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Immediate loading in dental implants – A Review

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Abstract

The introduction of osseointegrated implants have replaced traditional fixed bridges and removable prosthesis. The implant procedure performed today mostly use two – stage protocol. However, this requires a waiting period of 3-6 months, to overcome the duration of treatment and to decrease the number of surgical appointments, with the evolution of new implant designs, immediate loading of implants have been used with ultimate success. This concept of immediate loading actually began 40 years ago with the contribution of Dr Leonard I. Linkow. Immediate loading is described as

functional loading immediately after implantation (or within 3-4 days after surgery).

Keywords: Immediate loading, Implants, Osseointegration.

Introduction

Branemark et al. in the 1960s introduced the concept of osseointegration. He first used titanium implants with a two-stage surgical approach, where the osteotomy site was prepared and left for 3-6 months for healing, and later a second surgery was performed. Hence, this technique is known as the Two-stage technique.[1] However, the discomfort, anxiety, and inconvenience associated with the waiting period for 3-6 months were challenging. Hence, patient-mediated requests for expedited treatment process lead clinicians and researchers to adopt newer techniques by reducing healing phases, reducing surgical procedures with success rates similar to conventional loading protocols. Improvements in the surgical techniques and implant structure lead to the introduction of immediate loading protocols by Dr. Linkow. A growing interest in one-stage implant procedures is developed during the last ten years due to reduced or no healing periods before loading. This is advantageous for patients since only one surgical procedure and minimal waiting period for the prosthetic appliance is needed[2]. Today, IL protocols are being adapted as they offer many advantages to the patient and clinician by maintaining the height of peri-implant soft tissues and bone density and also help in the reduction of pain, chair time, and material. [3]

Implant Loading Protocols

Espoito et al. have defined three protocols for implant loading:[4]

Conventional loading - loading implants after two months from implant placement.

Early loading – loading implants between 1 week and 2 months of implant placement.

Immediate loading – loading implants within 1 week from implant placement.

Mish and co-workers proposed the following definitions for immediate loading.[5]

Immediate occlusal loading – occlusal loading within 2 weeks of implant insertion.

Early occlusal loading – occlusal load to an implant between 2 weeks and 3 months after implant placement.

Nonfunctional immediate restoration – an implant prosthesis in a partially edentulous patient delivered within 2 weeks of implant insertion with no direct occlusal load.

Nonfunctional early restoration– an implant prosthesis in a partially edentulous patient delivered within 2 weeks of the implant.

Delayed occlusal loading – occlusal loading to an implant restoration more than 3 months after implant insertion.

Definition of Immediate Loading

Wang et al. have proposed the definition of IL – Immediate supported restoration placed in the occlusal loading within 48 hours after implant placement. .[6]

Principle of Immediate Loading

With the help of the implant, when a controlled load is applied to the bone, bone responds by remodeling its architecture according to the magnitude and direction of the load applied. It has been described by frost mechanostatic theory that bone adapts itself by different biologic processes: trival, physiological, overload, and pathological. Remodeling is described as a simultaneous process of formation and resorption that replaces previously existed bone, tends to remove or conserve bone and is activated by reduced mechanical usage in the trival loading zone or micro damage in the pathological loading zone. Main objective of IL implant prosthesis is to reduce the risk of occlusal overload and thereby, resulting in increase in the remodeling rate of the bone.[7]

Indications [8]

1. Completely edentulous jaw
2. Partially edentulous jaw
3. Patients with missing dentition requiring long-span fixed partial denture
4. Patients who are not willing to use a removable prosthesis
5. Patients who cannot wait for 3 months for a prosthesis
6. Poor oral muscular coordination
7. Unrealistic patient expectations for complete dentures
8. Patient psychologically against removable dentures
9. Single tooth loss, avoid preparation of sound teeth.

Contraindications[8]

1. Chronic smoker
2. If the bone volume is not adequate
3. Severe metabolic disease
4. Poor bone density
5. Severe Para function such as bruxism, clenching, and tongue thrust.
6. Non-complaint patient types such as those with diet limitations, gum chewing, etc.

