



A Review On Splinting And Healing Of Basal Implants

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Abstract

Basal implants are advanced single-piece cortical dental implants. They are uniquely and specifically designed for the sole purpose of giving anchorage from the basal cortical bone and have gone through several changes and modifications in the past several decades. But there are a lot of controversies regarding the need for splinting the implants and loading protocols.

So this article focused on the biomechanics, the need for splinting and healing process, and its impact on the loading criteria of basal implants.

Keywords: Basal implants, Splinting, Healing, Loading protocol

Introduction

Basal implants can be considered as a boon for edentulous patients with reduced or inadequate bone height without any need for bone augmentation procedure as these implants are uniquely and specifically designed for the sole purpose of giving anchorage from the basal cortical bone and have gone through several changes and modifications in the past several decades¹. They are also known as a cortical/bicortical implant system, and also called as lateral implants or disk implants. Basal implants are considered as advanced single-piece cortical dental implants with immediate loading protocol².

Basal bone is very strong, never gets resorbed throughout life, and forms the stress-bearing part of our skeleton. So dental implants, when placed in this bone, can be immediately loaded with teeth.³ Since the cortical walls around the extraction site are stable at the time of extraction, placement of implants into

fresh extraction sockets is more successful than placement after a few months.⁴

In this article, we are going to review the biomechanics, the healing process, and the need for splinting for basal implants.

Basic Concept Of Basal Implants

Basal implants are advanced single-piece cortical dental implants with immediate loading protocol². Achievement of bicortical buccolingual (or palatal) anchorage in addition to crestal anchorage is one of the most important criteria for the success of these implants

The science behind basal implants is already proven in orthopedic implants (hip/knee joint replacement). Once the patient is fitted with artificial teeth, he /she is asked to start using it immediately⁵.

A minimum of 6 to 10 implants in the maxilla and 5 to 9 implants in the mandible are required for immediate loading protocol. Implants should be

protected from micromovements during the osseointegration process which improves bone reconstruction. So, the Installation of an adequate number of cortically anchored basal implants, respecting the principle of absolute intracortical stability, remains the guiding policy for the implant treatment designed for long-term success (>or = 10 yrs)

Biomechanics

Basal implants should be safely installed in the major bony buttresses of the jaw in order to efficiently absorb and distribute mechanical stress during masticatory function.

Cortical bone is highly resistant bone and it keeps almost the same structure throughout life. On contrary, cancellous bone is more sensitive to physiological and biological changes. In some cases, dramatic alveolar bone loss can be observed due to hormonal changes (eg: in menopausal women)⁶. Males aged above 50 years also show severe alveolar bone loss even in well-osseointegrated root form 8-11mm long implants. In such cases, basal bone can be utilized for the placement of implants.

Intracortical stability is very important. Overload or instability leads to post-implantation fibrosis (instead of osseointegration) and various complications⁵.

Implant designs providing greater primary stability may thus reduce micromotion to such a degree that bone regeneration is possible even with early loading.

Splinting:

Splinting of implants has been a controversial issue. It is also claimed that splinting can prevent overloading and simplify clinical procedures and enhance esthetics.

Splinting can be of greater advantage when adjacent implants fail. If multiple adjacent implants are splinted together, prosthetic reconstruction of the

implant bridge can be done even if one/more implants fail. It's a noninvasive approach rather than having to remove the entire prosthesis and fabricate a new one.

Deformation energies in the immediate loading scenario can be higher than in healed bone due to softer bone around fresh inserted implants. Total deformation energy in healed bone is 30% less than in freshly operated bone⁷.

Implants are more elastic than bridge cores. So, improved primary stability by the early application of a bridge instead of no external splinting could lead to the correct appliance of wolffs law to the correct amount of bone remodeling stimulation focus and deformation forces and deformation energy distribution in the whole system and prevent failures⁸.

Wolffs law: Bones in a healthy person will adapt to loads under which it is placed. (German anatomist and surgeon – Julius wolff 19th century) i.e., if loading on a particular bone increases, the bone will remodel itself over time to become stronger to resist that sort of loading.

