Basal Implantology- A Review

Dr. Rachita Mustilwar[1], Dr. Nikhat Fatima[2], Dr. C.M. Zameer Ahmed[3], Dr. Hiroj Bagde[4], Dr. Lynn Johnson[5], Dr. Furkan Ahmed Khan[6]

1. Lecturer, Department of Periodontology, Rural Dental College, PIMS (DU), Loni, Maharashtra, India, dr.rachu@gmail.com (Corresponding author)
2. Professor, Department of Periodontology, Rama Dental College, Kanpur, India
3. Post Graduate, Department of Prosthodontics & Crown and Bridge, Dayananda Sagar College of Dental Sciences, Bangalore
4. Associate Professor, Department of Periodontology, Rama Dental College, Kanpur, India
5. Associate Professor, Department of Periodontology, Rama Dental College, Kanpur, India
6. Senior lecturer, Department of Prosthodontic and crown & bridge, Sri Aurbindo college of Dentistry (SAU), Indore

,

Abstract:
Implant insertion is a difficult process in the rehabilitation of atrophied edentulous jaws. Today, it is feasible to perform a variety of bone augmentation treatments, such as ridge augmentation and sinus lift, which raises the risk, cost, and required number of surgeries for dental implant therapy. Ironically, patients with badly atrophying jaw bones receive little to no care. In order to prevent dangerous and expensive bone augmentation surgeries, basal implants are useful. The basal bone supports basal implants because it is often free of infection and less prone to resorption. We will explain basal implantology in this review.

Keywords: Basal implants, BOI Implant, BCS Implant, Disk Implant, atrophied ridges;

DOI Number: 10.14704/nq.2022.20.11.NQ66133 **NeuroQuantology 2022; 20(11): 1425-1432**

Introduction

Dental implants were formerly thought of as a "last resort" for the treatment of edentulous individuals. As implant dentistry developed, the original Brnemark technique needed lengthy healing times of many months before the manufacturing of the final prosthesis could start [1]. In modern dentistry practise, replacing missing teeth with dental implants based on crestal implantology, where the implant is positioned in the crestal alveoli, has become a common and predictable procedure. Vertical bone height should be at least 10 to 13 mm for effective dental implant insertion. However, ridge argumentation operations must be carried out to restore lost alveolar bone dimension in edentulous regions if appropriate bone height is not present for the effective placement of a dental implant. Such surgeries include nerve repositioning, sinus lift techniques, autologous or allogenous bone graft implantation, and even nose lifts. Each of the aforementioned treatments has its own set of benefits and risks. Implant designs must be modified for individuals with significantly atrophic ridges in order to prevent these operations. As an alternative, basal implants and mini implants are available.

A contemporary implantology technique called basal implantology, also known as bicortical implantology or simply cortical implantology, makes use of the basal cortical region of the jaw bones for the retention of dental implants that are specially made to fit into the basal cortical bone sections. For these unique and cutting-edge implants to stay in place, the basal bone gives high-quality cortical bone [2, 3].

History:

Dental professionals, mostly from Germany and France, have created and enhanced basal implants across numerous stages. The first single-piece implant was created and used by Dr. Jean-Marc Julliet in 1972. It is still effectively used today, with the sole drawback being the absence of a surgical kit [4,5]. In the middle of the 1980s, French dentist Dr. Gerard Scortecci modified the basal implant system and dubbed it "Diskimplants." Many German dentists have created new implant systems and surgical equipment based on Dr. Gerard Scortecci's Diskimplant, leading to the creation of the contemporary Basal Osseointegrated Implant (BOI), also known as the "Lateral Implant." These implants were developed to allow for the transfer of masticatory force in both the vertical and basal regions [4,5]. Dr. Stefan Ihde in 1997. The surfaces of these lateral implants were first roughened and came in a restricted range of sizes and forms. Soon after, he made improvements to the basal implants. The edges added to the spherical base plates prevented the implants from rotating in the bone before integrating. The vertical implant shaft's bending zones and the fracture-proof base plate were both developed in 2002 in Europe and the US, and both were later patented. 2005 saw the introduction of screwable designs (BCS, GBC) [4]. In 1999, the surfaces of the vertical shaft were polished. In 2003, the entire basal implant was manufactured with polished surfaces. This form was created to offer adequate flexibility for bone stimulation and growth [4].

