International Journal Dental and Medical Sciences Research
Volume 3, Issue 1, Jan-Feb 2021 pp 486-493 www.ijdmsrjournal.com ISSN: 2582-6018

A comparative study to evaluate clinically and radiographically the placement of single implant in the healed socket in the posterior mandibular area under immediate and conventional loading.
Oral and Maxillofacial Surgery.

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Submitted: 10-01-2021 Revised: 18-01-2021 Accepted: 21-01-2021

ABSTRACT-Aim and Objectives- The purpose of this study is to compare and evaluate immediate loading versus conventional loading of implants clinically and radiographically. Immediate loading or provisionalization of implants results in reproducible osseointegration and high implant survival rates. The high success rate was attributed to the higher percentage of bone contact with the implant surface due to the micromotions resulting from early or immediate loading of implants. Also immediate loading of implants results in fewer surgical visits, thus reduces the duration of treatment. Materials and Method – In this study 40 medically fit patients of the age group of 18 to 60 years with single or multiple missing teeth in the posterior mandibular area are selected. Patients are divided into group A- Immediate loading & group B- conventional loading, 20 patients in each group. Follow up was done for all patients at 1st, 3rd and 6th month after placement of implants to assess the amount of crestal bone loss and stability of implant. Result- Clinical, radiographic and statistical observations shows that both immediate and conventional loading loading of implants have almost similar outcome. Thus the risk to benefit ratio must be assessed for each patient and evaluated separately. Greater the primary stability of implants the more likely immediate loading can be performed.
Conclusion- Immediate loading of implant achieved similar success rates as those reported in the conventional loading of two stage approach.
Key words: Dental implants, immediate loading, conventional loading, crestal bone.

I. INTRODUCTION-

Dental implants are used to replace both the form and the function of missing teeth.

Implant dentistry include spectrum of loading schedules which include :
Immediate loading – 0 to 20 days of implant placement
Early loading – 2 to 3 weeks of implant placement
Conventional loading - 3 to 6 months of implant placement
Delayed loading – 6 to 12 months of implant placement

Immediate loading or provisionalization of implants results in reproducible osseointegration and high implant survival rates. Immediate loading or provisionalization strategy has been explored in many case reports and clinical studies over the past decade. The high success rate was attributed to the higher percentage of bone contact with the implant surface due to the micromotions resulting from early or immediate loading of implants.
In this study comparison will be done on implant survival between immediate and conventional loading of implants placed in healed extraction sockets in posterior mandibular area.
And also to study marginal bone adaptation and soft tissue changes following immediate and delayed loading.

The above mentioned comparative study will be performed by evaluating the parameters like stability, amount of bone loss and periodontal probing depth.

Since the 1970s one of the major guidelines for successful osseointegration of dental implants has been a non loaded healing period of 3 months for implants placed in the mandible and 6 months for those placed in the maxilla.

With the availability of new types of implants and a growing understanding of the biological principles of osseointegration, however, the necessity of this tenet in all cases of implant surgery has been challenged. In recent years,

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histologic and histomorphometric studies in both animals and humans have shown that more rapid and greater bone-to-implant contact can be achieved with implants that incorporate certain surface characteristics compared with the original machined-surface implants. For instance, Lazzara et al. reported unloaded 6-month average bone-to-implant contact amounts of 72% with threaded commercially pure (CP)-titanium implants versus 34% for machined-surface implants, all placed in the posterior maxilla. Such findings are significant in that these types of implants may allow an implant to sufficiently resist functional loading sooner than was originally thought.

Indeed, a number of clinical and case studies have reported that immediate loading of implants with a provisional prosthesis following stage 1 surgery can be a very successful treatment alternative.

The benefit of immediate loading, of course, is that it significantly shortens the treatment duration for patients, eliminating one of the surgeries and allowing patients to wear a fixed interim restoration immediately following implant placement.

In addition, it may reduce the risk for trauma to the implant-bone interface, which can be caused by a removable transitional complete denture worn during the usual interim.

Primary stability and minimal micromovement are essential for Osseointegration..

When the implant is placed into the healed socket, it should be torqued to 35 Newton-centimeters(Ncm) to ensure stability. If it torques down and feels tight while it is being torqued down, then it is safe for immediate loading. If it has mobility while it is torqued down, then it should not be loaded immediately.

