



Original Research Article

A review on loading protocols in implants

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ABSTRACT

In the last few decades implant has emerged overall in all countries and there are different loading protocols for the placement of implants like early loading delay loading or conventional loading. Here in this article, we are going to give a review on loading protocols in implants for the better understanding of general dentist as well as for implantologists. Different protocols have been discussed briefly by us for the selection of loading technique in implant dentistry.

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1. Introduction

In the last few decades, implant dentistry has emerged as a fully accepted discipline in dentistry. During this period of development, its concepts and treatment modalities have undergone tremendous changes. Overall number of missing teeth are probably increasing worldwide due to the aging population and caries & periodontal problems are the most common causes for this. So, need for prosthetic treatment especially in partially edentulous patients is increasing day by day. Teeth loss results in impaired oral function, diminished self-esteem and attractiveness, loss of social status, and an overall poorer quality of life and an oral prosthodontist can restore normal function, esthetics, and comfort by replacing with either removable or fixed prosthesis. The fixed prosthesis can be either dental bridges/crown or implants. Although, initial costs are higher for implants compared to fixed partial dental prostheses but survival rate of implant prosthesis must be considered when determining cost-effectiveness by comparing the both.

The replacement of missing teeth with implant supported restorations has become a treatment modality accepted by the scientific community for fully and partially edentulous

patients.¹ There are various factors that can influence quality and predictability of various loading protocols for completely and partially edentulous arches and 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.² A healing period of 3 to 6 months before loading was originally considered as a standard procedure using dental implants for treatment of patients. Later on, the conventional treatment protocol was questioned & immediate loading was introduced to eliminate waiting time for healing. The healing phases are divided into three-

1. Osteophytic phase – When an implant with a rough surface is inserted in the mandibular or maxillary spongy bone or marrow. Only a small quantity of the bone proceeding from trabecular bone of the interior of the marrow is in the contact with the implant surface. There is production of osteoid tissue on implant surface and this phase lasts for 1 month.
2. Osteoconductive phase – It is prolonged for 3 months. The bone will continue being placed on the surface of

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the metal.

3. Osteo-adaptive phase – There is no increase or loss of the bone on the metal.¹

1.1. Terminologies in implant loading

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

1.2. Immediate loading

The prosthesis is attached to the implants on the same day the implants are placed.

1.3. 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.

1.4. Conventional loading

The prosthesis is attached to the implants in a second procedure 3 to 6 months after the implants are placed.

1.5. Delayed loading

The prosthesis is attached in a second procedure later than the conventional healing period of 3 to 6 months.²

1.6. Protocols for implant loading

1.6.1. Bone density

The surgical protocol, healing, treatment plans, and progressive loading time spans are unique for each type of bone density. Bone density can be described as the relative amount of marrow spaces present in a unit of bone tissue.³ Misch in 1988 described four bone densities found in the edentulous regions of the upper & lower jaws based on macroscopic cortical and trabecular bone characteristics, in which D1 bone is primarily dense cortical bone, D2 bone has dense to thick porous cortical bone on the crest and coarse trabecular bone underneath, D3 bone has thinner porous cortical crest and fine trabecular bone within and D4 has almost no crestal cortical bone and fine trabecular bone composes almost all of the total volume of bone.⁴ Misch also categorized the bone density on the basis of clinical hardness of bone as perceived during drilling prior to implant placement into four groups D1-D4. In which observed that drilling and placing implants in D1 has the tactile analogue of oak or maple wood, D2 bone is similar to the tactile sensation of drilling into spruce or white pine wood, drilling into D3 bone has the tactile analogue of balsa wood whereas, D4 bone is similar to drilling into Styrofoam.⁵ Misch found that there is a huge difference

in the bone mechanical bone strength varying from D1 to D4 that can be interpreted on a scale with values ranging from 1 to 10, on this scale D1 can be relatable in strength with 9/10 points, where as D2 on 7-8, D3 with 50% less strength than D2 falling in 3-4 scale value and D4 with 1-2 score with 10 times weak strength compared to D1. It was observed that bone is 60% mineralized at 4 months after implant surgery, and the strength of bone is related to the amount of mineralization, so, it is judicious to wait longer before loading an implant, when the bone density is D3 or D4. A period of 3 to 4 months is adequate for D1 and D2 bone, whereas healing period of 5 to 6 months is beneficial in D3 to D4 bone.⁶ If the bone is dense on implant placement, immediate loading has been proven in many studies to be successful, but if the bone density is questionable, a cover screw can be placed on the implant, the soft tissue sutured over it, and the implant allowed to integrate for a few months. Many clinicians suggest waiting four months before uncovering such a questionable implant.

1.7. Loading in edentulous patients

For the edentulous mandible and maxilla, existing literature supports loading of microroughened implants between 6-8 weeks subsequent to implant placement with fixed or removable prostheses in the mandible, and fixed prostheses in the maxilla. That is why for the majority of these patients, loading of dental implants within this time frame should be considered in daily routine. For the edentulous mandible, the literature supports immediate loading of microroughened implants with fixed prostheses or overdentures. Conventional loading is recommended under specific conditions in the edentulous maxilla and mandible and these conditions include alveolar ridge augmentation, sinus floor elevation, and the presence of parafunction, maxillary overdentures, and compromised host status.²

1.8. Occlusion

If the patient is having the signs of clenching or bruxism, then it is better to avoid the immediate loading in such patients because patients with bruxism place several times more load on teeth or implants than normal patients. And it is preferable to allow more time for the implants to integrate for bruxism patients to provide an optimum chance for adequate integration before loading. Dentist can easily identify the condition to teeth clenching by observing the wear on the surrounding teeth or on crowns or prosthesis teeth.