Basal osseointegrated and basal cortical screw-type implants are the two forms of basal implants. Basal implants were made so that the strong cortical bone of the jaw could be used without the risk of infection [6].

Basal implant benefits include Single/monobloc units are more effective in atrophic and compromised bone conditions because they use basal cortical bone as support, have better masticatory force distribution, show less evidence of peri-implantitis, and have better results in patients with medical conditions like diabetes or chronic periodontitis [7, 8].

The disadvantages of the conventional implant are that it needs a lot of bone, which usually necessitates bone augmentation surgeries, increasing the cost and length of the procedure; that it is frequently placed into poor-density spongy bone that cannot be loaded right away and needs healing time of about 3 to 8 months; that it has a screw connection that could result in future screw loosening or breakage under the prosthesis; and that it is prone to infection because of its rough surface area.

When many teeth are missing or must be pulled after a bone augmentation operation has failed, in cases with thin ridges, where there is a lack of bone in the buccolingual thickness, and in cases where bone height is insufficient, basal implants may be considered [7].

Patients who have recently had a myocardial infarction, a cerebrovascular stroke, immunosuppression, chemotherapy, or antiplatelet treatment are not good candidates for these kinds of operations [8].

Basal Implant Types Based on Morphology

There are four fundamental kinds of basal inserts available
I'm Screw Form.
II disc form.
Plate Form III
IV. Other Forms

Both types can be further classified into

1. Screw Form
2. Compression Screw Design (KOS Implant)
3. Bi-Cortical Screw Design (BCS Implant)
4. Compression Screw + Bi-Cortical Screw Design (KOS Plus Implant)
5. Basal Osseointegrated Implant (BOI)/Trans-Osseous embed (TOI)/Lateral Implant (Disc Form)1)

According to the abutment connection
i. One-piece implant

1. External Threaded Connection.
2. Threaded internal connection
3. a) Hexagon on the outside.
4. b) Octagon on the outside.

2) According to the basal plate design,

1. Basal circles with angled edges
2. Basal circles with level edges are called S-Type Implants.

3) according to the number of disks.

1. Single Disk.
2. Twofold Disk.
3. Triple Disk.
4. Plate Form
5. BOI-BAC Implant
6. BOI-BAC2 Implant
7. Different Forms
8. TPG Implant (Tuberopterygoid).
9. ZSI Implant (Zygoma Screw).

Implant Morphology

The BOI implant is made from either unadulterated pure titanium or, for increased strength, a titanium-molybdenum alloy [9].

In a single-piece BOI abutment, the projection part is tapered and stays exposed in the mouth. In a two-piece BOI implant, however, the abutment bit can be either an externally threaded screw or an internally threaded screw with a hexagonal or octagonal restorative platform on the outside [9].

1. b) Neck: This is the part that sits directly beneath the abutment.This part's diameter can be made smaller, which helps the gums heal faster after surgery, makes it less stiff, and lets it bend 15° to 25° [10].

13. c) Vertical Shaft: This is the component of the implant that connects all of its parts.The shaft is kept clean and polished to prevent plaque buildup and discomfort. Additionally, depending on the type of titanium used, it might be flexible or rigid. The vertical shaft, which is usually between 10 and 13.5 mm long, is only there to hold the weight of the other parts.
1. d) Crestal Disk: This is the implant's main plate. Because it rests on the crestal bone once the implant has been placed, it is known as the crestal disc. This disc performs two functions: it provides and maintains the primary strength and stability after implant insertion; and after osseointegration, it transforms into a load-bearing and distributing component [11].
1. e) Basal Disk: This final component of the implant body is the second disc located at the implant's base. This load-bearing and distributing portion is also kept in pristine condition. The portion of the shaft connected to the basal disc can also be bent by 15° to 25° [9,11]. Typically, there is 5 mm between the crestal and basal discs.
1. These are single-piece implants with changes to the abutment and the implant part that are comparable to the BOI implant. Conical Straight, funnel-shaped, angled, and multi-unit abutments are all possible for BCS implant abutments. The BCS implant has wide diameter cutting screws that make a difference in connecting with the buccal and palatal/lingual cortical plates and also, at first, give the implant primary stability and load-bearing ability and later, go about as a load-bearing and distribution component [9,11]. This is in contrast to the BOI implant, which has a disc in the implant portion. These flapless implants have a small mucosal infiltration diameter and are highly polished [12].

