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Basal implants: A new solution to old problem to Residual Ridge Resorption- A review

Dental Science

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ABSTRACT

Severely atrophic ridges can be restored with conventional implants that requires expensive surgical procedures. It also involves a great risk of post-operative discomfort and complications that does not authenticate success of the procedure done. In such scenarios, basal implants are the best option to treat with. Basal implants are specifically designed to provide guaranteed rehabilitation in severely atrophic jaws and several designs of these implants exist today that have made basal implants flexible enough to accommodate any situation. A review was undertaken to analyse if Basal implants provided solution to the problem of resorbed residual ridge without extensive surgery.

KEYWORDS

INTRODUCTION :

The endosseous implants primarily indicated to replace the missing tooth or teeth structure with a prosthesis which essentially similar to the morphology of an original tooth which facilitates function and aesthetics. These implant are called crestal implants that are placed in the crestal alveoli of bone. They transmit load primarily in the vertical direction from their surfaces. Thus, this term encompasses the cover screws, cylinders, and blade implants. These screws are usually 10–13 mm in length and 5-7 mm in width in case they are placed in the anterior mandibular region as this part of the mandible usually has sufficient vertical bone height.[1] However, this design cannot be implemented in patients with severely atrophied mandibular ridges.

Severely atrophic ridges can be restored with conventional implants that requires expensive surgical procedures like inlay or onlay alveolar grafts, nerve repositioning, sinus lift and even nasal lift.[2] Basal implants are specifically designed fixed rehabilitation in atrophic jaws that have made basal implantology flexible enough to accommodate any situation.[3]

Synonyms: Basal osseointegrated implants are also known as-
1.Disk Implants- Dr. Gerald Scortecci
2.Lateral Implants
3.Bicortical Implants
4.Orthopedic Implants

HISTORY:

Majorly the German and French dentists, have developed and improved the Basal Implants in several stages over the years.

1972- Dr. Jean Marc Julliet – First single piece implant but no surgical kit. [4,5,6]

Mid 1980's- Dr. Gerald Scortecci- Basal implants with matching surgical tools called them Disk Implants.

1990 - German dentists - new implant systems and surgical tools based on Dr. Gerard Scortecci's Diskimplant- modern Basal Osseointegrated Implant (BOI), also known as Lateral Implant. These implants were designed to enable masticatory load transmission in the vertical as well as its basal part. [7]

1997- Dr. Stefan Ihde manufactured lateral basal implants which are limited in shapes and sizes . Later round base plates got edges, preventing early rotation of the implants in the bone before integration. Also bending areas in the vertical shaft was introduced by Ihde.[8]

2002- Fracture proof base plate design and the introduction of screw designs in the lateral base implants.

2003- The surface of the basal implant was polished.Two-piece abutment design was also changed to one-piece implants.The cemented implants were later changed to internal screw connections. These designs are mainly used in maxillofacial surgeries.

RATIONALE OF USING BASAL IMPLANTS:

Jaw bone comprises of two parts the tooth bearing alveolus or crestal part and the basal bone.

Crestalbone	Basalbone
The crestal bone is less dense in nature and is exposed to infections from tooth borne pathologies, injuries or iatrogenic factors and is therefore subject to higher rate of resorption.	Basalboneisheavilycorticatedand is rarely subject to infections and resorption. Load bearing capacity ofthespongycrestalboneisveryless ascomparedtocrestalbone.

INDICATIONS:

In Cases

1. When several teeth are missing or have to be extracted.
2. Two stage implant placement and bone augmentation failure.
3. Horizontal and vertical bone deficiency.

CONTRAINDICATIONS:

In Cases

1. Missing innervations of chewing muscles.
2. Medical compromised conditions including Recent myocardial infarction (heart attack) Cerebrovascular accident (stroke), Immunosuppression ,Chemotherapy or Radiotherapy.
3. Medicines: Drugs that are utilized in the treatment of cancer, drugs that inhibit blood clotting and bisphosphonates in the treatment of osteoporosis.

MERITS AND DEMREITS OF BASAL IMPLANTS[19]:

Basal implants offer great advantages over the conventional implant procedure. BOI and BCS basal implants are best options for immediate loading. Lateral basal implants (BOI) they can be inserted through the lateral aspect of the jaw bone and require minimum height of 3 mm.

BCS (screw basal implants) can be placed without any flap and suture. Incidence of periimplantitis is lower with the basal implants than conventional ones.