Bone modeling may be controlled by mechanical factors, as is the case with orthodontic tooth movement, or by growth factors, as is the case with bone healing, bone grafting, and osseointegration. Microstrain (ME) is a method of measuring the load applied to bone as percent deformation of tissue.

For example, a load of 200 ME produces a deformation of 0.2% of the tissue. Between the range of200 and 2,500 ME, there is normal functional response in which strong bone is produced that is effective in facing increased loads. Atrophy occurs in cases in which the force is low (i.e., less than 200 ME).

When the load is between 2,500 and 4,000 ME (i.e., a deformation of 0.25% to 0.4%), hypertrophy occurs, and there is a change in the size of the bone segment. The modelling that occurs during hypertrophy is lamellar bone formation.

If the load exceeds 4,000 ME, there is a pathological overload, and the modelling that occurs is woven bone formation. In this situation, the bone responds as quickly as possible to meet the excessive load by producing the tissue that can be formed the fastest (i.e., woven bone, which has limited load-bearing capacity).

Hence to decrease the risk of occlusal overload and its resultant formation of woven bone, which can be achieved by increasing the functional surface area to the implant- bone interface. This can be achieved by increasing the number of implants, selecting large diameter implants, improving implant design and its surface conditions. Minimizing the surgical trauma during osteotomy preparation like thermal injury and Microfractures can also decrease the risk of immediate occlusal overload.

Thus the rationale for immediate loading is not only to reduce the risk of fibrous tissue formation but also to minimize woven bone formation and to promote lamellar bone maturation to sustain occlusal load.

Aims and Objectives-

Aims:

The aim of this study is to compare and evaluate immediate loading versus conventional loading of single implants placed in the healed socket of the posterior mandibular area clinically and radiographically.

Objective:

1. To evaluate the stability of the implant clinically using resonance frequency analyser (OSSTELL).
2. Radiographic assessment of vertical bone loss mesially and distally to the implant at 1, 3 and 6 months.

II. MATERIALS AND METHODS-

SOURCE OF DATA:

Patients reporting to the department of Oral and Maxillofacial Surgery, M.R Ambedkar Dental College and Hospital Bengalore, with chief complaint of missing tooth and requiring replacement of missing tooth or teeth will be selected for the study.

METHOD OF COLLECTION OF DATA:

The study is proposed to include 40 medically fit patients irrespective of gender and of age group between 18 to 60 yrs with missing tooth and/or edentulous span in the posterior mandibular area, visiting the department of oral &

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maxillofacial surgery, M. R. Ambedkar Dental College & Hospital, Bengalore. Patients will be included in the study after obtaining ethical clearance from the institution and informed consent from the patients. Patients will be divided into group A & B, 20 patients in each group.

Inclusion Criteria:

1. Age at least 18 years.
2. Patients with missing tooth with healed socket.
3. Patients willing for follow up.

Exclusion Criteria:

1. Untreated periodontal diseases
2. Patients unwilling for follow up
3. Medically compromised patients
4. Absence of opposing dentition

Armamentarium

1. Sterile gloves, syringes and local anesthesia
2. BP handle and No.15 blade
3. Periosteal elevators
4. Implant physio-dispenser
5. Implant kit and implants
6. Langenbeck retractors
7. Saline for irrigation
8. Suturing kit

PROCEDURE:

Implant placement will be performed under local anesthesia. Preoperative analgesics and antibiotics will be administered. An incision of adequate length mesiodistally along the buccal side of alveolar crest is made and the mucoperiosteal flap is reflected. A pilot hole is made using an internally irrigated pilot drill with implant hand-piece at a minimum distance of 3mm from the edge of adjacent natural dentition. A paralleling instrument is used to check the proper angulation before proceeding with next diameter drill. Then an intermediate drill is used to make a channel of proper depth occluso apically. Finally a full diameter drill is used to complete the final drilling.

The completed implant receptor site is irrigated with sterile saline. Then an implant will be placed and a radiograph will be taken to check the implant placement. Careful reposition of the mucoperiosteal flap to be done for maximum tissue adaptation and then suturing will be done.

In case of immediate loading, a healing abutment is attached to the implant, impression is made and a temporary crown is fabricated and placed under occlusion during the same clinical visit.

