

Immediate Loading Implants - A paradigm shift: A review

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ABSTRACT

There is a growing trend in implant dentistry to decrease the treatment times associated with implant therapy. This can be achieved with immediate occlusal loading protocol. Immediate loading (IL) of dental implants is an eminent and acknowledged treatment strategy which is extensively being used for the rehabilitation of missing teeth. IL may be described as functional loading (With occlusal contacts) immediately after implantation (or within 3–4 days after surgery) without waiting for the healing period. IL has gained popularity nowadays as it includes less possible trauma to the tissues, overall treatment time is decreased, reduced patient's discomfort and anxiety, better patient acceptance and good function and aesthetics.

KEYWORDS: Immediate loading (IL) implants, Rehabilitation, Osseointegration

INTRODUCTION

The introduction of osseointegrated implants has revolutionized the art and science of modern dentistry giving a new lease of life to the restorative aspects in day-to-day practice.¹ The healing of dental implants in the jawbone is based on the principle of osseointegration^{2,3} which includes a healing period of several months and was based on acquiring direct bone-to-implant contact (BIC) and must be proved by means of histologic analysis.⁴ Thereby, predictable formation of a direct bone-to-implant interface is a treatment goal in implant dentistry.⁵ Osseointegrated dental implants are placed traditionally, following a two-stage protocol. The 2-stage surgical protocol established by Branemark et al⁶ includes (1) positioning and placement of the implant below the crestal bone to allow for stress healing without loading, (2) a soft-tissue covering over the implant to be obtained and maintained for 3 to 6 months, and (3) a minimally loaded implant environment to be maintained for 3 to 6 months. After this procedure, a second-stage surgery was necessary to uncover these implants and place a prosthetic abutment.⁵ Hence, according to the Brånemark protocol, dental implants, regardless of their design or system, an undisturbed healing period of three months is required in the mandible and six months in the maxilla.¹ While these periods purportedly allowed time for osseointegration of the implants within the respective arch,⁷ but this two stage protocol involved certain disadvantages i.e. it made the implant treatment lengthy. In patients who were either completely or partially edentulous, a long term, clinical rigid fixation had been reported after this protocol.^{8,9} Furthermore, Brånemark's recommendations for healing were based on empirical data that were never scientifically proven and never

experimentally ascertained.⁷ Nowadays, with the ever increasing demand for esthetics, the interim period of edentulousness even after implant placement can cause psychological, social or functional problems especially if the edentulous area is in appearance region.¹⁰ Furthermore, the discomfort, inconvenience, and anxiety associated with such a long waiting period remain a challenge to both the patients and clinicians.¹¹ In the scientific literature it has been reported that root-form implants may osseointegrate, even though the implants extend above the bone and through the soft tissues during early bone remodeling.¹²⁻¹⁵ This surgical approach has been termed as a 1-stage or nonsubmerged implant procedure since it discards the need for second-stage implant uncover surgery. Thereby, eliminates the discomfort, inconvenience, and appointments of the surgery and suture removal. Consequently, immediate loading of dental implants was introduced to achieve triumph over original Branemark protocol.¹⁶ Immediate loading implant has been defined as an "implant that carries a prosthetic superstructure which makes occlusal contact within the first 1 or 2 days after placement".¹² It can also be described as a situation where the superstructure is attached to the implants no later than 72hr after surgery.¹⁷ It not only includes not submerged one stage surgery but actually loads the implant without compromising osseointegration.⁵ When the occlusion is re-established within 2 weeks it is called an early loading implant but when loading is only allowed after several weeks, it should be called 'delayed' of the loading irrespective of the fact that it is a one stage - or a two-stage procedure.¹⁸ Under these conditions, successful immediate loading of screw-type dental implants has been reported as early as 1979.¹⁹ Later on, many clinical

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& experimental studies by Chiapasco et al.²⁰; Schnitman et al.²¹; Tarnow et al.²² had been reported which acknowledged the patients the prospects of expected dental rehabilitation. These studies ultimately led to the introduction of the concept of immediate loading.¹² A key element in immediate occlusal loading protocols involves eliminating micromovements between implants and osteotomies.^{23,24} The ultimate goal of an immediate loading protocol is to predictably decrease surgical interventions and to reduce the time gap between surgery and prosthesis completion,²⁵ but without decreasing the success rates associated with implant treatment and the unloaded healing protocol.²³

PRINCIPLE OF IMMEDIATE LOADING

With the help of the implant whenever a controlled load is applied to the bone, bone responds by remodelling its architecture according to the magnitude and the direction of the load applied. It has been described by Frost mechanostat theory which suggests that bone adapts itself by different biologic processes: trivial, physiological, overload and pathological. Remodelling is described as a simultaneous process of formation and resorption that replaces previously existing bone, tends to remove or conserve bone and is activated by reduced mechanical usage in the trivial loading zone or micro damage in the pathological loading zone. Main objective of immediately loaded implant prosthesis is to reduce the risk of occlusal overload and thereby, resulting in increase in the remodeling rate of bone. Woven and lamellar are the two types of bone forming at the interface. Woven bone is produced in response to extraordinary loading condition, forming at a rate of more than 60 microns each day and is found to be less mineralized¹² whereas lamellar bone forms at a rate of 1-5 microns each day. Thereby, a higher turnover rates lead to higher risks for the bone-implant interface.²⁶

INDICATIONS & CONTRAINDICATIONS

Not every patient or every tooth site is indicated for the immediate loading approach. Patients must understand the limitations of such treatment and be willing to accept the scientifically based precautionary measures.¹² Chief among them is the fact that, in order to limit the functional forces during osseointegration, patients need to abstain from chewing anything but soft food or otherwise applying force to the restoration for approximately 3 months.²⁷

Indications^{5, 12, 28}:

- Completely edentulous jaw.
- Partially edentulous jaw.
- Patients with missing dentition requiring long span fixed partial denture .
- Patient who are not willing to use a removable type prosthesis.

