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An Insight into Basal Implants

[1]Swathi A, [2]Ravi Kumar Nagabhairava, [3]Malathi Dayalan, [4]Roopa J C
[1]*PG Student, Department of Prosthodontics, The Oxford Dental College, Bangalore.*
[2]*Professor,Department of Prosthodontics, The Oxford Dental College, Bangalore.*
[3]*Head of the Department, Department of Prosthodontics, The Oxford Dental College, Bangalore.*
[4]*PG Student, Department of Prosthodontics, The Oxford Dental College, Bangalore.*

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ABSTRACT: Implants have become an expected treatment for restoring the edentulous area, but it requires sufficient bone for successful placement. To ensure a successful outcome, procedures such as alveolar grafts, nerve repositioning, sinus lift and nasal lift must be performed. Without these procedures, treatment with conventional implants may not be successful. Basal implants are a ray of hope for patients with atrophic ridges which can be rehabilitated without any extra surgical interventions. Basal implant placement technique unquestionably calls for a skilled operator with a solid understanding of anatomy. They also give rapid loading, which helps patients regain confidence and engage in typical social interactions.

KEYWORDS: Basal implants, BOI and BCS implants, KOS and KOS plus implants, Osseo adaptation, strategic area.

I. INTRODUCTION

These days restoring the edentulous area with implants has become an expected treatment. There should be sufficient bone available for successful implant placement. Whenever the criteria are not followed properly then treatment planning for inserting implants becomes more difficult. There should be a need to restore the lost alveolar dimensions for a predictable successful outcome of the treatment. Such procedures include alveolar grafts, nerve repositioning, sinus lift and even nasal lift, without which treatment with conventional implants might not be very successful.

And also in recent years, patient demands for immediate restoration and desires to eliminate the compromised esthetics, function, discomfort and inconvenience associated with traditional twostage implant procedures. These have fostered interests in early and immediate loading. Treatment plans which include several steps of surgery are less attractive or simply rejected because the costs of lost work-time and travelling add up to the total costs of treatment. In addition, the willingness to wait for the healing of the bone and to suffer a multi-step treatment plan is rapidly vanishing.

Placement of root form implants in the atrophic regions of the jaw especially in posterior mandible and below the maxillary sinus can be difficult and often impossible. Adjunctive procedures for enlarging the bone volume increase the risks of overall treatment and they reduce thereby the predictability.

Basal implants provide transmission of masticatory forces to the stable cortical bone. These implants are placed bicortically and transosseously and at least one base-plate is anchored in the basal cortical bone.

They utilize basal bone areas free of infection and resorption, which are not necessarily located near the masticatory surfaces, therefore are also well suited for placement immediately after extractions. At the same time load bearing capacities of cortical bone are many times higher than those of spongious bone.

Basal implantology also known as bicortical implantology or just cortical implantology. It is an advanced technology which utilizes the basal cortical portion of the jaw bones for retention of the dental implants. These kinds of implants, they do not require bone graft and bone augmentation.

II. CLASSIFICATION

The types can be further categorized into

i. ScrewForm

- Compression Screw Design (KOSImplant)
- Bi-Cortical Screw Design (BCSImplant)
- Compression Screw + Bi-Cortical Screw Design (KOS PlusImplant)

ii. Disk Form - Basal Osseointegrated Implant (BOI) / Trans-Osseous Implant (TOI)/ LateralImplant)

- **According to abutment connection**
  - Single Piece Implant.
  - External Threaded Connection.
  - Internal ThreadedConnection

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- External Hexagon.
- External Octagon.

- **According to basal platedesign**
- Basal disks with angled edges.
- Basal disks with flat edges also called as S-TypeImplant.

- **According to number ofdisks**
- Single Disk.
- Double Disk.
- Triple Disk.

iii. PlateForm
- BOI-BACImplant.
- BOI-BAC2 Implant.

iv. OtherForms
- TPG Implant(Tuberopterygoid).
- ZSI Implant (ZygomaScrew)

III.IMPLANT MORPHOLOGY

1) BOI Implant Morphology:

To increase the implant's strength, the BOI implant is either made of pure titanium or a titaniummolybdenum alloy. The components of the BOI implant are listed below and can be single or double pieces.

● **Abutment portion:** The abutment part of single-piece BOI implants is conical and remains exposed in the oral cavity; however, in two-piece BOI implants, the abutment section can be either an externally or internally threaded screw with either an exterior hexagonal or octagonal restorative platform.

