

*Review article***An Alternative to Conventional Dental Implants: Basal Implants**

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ABSTRACT: The conventional crestal implants are indicated in situations when an adequate vertical bone supply is given. These crestal implants function well in patients who provide adequate bone when treatment starts, but prognosis is not good as soon as augmentations become part of the treatment plan. Augmentation procedures tend to increase the risks and costs of dental implant treatment as well as the number of necessary operations. Patients who have severely atrophied jaw bones paradoxically receive little or no treatment, as long as crestal implants are considered the device of first choice. In this article the indications of using basal implants and the differences that exist between basal implants and crestal implants are discussed.

Keywords: Basal Implants; Crestal Implants; Basal Implantology; Immediate Loading.

INTRODUCTION

In crestal implantology (Implants are referred to as crestal-type implants if they are inserted into the jaw bone coming from the crestal alveoli and whose main load-transmitting surfaces are vertical. The term thus covers screws, cylinders, and blade implants.), it is standard practice to insert screws at least 10 to 13 mm in length in the anterior segment of the mandible because this part of the mandible usually offers sufficient vertical bone. But the patients with very little available vertical bone are at a particular disadvantage.¹

Basal implantology also known as bicortical implantology or just cortical implantology is a modern implantology system which utilizes the basal cortical portion of the jaw bones for retention of the dental implants which are uniquely designed to be accommodated in the basal cortical bone areas. The basal bone provides excellent quality cortical bone for retention of these unique and highly advanced implants. Because basal implantology includes the application of the rules of orthopedic surgery, the basal implants are also called as "orthopaedic implant"² to mark a clear distinction between them and the well-known term "dental implant". These basal implants are also called as lateral implants or disk implants.³

Basal bone is defined as the osseous tissue of the mandible and maxilla underlying the alveolar processes.⁴ It is relatively fixed and unchangeable framework of the mandible and maxilla.⁵ Using the Basal Bone,

implantologist can now place implants in regions where traditional implants would not be possible. The traditional Implants use the alveolar bone - this type of bone is lost after teeth are removed and decreases through life as function reduces. The basal bone is always present throughout life; it is very strong and forms the stress bearing part of our skeleton. Dental implants when placed in this bone can also be loaded with teeth immediately. This science is already proved in orthopedic implants (Hip / Knee replacements). Once the patient is fitted with the artificial joint he is asked to start using it immediately.¹

HISTORY OF THE BASAL IMPLANTS

First single-piece implant was developed and used by Dr. Jean-Marc Julliet in 1972. Because no homologous cutting tools are produced for this implant, its use is fairly demanding. In the mid-1980s French dentist, Dr. Gerard Scortecchi, invented an improved basal implant system complete with matching cutting tools. Together with a group of dental surgeons, he developed Disk-implants. Since the mid-1990s, a group of dentists in Germany have developed new implant types and more appropriate tools, based on the Disk-implant systems. These efforts then gave rise to the development of the modern BOI (Basal Osseointegrated Implant or lateral basal implants. In this design, load transmission was supposed to take place both in the vertical and in the basal implant part (Figure 1).⁶ Soon **Dr. Stefan Ihde** introduced bending areas in the vertical implant shaft.⁸ In 2005 the lateral

basal implants were modified to screwable designs (BCS) (Figure 2).⁷



Figure 1: A 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.⁷



Figure. 2: Basal compression screw with large and polished thread for cortical engagement.⁷

RATIONALE OF USING BASAL IMPLANTS

Teeth are present in less dense bone portions of the jaw bones called the alveolar bone. This is also known as the crestal bone of the jaw. The less dense alveolar or crestal bone gradually starts getting resorbed and recedes once the teeth are lost. The bone which ultimately remains after regression of the alveolar bone following loss of teeth is the basal bone which lies below the alveolar bone. This basal bone is less prone to bone resorption and infections. It is highly dense, corticalized and offers excellent support to implants. The conventional implants are placed in the crestal alveolar bone which comprises of bone of less quality and is more prone to resorption. The basal bone, is less prone to bone resorption because of its highly dense structure. The implants which take support from the basal bone offer excellent and long lasting solution for tooth

loss. At the same time, load bearing capacities of the cortical bone are many times higher than those of the spongy bone.⁷

TYPES OF BASAL IMPLANTS

The two types BOI (Basal Osseo Integrated) and BCS (Basal Cortical Screw) basal implants are specifically designed to utilize strong cortical bone of the jaw. Screwable basal implants (BCS brand) have been developed with up to 12 mm thread diameter can be inserted into immediate extraction socket (Fig 2).⁷

BOI (LATERAL BASAL IMPLANTS)

Lateral basal implants are placed from the lateral aspect of the jaw bone.⁷ Masticatory load transmission is confined to the horizontal implant segments and, essentially, to the cortical bone structures.