Advantages[9]

1. Immediate function and esthetics of the patient, thus reducing the treatment time. The prosthesis enhances the esthetics by sculpting the soft tissue
2. No need for a temporary denture or multiple fixed temporaries. This reduces the number of visits, cost, and the problem with micro motion
3. Elimination of second-stage surgery
4. Increased rate of healing with early daily periods of cyclic micromotion
5. Adjacent papilla are well preserved, contributing to the final esthetic result
6. Since the patients are spared from wearing a temporary denture, monthly soft relines are not required
7. When the loading forces are controlled, the concept results in long-term clinical success in similar areas of poor bone quality.

Disadvantages [9]

1. Unpredictable nature of the concept
2. Difficulties of implant placement, especially in the posterior arch
3. No procedure representing a reliable guideline for this type of treatment
4. Micro movement of the implant that can cause crestal bone loss or the implant failure is greater than with the two-stage approach
5. No chance for the dentist to evaluate the crestal bone as with the two-stage technique
6. More chance for the Para function from the tongue or foreign habits like pen biting causing implant failure
7. Increased number of implants makes increased fee and decreased patient acceptance
8. The risk of complications to the neurovascular bundle is more.

Guidelines For Immediate Loading Implants By Tarnow Et Al. :[10].

- IL should be attempted in dentulous arches only to create cross-arch stability.
- The implants of at least 10 mm long should be used.
- A diagnostic wax-up should be issued for the template and the provisional restoration fabrication.
- A rigid metal casting should be used on the lingual aspect of the provisional restoration.
- A screw-retained provisional restoration should be used where possible.
- If cemented, the provisional restoration should not be removed during a 4-6 month healing period.
- All implants should be evaluated with periotest at stage I, and the implants that show the least mobility should be selected for the IL.

- The widest possible anteroposterior distribution of the implants should be used.

According to mish & co-workers treatment plan guidelines for immediate loading

- **Surface Area Factors**: The dentist should consider the following surface area factors.
- **Implant number:-**Eight splinted implants are suggested for the completely edentulous maxillary arch and six splinted implants or more for the mandible.
- **Implant size:** Larger diameter implants are required in the posterior regions of the mouth. If a larger diameter is not possible, bone grafting or a greater implant number is suggested.
- **Implant design**: High surface area implants (More threads, deeper threads).
- **Implant surface condition**: Hydroxyapatite coated implants in poor bone density types. Ex (D4). Rough versus smooth or machine surface conditioned implants in good bone density situations (Ex: D2 and D3).

Force Factors

- **Patient conditions**: Para-function, crown height, and muscular dynamics require more implant surface area.
- **Implant position**: In the completely edentulous maxilla, anterior implants should be at least in the bilateral canine position and posterior implants in the first to second molar position for the largest anteroposterior dimensions. When the forces are greater, an additional implant between canines may be placed. In the mandible, the largest anteroposterior dimension possible should be used; three implants, one in the anterior region and one in each posterior region, are necessary.
- **Occlusal load direction:** Narrow occlusal table and no posterior offset loads on the transitional prosthesis. No posterior cantilevers should exist on transitional restorations in either arch.

Decision factors for immediate implant loading

- According to Gapski and coworkers, factors influencing the outcomes of IL are categorized into 4 types[9].
- **1. Surgery related factors: -** Primary stability, Non-traumatic surgical technique
- **2. Host-related factors: -** Bone quantity, quantity, healing, patient compliance and oral hygiene.
- **3**. **Implant-related factors**: Macro (thread), Micro (Surface coating) structure of implants.
- **4. Occlusion related factors**: Occlusal forces, prosthetic design

Immediate Loading of Completely Edentulous Patients

- There are two different options for immediate occlusal loading of the completely edentulous patient.
- **Option 1**: Loading the implants on the same day of the surgery:-[11]
- In this procedure, a surgical template for osteotomy preparation is fabricated before the surgical appointment, and an Osteotomy site is prepared. Two different approaches for the delivery of the prosthesis may be used. One is the fabrication of a new denture or modification is patient's old denture. In both the cases, dentist hollows the restoration at the sites where implants need to be placed. If more than two pontics are designed, a metal reinforced structure is suggested. After the implants are inserted, the final abutment is placed, and the abutment is tightened by giving a torque of 30Ncm or more. The dentist prepares the final abutments intraorally for parallelism and proper height requirements. Later, the dentist relines the transitional prosthesis with light-cured composite so that restoration may be removed and reinserted several times for recheck during the initial light cure process.

