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Review Article

Loading Protocols in Implant Dentistry- Guidelines for a General Dentist

Dr. Hari Priyanka Kuchipudi[1*], Dr. Y. Sravanthi[2], Dr. T. Krishna Mohan[3]
[1]Post Graduate Trainee, Deptartment of Prosthodontics, Crown and Bridge Including Implantology, Sibar Institute of Dental Sciences,Guntur, Andhra Pradesh, India
[2]Reader, Deptartment of Prosthodontics, Crown and Bridge Including Implantology, Lenora Institute of Dental Sciences, Rajanagaram, Rajahmundry, Andhra Pradesh, India
[3]Professor, Deptartment of Prosthodontics, Crown and Bridge Including Implantology, Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh, India

***Corresponding author:** Dr. Hari Priyanka Kuchipudi
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Abstract

Dental implants are in dynamism of the new world. Different systems are available in the market according to the patient's economical standards. Even implants systems able to manage the treatment time simultaneously with cost. As it's a surgical procedure and can be performed for replacement of single tooth or the whole edentulous arch there are protocols which needs to be followed. Various categories and criteria's-based evaluation decides the implant placement strategies. It's a specialty practice but now a day's even general dentists are successfully placing implants. Keeping all this in mind this review is put forward about loading protocols in the implant dentistry which will be helpful for Implantologist throughout the world.

Keywords: Dental Implants, Conventional loading, Immediate loading, Implants protocols.

INTRODUCTION

Multiple factors have been found to influence and/or alter the quality and predictability of various loading protocols for completely and partially edentulous arches. These factors include the health of the patient; oral conditions such as periodontal status, occlusion, and function/parafunction; characteristics of the proposed implant site; implant size and shape; implant material and surface properties; and timing and methodology of implant placement, including primary implant stability, loading procedures, and long-term maintenance. These factors remain relevant, and because implants as well as associated materials and procedures have evolved, continued evaluation remains important. The predictable optimization of treatment outcomes through more efficient treatment methods based on sound science remains a valid goal for both clinician and patient [1]. Treatment with dental implants has proven to be a predictable modality for replacing missing or failing teeth with various types of fixed or removable dental prostheses. A large body of scientific evidence of varying quality has demonstrated that successful outcomes can be achieved with different clinical treatment protocols for a wide range of indications. While it was traditionally thought that healing periods of 3 to 6 months combined with submersion of implants under the oral mucosa was critical for predictable osseointegration of dental implants, modified surgical and loading protocols have demonstrated similar outcomes over time. Loading protocols for dental implants have been a central focus of discussion in the field since the origin of osseointegration. Maxillary bone is porous and mandibular bone is dense. Placing implants in such situations makes huge differences in loading. Several consensus conferences have been held on the topic, and recommendations have been published based on the evidence available at the time. To make dental implant treatment a pleasant experience for every patient is not easy, but it should be our objective to make it more acceptable and more comfortable for our patients. The introduction of 1-stage surgery, flapless surgery, and immediate implantation allows the clinicians to offer minimally invasive surgery to many patients with a predictable outcome. The concept of immediate function includes immediate esthetics and immediate occlusal loading [2]. It is well recognized that immediate restoration after implant placement can enhance the esthetic result when restoring anterior maxillary implants. In fact, providing the patients with a definitive prosthesis at the time of dental implant placement is the ultimate goal of advanced dental implant treatment. The state-of-the-art dental implant treatment is to apply the same standard to more complex cases. The rehabilitation of the posterior maxilla represents a challenge for clinicians because

compromised bone is often present in this jaw region, especially in elderly patients, in whom the sinus antrum tends to enlarge over time. The often-insufficient residual bone volume makes implant placement posterior to the first premolar difficult. The first and second molars are the most commonly missing teeth [3], most frequently lost owing to periodontal and caries disease [4-7]. Although not indispensable [8], molars are important for masticatory reasons and may be successfully replaced with fixed prostheses supported by osseointegrated implants [9]. Many therapeutic options for the rehabilitation of the posterior maxilla have been suggested. Distal cantilevers are a known stratagem for the positioning of teeth in the absence of a fixed support.

