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RESEARCH ARTICLE

BASAL IMPLANTS – AN ALTERNATE TREATMENT MODALITY FOR ATROPHIED RIDGES

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ABSTRACT

Rehabilitation of an atrophied edentulous jaws by placing implants is a challenging procedure. Although various bone augmentation procedure like ridge augmentation, sinus lift are in practice but it may lead to the morbidity of donor's site. Sometimes patient is not willing for such extensive surgical procedures. In such cases basal implants is a viable treatment option. Basal implants derive support from the basal bone area which usually remains free from the infection and less prone to resorption. This article discusses about the review literature of basal implants .

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INTRODUCTION

Implant placement in severely atrophic jaws is especially challenging because of the poor quality and quantity of the implant bed. Calvarial[1] or iliac bone grafts, displacement of the mental nerve and procedures involving sinus lifting are often used to overcome the initially unfavourable anatomical and mechanical conditions. Despite acceptable success rates, unpredictable degrees of morbidity are involved with these approaches at the donor and/or recipient sites[2]. Furthermore, patients are sometimes reluctant to undergo such extensive procedures. Basal implants were essentially developed for use in atrophied jaw bones and are also called lateral implants or disk Implants. These implants are not differentiated by the way they are placed and also by the way forces are disseminated.

"Basal Implant" is a term used in reference to the principles of utilizing basal bone areas which is free of infection and resorption[2], and the employing of the cortical bone areas. The load bearing tolerance of the cortical bone is many times higher than that of the spongious bone [Figure1].

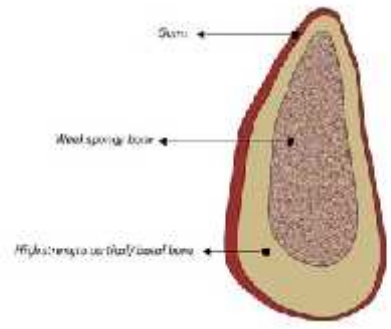

Figure 1 Cross section of bone

History

Basal implants were developed and improved in various stages, by the German and French dentists primarily. Single-piece implant was first developed and used by Dr. Jean-Marc Jullietin 1972[4]. His design was available in two sizes. Dr.Gerard scortecci, a French dentist in the mid 1980s presented an improved basal implant system complete with matching cutting tools. Two types of implants were developed by him, called "Diskimplants", with internal and later external connectors attached to the prosthetic superstructure. In the

mid-1990s a group of dentists in Germany developed new implant types and more appropriate tools, as well as practical accessories, based on the system of Diskimplants. In 1997, lateral basal implants were introduced by Dr.Ihde in the way the "Diskimplants" were developed. These implants were round in design and the surface was initially roughened [Figure 2] .

Figure 2 Polished and Roughened surface

Dr.Ihde later developed improved types of basal implants:

- In 2002 the base plate design was invented that was fracture proof and was later patented in United States and Europe.
- Bending zones were introduced in the vertical implant shaft.
- 2005 onwards, the experiences with lateral basal implants were transformed to screw designs

(BCS, GBC).

In 1999, the surface structure of the vertical implant parts were produced polished and year 2003 Onwards, all the basal implants were produced polished. The reason was, that polished surfaces showed no tendency to mucositis, peri-implantitis and reintegration of the implants was possible in case of loosening. The roughened osseous-surfaces were also observed to have reduced tendency to re-integrate. The design of the abutment was also developed, initially basal implants were designed as two-piece designs, leading to the introduction of the one-piece implants. The two head sized became availab lfor cemented constructions and later it led to the development of Internal screw connections. These designs are important for maxillo-facial use and the fixation of epitheses.

Types of Basal Implants

There are two types of basal implants, BOI (Basal Osseo Integrated) and BCS (Basal Cortical Screw) specifically designed to utilize the strong cortical bone. Screwable basal implants (BCS brand) have been developed with a thread diameter of up to 12 mm for insertion into immediate extraction sockets.