- Immediate loading protocol should be limited to the patients who have the most to gain and least to lose. Eg. Patients who cannot tolerate a removable prosthesis due to social or psychological reasons.
- Patients who cannot wait for 3 months for the prosthesis.

Other indications described are as follows²⁸ :

- Poor oral muscular coordination.
- Unrealistic patient expectations for complete dentures.
- Patient psychologically against removable prosthesis.
- Single tooth loss; avoid preparation of sound teeth.

Contraindications The suggested contraindications, in general, for consideration of an immediate loading protocol include the following^{5,12}:

- Chronic smoker.
- If bone volume is not adequate.
- If density of bone is not good (D4).
- Parafunctional; chewing habits (bruxing, clenching, tongue thrust).

GUIDELINES FOR IMMEDIATE LOADING IMPLANTS by Tarnow et al²²

1. Immediate loading should be attempted in dentulous arches only, to create cross-arch stability
2. The implants should be at least 10mm long.
3. A diagnostic wax-up should be used for the template and the provisional restoration fabrication.
4. A rigid metal casting should be used on the lingual aspect of the provisional restoration.
5. A screw retained provisional restoration should be used where possible.
6. If cemented, the provisional restoration should not be removed during the 4-6 month healing period.
7. All implants should be evaluated with Periotest at Stage I, and the implants that show the least mobility should be selected for the immediate loading.
8. The widest possible anterior-posterior distribution of the implants should be used.

OCCLUSAL OVERLOAD IN IMMEDIATE LOADING³³

Occlusal overload have been found to cause implant/implant prosthesis failure and peri-implant bone loss and/or loss of osseointegration. The main principles of implant occlusion have been derived from occlusal principles in tooth restoration.

Three occlusal concepts (balanced, group function and mutually protected occlusion) have been successfully accepted nowadays with certain modifications for implant-supported prostheses. All of the concepts may have maximum intercuspation (MIP) during habitual and/or centric occlusion.

Possible Overloading Factors:

- Overextended cantilever-
415mm in the mandible (Shackleton et al. 1994)
410–12mm in the maxilla (Rangert et al. 1989; Taylor 1991)
- Parafunctional habits/Heavy bite force
- Excessive premature contacts-
4180 mm in monkey studies (Miyata et al. 2000)
4100 mm in human (Falk et al. 1990)
- Large occlusal table
- Steep cusp inclination
- Poor bone density/quality
- Inadequate number of implants

Basic principles of implant occlusion may include:-

- occlusion - bilateral stable
- occlusal contacts and force - evenly distributed
- there should be no interferences between centric relation and habitual position.
- smooth, even, lateral excursive movements without ANY interferences

POTENTIAL COMPLICATIONS ASSOCIATED AND SOLUTIONS

Clinical complications which are associated with immediate implants are loosening and fracture of screw, fractures of prosthesis and veneering materials, continuing marginal bone loss below the first thread along the implant, implant fractures, and implant loss.

To overcome such complications, following methods based on application of sound biomechanical principles such as passive fit of the prosthesis, cantilever length can be reduced, narrowing the bucco-lingual/mesiodistal interface and implant prosthesis, to maintain implant load within the physiological limits of individualized occlusion, and finally to provide long-term stability of implants and implant prostheses.³⁴

IL of dental implants has recently gained popularity and have yielded a wide range of clinical survival.³⁵⁻³⁹ It has been documented that using these implants direct bone interface, on occasion, could be developed and maintained for more than 20 years.⁴⁰ In the middle 1980s, high success rates from immediately loaded implants had been first documented in humans just at the time when the 1-stage implant protocol became popular.¹ Babbush et al. (1986) reported a cumulative success rate of 88% on 1739 immediately loading TPS implants.⁴¹ Furthermore, it is recommended that special surgical techniques be used to increase bone density in the implant bed before implant insertion to improve primary stability which is considered as gold standard to reduce the micro-movement and well as to establish long term success for immediate loading.^{10,42} It is scientifically proved that IL is a desirable procedure, if the outcome in terms of implant survival and success is comparable with that of conventional loading but still Future studies should be done to evaluate long-term data of immediate restorations on implants and possible applications of this technique in

situations where quality of bone is poor, multiple implants or augmentation procedures exist, must be overcome.¹

CONCLUSION

The last decade has seen a profound shift in implant dentistry from the lengthy healing original protocols to immediate loading has demanded a cognitive revolution. Immediate loading of a dental implant consists of a nonsubmerged 1-stage surgery in which loading of the implant is done with a provisional restoration at the same appointment or shortly thereafter. Immediate loading of dental implants are proven to reduce the treatment time and thus increase patient acceptance. Future studies should be conducted to evaluate long-term data of immediate restorations on implants and possible applications of this technique in situations where problems of poor bone quality, multiple implants or augmentation procedures must be overcome.

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