

# Immediate Implant Loading – A Paradigm Shift

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## ABSTRACT

The marked rise in patients' demands as regards quality of life and a good appearance makes it mandatory for the Prosthodontist to provide a dental prosthesis with optimal functional, esthetic and physiological requirements. Recent researches in dental implants advocate precise preparation of the implant bed and an adequate primary stability for more vital bone to be in contact with the implant interface facilitating immediate loading. Improvements in implant designs and surface modifications have favored reduced treatment time.

**Keywords:** Dental Implants, Osseointegration, Immediate Loading

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## INTRODUCTION

The marked rise in patients' demands as regards quality of life and a good appearance makes it mandatory for the Prosthodontist to provide a dental prosthesis with optimal functional, esthetic and physiological requirements. Modern dentistry aims to restore the patients to normal contour, function, esthetics, speech, comfort and health of the stomatognathic system. Dental implants have emerged as a promising option for this purpose.

Originally, an unloaded healing period was considered essential for the achievement of osseointegration of dental implants (1). It has usually been recommended that the surgical sites should be left undisturbed for at least 3–6 months after the surgery for uneventful healing. This enhances osseointegration between the implant and the bone (2). The purpose of this approach is to avoid implant micro movement around the bone-implant interface during healing phase which may induce fibrous tissue formation instead of osseointegration, leading to implant failure. Hence the submerged implants were favored for the initial

rigid fixation (3).

The problems with the two-stage surgical protocol included: avoiding any prosthesis for a minimum of 2 weeks; loose denture, pain, difficulty with chewing with transitional removable prosthesis wearing period and the necessity of additional surgery to expose implant fixtures. It was speculated that the early occlusal loading may interfere with the ability of new bone being formed to restore the necrotic bone at the implant/ bone interface usually occurring from surgical trauma (4). In fact, earlier results with immediate implant loading were often unpredictable (5, 6). However, improvements in implant design and surface have changed the loading protocols favoring early and immediate loading concepts. Rough acid-etched surfaces allow reduced healing periods because of more rapid bone integration (7). Attempts continue to be made to shorten these time periods, through the production of new implant surfaces, the development of new techniques.

With the introduction of one-stage implants, improvement in implant design and development of roughened implant

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surfaces and better force understanding have all collectively made the concept of immediate implant loading possible. The paradigm has thus shifted from “No load on implants during healing” to “No micro movements of implants”. Immediate loading actually loads the implant with a provisional restoration at the same appointment or shortly thereafter thus eliminating the second stage implant uncovered surgery (8). The placement of a temporary restoration on the day of implant surgery may offer esthetic, psychological and functional advantages (9). The advantages of immediate loading of dental implants include: reduced time of treatment, greater acceptance on the part of patients and better function and esthetics (10). Immediate loading of oral implants has been defined as a situation where the superstructure is attached to the implants no later than 72 hours post surgery (11, 12).

### DEFINITIONS

Immediate implant loading can be briefly defined as the loading of a dental implant immediately or few hours after being placed. Misch and coworkers defined as immediate occlusal loading within two weeks of implant insertion. Wang et al defined Immediate implant loading as an implant-based surgical technique in which the “implant supported restoration is placed into occlusal loading within at least 48 hours after implant placement.” on basis of the consensus obtained from International Congress of Oral Implantologists meeting at Naples (Italy) in May 2006. The terms ‘non-functional immediate loading’ and ‘immediate restoration’ are used when a prosthesis is fixed to the implants within 72 hrs without achieving full occlusal contact with the opposing dentition.

### INDICATIONS AND CONTRAINDICATIONS FOR IMMEDIATE LOADING (13-15)

The implant can be placed in the edentulous as well as partially edentulous mandible and maxilla. They are

indicated in fresh extraction sockets also. However, contraindications for implant placement includes insufficient bone volume, severe maxillomandibular skeletal discrepancy, heavy smoking, local radiotherapy to the head and neck region, severe chronic renal or liver disease, uncontrolled diabetes, stroke, recent infarction, immunocompromised status, pregnancy at the time of evaluation, bleeding disorders, metabolic disorders, poor oral hygiene, acute infection of the implant site, bruxism and general contraindications for surgical procedures.