DEFINITIONS OF LOADING PROTOCOLS

Loading protocols were considered during a consensus meeting held at a congress in Barcelona, Spain, in 2002. The following definitions for implant loading were agreed upon by Aparicio and coworkers [10]:

- Immediate loading: The prosthesis is attached to the implants on the same day the implants are placed.
- Early loading: The prosthesis is attached in a second procedure, earlier than the conventional healing period of 3 to 6 months. The time of loading should be stated in days/weeks.
- Conventional loading: The prosthesis is attached to the implants in a second procedure 3 to 6 months after the implants are placed.
- Delayed loading: The prosthesis is attached in a second procedure later than the conventional
- healing period of 3 to 6 months.

The Third ITI Consensus Conference, held in 2003 in Gstaad, Switzerland, modified the definitions as follows [11]:

- Immediate loading: A restoration is placed in occlusion with the opposing dentition within 48 hours of implant placement.
- Early loading: A restoration in contact with the opposing dentition and placed at least 48 hours
- after implant placement but not later than 3 months afterward.
- Conventional loading: The prosthesis is attached in a second procedure after a healing period of 3 to 6 months.
- Delayed loading: The prosthesis is attached in a second procedure that takes place sometime later than the conventional healing period of 3 to 6 months.
- Immediate restoration: A restoration inserted within 48 hours of implant placement but not in occlusion with the opposing dentition.

For a Consensus Conference of the European Association for Osseointegration (EAO), held in Zurich, Switzerland, in 2006, a review was presented by Nkenke and Fenner [12]. The group accepted the following definitions:

- Immediate loading: A situation in which the superstructure is attached to the implants in occlusion with the opposing dentition within 72 hours.
- Conventional loading: A situation in which the prosthesis is attached to the implants after an unloaded healing period of at least 3 months in the mandible and 6 months in the maxilla.
- Nonfunctional immediate loading and immediate restoration are used when a prosthesis is fixed to the implants within 72 hours without achieving full occlusal contact with the opposing dentition.

Cochrane reviews are recognized as a gold standard in evidence-based health care. Recently, Esposito and coworkers published an updated version of their systematic review regarding different times for loading dental implants, and based it on the following Definitions [13]:

- Immediate loading was defined as implants in function within 1 week after their placement. No distinction was made between occlusal and nonocclusal loading.
- Early loading was defined as putting implants in function between 1 week and 2 months after placement.
- Conventional loading was defined as putting implants in function after 2 months. For the purpose of the literature reviews, conclusions, and consensus statements for the 2008 ITI Consensus Conference, our group agreed to use the definitions of the 2003 ITI Consensus [11].

LOADING PROTOCOLS IN EDENTULOUS PATIENTS

For the edentulous mandible and maxilla, existing literature supports loading of microroughened implants between 6 and 8 weeks subsequent to implant placement with fixed or removable prostheses in the mandible, and fixed prostheses in the maxilla. Therefore, for the majority of patients, loading of dental implants for these indications and within this time frame should be considered routine.

- A lower level of evidence exists to support loading of dental implants with maxillary overdentures for this time frame (6 to 8 weeks).
- There is no evidence available at this time to support loading of dental implants in the edentulous arches between 2 and 6 weeks after implant placement.
- For the edentulous mandible, the literature supports immediate loading of

microroughened implants with fixed prostheses or overdentures.

- This consensus statement is made with the understanding that the treatment is complex.
- Treatment within this time frame, for the above indications, can be considered a valid treatment option for clinicians with the appropriate education, experience, and skill. Conventional loading (greater than 2 months subsequent to placement) is recommended under specific conditions in the edentulous maxilla and mandible. These conditions include, but are not limited to, alveolar ridge augmentation, sinus floor elevation, and the presence of parafunction, maxillary overdentures, and compromised host status.

