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Evaluation of the dimensional alveolar bone changes in immediate post-extraction implant placement in the maxillary premolar area with or without loading: A randomized controlled clinical trial

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ABSTRACT:

The objective of this study was to assess the dimensional changes in alveolar bone following immediate post-extraction implant placement with loading versus without loading in the maxillary premolar region. Thirty patients were randomly allocated into two groups. Group A: Immediate Implants with loading; Group B: Immediate Implants without loading. Atraumatic extraction was conducted, followed by implant installation. If necessary, the space between the implant and the socket wall is filled with bone graft material. The height of the alveolar bone crest, the width of the alveolar bone, and implant stability were evaluated. CBCT images were utilized to assess the alveolar bone breadth surrounding all sides of the implants. At 0.3, six months postoperatively, utilizing the superimposition and subtraction approach. The results indicated no significant difference between the two groups concerning changes in bone height and width at three and six months. The study demonstrated that early loading of dental implants produces predictable outcomes for the preservation of alveolar ridge width and height, equivalent to conventional loading protocols.

Introduction:

Recent advancements in clinical techniques and biomaterials have significantly broadened the indications for dental implant treatment options. Dental implants have effectively replaced absent teeth, leading to the evolution of various insertion and loading protocols from the original method to facilitate quicker and less complex surgical procedures. The insertion of

implants soon after tooth extraction is a common clinical practice and is regarded as equally predictable as implant placement in healed sites.
[1]

The third International Team for Implantology (ITI) consensus conference in 2004 recommended a novel classification for immediate implant implantation. Type I: Immediate placement of a dental implant into the extraction socket concurrently with the extraction, without healing of bone or soft tissue. Type II: Early placement occurs 4 to 8 weeks post-extraction, while the socket is covered by soft tissue but exhibits no significant bone healing. Type 3: placement of dental implant 12-16 post-extraction, following complete soft tissue healing and substantial bone healing. Type 4; insertion of a dental implant after a minimum of 6 months post-extraction, during which the extraction socket has undergone healing. [2]

When placed in an extraction socket, dental implants can be especially challenging to load and integrate into full function. There are four distinct ways dental implants can be loaded immediately. After two weeks of implant placement, the term "immediate occlusal loading" describes a fully functional occlusal loading of the implant. When functional loading happens between two weeks and three months after implant installation, it is referred to as early occlusal loading. When a prosthesis is placed on top of an implant within two weeks of the implant being placed, but without direct functional occlusal loading, it is considered non-functional immediate restoration. As it relates to implant prostheses, non-functional early restoration occurs between two weeks and three months after implant insertion. In conclusion When an implant repair takes place more than three months after placement, it is called delayed occlusal loading.[3]

The immediate loading of dental implants offers the advantages of reducing treatment duration, preserving remaining bone, and providing direct benefits to patients through the swift restoration of aesthetics, speech, and function.[4]. Conversely, others indicated that early loading of dental implants had adverse effects due to the formation of a fibrous capsule within the bone defect, resulting in insufficient primary bone contact and, consequently, a lack of osseointegration.[5]

The present study aims to compare the immediate versus delayed loading of dental implant placed directly into fresh extraction socket.

Subjects and methods:

Sample size calculation:

An analysis of power showed an 80% power. Based on the results of an earlier study, we can set an alpha (α) level of 0.05 (5% confidence interval) and a beta (β) level of 0.2.With 12 cases in each group, the total predicted sample size (n) was 24. There were a total of 30 cases (15 in each group) since the sample size was increased by 25% to cover possible dropouts at different follow-up periods. G*Power version 3.1.9.72 was used for the sample size computation. Thirty patients were enlisted for this study, with a split into two categories:

Group A: Immediate Implants with loading

Group B: Immediate Implants without loading

Patients were randomly chosen for the outpatient clinic of the Oral Medicine and Periodontology department at Cairo University. All patients participating in this study have provided informed permission following a comprehensive explanation of the procedures. Criteria for inclusion: Patients possessing a minimum of one non-restorable tooth in the maxillary premolar region requiring extraction. Patients with a robust systemic disease. Patients aged 20 to 45 years. Buccal bone thickness must be a minimum of 1mm. [6]

Exclusion criteria: 1) Patients exhibiting indications of acute infection in the relevant location. (2) Patients exhibiting habits that may compromise implant lifetime and influence research outcomes, such as parafunctional behaviors. [7] Current and former smokers [8] Pregnant females.