However, although they offer great advantages, there are some disadvantages of using basal implants that for BOI implants requires

open flap surgery and it require skillful work which is only achieved through properly trained and experienced hands.

COMPARISON BETWEEN BASAL IMPLANTS AND CONVENTIONAL IMPLANTS[20] :

	Basalimplant	Conventional implant
Indication	Canbeplacedinbonethat is deficient in height and width.	Requireadequatebone Heightandwidth.
Mechanism	Osseoadaptation occur.	Osseointegration occur.
LoadingProtocol	Single sitting surgical procedure, immediate loading is possible.	Multiple sitting surgical procedure. Delayed loading 3~6 months.
Armamentarium	Simple	Complex
Cost	Costeffective	Expensive
From the patient point of view	Complications are less in this procedure.	More complications
Maintenance	Strengthis great. Less maintenance	Two piece some time the relation between them make problem.
Size and design	Wide range of size and design are available.	Limited range of size and design are available.
Bone used	Basal bone is denser, mineralized and less prone to bone resorption.	Crestal alveolar bone is less quality and is more prone to resorption.
Additional surgery	Notrequired.	Required.
Eligibility to patient	Compatible for all.	Smoker and diabetic patients are contraindicated.
Size and Design	size and design in wide range are available.	Limited range of size and design
Prosthodontic procedure	Very simple and less chair side time	Complex and more chair side time.

Basal Implant Classification:

Based On Morphology:

There are four basic types of basal implants available-
I. Screw Form.
II. Disk Form.
III. Plate Form.
IV. Other Forms.

Both of the types can be further categorized into-

I.**Screw Form**

a. Compression Screw Design (KOS Implant)
b. Bi-Cortical Screw Design (BCS Implant)
c. Compression Screw + Bi-Cortical Screw Design (KOS Plus Implant)

II. Disk Form

Basal Osseointegrated Implant (BOI) / Trans-Osseous Implant (TOI) / Lateral Implant-
1) According to abutment connection-
i. Single Piece Implant.
ii. External Threaded Connection.
iii. Internal Threaded Connection-
a) External Hexagon.
b) External Octagon.

2) According to basal plate design-
i. Basal disks with angled edges.
ii. Basal disks with flat edges also called as S-Type Implant.

3) According to number of disks-
i. Single Disk.
ii. Double Disk.
iii. Triple Disk.

III. Plate Form

a. BOI-BAC Implant.
b. BOI-BAC2 Implant.

IV. Other Forms

a. TPG Implant (Tuberopterygoid).
b. ZSI Implant (Zygoma Screw).

Implant Morphology:

The BOI and BCS implant today has a smooth and polished surface as it was found that polished surfaces are less prone to inflammation (mucositis, peri-implantitis) than rough surfaces. [9,10,11]

The KOS and KOS Plus implants are surface treated (sand and grit blasting with subsequent acid etching), however, the implant neck is kept highly polished in KOS implant. In the KOS Plus implant, its neck and the basal cortical screw part are kept heavily polished.

A. BOI Implant Morphology

The BOI implant is manufactured either from pure Titanium or from Titanium Molybdenum alloy to enhance strength of the implant.[10,14.] These can be either single piece or two piece, following are the parts of the BOI implant (Fig. 1)-

a) Abutment Portion

In single piece BOI implants the abutment portion is conical and remains exposed in the oral cavity, whereas in two piece BOI implant the abutment portion can be an externally threaded screw or an internally threaded screw with either an external hexagonal or octagonal restorative platform[4].

b) Neck

It is the portion lying directly below the abutment portion. This portion may or may not be constricted in diameter; constriction provides better post-healing gingival adaptation and also reduces rigidity and allows for bending by 15°-25°. [4,8]

c) Vertical Shaft

This is that portion that connects all the components of the implant. The shaft is kept smooth and polished to discourage plaque accumulation and inflammation; also it can be either elastic or rigid depending on the diameter and the type of titanium used. The vertical shaft is purely a load bearing component and is usually 10 – 13.5 mm long. [4]

d) Crestal Disk

It is the first disk in the implant. It is called crestal disk as it lies in the crestal bone after placement of the implant. This disk serves a dual purpose i.e.; immediately after implant placement this disk provides and maintains primary stability and after osseointegration this disk converts into a load bearing and distributing component .

e) Basal Disk

It is the second disk at the base of the implant and is the last component in the implant body. This part is also kept polished and is a load bearing and distributing component. The part of the shaft connected to the basal disk is elastic and can also be bent by 15°-25°. [4,6]

Distance between the crestal and basal disks is usually 5 mm.