LOADING PROTOCOLS IN DENTULOUS PATIENTS

The literature supports immediate loading of microroughened implants with fixed prostheses. This consensus statement is made with the understanding that the treatment is complex and can be considered a valid treatment option for clinicians with the appropriate education, experience, and skill. Insufficient data exist to support immediate loading of dental implants with overdenture prostheses in the edentulous maxilla. For the partially edentulous posterior mandible and maxilla, in the absence of modifying factors such as fresh extraction sockets, augmentation, and short implants, existing literature supports loading of microroughened implants between 6 and 8 weeks subsequent to implant placement. Therefore, for the majority of patients, loading of dental implants for these indications and within this time frame should be considered routine. Conventional loading (greater than 2 months subsequent to implant placement) should be the procedure of choice for partially edentulous posterior sites (maxilla and mandible) when: Stability is considered inadequate for early or immediate loading. Specific clinical conditions exist, such as compromised host and/or implant site, presence of parafunction or other dental complications, need for extensive or concurrent augmentation procedures, sinus floor elevation. For the partially edentulous posterior mandible, immediate loading of microroughened implants can be considered a viable treatment option. Caution is recommended in interpreting published outcomes for this indication, as inclusion and exclusion criteria are inconsistent, and many confounding factors are evident. Treatment within this time frame, for this indication, is complex and can be considered a valid treatment option for clinicians with the appropriate education, experience, and skill. Insufficient evidence exists to support immediate loading of dental implants in the partially edentulous posterior maxilla.

Conventional Loading of Mandibular Implant Overdentures

This loading protocol describes the use of two to four implants placed in edentulous mandibles, to be connected to an overdenture after a healing period of 3 to 6 months. Several implant prosthetic designs have been proposed, such as two implants with single ball shaped or locator attachments [12, 13], two implants splinted with a rigid bar construction [14], four or more implants connected with a rigid bar construction,[15] and four or more single implants with ball-shaped or locator attachments.

Conventional Loading of Maxillary Implant Overdentures

This loading protocol describes the use of four to six implants placed in the edentulous maxilla and restored with an overdenture after a healing period of 3 to 6 months. The implant-prosthetic design includes four or more freestanding implants [16] or four to six implants connected by a bar device [15]. Ferrigno *et al.*, [16] conducted a multicenter study with a conventional loading approach and reported a 10-year outcome with a lower survival rate than mandibular implant overdentures.

Early Loading of Mandibular Implant Overdentures

This approach describes mandibular implant overdentures that were functionally loaded no earlier than 48 hours after implant placement and no later than 3 months afterward. Two implants combined with an overdenture retained by single ball-shaped or locator abutments [17-19] was the only prosthodontic design identified. Roynesdal *et al.*, [20] compared conventional and early loading of two solid-screw dental implants supporting a mandibular overdenture. The authors concluded that the survival rate of rough-surfaced implants loaded 3 weeks after implant placement was similar to that of implants loaded in a conventional time frame, on the assumption that primary stability was achieved. Payne and coworkers [21, 22], in a randomized controlled trial, reported that pairs of unsplinted SLA-surfaced implants can be successfully loaded with mandibular overdentures 6 weeks after surgery. Turkyilmaz and Tumer [23] concluded that the implant survival rate in the anterior mandible was not compromised when using a 1-week functional early loading protocol with unsplinted implants supporting an overdenture. In summary, for the group of mandibular implant overdentures with an early loading approach, four publications reported results with rough-surfaced implants [22-24]. An optimal level of evidence was supported by one RCT and three prospective controlled studies. While promising results were reported in the selected publications, this scientific evidence is based on 68 patients and 136 implants with a 2-year follow-up. The prosthodontic survival rate was reported in only two of the four selected articles.

Early Loading of Maxillary Implant Overdentures

This approach describes maxillary implant overdentures that were functionally loaded no earlier than 48 hours after implant placement and no later than 3 months afterward. Implant-prosthetic designs included four to six implants connected by a bar construction [25] and three freestanding implants with single ball or locator attachments [26]. Raghoebar *et al*., [25] reported on an early loading protocol with overdentures supported by splinted implants. The authors concluded that in selected cases early loading of implants could develop into a predictable treatment modality. In a different approach with early loading, Payne *et al*., [26] investigated the use of freestanding narrow-diameter implants loaded at 12 weeks with maxillary overdentures. The implant survival rate after a 2-year follow-up was 87.2%.