1. These single-piece implants are made of titanium aluminium vanadium or titanium molybdenum alloy.These implants are designed similarly to compression screws in that, after being screwed into the bone, the cancellous bone around the implant will pack around the implant to create a denser, more compact bone.
2. Abutment Portion [9, 10]: This portion of the implants remains exposed in the oral cavity and serves as the restorative platform. These implants provide several options for which abutment to use in whatever region.

Conical in form, A vertical microgroove may also be included in the straight abutment for cemented crowns, which serves as an additional anti-rotational element. b. Abutment with a conical inclination.c. Ball abutment, in d. e. Abutment for a large number of unitsFor single-piece implants, these abutments are necessary.

1. The implant's neck [9,10] is forcefully polished and constrained to aid in improved gingival adaptation and to hinder plaque formation. The implant's neck may be bent 15° to 25°. implant Portion, iii. In order to put compressive stresses on the cancellous bone and transform it into a denser cortical-like bone, this section of the implant contains a thread with broad construction and wide twists. The basal cortical screws are located in the apical third of the KOS Plus implant. These additional screws aid in the implant's

engagement with the buccal and palatal/lingual cortical plates, as well as in achieving initial stability and later functioning as a load-bearing and distributing component. It should be noted that the BCS component is constantly being incredibly refined in KOS Plus implants.

After-Implant Healing (BOI and BCS Implant)

Activation of Phase I The progenitor cells, or undifferentiated human mesenchymal cells, generate osteoblasts and osteoclasts at this stage. Three days pass in this period.

Phase II: Resorption Osteoclastic movement takes place at this stage, exposing fragile, porous bone. The rate of osteoclastic activity is 40 m per day.

Reversal Phase III: Osteoblastic migration takes place at this stage. In the haversian channels, the osteoblasts lay down new bone at a rate of 1-2 m per day.

Phase IV: The Progressive In this phase, the osteoblasts shape concentric lamella in the haversian channels, which causes the canal's diameter to drop and the thickness of the bone to increase. The width of the Haversian trench is 40–50 metres at this point. Non-Mineralized Matrix Osteoid is the form of the bone, and this stage lasts for a very long time.

Phase of Mineralization (V) After a period of ten days, the mineralization stage begins. This phase consists of two phases. Stage 1 of primary mineralization This stage accounts for 60% of total mineralization and gives the osteoid its basic hardness. Stage of Secondary Mineralization (b) Final hardness and bone shape are imparted at this stage. For six to twelve months, this period lasts.

Dormant Phase, or VI Osteoblasts transform into osteocytes at this stage, lining the Haversian canals and assuming mechanical, metabolic, and homeostatic functions. It should be noted that during these stages, the implants are subject to functional loads, which results in continuous stimulation of the BMU throughout the implant's existence. This causes the peri-implant bone density to increase throughout the implant's life and adapt over the implant's surface, a process known as "osseo adaptation," and it is in this way that rebuilding plays a crucial role and is referred to as the "fourth dimension." [[These implants are also known as "Orthopedic Implants" since they use the same standards of peri-implant healing and bone densification. In simple terms, it tends to be emphasised that peri-implant healing is a lifetime process employing the notion of tiny movement as well as bone compression. Since the KOS and KOS plus implants are surface-treated, peri-embed healing occurs, as suggested by the notion that osseointegration and remodelling are lifelong processes.