B. BCS Implant Morphology

These are single piece implants designed similarly to the BOI implant with modifications in the abutment and the implant portion. BCS implant abutment can be Conical Straight, Conical Angled and Multi-Unit abutments. The BCS implant has wide diameter cutting screws which helps in engaging the buccal and palatal/lingual cortical plates and initially provide primary stability and load bearing capacity to the implant and later on act as a load bearing and distribution component (Fig. 2). [4,5]

C. KOS and KOS Plus Implant Morphology-

These implants are single piece implants of Titanium Molybdenum or Titanium Aluminum Vanadium alloy. These implants are designed like compression screws, i.e.; these implants when screwed into the bone will compress the surrounding cancellous bone to form more compact and dense bone (Fig. 3).[1,4,8]

i. Abutment Portion [1,4]

This is the restorative platform of these implants and remains exposed in the oral cavity. These implants offer a wide variety of abutment options which are-

a. Conical Straight abutments for cemented crowns, this abutment might also have a vertical microgroove that serves as an anti-rotational feature.
b. Conical Angled abutments.

c. Locator abutments.
d. Ball abutments.
e. Multi-Unit abutments.
*(these abutments are part of single piece implant)

ii. Neck
This part of the implant is highly polished and is constricted to aid in better gingival adaptation and to discourage plaque accumulation. The neck of the implant is bendable by 15°-25°.

III. Implant Portion
This portion of the implant has the threads which have wide structure and wide turns this enables them to apply compressive forces on the cancellous bone and convert it to a denser cortical like bone. In KOS Plus the apical third of the implant comprises of the basal cortical screws these additional screws which aid the implant in engaging the buccal and palatal/lingual cortical plates and help in gaining primary stability and later function as a load bearing and distributing component. It should be noted that in KOS Plus implant the BCS part is always highly polished.

SURGICAL TECHNIQUE:
Conventional implants and basal implants have different surgical technique. The technique for placing basal implants is simple which avoids extensive drilling of bone. [4,9]

For placement of basal implant surgery , for almost any case a "Pathfinder Drill"(single pilot osteotomy) is sufficient.

For KOS, KOS Plus and BCS implants, the kit also consists of manual drills for a controlled osteotomy preparation. [9,10]

Basal implantologist's do not advocate raising a flap for these implants as it results in a decreased blood supply and also because of the design of these implants raising a flap is pointless, another factor to be considered is the immediate loading of these implants; a sutured site is not a favourable area to receive an immediate prosthesis.[4,9,10]

BOI implants have different approach. They can be placed laterally by raising the flap and cutting in a lateral direction to form a "T" shaped osteotomy. The implant consequently is placed laterally and the flap is closed over it .[11,12,13,14]

Treatment Of Atrophied Ridges
a.**Atrophied Mandible-**
Over the years two schools of thought have developed regarding implant restorations in atrophied mandible, they are-

i. **Multi-Implant Concept of French School**
Propagated and founded by Scortecci this school favors a large number of basal implants in the mandible mostly around 7-12 implants. According to this school basal and crestal implants are combined to result in a restoration that is so rigid that it does not permit any torsion across the mandible also this does not allow the jaw system to reorient forces. Since, it is almost impossible to stop mandibular torsion, there is generation of excessive forces on the implant body which leads to overload osteolysis and causes implant failure.[4,6]

ii. **Strategic Implant Positioning Concept of German School**
"This school was founded by Dr. Ihde. According to this school 4 implants are placed in the mandible preferably in the canine and second molar regions this allows for mandibular torsion and reorientation of forces which gets compensated by flexibility of the prosthesis, thus, overload osteolysis and implant failure is avoided. [4,15]

Infranerval Implantation Technique :
"In the atrophied mandible with advancing resorption the IA nerve lies closer to the crest, in such cases it becomes difficult to place crestal implants without bone augmentation or nerve repositioning. BOI implants don't require such procedures prior to their placement as the osteotomy preparation can be modified, i.e.; the osteotomy prepared for the basal disk is prepared approx. 2-3 mm below the nerve, this way the basal disk gets inserted below the nerve and need for extensive procedures is avoided. This technique is also called as Infraneural Implantation (Fig. 4). [4,15,17]

b. Atrophied Maxilla
Implant restorations with atrophied maxilla poses a great challenge due to pneumatized sinus and the porous bone. compression screw implants take care of porous bone and for the sinus two techniques have been described.

