Early	4	861.75	30.783	-1.282	0.248	NS
6M.Bone.Density	Immediate	4	883.5	35.341			
	Early	4	965.25	26.961	-3.678	0.012	S
9M.Bone.Density	Immediate	4	960.75	33.619			
	Early	4	1125.5	90.784	-3.404	0.029	S

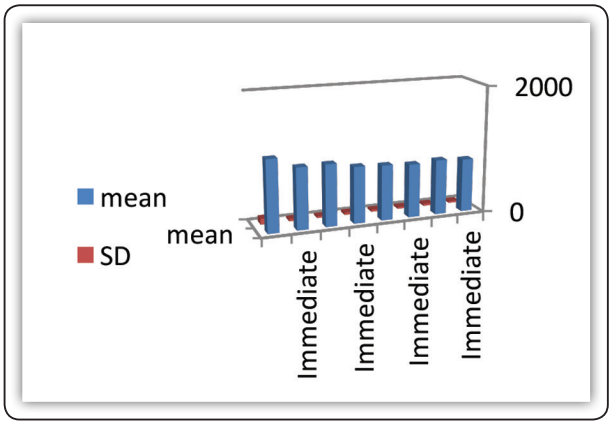

FIG (3)

DISCUSSION

The results of the study support that loading after one month should be considered routine for the majority of clinical situations in the posterior mandible with single crowns. Immediate loading of dental implants in the partially edentulous posterior mandible is a viable treatment alternative.

The present study found that the early loaded dental implants had higher statistically significant effect ($p<0.05$) on mean bone density than the immediately loaded implants at the intervals 6M, and 9M.

The results of this study showed that the early loaded dental implants had a higher statistically significant effect ($p<0.05$) on mean bone density than the immediately loaded implants at the intervals 6M, and 9M.

This result is due to Early loading, in contrast to immediate occlusal loading, is based on the interaction of the implant surface with the host bone for achieving biologic implant stability[14].

Salvi et al reported on a prospective controlled clinical trial that evaluated the effect of early loading of ITI implants, based on clinical and radiographic parameters. Four to five weeks after implant placement, abutments were connected, and single-tooth crowns were cemented. After 1 year, implant survival rate was 100%. They concluded that early loading (four to five weeks) did not appear to jeopardize the osseointegration healing process in the posterior mandible [14].

Rocca et al immediately loaded crowns in the posterior mandible, all of this crown was permanently cemented on the day of implant insertion. The cumulative success rate was 95.5%[15].

This result of Salvi and Rocci support the result of this study.

It's highly recommended to increase the number of patients and to extend the follow up time to give clear view about the dental implant loading protocols.

CONCLUSIONS

- There are significant difference in bone density between the early loaded dental implants and the immediately loaded implants.
- But we can say that both early loaded dental implants and immediately loaded implants was in acceptable range.

REFERENCES

1. Walton, T. The outcome of implant-supported fixed prostheses from the prosthodontic perspective: proposal for a classification protocol. Int J Prosthodont 1998; 11:595-601.
2. Brånemark P-I, Adell R, Breine U, Hansson Bo, Lindström J, Ohlsson A. Intraosseous anchorage of dental prostheses. I. experimental studies. Scand J Plast Reconstr Surg 1969; 3:81-100.
3. Brånemark P-I, Hansson BO, Adell R, Breine U, Lindstrom J, Hallen O, Ohman A. Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. Scand J Plast Reconstr Surg 1977;16:1- 32.
4. Brånemark PI, Zarb GA, Albrektsson T (eds). Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry. Chicago: Quintessence, 1985;199-209.
5. Ledermann PD. Stegprothetische versorgung des zahnlosen unterkiefers mit hilfe plasmabeschichteten titanschraubimplantaten. Deutsche Zahnärtzlische Zeitung 1979;34.907-911.
6. Schnitman PA, Wohrle PS, Rubenstein JE. Immediate fixed interim prostheses supported by two-stage threaded implants: methodology and results. J Oral Implantol 1990;2:96-105.
7. PA ¨ R-OLOV O ¨ STMAN Immediate/early loading of dental implants. Clinical documentation and presentation of a treatment concept. Journal compilation 2008 Blackwell Munksgaard PERIODONTOLOGY , Vol. 47, 2008, 90–112
8. Attard, N.J. & Zarb, G.A. Immediate and early implant loading protocols: a literature review of clinical studies. J Prosth Dent 2005; 94:242-258.

9. Gotfredsen K, Berglundh T, and Lindhe J. Anchorage of titanium implants with different surface characteristics: an experimental study in rabbits. Clin Implant Dent Relat Res 2000;2(3):120-8.

10. Ledermann PD. Stegprothetische versorgung des zahnlosen unterkiefers mit hilfe plasmabeschichteten titanschraubimplantaten. Deutsche Zahnärtzlische Zeitung 1979; 34:907-911.

11. Schnitman PA, Wohrle PS, Rubenstein JE. Immediate fixed interim prostheses supported by two-stage threaded implants: methodology and results. J Oral Implantol 1990; 2:96-105.

12. Cochran D, Buser D, Bruggenkate C, Weingart D, Taylor T, Bernard J-P, Peters F, Simpson J. The use of reduced healing times on ITI® implants with a sandblasted and acid-etched (SLA) surface: Early results from clinical trials on ITI® SLA implants. Clin Oral Impl Res 2002; 13:144- 153.

13. Cochran DL, Morton D, Weber H-P. Consensus statements and recommended clinical procedures regarding loading protocols for endosseous dental implants. Proceedings of the third ITI consensus conference. Int J Oral Maxillofac Implants 2004; 19:109-113.

14. Salvi GE, Gallini G, Lang NP. Early loading (1 or 4 weeks) of sandblasted and acid-etched (SLA) ITI implants in the posterior mandible. A 1-year randomized controlled clinical trial. Clin Oral Implants Res. 2004 Apr;15(2):142-9.

15. Rocci A, Martignoni M, Gottlow J. Immediate loading of Branemark System TiUnite and machined-surface implants in the posterior mandible: a randomized open-ended clinical trial. Clin Implant Dent Relat Res. 2003;5 Suppl 1:57- 63

16. Frederiksen, N., L. Advanced Imaging, In Oral Radiology Principles and Interpretation. J. Pharoah, pp. 2009;4(34): 207-224

17. Benson, B.W., Shetty, V. Dental Implants, In: Oral Radiology Principles and Interpretation, S.C. White & M. J. Pharoah, pp. (2009);6: 597-612.

18. Chan H-L., Misch K., Wang H-L. Dental Imaging in Implant Treatment Planning. Implant Dent. (2010);19:288-298

19. Resnik R.R., Kircos L., Misch C.E. (2008). Diagnostic Imaging and Techniques, In: Contemporary Implant Dentistry, C.E. Misch (ed), pp. 38-67, Mosby, Elsevier, ISBN 978-0-323-04373-1, Canada.

20. Misch C., E. (2008). Density of Bone: Effects on surgical approach and healing, In: Contemporary Implant Dentistry, C.E. Misch (ed), pp. 645-667, Mosby, Elsevier, ISBN 978-0-323-04373-1, Canada.

21. Scarfe, W.C., Farman, A.G. (2008). What is Cone-Beam CT and How Does it Work? Dent Clin N Am, 52, 707-730

22. Mühlemann HR. Periodontometry: a method for measuring tooth. Surg Oral Med Oral Pathol 1951; 4: 1220–1233.