Surgical Procedures:

Prior to surgery, all patients had assessment via CBCT to evaluate labial bone thickness and width, ensuring appropriate implant length and diameter. Atraumatic extraction was conducted utilizing periotomes. Implant insertion was executed in accordance with the manufacturer's specifications. All implants were positioned palatally and 3 mm to 4 mm apical to the free gingival margin (FGM) to enhance aesthetics. [9] The vertical position of the implant relative to the face mucosal margin (implant vertical position) and the size of the buccal/lingual bone plate (size of buccal/palatal gap) are recorded after implant implantation. Bone graft material can be used to fill the space between the implant and the socket wall if that becomes necessary. The implants are then randomly assigned to either the test group, which includes implants that load immediately, or the control group, which includes implants that do not load at all. A screw-retained provisional crown with a flat or concave emergence profile is used to quickly repair the test implants. This crown is designed to avoid occlusal contacts during both centric and excursive movements.

Following surgery, all patients are required to take antibiotics, anti-inflammatory medications, and an antiseptic mouthwash as prescribed. All patients had CBCT after surgery to assess bone density and dimensions using superimposition and subtraction methods.

The initial course of treatment following surgery should consist of antibiotics, specifically 500 mg of amoxicillin taken orally four times a day for five days [10]. Second, NSAIDS; 600 mg of ibuprofen three times daily with meals for three days? The doctor prescribed a two-week course of an antiseptic mouth rinse with 0.2% chlorhexidine to the patient. [11]

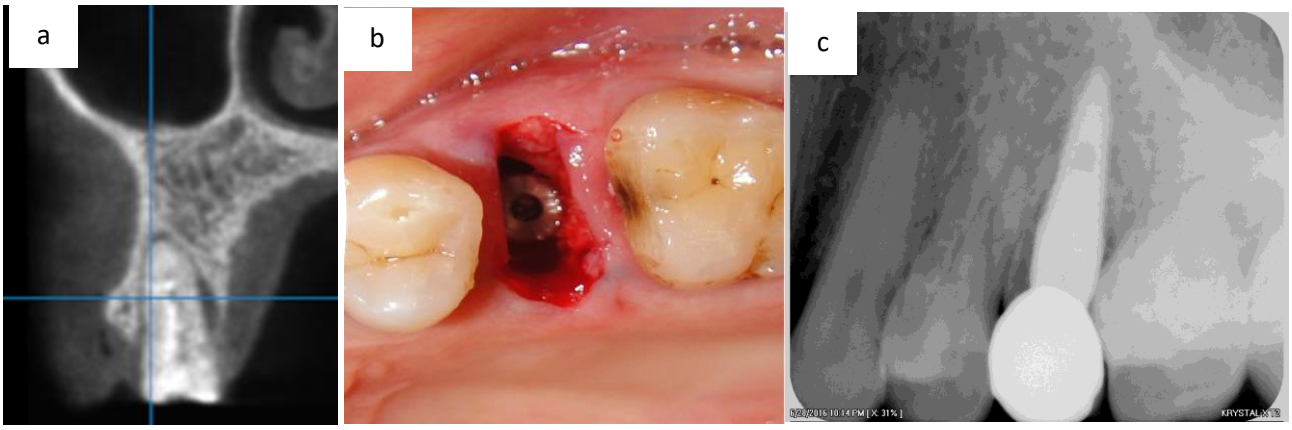

Figure (1) Case presentation of immediate implant placement with loading

a) Radiographic examination using CBCT before extraction, b) implant insertion into fresh extraction socket, c) radiographic examination using peri-apical after implant placement

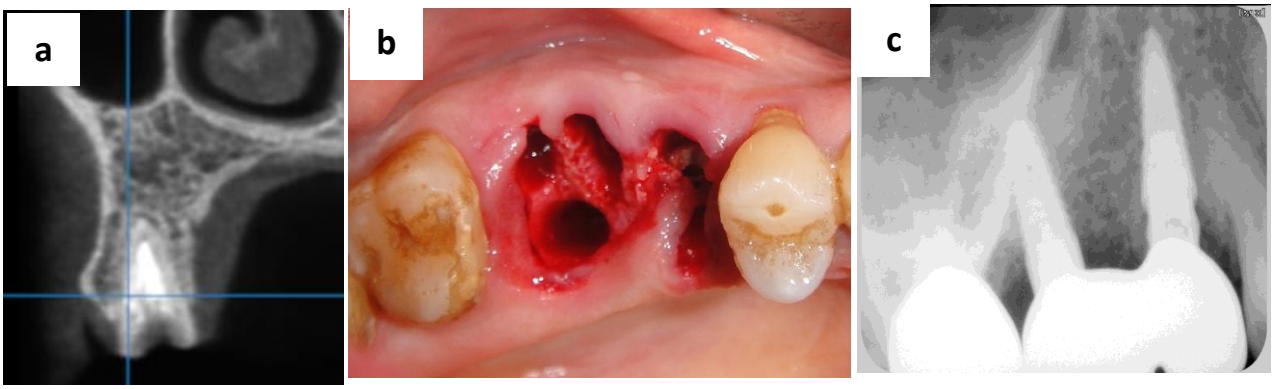

Figure (2) Case presentation of immediate implant placement with loading

b) Radiographic examination using CBCT before extraction, b) implant insertion into fresh extraction socket, c) radiographic examination using peri-apical after implant placement

Results:

Bone height Change: A At 3 months, Bone height Change of Group I was (6.30±8.63) and group II was (3.32±6.20) table (1). The difference between the two reading was non-significant (p=0.343). At 6 months, Bone height Change of Group I was (9.26±9.51) and group II was (8.00±4.61) the difference was non-significant (p=0.684).