The dentist adjusts the temporary prosthesis to fit the abutment before the approximation of the tissues. By this, an inspection of interproximal and margin regions can be done thoroughly before soft tissue closure. Approximation of the tissues is done by placing sutures before cementing the prosthesis. Sutures are placed 5mm away from the incision line margin to facilitate their removal at a later date without removing the transitional prosthesis. The restoration for proper occlusal contact and in centric occlusion is evaluated.

- **Option 2**: Split the surgical appointment from the prosthesis delivery appointment:-[11]
- Place the implant and make an impression at surgery; the dentist records a vertical occlusal dimension and centric bite registration. The bite registration maybe with the shell of transitional restoration or with a base plate and wax rim Impressions are poured in the laboratory, and abutments are prepared for restoration and fabrication of months (dependent on the bone density) the transitional prosthesis is removed, and final prosthesis is fabricated.

Immediate Loading In Partially Edentulous Patients

IL concept can also be used for partially edentulous patients and single tooth application. Misch protocol included a provisional prosthesis primarily for esthetics, and the implant prosthesis is completely void of any occlusal contacts. Hence, this concept is known as non-functional immediate teeth (N-FIT) concept.

N-FIT concept :-[11]

The N-FIT concept is similar to IL technique of completely edentulous patients, with two major exceptions. Rather than placing extra implants, most often, the ideal number of implants are positioned in the ideal locations. The implant-supported transitional prosthesis is placed out of all direct opposing occlusal contacts during the bone-healing period.

Indications:-[11]

- Partially edentulous with centric occlusal contacts and excrusions on the natural teeth.
- Division D1, D2, D3 bone in regions of implants.
- Screw-shaped implant bodies, 4mm or more in diameter with increased surface area designs to decrease crestal stresses.
- Contraindications:- Patients with parafunctional oral habits

Protocol for non-functional immediate teeth

- Impression of opposing arch is made and e tooth shade and centric bite registration is done. Stage I implant surgery is performed, fixation screw are removed and ball impression pins are inserted. Impression is made with additional silicone material. It is made sure that no impression material is left under flap or around implants. Ball impression pin and abutment are removed for cement. per-mucosal healing caps are placed and suturing should be done. Later lab procedures are done. 10-14 days after the surgery sutures are removed. Healing caps are removed, two- piece abutment and abutment screw are placed, transitional prosthesis is cemented and post operative insturctions are ginven to the patient.

Potential Complications and Solutions

- IL may often lead to technical complications, like fracture of the prosthesis, loosening of the abutment screws, MBL, implant fractures and implant loss. Loosening of the abutment screws may be due to gingival healing after surgery which results in space around the abutments, formed during relining of impressions. To overcome such complications, certain methods following

- biomechanical principles such as passive fit of the prosthesis, reducing cantilever length, narrowing the bucco-lingual or mesio-distal interface and implant prosthesis, maintaining implant load within the physiological limits of individualized occlusion can be followed. All these techniques are of paramount importance to reduce the risk of peri-implantitis. [12]

Conclusion

Immediate loading could represent a reliable and effective protocol to rehabilitate single or multiple missing teeth and offers important advantages for the patient, in terms of function, aesthetics and comfort. However the clinical success of this technique is highly dependent on many factors: patient selection, bone quality, bone quantity, implant number and design, primary stability etc. Thus, the placement of implants and their immediate restoration whether provisional or final can be very advantageous. However, care and appropriate surgical and prosthetic considerations need to be highly contemplated when performing these-procedures.

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