Immediate Loading of Mandibular Implant Overdentures

Immediate loading with mandibular implant overdentures is a protocol in which implants are connected to the prosthesis and placed in occlusal contact within 48 hours after implant placement. Implant prosthetic designs included immediate prosthetic loading of a single implant in the anterior mandible [27], two single implants with ball and locator attachments [28], two immediately loaded and splinted implants [29], three free-standing implants immediately loaded with a ball or locator attachment [30], and four or more implants connected with a bar construction [31]. Early Loading of Fixed Implant-Supported Prostheses in the Edentulous Mandible. This loading protocol describes mandibular fixed implant rehabilitations that have been in functional loading 48 hours after implant placement, but no longer than 3 months. Implant prosthetic protocols were described as four to five implants supporting a fixed one-piece rehabilitation [24]. In a 3-year follow-up, Collaert and De Bruyn [32] reported that early loading of four to five implants in the edentulous mandible with cross-arch fixed prostheses was a predictable procedure. Friberg and Jemt [33] compared the outcomes of early loading with rough- and machined-surface implants. In this 1-year follow-up study the authors concluded that the implant survival rate was significantly higher for rough-surfaced implants. In a similar clinical trial, Arvidson *et al*., [24] reported that treatment outcomes for early loading in the edentulous mandible with fixed prostheses are comparable with conventional protocols. In addition, no increase in the incidence of implant–prosthetic complications were reported when compared to conventional protocols. Patient benefits included reduced treatment time and improved quality of life.

Early Loading of Fixed Implant-Supported Prostheses in the Edentulous Maxilla

Early implant loading with fixed rehabilitations describes a protocol in which implants have been in occlusal contact no earlier than 48 hours and no later than 3 months. Implant prosthetic protocols included five to eight implants supporting maxillary fixed implant rehabilitations [34] Olsson *et al.*, [28] and Nordin *et al*., [27] concluded that early loading protocols can be applied with predictable results using rough-surfaced implants for the rehabilitation of the edentulous maxilla with fixed prostheses. In an RCT, Fischer *et al.*, [35] showed no important differences between early and delayed loading of implants in the edentulous maxilla after 5 years of function.

Immediate Loading of Fixed Implant-Supported Prostheses in the Edentulous Mandible

Immediate loading with mandibular implant overdentures describes a protocol in which a fixed provisional contact is attached to the implants and placed in occlusal function within 48 hours after implant placement. Implant-prosthetic protocols were described as cross-arch fixed rehabilitations with anterior-posterior distribution of five to eight implants [30], segmented rehabilitations with anterior- posterior distribution of six implants [31], and full arch prostheses with anterior implants and distal cantilevers.

Immediate Loading of Fixed Implant-Supported Prostheses in the Edentulous Maxilla

This loading protocol describes maxillary implants that have been placed in occlusal function via fixed prostheses no later than 48 hours after surgery. Implant prosthetic designs have been proposed as four to six implants with full-arch prostheses and distal cantilevers [36], five to eight implants with a one-piece full-arch prosthesis [37], and eight implants distributed along the edentulous maxilla to support a segmented rehabilitation. Immediate Loading of Immediately Placed Implants with Fixed Prostheses in the Edentulous Mandible. This loading protocol describes maxillary implants that have been immediately placed into extraction sockets and into occlusal function with fixed prostheses no later than 48 hours after surgery. The implant prosthetic protocol included 4 to 6 immediately placed implants supporting fixed prostheses with distal cantilevers [38] and 8 to 10 implants splinted by a one-piece full-arch fixed rehabilitation.

Immediate Loading of Immediately Placed Implants with Fixed Prostheses in the Edentulous Maxilla

This protocol describes maxillary implants that have been inserted immediately into extraction sockets and placed in occlusal function no later than 48 hours with a fixed prosthesis. Implant-prosthetic designs were described as 6 to 8 implants splinted by a full-arch prosthesis [39] and 8 to 12 implants splinted by a one piece full-arch fixed rehabilitation.

Staged Approach for Fixed Implant Rehabilitations in Edentulous Jaws

This approach describes a treatment sequence for patients who present a failing dentition and are

receiving fixed implant rehabilitation. According to Cordaro *et al.*, [40] the main advantage of this protocol is the avoidance of a removable provisional phase. In addition, the protocol was presented as an alternative to immediate implant placement and loading [41]. The electronic search performed for this review failed to show any relevant clinical trials for this treatment modality.

CONCLUSION

Implant loading protocols must be followed thoroughly for a successful implant placement, retention, esthetics and function. This review summarizes various loading protocols for all the situations where implant dentistry is required. Following so will not only increase the data to literature but also help the specialist, Implantologist and general dentist to increase quality of life of the individuals undergoing implant therapy.

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