BOI (Lateral Basal Implants)

These implants are placed in the jaw bone from the lateral aspect. The masticatory load transmission is confined to the cortical bone structures and horizontal implant segments.

Anterior Implants: With the availability of vertical space, the implants used in the anterior region are usually the ones with two disks. The basal implant disks have a diameter of 9 or 10 mm and the crestal disk has a diameter of 7 mm. The crestal and basal plate of multi-disc implants have different functions. The main purpose of the crestal plate is to provide supplementary support to the implant. The emphasis of crestal plate is lost once the basal plate has ossified to full load. The double disks are not inserted due to the lack of sufficient bone as it leads to failure. A single BOI with a diameter of 7 to 9 mm and shafts between 8 to 13.5 mm can be used instead.

Posterior Implants: Square shaped basal implants are used in the posterior region that have a disk diameter of 9 to 12 mm or 10 to 14 mm with shafts of 10 to 13.5 mm in length, depending on the available horizontal bone . [Figure 3][4]

Figure 3A typical basal implant for lateral insertion (BOI® brand) with a stable base plate, reduced Vertical implant portions, two integrated bending areas, reduced and polished mucosal penetration diameter

BCS (Screw Basal Implant)

The screw basal implants are flapless implants that are inserted through the gingiva, without giving a single cut, inserted like a conventional implant. Bicortical screws (BCS) are also considered basal implants, as they transmit masticatory loads deep into the bone, usually onto the opposing cortical bone. The screw basal implants provide initially some elasticity and they are not prone to peri-implantitis due to the highly polished surface and thin mucosal penetration diameter [Figure -4][4].

Figure 4 A typical basal compression screw (BCS®brand) with large and polished threads, for cortical engagement.

Parts of Basal Implants [Figure 5]

The basal implants are single piece implants in which the implant and the abutment are fused into one single piece. This minimizes the failure of implants due to interface problems, the connections which exists in conventional two and three piece implants.

Figure 5 Parts of Basal Implant

Surface of the Implants

- Polished surface
- Stops bacteria and plaque from adhering to the implant neck or body.

Body of the Implants

- The thin implant body is combined with wide thread turns that enhances the vascularity around the implant and increases the bone implant contact.

Neck of the Implant

- The abutment can be bent by 15 – 25 degrees depending upon the length of the implant, provided the implant is placed in dense corticated bone.
- The polished surface protects the implant surface from bacterial attachment.

Manufacture of BOI Implants

Manufacture of BOI implants [5]became affordable only recently by advanced CNC-controlled technology [Figure-6]. This technology and the sophisticated manufacturing techniques associated with it have created the possibility to design stable and delicately shaped implants from titanium ingots with known basic properties without significantly altering the structure of the material.[Figure7][5]

Figure 6 CNC milling machine

Figure 7 Different staged of processing

Insertions tools and Implant design

To insert BOI implants a T- shaped osteotomy has to be cut (vertical and horizontal cut) At the same time this instrument prepares the ground for the lateral cutters to be used in the next step. The lateral cutters aue used to create the horizontal dimensions of the osteotomy.

Several lateral cutters [Figure -8] with incremental diameters are used successively, starting with 7mm.Twin cutters [Figure 9] are used for double disk implants. They define disc to disc distance and ensure that both the cuts are parallel[5]. They are available in two diameters, 9mm and 7mm types define a disc to disc distance of 5mm and 3mm respectively.

External Implants

These implants evolved from rotationally symmetrical designs with one or several load transmitting surface. The size of these implants is given as base surface or radius in mm.