### CRITERIA FOR SUCCESS OF IMPLANTS (16)

The criteria for the success of implants include Bleeding index, Plaque index and Peri-implant probing depth. The Implant stability is measured either by Periotest values or Resonance Frequency Analysis.

### FACTORS AFFECTING THE SUCCESS OF IMMEDIATE IMPLANT LOADING

#### Surgical factors

- **Primary implant stability:** It is widely evident in the literature that primary stability seems to be the most important factor for immediate implant loading. If an implant is placed in the soft spongy bone with poor initial stability, it usually results in the formation of connective tissue encapsulation, similar to the pseudoarthrosis observed in an unstabilized fracture site. Micro movements of more than 100  $\mu$ m are sufficient to jeopardize healing with direct BIC (17). This observation was also reported by Szmukler-Moncler et al. and Jo et al. supported the fact that the main factor influencing the success of immediate loading is the primary stability of the implants at the time of the loading (18, 19).
- **Surgical technique:** Gentle surgical placement is also a key element for implant success regardless of the applied treatment protocol. Exces-

sive surgical trauma and thermal injury may lead to osteonecrosis and result in fibrous encapsulation of the implant (20). Heat generated during drilling without adequate cooling is associated with bone damage (21-22).

#### Host factors

- **Quality and quantity of cortical and trabecular bone:** In most of the studies on immediate loading, good bone quality has been mentioned as an important prognostic factor for the success of the procedure. The prime factor that determines the success of immediate loading is the quality of the bone, the suggested best type being type II. Host bone density plays an important role in determining the predictability of the immediate implant loading success. An implant placed in compact dense bone is more likely to ensure initial stability and thus, better will be able to sustain such immediate forces.
- **Wound healing:** Metabolic diseases that directly affect bone metabolism may significantly influence implant wound healing. In fact, some data have demonstrated that early load increased BIC and allowed a faster remodeling process when compared to unloaded controls (16). This concept of the mechanical stimulation of bone around implants was also evaluated and confirmed by Rubin and McLeod (23). It can be speculated that immediate loading of dental implants may accelerate bone formation, but primary stability is essential for this process to occur.

#### Implant factors

- **Designs/configurations:** Implant configuration has been considered as an essential requirement for implant success. The screw implant design develops higher mechanical retention as well as greater ability to transfer compressive forces. The screw design not only minimizes

micro motion of the implant but also improves the initial stability, the principal requirement for immediate loading success. Use of threaded implants results in high percentage of the implants in contact with bone cortex. Threaded implants show a greater functional area effecting a better stress distribution at the implant bone interface. As a general concept, the screw implant design develops higher mechanical retention as well as greater ability to transfer compressive forces.

- **Surface textures:** Rough implant surfaces render a significant increase of BIC. The shear strength of implants with a rough surface was shown to be about 5 times as high as that of implants with a smooth surface. In addition, greater forces are required to remove implants with a rougher surface compared to implants with a smoother surface. Rough implant surfaces render a significant increase of BIC (7). In addition, greater forces are required to remove implants with a rougher surface compared to implants with a smoother surface (24). Future studies should still be conducted in regions with softer bone to evaluate if implant surfaces play a relevant role in immediate implant loading success.
- **Dimensions of the implant:** The implant length may also influence the outcome of immediate implant loading. For every 3mm increase in length of a cylinder-shaped implant, the surface area increases by an average of 20–30%. The majority of studies have suggested that implants should be 10mm long to ensure high success rates. Therefore, the critical length and diameter of immediately loaded implants remains to be determined.

### Occlusal factors

The occlusal scheme may be another key factor for a successful outcome with immediately loaded implants.