1.9. Immediate loading guidelines

Immediate loading should be attempted in dentulous arches only, to create cross-arch stability. The implants should be at least 10mm long. A screw retained provisional

restoration should be used where possible and if cemented, the provisional restoration should not be removed during the 4-6 months healing period. All implants should be evaluated with Periotest and the implants that show the least mobility should be selected for the immediate loading. The widest possible anterior-posterior distribution of the implants should be used.⁷ Eight splinted implants or more are suggested for completely edentulous maxillary arch & six splinted implants or more for mandible. The other factors that are considered in immediate loading protocols are implant design like high surface area implants, patient factors (like bruxism, muscular dynamics), position of the implant (likewise in completely edentulous maxilla anterior implants should be at least in bilateral canine position & posterior implants in 1st to 2nd molar position for largest antero-posterior dimension whereas in case of mandible the largest anteroposterior dimension possible should be used and at least three implants, one in the anterior and one in each posterior region is necessary). Patients with parafunctional oral habits (as like anterior and lateral tongue thrust or biting on a pipe while smoking) are the contraindications to immediate loading implants.⁸

1.10. Esthetics

Although, esthetics is major factor that a patient considers. So, a rush to load an implant in an esthetically critical area is counterproductive if an implant fails to osseointegrate as like in maxillary canine region where tooth or implant has significant stresses on it. Thus, in such cases early or conventional implant loading is better immediate loading.

1.11. Location of implant related to bone density

The anatomy and usual bone density of several locations in the mouth are important to predict the osseointegration and implant success. The familiar bone density suggested by Misch, D1- D4, are often used to indicate bone density,^{5,6} and they are also indicative of the possibility for implant long-term success. The mandibular anterior area (D1 bone) is considered to be most desirable and predictable for implant success. Therefore, earlier implant stability is expected to be achieved here. The posterior mandibular area (D2 bone) is usually also considered to allow more predictability for implant success. However, location of the inferior alveolar canal, mental foramen, or mylohyoid indentation of the lingual surfaces of the mandible often inhibit optimum implant length, diameter, and location of placement. The maxillary anterior area (D3 bone), usually including the premolars, is often quite porous and trabeculated. This anatomic area requires more time for osseointegration; implant success is more difficult to achieve here, so it is better to go for conventional loading in our opinion and if has any doubt regarding the stability of implants in this area then waiting a few months to

let the osseointegration and implant stability will increase. The maxillary posterior area (D4 bone) is very porous and implant success is relatively unpredictable so, it is suggested that implants placed in this area should be allowed the optimum time of several months before loading.

1.12. Conventional Loading

In conventional loading the use of 4-6 implants placed in the edentulous maxilla and restored with an overdenture after a healing period of 3 to 6 months. Cavallaro and Tarnow proposed a criterion by using a minimum of four freestanding implants with locator abutments to support palate-free maxillary overdentures and after a conventional healing time, prostheses were attached to the implants, resulting in a 100% survival rate in a 12- to 48-month follow-up time.⁹ Although, more clinical trials are needed to scientifically and clinically validate the use of freestanding implants supporting maxillary over dentures with or without palatal coverage with conventional loading since their report was concluded only from the 5 consecutive cases. In a conventional loading protocols 3-4 months of healing period is required for the consolidation of extraction socket and taking into account the prosthetic treatment, patients have to wait up to 1 year for replacement of a lost teeth. The cases where implants are placed in type IV bone/D4 bone or heavily grafted bone, conventional loading protocol is much beneficial.

1.13. Branemark's loading protocol

Flush with bone level, covered with gingiva. Final prosthesis should be done after 3 to 6 months of initial healing.⁸

1.14. Early loading

The implant is placed after extraction and soft tissues are allowed to heal for six to eight weeks, and then after GBR can be performed at the time of extraction and/or at the time of implant placement. The early loading protocols are more predictable than immediate loading in esthetically critical areas & the esthetic criteria had already mentioned above for early loading protocol also.

2. Conclusion

Dental implants either conventional, early or immediate loading protocols are well-documented and predictable. Immediate loading in partially edentulous patients is possible in select cases depending upon the selection criteria to be decided by the dental surgeon or implantologist. Also, many patients are eager to have their treatment completed as rapidly as possible but individual dentists must rule out all factors before selecting the early or immediate loading. Thus, appropriate patient selection remains a critical for dentists & it all depends upon dentist's clinical & theoretical

knowledge as well as his hand skill in the practical work. Also, in nutshell we can say that it is difficult to conclude that which protocols is much better than to other one because different case studies have different analysis for these different protocols on the success of implant.

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4. Conflict of Interest

The authors declare they have no conflict of interest.

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