Inlays for atrophied ridges at the base:

Inlays for atrophied ridges at the base: The prosthodontist has difficulties restoring ridges that have atrophied. Such situations can be restored using basal implantology without requiring significant operations. The following factors must be taken into account before reconstructing the mandible and maxilla:

1. General Systemic Conditions: Recent myocardial infarction, cerebrovascular accident, immunosuppressant medication, chemotherapy, radiation, or bisphosphonate therapy should not be present in the patient. Smoking and diabetes do not pose a serious threat.
2. Stress shielding is avoided because this implant and bone are both viscoelastic structures.
3. Loading: According to basic implantology, there is no such thing as

an "unloaded" implant because lateral forces always exist whether the implant receives a superstructure or not. This is because the cranial bone is permanently in a state of torsion, meaning that constant lateral stresses are applied to the cranial bone at all times due to the action of the attached facial muscles. Because of this, basal implants can either get a superstructure right away, after three days, one week, or six to eight weeks, or they can get a temporary restoration for three to six months before getting a permanent restoration [13–15].

4. The option for both jaws' restoration: The stomatognathic system is made up of a mobile (mandibular bone), which serves as the force-applying component, and a stationary (maxillary bone), which absorbs a large portion of the applied forces. As a result, it is crucial that the mandible be restored first. Additionally, a conventional mandibular denture on an atrophied foundation is unstable, which affects chewing function and causes the associated muscles to gradually lose their tonicity. With fixed rehabilitation, these problems can be avoided, so the mandible should be fixed up first [13].
5. Methods of treating atrophied ridges:

Regarding implant restorations in atrophied mandibles, two schools of thought have emerged over the years.

1. Multi-Implant This school, which Scortecci propagated and developed, advocates a significant number of basal implants in the mandible, often 7 to 12 implants. This school holds that the combination of basal and crestal implants produces a repair that is sufficiently stiff that it prevents torsion across the mandible and prevents the jaw system from reorienting stresses. Due to the near-impossibility of stopping mandibular torsion, excessive stresses are generated on the implant body, which promote overload osteolysis and eventual implant failure [16].
2. German School Strategic Implant Positioning Concept: Dr. Ihde created this institution. This school recommends placing four implants in the jaw, ideally in the canine and second molar areas. This lets the mandible twist and reorient its force, which is balanced by the prosthesis's flexibility and stops overload osteolysis and implant failure [11,12,14].
3. Atrophied maxilla [16,17,18]: The porous bone and pneumatized sinus make it difficult to insert implants. Porous bone is taken care of by compression screw implants, and two different ways to put implants in the sinus have been reported.
4. The sinus is divided into two or three sections to make it easier to put the basal disc into the sinus. The operator has the option of lifting the sinus membrane and performing a graft, according to basal implantologists. This method can only be used to put one implant into each sinus, and its main goal is to get support from both the bone and the gums.
5. Tuberopterygoid Screws: These implants, which are inserted into the pterygoid bone, help to strengthen the prosthesis. These are utilised in conjunction with the Sinus Section procedure and are positioned between

20 and 45 degrees in the bone. If the prosthesis is to be put in correctly, the angle between the Basal Osseointegrated Implant and the Tuberopterygoid Screw cannot be more than 90 degrees.

These zygomatic implants are inserted into the zygomatic bone and feature cortical screws with sharp edges that obtain bi-cortical support.

Cortically Fixed is a technique developed by Dr. Henri Diederich that was first announced in 2013. It is based on basal cortical implantology and is especially designed to restore atrophied jaws, regardless of the quantity of bone that is present, without the need for augmentations.

This implant is essentially a plate-form device that resembles little plates with an abutment platform. Thanks to their innovative design, they can be bent to fit any surface and are fastened to the bone with tiny bone-expanding screws. One benefit is that they need less holes, and because they are not flexible, they can be used to simulate bone [18,19].

Added difficulties: functional overload One of the risks associated with basal implants is osteolysis; as long as the surrounding bone is not pulled away from the implant and the region is not superinfected, the loss of mineralization is often reversible and widespread. Basal implants in this state have a good chance of reintegrating at a high level of mineralization if stresses are lowered enough.

Additionally, it has benefits such as a flapless technique with less surgical effort (thin mucosal penetration), decreased post-operative pain, preventing edoema, and decreased discomfort [20]. They can be utilised to contact the cortical bone at the union of the pterygoid with the maxilla and to bypass the mandibular nerve in the jaw. Abutments can be positioned up to 15° in each direction of the implant axis. Regarding the well acknowledged principle "primum nihil nocere," [21] as well. After being immediately implanted, these implants represent little danger for light loading [22].