● **Neck:** It is the area located immediately beneath the abutment part. This area may or may not have a constricted diameter; a constricted diameter improves gingival adaptation after healing, lowers rigidity, and permits bending by 15° to 25°.

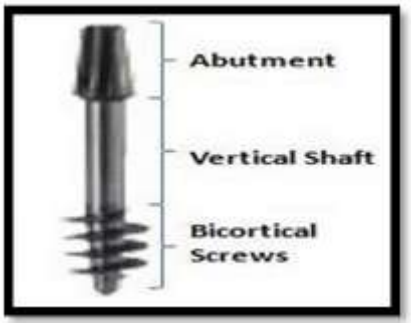
● **Vertical Shaft:** This part of the implant joins each of its individual parts. To prevent plaque buildup and inflammation, the shaft is kept smooth and polished; depending on the titanium's type and diameter, it can also be either elastic or rigid. The vertical shaft is purely a load bearing component and is usually 10 – 13.5 mm long.

● **Crestal Disk:** That is the implant's initial disc. It is known as a crestal disc because, upon implant placement, it rests in the crestal bone. This disc has two functions: it first offers and maintains primary stability following implant insertion, and after osseointegration, it transforms into a load-bearing and distributing component.

● **Basal Disk:** It is the second disk at the base of the implant and is the last component in the implant body. It is a load-bearing and loaddistributing component that is also kept polished. The portion of the shaft that is attached to the basal disc is flexible and can be bent 15° to 25°. The average distance between the crestal and basal discs is 5 mm.

2) BCS Implant Morphology

With changes to the abutment and the implant part, these single-piece implants are constructed similarly to the BOI implant. Conical Straight, Conical Angled, and Multi-Unit abutments are all possible for BCS implant abutments.



The buccal and palatal/lingual cortical plates are engaged by the wide diameter cutting screws on the BCS implant, which initially give the implant its primary stability and load-bearing capacity before eventually acting as a load-bearing and distribution component. These flapless implants have a very small mucosal penetration diameter and are also highly polished.

3) KOS and KOS Plus Implant Morphology

These implants are made of titanium molybdenumor titanium aluminum vanadium alloy and are single- piece implants. These implants are made to function similarly to compression screws; when inserted into the bone, they will compress the cancellous bone around them to create denser, more compactbone.

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- **Abutment Portion:** 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 area.

a. Conical Straight abutments for cemented crowns, thisabutment might also have a vertical microgroove that serves as an anti-rotationalfeature.
b. Conical Angledabutments.
c. Locatorabutments.
d. Ballabutments.
e. Multi-Unit abutments. *(these abutments are part of single piece implant)

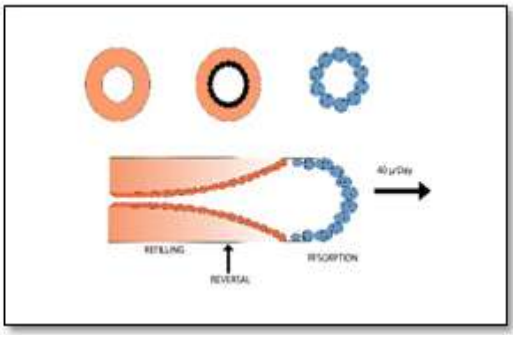
- **Neck:** This part of the implant is highly polished and is constricted to aid in better gingival adaptation and to discourage plaque accumulation. The neck of the implant is bendable by15°-25°.
- **Implant Portion:** The broad structure and wide turns of the threads on this part of the implant allow them to exert compressive forces on the cancellous bone andtransform it into a denser cortical-likebone.

The additional screws in KOS Plus apical third, known as basal cortical screws, enable the implant engage the buccal and palatal/lingual cortical plates, establishing initial stability before going on to serve as a load-bearing and distributing component. It should be mentioned that the BCS component of the KOS Plus implant is constantly thoroughly polished.

IV. PERI-IMPLANT HEALING IN BASAL IMPLANTS

Peri-Implant Healing (BOI and BCS Implant) Since these implants have a unique design their peri-implant healing is also unique. What conventional implantologists call as "Osseointegration" is called as "Osseoadaptation" by basal implantologists.