Table 1: Comparison between groups according to Bone height change

Bone height Change	Group I		Group II		p
	Mean	SD	Mean	SD	
At baseline- At 3 months	6.30	8.63	3.32	6.20	0.343
At baseline- At 6 months	9.26	9.51	8.00	4.61	0.684

Bone width Change:

At 3 months, Bone width Change of Group I was (2.72±2.34) and group II was (2.14±6.99) the difference was non-significant (p=0. 787) (table 2). At 6 months, Bone width Change of Group I was (4.54±2.94) and group II was (4.78±5.72) the difference was non-significant (p=0. 898).

Table **2**: **Comparison between groups according to Bone Width Change**

Bone width Change	**Group I**		**Group II**		**p**
	Mean	**SD**	**Mean**	**SD**	
At baseline- At 3 months	2.72	2.34	2.14	6.99	.787
At baseline- At 6 months	4.54	2.94	4.78	5.72	.898

Discussion:

This study aims to assess the efficacy of instant loading versus delayed loading of immediately inserted dental implants regarding ridge breadth and height. Immediate-loading implants exhibited a success rate of 90%, while conventional loading implants demonstrated a success rate of 95.7%. The outcomes were comparable to earlier findings regarding the success rates of conventional implants, however the failure rate of instantaneous implants was marginally elevated. This may result from intrinsic limiting considerations associated with the rapid loading of the implant. Excessive occlusal or lateral forces pose a danger of micro-movement of the implant fixture, thereby compromising effective osseointegration. Evidence indicates that rapid implant placement offers more advantages over delayed implant insertion, including time efficiency, reduced procedural requirements, enhanced preservation of ridge width, and consequently, increased patient satisfaction. **[12].** For instantly loaded implants to work, you need good primary stability, screw-shaped implants with a rough surface, a minimum implant length of 10 mm, enough bone quality (D2 or D3), and lateral stress reduction.. **[13].** Primary stability of immediately placed implants seems to be the most important factor in immediate loading.

Although quick placement and loading of implants are now more predictable and successful than in the past **[12].** This methodology is not applicable to all patients receiving immediate implants. The immediate loading process necessitates increased chairside duration during implant insertion for both the restorative dentist and the patient. Consequently, meticulous patient selection is essential for the success of this surgery. The prompt placement of dental implants exhibits a superior success rate due to the flapless technique. Although a comprehensive examination of the labial plate of bone is evident after flap reflection, this is typically unnecessary.. [14]. Reports indicate that any form of flap elevation can compromise the blood supply to the periosteum, complicating the prediction and management of postoperative peri-implant tissue loss during the healing process. [15]**.** In light of this, the flapless technique primarily maintains the periosteum blood supply to reduce peri-implant tissue loss, offers a less traumatic procedure, and shortens the patient's recovery and surgical duration [16]

Our study differs from that of [17] our research Although there were no notable differences between the two groups, the study did find that 20 individual implants were promptly put into fresh extraction sockets in the aesthetic zone, resulting in an average bone loss of 1.02 ± 0.53 mm.

The buccal plate receives blood flow from the space between the alveolar ridges, the bone

marrow, the outside periosteum, and the periodontal ligament. [18]. According to [19].A thickness of less than 1 mm is typical for the buccal bone wall of maxillary anterior teeth, suggesting that cortical bone is the predominant kind of bone in this region. After a tooth is extracted, the periodontal ligament stops acting as a blood vessel, leaving the periosteum as the only blood vessel.

Also, when a flap is raised, this final source disappears, which could cause the buccal plate to resorb. The results imply that: a) a smaller buccal plate to begin with would cause more noticeable bone resorption, and b) flap-less operations could slow down the process of bone loss. The first hypothesis was found to be somewhat positively correlated with the initial buccal bone plate thickness of 1 mm. [20].

In conclusion, bone height decreased over time in both groups, although the rate of loss did not differ significantly between the loading and non-loading groups. Overall, the results show that although bone width decreased over time in both groups, Group I and Group II did not significantly differ in the rate of loss. Examine and improve Group I's loading procedures to maximize their ability to maintain or enhance bone health.

CONCLUSION: 1) According to the study's findings, quick loading of dental implants is a successful therapy procedure in some circumstances. 2) Treatment time can be decreased with immediate loading. 3) An acceptable substitute for conventional delayed loading rehabilitation is immediate loading.

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