References:

1. Adell R, Eriksson B, Lekholm U, Brånemark PI, Jemt T. Long-term follow-up study of osseointegrated implants in the treatment of totally edentulous jaws. Int J Oral Maxillofac Implants 1990;5:347-59.
2. Nair C, Bharathi S, Jawade R, Jain M. Basal implants- a panacea for atrophic ridges. JDSOR; 2013 Jan-March.
3. Hobkirk JA, Watson RM, Searson LJJ. Introducing dental implants. London: Churchill Livingstone; 2003.
4. Stefan I. Principles of BOI- Clinical, Scientific, and Practical Guidelines to 4-D Dental Implantology. Germany: Springer, Heidelberg; 2005.
5. Babita Y, Choudhary N, Nazish B, Gaurav T, Pranit K. Basal Osseointegrated Implants. IJAHS. 2016;3:1–8.
6. Ihde S. Principles of BOI. Heidelberg: Springer; 2005. p. 1.
7. Steigenga JT, Al-Shammari KF, Nociti FH, Misch CE,Wang HL. Dental implant design and its relationship to long-term implant success. Implant dentistry. 2003 Dec 1;12(4):306-17.
8. Sharma R, Prakash J, Anand D, Hasti A. Basal implants- an alternate treatment modality for atrophied ridges. IJRID 2016 SeptOct; 6(5):60-72.
9. Misch, Carl E. Contemporary Implant Dentistry. St. Louis: Mosby, 1993.
10. Yadav R. S, Sangur R, Mahajan T, Rajanikant A. V, Singh N, Singh R. An Alternative to Conventional Dental

Implants: Basal Implants. Rama Univ J Dent Sci, 2015;2:22-28.
11. Apse P, Zarb GA, Schmitt A, Lewis DW. The longitudinal effectiveness of osseointegrated dental implants. The Toronto study: peri-implant mucosal response. Int J Periodontics Restorative Dent 1991;11(2):95-111.
12. Ahmad O, Thamer B. Basal screw implantology without sinus lifting. Pak Oral Dent J. 2014;34:414–6.
13. Ihde Stefan. Principles of BOI- Clinical, Scientific, and Practical Guidelines to 4-D Dental Implantology. Springer, Heidelberg; Germany, 2005.
14. Ihde Stefan. Comparison of Basal and Crestal Implants and their Modus of Application. Smile Dental Journal, 2009;4:36-46.
15. Haedecke, F. Immediate Function and Graftless Solution for Complete Loss of Alveolar Ridge in the Molar Region after Infection of Two Crestal Titanium Implants: Description of a Case Treated with an Individualisable New Implant Type and the New Implant Material PEEK. Presented at 46th Annual Congress of French Society of Maxillofacial and Oral Surgery, Versailles, France, 2012.
16. Park HS, Lee YJ, Jeong SH, Kwon TG. Density of alveolar and basal bones of the maxilla and mandible. Am J Orthod Dentofacial Orthop 2008;133:30-37.
17. David, A, Ghazaei, F. Case Description of a New Graftless Solution for a Patient with Complete Alveolar Ridge Loss in the Molar Part of the Maxilla. Presented at Polish Association of Implantologists, Poznan, Poland, 2013.
18. Vares Yan, Diederich Henri, Ansel Alain. Posterior Maxilla Implant Rehabilitation: A Challenging Task. http://www.dentaltown.com/magazine/articles/5247/ce-posteriormaxilla-implant-rehabilitation-a-challenging-task
19. Diederich Henri, Marques Alexandre Junqueira, Soares Léo Guimarães. Immediate Loading of an Atrophied Maxilla using the Principles of Cortically Fixed Titanium Hybrid Plates. Adv Dent and Oral Health, 2017;3:001-004.
20. Otoum A. Master of Immediate Loading Thamer Bsoul, Bds, Jdbbasal Screw Implantology Without Sinus Lifting. Pak Oral Dent J. 2014;34(3).
21. Jain M, Bulbule N, Anasane N. Trends in restoring atrophied mandibular ridges with implants over a period of three decades. Int J Curr Res 2017 Mar;9(3):47950- 47956.
22. TP T, Ganapathy D, Jain AR. Basal implants - A review. Drug Invention Today. 2018;10(3):3430–3.