According to philosophy of basal implantology the process of Osseoadaptation is carried out by a "Bone Multicellular Unit" (BMU), it is said to be like a cutting cone with a tail, the cutting cone comprises of osteoclastic cells that eat away the peri-implant bone and the tail comprises of osteoblastic cells that lay down bone, as this unit moves in the bone the osteoclastic activity is subsequently followed by osteoblastic activity. The formation of this BMU takes place when the BOI and BCS implant are subject to immediate loading which leads to remodeling of bone under functional stresses leading to development of this unit, and thus initiates the healing phase and leads to formation of a dense peri-implant bone.



The cascade of processes involved is as follows –

● **Activation Phase:** In this phase the precursor cells/human mesenchymal stem cells develop into osteoblasts and osteoclasts. This phase lasts for 3 days.

● **Resorption Phase:** During this phase osteoclastic activity occurs which reveals soft and porous bone. Osteoclastic activity occurs at a rate of 40µm/day.

● **Reversal Phase:** In this phase osteoblastic activity takes place. The osteoblasts lay down neo bone in the haversian canals at a rate of 1-2µm/day.

● **Progressive Phase**: This phase involves the osteoblasts forming concentric lamella in haversian canals, which leads to reduction in diameter of the canal and increase in bone density. At this stage the diameter of the haversian canal is 40- 50µm. The bone formed is a Non-Mineralized Matrix Osteoid and this phase lasts for 3 months.

● **Mineralization Phase**: After 10 days of osteoid formation mineralization phase begins.

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This phase involves two stages

a) **Primary Mineralization Stage:** This stage imparts primary hardness to the osteoid and accounts for 60% of allmineralization.

b) **Secondary Mineralization Stage:** This stage imparts final hardness and final morphologyof bone. This phase lasts for 6-12months.

- **Dormant Phase:** In this phase osteoblasts develop into osteocytes and line the haversian canals and take up mechanical, metabolic and homeostatic functions.

V. INDICATIONS

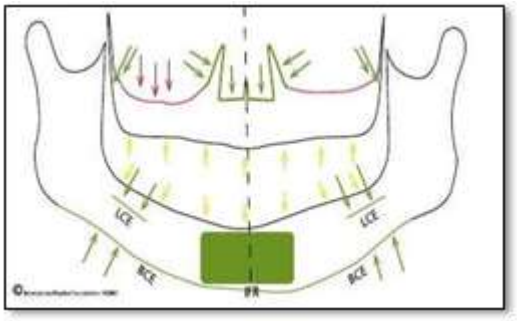
- Bone volume incompatible with direct placement of axial (crestal) root-form implants.
- Bone volume suitable for root-form implants but bone quality is poor(D4).
- Bone grafting and/or sinus floor elevation refused by the patient orcontraindicated.
- High, thin knife ridge (buccal-lingual width).
- Severemaxillaryand/ormandibularatrophy (bone height<4mm).

VI. CONTRAINDICATIONS

- Heavy smokers.
- Heavy bruxism, clenching, uncontrolled malocclusion, and/or a history of fractured teeth, especially when associated with psychologicalproblems.
- High-dose IV bisphosphonates for treatment of severe osteoporosis or cancer (risk of osteonecrosis of thejaw).
- Facial and trigeminal neuropathies associated with a depressive state, epilepsy.
- Severe heart disease, recent stroke, or heart attack (risk of infectious endocarditis)

VII. STRATEGICAREA

• Yellow: 1 st cortical.
• Green arrows in mandible mark 2 nd cortical. In the distal mandible both lingual cortical engagement (LCE) and basal cortical engagement (BCE) are possible for screwlike strategic implants. Most patients provide a highly mineralized interforaminal region (IFR) which provides in most cases enough stability from inside the mandible for the implant anchorage without additional 2 nd cortical engagement.
• Green 2 nd cortical in the maxilla: the floor of the nose, parts of the basal sinus cortical, bone of the outer distal maxilla.
• Red lines: Resorption prone cortical areas of the sinus floor



VIII. SURGICAL PROCEDURES

For Disk implants:

• The specific instrument used for osteotomy, termed a "cutter," consists of a titanium shaft with cutting blades and a toothed circular base.
• As it rotates, the cutter functions as a circular micro-saw that prepares the Tshaped implant lodging in a single step that lasts only several seconds.
• The cutter is slightly smaller in dimension than the implant to ensure primary stability when the implant is impacted into the bone.
• Double-disk and triple-disk cutters exist for double- and triple-disk Diskimplants®. The distance between two cutting disks on multi- disk cutters is always 3 mm.
• This implant is placed in the edentulous locations under local anesthesia (2% lignocaine with 1:80,000 adrenaline).
• After raising a full thickness flap, the implant bed is created through lateral access using vertical cutters, horizontal cutters and combination cutters.
• These cutters are used with a high speed airotor handpiece for the vertical cut and a reduction gear contra-angle handpiece at a speed of 3000 rpm with copious irrigation for the lateral horizontal cuts. The first vertical bone cut is performed with tungsten carbide surgical bur followed by the vertical cutter.
• This is followed by the lateral cutter which enlarged the lateral cut according to the implant size and type used. • The implant is inserted through a lateral access using carefully dosed hammer style strokes with a pencil osteotome and mallet.
• The rectangular side of the basal disk faces the vestibular aspect and the rounded side remained on the medial aspect.
• The presence of sufficient support was verified visually and manually by testing with fingers.
• Any part of the projecting disk was then bent and adapted to the bone surface.

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• In cases where there was a bony defect left behind, the implant surface was covered on its buccal/labial side with particulate alloplastic graft followed by placement of a resorbable membrane. However, this was done for esthetic areas only like the maxillary anterior region as primary stability was not a problem with these implants.

Screw form implants:

• Throughout the surgery the mode of irrigation used is external and usually for almost any case a single pilot osteotomy with a "Pathfinder Drill" is sufficient for KOS, KOS Plus and BCS implants, the kit also consists of manual drills for a controlled osteotomy preparation.

• Basal implantologists do not advocate raising a flap for these implants as it results in a decreased blood supply and 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.

Handling:

• Hold the implant by the holder and place the insertion tool on the implant head. The endosseous implant surface must not be touched. Pull out the implant with the plug and then twist off the plug with the needle holder at the predetermined breaking point.

• Insertion using manual tools

• Insert the implant by hand until it is firmly seated in the jaw.

Definitive implant insertion:

• Using the ratchet, torque ratchet or contra-angle, screw the implant clockwise into the cavity. With KOS® B, the use of the torque ratchet is mandatory. The endosseous (blasted) part of the implant must be completely covered by bone. The polished implant neck is located in the mucosa.

• The head of the bendable KOS implants can be bent into the desired position after insertion with the aid of the mounted insertion tool and ratchet.

• Maximum bend: approx. 15°. Only one bending operation may be performed. In the maxilla, the motorized insertion tool should be used due to its better implant guidance during insertion.

IX. PROSTHETIC MANAGEMENT FOR DISK IMPLANTS:

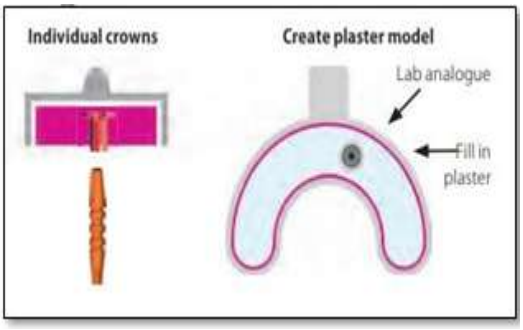
• Impression copings in place. Even though the pterygoid implant is angled 45°, the flat emergence profile makes it easy to take the impression.

• Impression copings connected with Luxabite. A transpalatal bar is used to prevent distortion of the impression. • Impression taken with heavy silicone.

• A plaster rim is used to validate absolute passive fit.

Prosthetic management for screw form implants:

- Impressions were taken immediately after the bending of implants. The implants were bent to gain maximum abutment Parallesim. Impression post with anti-rotation protection is attached to the implants. Pressure less impression with silicone material is made.
- Implant post are transferred along with the impression and implant analogues are placed. Final cast with implant analogues is achieved. Then the dental lab fabricates the final metal framework and ceramic prosthesis. The final prosthesis was permanently cemented in the patient's mouth three days aftersurgery.



X. CONCLUSION:

• Basal implants are a ray of hope for patients with atrophic ridges which can be rehabilitated without any extra surgical interventions like bone augmentations thus, reducing the time and cost of the treatment plan and also provide immediate loading which help the patients to gain confidence and socialize normally.

• Technique of placing basal implants definitely requires a skilful operator with a sound knowledge of anatomy. Further research and development and more concrete data on clinical cases are required to prove their efficacy and complications are rare but can be fatal if the procedure is not performed properly.

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