Basic principles of implant occlusion may include bilateral stability in centric (habitual) occlusion, evenly distributed occlusal contacts and force. There should be no interferences between retruded position and centric Position and smooth, even, lateral excursive movements.

### PROCEDURE FOR IMMEDIATE LOADING

Recently, single-stage, immediate loading of implants are done using flapless surgery. Single-stage protocol involves either one-piece implant, consisting of implant and abutment manufactured as one-piece or placement of two-piece implant system in one surgical procedure. Planning for immediate loading of dental implants is facilitated by advanced imaging techniques. These techniques allow for selection of implant sites that have the highest Hounsfield values, which correlate with denser bone (17). In the flapless surgical procedure, a round tissue punch is used to remove the soft tissue on the crestal bone at the implant site, or the osteotomy is directly initiated through the soft tissue. Primarily two different options are available for immediate occlusal loading: First option loads the implants the same day as the surgery; Second option is to place the implant and make an impression at surgery and 7 to 12 days later, deliver the transitional prosthesis.

- **Option I:** On the day of surgery, the implant is inserted into the pre established positions. After implant insertion the final abutment is placed and tightened. Final abutments are prepared intraorally for parallelism and proper height requirements. The transitional prosthesis relined with light cured composite to eliminate toxic contact of monomer with the bone. The transitional prosthesis is evaluated for harmonious occlusal contact in centric occlusion.
- **Option II:** Implant positioning during surgery are same as in option I. However, in option II an

impression with additional silicone impression of implant body position is recorded. After the impression, the abutments are removed from the implant body and replaced with permucosal extension. The laboratory inserts the implant body analogs connected to the abutment into the impression, pours the impression with die stone and mounts the cast to the opposing arch. The laboratory selects and prepares the abutment for restoration and fabricates a transitional prosthesis. After 7-14 days of surgery, per mucosal extensions are replaced with the selected and prepared abutments the transitional prosthesis is also cemented.

In flapless surgery, surgical trauma is minimal that's why postoperative pain and discomfort are greatly minimized (21). Furthermore, the intact periosteum maintains a better blood supply reducing the likelihood of early bone resorption. In addition, it maintains the soft tissue architecture and hard tissue volume, lessens the surgical time and allows the patient to resume normal oral hygiene procedures immediately. A second surgical procedure for placing the abutment and for adjusting the mucosa is eliminated. Overall, the total management time, number of visits and the materials required are reduced. However, flapless implant placement generally is a blind procedure and care must be taken during surgery. Angulation of the implants is critical to avoid perforation of the cortical plates, mainly the lingual cortical plate in mandibular molar area and the labial cortical plate in maxilla.

### COMPLICATIONS

Implant overloading attributes to clinical complications such as screw loosening, screw fractures, fractures of veneering materials, prosthesis fractures, continuing marginal bone loss below the first thread along the implant, implant fractures, and implant loss. These complications can be

prevented by application of sound biomechanical principles such as passive fit of the prosthesis, narrowing the buccolingual/mesio-distal width of implant prosthesis, reducing cantilever length, maintaining implant load within the physiological limits of individualized occlusion. For accomplishing these objectives, improved force direction, increased support area and reduced force magnification are indispensable.

## CONCLUSION

It is generally accepted that immediate loading of implants is desirable, if the survival and success is comparable with that of conventional loading. Reviewing the scientific articles in the literature shows that the waiting periods for loading implants have changed. The large number of reviews suggests that immediate loading has achieved considerable success. The level of predictability and high success of current implant therapy has provided reasons for reassessing long adopted surgical and prosthetic guidelines. Due to the trend of shortening treatment time, immediate loading of implants have reemerged as an alternate approach.

However, certain guidelines need to be followed to ensure success which includes meticulous case selection and regular maintenance. When primary stability is achieved and a proper prosthetic treatment plan is followed, immediate functional implant loading is a feasible concept.

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