i.**Sinus Section Technique-** In this technique to facilitate placement of the basal disk in the sinus, two /three walls of sinus are sectioned .There can be option for of lifting the sinus membrane and grafting on the operator. When the placement can be done in this way bi-cortical support is increased drastically (Fig. 5). [4,6,18]

ii.**Tuberopterygoid (TPG) Screws-**
These implants provides additional support to the prosthesis by placing into pterygoid bone. These are also used in combination with Sinus Section technique and are placed at 20º-45º in the bone. The angulation between BOI implant and TPG screw should not exceed 90º otherwise prosthesis placement becomes difficult (Fig. 6). [4,6,18]

iii. **Zygomatic Screw Implant (ZSI)-**
These are zygomatic implants that are placed in the zygomatic bone and these also have sharp edged cortical screws that gain bi-cortical support. (Fig. 7).[4,6,18]

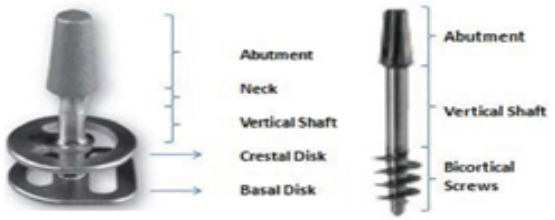

Figure-1: Basal Disk Implant / Basal Osseointegrated Implant (BOI); **Figure-2:** Bi-Cortical Screw (BCS) Implant

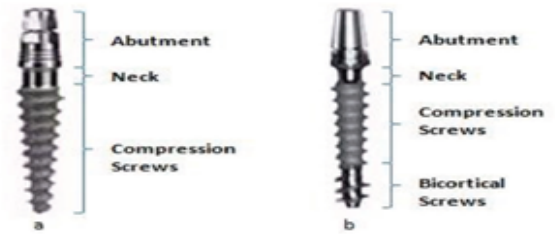

Figure-3: a. KOS Implant with Compression Screws; b. KOS+ Implant with Compression and Bicortical Screws

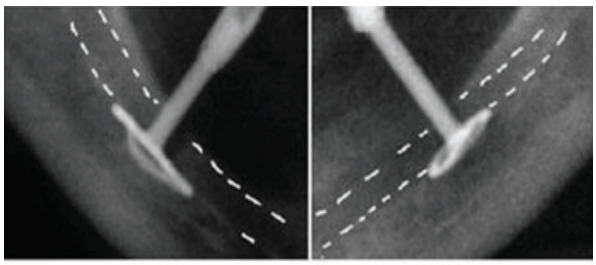

Fig 4. A And B Showing Infranerval/infraneural Implantation Of Basal Disk Implant (dotted Line Represents The I. A. Nerve)

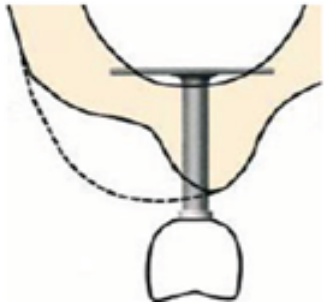

Fig.5 Sinus Section Technique

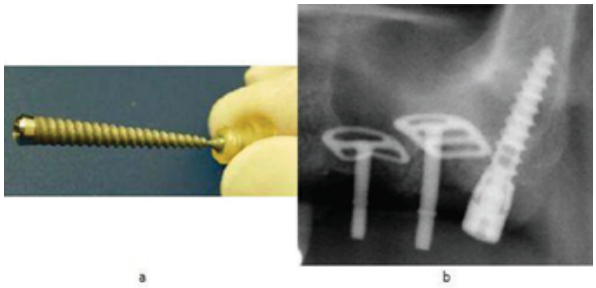

Figure-6:a. Tubero Pterygoid (TPG) Screw Implant; b. TPG Implant In situ

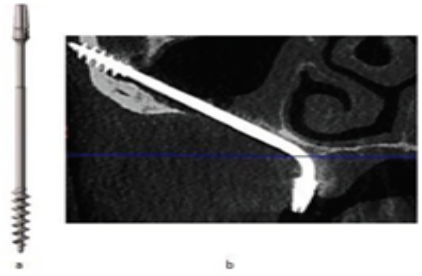

Figure-7: a. Zygoma Screw Implant (ZSI);b. Zygoma Screw Implant In Situ

Fig. 8: The Cortically Fixed @ Once Concept

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