In case of conventional loading, patient is recalled on second visit after 3 to 6 months, a punch excision is made at the implant site, healing cap is removed, an extension healing abutment is attached, impression is made and restored with a provisional crown placed under occlusion to initiate the healing of soft tissues around the abutment and crown.

Patient is recalled on 1st, 3rd and 6th month after the placement of implants to evaluate radiologically for osseointegration.

RADIOLOGICAL ASSESSMENT

1. Pre and post operative IOPA radiographs, Panoramic radiographs and CBCT scans were taken to assess the mesial and distal level of crestal bone around the implant.
2. All X-rays were taken at 1st, 3rd and 6th month post operatively to assess the vertical height of crestal bone.

ANALYSIS OF DATA:

1. Student T-test.

III. RESULTS-

Patient NO.	I S Q OSSTELL	Vertical crestal bone loss :Mesial(mm)			Vertical crestal bone loss :Distal(mm)		
Immediate loading		1m	3m	6m	1m	3m	6m
1	54	0	0.6	0.6	0.3	0.4	0.6
2	60	0	0.2	0.4	0	0.3	1
3	67	0.3	0.4	0.6	0.2	0.4	0.5
4	72	0	0.2	0.2	0	0.3	0.6
5	56	0.1	0.4	0.5	0	0.4	0.6
6	55	0	0.3	0.5	0	0.5	0.7
7	68	0	0.2	0.4	0.3	0.2	0.5
8	70	0.3	0.3	0.4	0	0	0.4

9	75	0	0.3	0.5	0.2	0.3	0.5
10	73	0.3	0	1	0.2	0.3	0.6
11	64	0.2	0.1	0.1	0	0.4	1
12	67	0	0.2	0.4	0	0.3	0.5
13	63	0.3	0.3	0.5	0	0.4	0.6
14	73	0.3	0.4	0.6	0.3	0.5	0.8
15	72	0.1	0.4	0.6	0	0.2	0.5
16	50	0	0.2	0.5	0	0.3	0.7
17	51	0	0.1	0.2	0.1	0.2	0.5
18	63	0.1	0	0.2	0	0.1	0.3
19	61	0.2	0.3	0.4	0.1	0.2	0.3
20	55	0	0.4	0.6	0	0.2	0.4

MASTER TABLE

Patient NO.	I S Q OSSTELL	Vertical crestal bone loss :Mesial(mm)			Vertical crestal bone loss :Distal(mm)		
Conventional loading		1m	3m	6m	1m	3m	6m
1	68	0	0.2	0.3	0	0.5	0.6
2	64	0.1	0.2	0.2	0	0.2	0.4
3	65	0	0	0.2	0.3	0.3	0.6
4	66	0.2	0.3	0.4	0	0	0.6
5	62	0	0.1	0.2	0.2	0.3	0.5
6	69	0	0	0.2	0.2	0.4	0.6
7	73	0.3	0.3	0.4	0.3	0.5	0.8
8	80	0.1	0.2	0.3	0	0.3	0.6
9	62	0.3	0.2	0.4	0.2	0.4	0.8
10	69	0	0.1	0.3	0.2	0.3	0.5
11	71	0	0	0.2	0	0.4	0.6
12	65	0	0.1	0.3	0	0.5	0.8
13	69	0.2	0.3	0.4	0	0.2	0.5
14	73	0.3	0.4	0.6	0.3	0.3	0.8
15	65	0	0.1	0.4	0	0	0.7
16	70	0.1	0.2	0.5	0.2	0.3	0.6
17	64	0	0.1	0.3	0.1	0.2	0.5
18	66	0	0.3	0.5	0	0.2	0.3
19	72	0.3	0.4	0.5	0.2	0.3	0.6
20	64	0	0.1	0.3	0.1	0.3	0.4

Vertical crestal bone measurement: Mesial (mm)

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Table 1: immediate loading

Vertical crestal bone measurement Mesial (mm)	Min-Max	Mean	SD
1 month	.05-.16	.11	.126
3 month	.37-.55	.34	.193
6 month	.30-.42	.46	.146

Table 2: conventional loading

Vertical crestal bone measurement Mesial (mm)	Min-Max	Mean	SD
1 month	.04-.15	.09	.120
3 month	.12-.24	.18	.121
6 month	.29-.40	.36	.116

Table 3: comparison between vertical crestal bone measurement immediate and conventional loading: Mesial (mm)