A temporary transpalatal bar can be used in atrophic, egg shell thin maxilla which is connected to the fixed, screw-secured basal implant prosthesis to provide immediate cross-arch stabilization thereby reducing the stress on the underlying bone. This bar can be removed after 6 to 12 months. Atraumatic occlusal conditions and passive fit of the implant-supported prosthesis helps to maintain osseointegration of the implant during function, which will reduce the bone loss over time. Interestingly, increased bone density and even increased bone volume have been observed after years of function in atrophic mandibles managed with fixed, basal implant-supported prostheses⁶

Proposed criteria for basal implant success ⁶

1	Clinically, an individual basal implant should be immobile in all directions.
2	An individual basal implant with slightly mobility, with no complaints from the patient and no clinical symptoms like pain, infection, or inflammation with healthy soft tissues does not need to be removed
3	Isolated radiologic findings shouldn't be the cause for removal of a Diskimplant, especially if it has been in service for years without any complaint from the patient because a radiograph may demonstrate minor peri-implant radiolucency that is of no clinical significance like pain or inflammation.
4	Following the first year of service, vertical bone loss around the implant is <0.2mm/year
5	Individual implant performance is characterized by an absence of persistent and/or irreversible signs and symptoms, such as pain, mobility, infection, neuropathies, or paresthesia
6	The cosmetic outcome fulfills the patient's reasonable expectations in light of his or her initial status

Healing

Bone is an inhomogeneous, linear elastic isotropic material whereas titanium implants are linear and elastic.

Albrektsson and Eriksson *et al* ^(10, 11) published several studies demonstrating that heating to 47°C for 1 min significantly reduced the amount of bone that grows into porous implant, whereas heating to 42°C for 1 min causes no demonstrable reduction in bone formation. Since lateral osteotomy with a cutter causes minimal operative trauma without thermal bone injury, this procedure is compatible with osseointegration, even in small bone volumes⁶. So maintenance of proper temperature during drilling plays a key role in the success of implants.

In basal Implants, 90% of deformation is absorbed by bone regardless of the healing state of the bone. When forces are applied on the healed bone, the stress is concentrated on the shafts of implants on the loaded side (concentrated around) whereas in freshly operated cases, it is on the cortical bone with a 2mm thick layer with low mineralization.

Soft bone areas represent force-induced activation and orientation of secondary osteons and hard tissue softening by activated osteoclasts.

In case of immediate placement of basal implants, immediate loading is required for proper osteoblastic activity⁶.

The cortical support provided by diskimplants and horizontal plate-form disk implants also eliminates the zones of deformation seen around root-form implants due to shear stress. The basal implant must be firmly locked in the bone bed in order to neutralize any rotational moment during the healing phase.

Stress is dissipated more evenly along basal implants. The large horizontal base of the diskimplant constitutes the largest bone-anchored diameter and works mainly in compression⁶.

Delayed Versus Immediate Loading

The success and reproducible osseointegration of basal implants depends on many factors like submerged technique, an immediate loading protocol, or a removable appliance.

The main reason behind primary implant loss before osseointegration is the usage of a removable full denture by a patient during the healing phase for submerged basal implants because the stress is placed on every implant on an individual basis during mastication, clenching, speaking, etc. In contrast, extremely rigid, screw-secured-to-implant fixed

bridge prevents micromovements, primary loss of osseointegration, early infection, bone loss, etc. In some situations, the bone gain is observed.¹²

Total Edentulism

In extremely atrophic jaws removable dentures on basal implants are not recommended as they promote micro-movements which leads to continuous bone resorption.

In totally edentulous and extremely atrophied jaws, immediate loading with a functional, screw-secured bridge is recommended as an external orthopedic fixator. In these situations, delayed loading is not suggestable as the use of a full denture during the 6-month waiting period can mobilize and/or damage the basal implants.

Immediate fabrication of a transitional screw-secured CrCo/titanium prosthesis is advisable as this appliance allows evaluation of esthetics, proper fit, occlusion, hygiene, phonetics, etc.

Partial Edentulism

Immediate loading is not recommended for partial edentulism for most of the cases. To avoid damage to basal implants during the healing phase (6 months), temporization must be well planned from outset. Patient is advised not to wear this removable denture during meals, if the implants are installed in the posterior region⁶.

Conclusion

For re-establishing atrophic jaws, basal implants have become a suitable choice due to the innovative work these implants have gone through as they don't need augmentations.

As implants are more elastic than bridge cores, improved primary stability can be achieved by early application of a bridge instead of no external splinting, and immediate implant splinting by circular bridge results in distribution and decrease in stress and deformation energy. Additional splinted implants will decrease the deformation between the implant-bone interface.

As 90% of deformation is absorbed by bone, immediate loading is required for proper bone remodeling in case of basal implants and as the prosthesis is given with occlusal loading within 72

hours, the protocols can be easily accepted by patients.

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