Figure 8 Lateral cutter

Figure 9 Twin cutter

The height of the threaded pin is given in G unit (1G = 1.5mm) and is measured from the upper margin of the base disc to the beginning of the thread, thus including the shoulder below the thread. Design with a semicircular base can be used to protect the implant against rotation within the osteotomy slot, the round side being inserted into the depth of the bone while the flat side borders on the bone laterally (i.e. medially and laterally) and towards the vestibular aspect. These designs offer good primary stability.Various implant designs: [Figure-10], [Figure 11], [Figure 12], [Figure 13]

Figure 10 Implants with specific relationship between disc diameter and shaft length, allows their application in greater number of clinical situations

Figure 11 Double disc implants used to replace canines

Figure 12 Implant with a basal plate bilateral circular but with a longer radius towards the angled ends, thus protected against rotation in bone cavity

Figure 13 Triple disc BOI implants with or without beveling, larger disc at the bottom

Implant Abutment *[5]*

The three abutment types are perfectly serviceable. These abutments have a more Internal/superior position of the internal threading as distinguishing features, allowing longer implant shafts to be adjusted in mucosal direction. [Figure -14], [Figure -15] Care must be taken that there should be no contact with the mucosa, since the apron style coverage tends to food accumulation. Abutment with an apically positioned neck area of 4mm length can be used if the transitional zones to the implant comes in close approximity to the submucosa.

Figure 14 Standard abutment design

Figure 15 Abutments made of Delrin, these abutments are not visible on xray and are quite elstic.

Indications of Basal Implants

1. In situations when multiple teeth are missing or have to be extracted.
2. When a bone augmentation procedure has failed.
3. Cases of thin ridges – That is deficiency of bone in buccolingual thickness.
4. Cases where bone height is insufficient.

Contraindications of Basal Implants

1. ***Medical conditions:*** A recent history of myocardial infarction (heart attack) would preclude the placement of dental implants. Cerebrovascular stroke, Immunosuppression also lead to the reduction in the efficacy of the immune system.
2. ***Medicines:*** An implantologist would require a complete details of all of the medicines and supplements that their patient takes. Drugs of concern are those that are utilized in the treatment of cancer and drugs that inhibit blood clotting.

Advantages of Basal Implants [7]

One piece implantology – Basal implants are one piece implants that minimizes the failure of implants due to interface problems between the connections that exist in conventional two and three piece implants.

Basal – cortical bone support – These implants require support from the basal bone which is a lot more resistant to resorption, unlike the conventional implants that mostly take support from the crestal bone. Basal cortical bone has a much faster and stable repairing capacity.

Works well in compromised bone situations – Bone augmentation/grafting, sinus lifting and nerve trans-positioning procedures can be avoided. These implants particularly take advantage of the bone available to avoid bone augmentation procedures. Whereas for conventional implants, the available bone has to be modified by augmentation procedures to suit the implants.

Better distribution of masticatory forces – The basal implants are imbedded in high quality basal bone. Hence, the masticatory forces get distributed to the cortical bone areas that are highly resistant to resorption and have a very high repairing capacity.

Peri-implantitis incidence – Peri-implantitis is the common etiology behind failure of conventional implants. This occours mostly due to the roughness of the implant surface along with the interface problems between the multiple parts of the implant. The monobloc smooth surface basal implants are used to eliminate the threat of peri-implantitis by around 98%.

Medically compromised situations – Basal implants work well in controlled diabetics, in smokers and patients suffering from chronic periodontitis.

Disadvantages of the Basal implants [8]

It is always necessary to keep a few more implants handy to avoid extensive planning including three dimensional exploration of bone conditions. The technique poses substantial challenges, for instructors and users alike, as far as the surgical and prosthetic treatment stages and the substantial knowledge requirements in the fields of biomechanics and bone physiology are concerned.

Complication of Basal Implants

Functional overload osteolysis*:* [9] Masticatory forces transmitted through the basal implants may create local microcracks in the cortical bone. These microcracks are repaired by formation of secondary osteotomes, a process called as remodelling. However, this temporarily reduces the degree of mineralization and increases the porosity of the affected bone. Hence, basal implants have a good chance of reintegration, if loads are reduced to an adequate amount.

CONCLUSION

Immediate loading of the laterally inserted disc design implants with a fixed and functional prosthesis is a definitely a safer and more reliable method for the management of the completely edentulous maxilla and mandible [10]. With respect to the accepted principle "primum nihil nocere" that is limiting treatment, the basal implants are the devices of first choice, whenever augmentations are part of an alternative treatment plan.

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