Vertical crestal bone measurement Mesial (mm)	Immediate loading	Conventional loading	P value †
1 month	.11 (.13)	.09 (.12)	<0.001**
3 month	.34 (.19)	.18 (.12)	<0.001**
6 month	.46 (.15)	.36 (.11)	<0.001**

- P ≤0.05 significant **p < 0.001 highly significant † Student t-test

Vertical crestal bone measurement: Distal (mm)

Table 4: immediate loading

Vertical crestal bone measurement Distal (mm)	Min-Max	Mean	SD
1 month	.03-.14	.08	.115
3 month	.24-.35	.30	.124
6 month	.50-.66	.58	.186

Table 5: conventional loading

Vertical crestal bone measurement Distal (mm)	Min-Max	Mean	SD
1 month	.06-.17	.12	.116
3 month	.23-.36	.30	.136
6 month	.53-.65	.59	.137

Table 6: comparison between vertical crestal bone measurement immediate and conventional loading: Distal (mm)

Vertical crestal bone measurement Distal (mm)	Immediate loading	Conventional loading	P value †
1 month	.08 (.11)	.12 (.12)	<0.001**
3 month	.30 (.12)	.30 (.14)	<0.001**
6 month	.58 (.19)	.59 (.14)	<0.001**

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IV. DISCUSSION-

In this study dental implants were placed in healed ridges in posterior mandibular area and clinical and radiographic evaluation done following immediate loading and conventional loading.

Data from the current available literature suggest that several factors like surgery, host, implant and occlusion- related factors influence the results of immediate implant loading. Surgical factors consist of primary implant stability and surgical technique.

Host factors include the quality and quantity of cortical bone and trabecular bone, wound healing and remodelling activity. Implant factors include designs, surface textures and dimensions of the implant. Occlusal factors include quality and quantity of force. In the results of this study immediate loaded implants in posterior mandible showed a mean vertical bone loss of 0.46 mm and 0.58 mm at mesial and distal regions respectively at 6 months follow-up. The data seems similar when compared to conventional loading of implants in posterior mandible which is about 0.36 mm and 0.59 mm at 6 months follow-up for mesial and distal regions. Hence the concept of immediate loading seems a favourable protocol in preserving the hard tissues. Another keen point to take note is that the maintenance of interdental papilla is better observed in immediate loading. The greatest and most advantageous application of immediate restoration of implants are those in which aesthetic needs and soft tissue preservation are most important. Immediate implant loading provided function, aesthetics, and psychological benefits to such patients and it had been a favourable cost benefit with regard to timing of treatment.

This approach cannot however be applied to every implant patient. In comparison to conventional loading, this procedure requires more chair side time at the time of implant placement for both patient and surgeon. Immediate loading also requires effective communication and coordination among surgical and restorative team, as there is a degree of flexibility involved in the delivery of the prosthesis. Careful patient screening and selection are required when an immediate loading is a treatment consideration. Micromovement of implants which can cause implants failure is greater than with conventional loading in which the implants are submerged. And it might be usual not to evaluate the implant crestal bone level by reflecting the soft tissue at the follow-up stages which is done in conventional loading during the second stage surgery. Immediate loading is still yet to be considered in certain conditions which were not included in the inclusion criteria like narrow alveolar crest, facial undercut of alveolar process, dental trauma, dis-use bone atrophy.

Conventional Loading has been evaluated extensively over the last 25 years and is reasonable well documented. However, the shortfall in evidence based and lack of appropriate randomized control trials suggests that much of what we do today is based on accumulated clinical experience rather than well designed and appropriately documented research. While immediate loading is emerging as a worthwhile and attractive alternative, the risk to benefit ratio must be assessed for each individual patient and evaluated separately. The greater the benefit and lower the risk assessment, the more likely immediate loading can be the appropriate treatment.

V. CONCLUSION-

The following are the conclusions drawn from current study:

- Immediate implant loading achieved similar success rates as those reported in the conventional 2-stage approach..
- Primary implant stability is a key factor to consider before attempting immediate implant loading.
- Surgery, host, implant and occlusion related factors may influence the outcomes of immediate implant loading.
- Studies are needed to understand the possibility of immediate implant loading in patients who are diabetic, osteoporosis, smokers and those who have other systemic compromising diseases.
- Long-term prospective studies are still needed to evaluate other potential determining factors for immediate loading of implants.

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