ANTERIOR IMPLANTS

If sufficient vertical space is available, the implants used are usually the ones with two disks. The basal disk has a diameter of 9 or 10 mm, whereas the crestal disk is 7 mm in diameter. The crestal and basal plate (disc) of multi-disc implants used for basal osseointegrated implants has different functions. The main purpose of the crestal plate is to provide additional stabilization of the implant. The crestal plate loses its importance once the basal plate has ossified to full load bearing capacity. If the insertion of double disks fails due to the lack of available bone, a single BOI with a 7- to 9-mm diameter and shafts between 8 and 13.5 mm can be used instead.⁷

POSTERIOR IMPLANTS

The implants used here are usually of a square shape, having a disk of 9 to 12 mm or 10 to 14 mm with shafts of 10 to 13.5 mm in length, depending on the desired vertical dimension and the available horizontal bone. If the vertical bone available above the mandibular nerve is, 2 mm, infranerve implant insertion (infranerve implant insertion: The disk is introduced below the mandibular nerve; the threaded carrier is located at the side of the nerve.) is indicated.⁷

BCS (SCREW BASAL IMPLANT)

These screwable basal implants are flapless implants and are inserted through gum, without giving a single cut, inserted like a conventional implant. Bicortical screws (BCS) are also considered basal implants, because they transmit masticatory loads deep into the bone, usually into the opposite cortical bone, while full osseointegration along the axis of the implant is not a prerequisite. BCS provide at least initially some elasticity and they are not prone to peri-implantitis due to their polished surface and their thin mucosal penetration diameter.²

PARTS OF BASAL IMPLANTS

The basal implants are single piece implants in which the implant and the abutment are fused into one single piece. This minimizes failure of implants due to interface problems, the connections which exists in conventional two and three piece implants (Figure 3).⁹

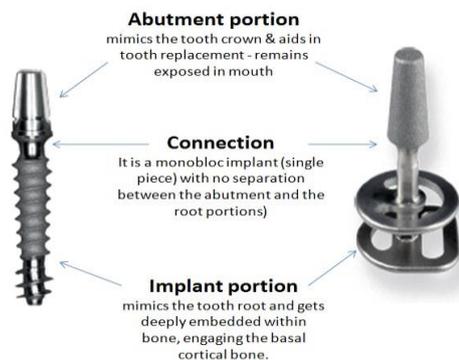
Single Piece (Monobloc) Basal Implants

Fig. 3: Parts of basal implants⁹

Implant Surface:

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

Implant body:

- Thin implant body combined with wide thread turns
- Enhance increased vascularity around the implant and increased mechanical bone implant contact.

Implant neck:

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

SURGICAL PROCEDURE OF THE BASAL IMPLANT PLACEMENT

Before insertion the oral mucosa is laterally elevated under local anaesthesia. Lateral basal implants are placed from the lateral aspect of the jaw bone. A vertical and a horizontal precision slot are cut into the jawbone to allow placement of the implant. BOI implants are inserted horizontally & transosseously, i.e. their base plate (disc) is designed to touch the outer and inner cortical bone. Basal implants changed treatment options in the upper jaw. Sinus lift procedures have become avoidable because all patients have sufficient horizontal bone naturally, even if vertical bone is missing. Screwable basal implants are flapless implants and are placed through gum, without giving a single cut.⁸

Basal implants get integrated in a totally different way than traditional two-phase implants do. One, the implantation site is different: it is fixed in the solid, bicortical part of the bone, and not in the spongy bone. This layer cannot be reduced to such a level that there would be not enough left for implantation. For another, basal implants can get fixed not only vertically, but also horizontally.¹⁰

INDICATIONS¹⁰

1. All kinds of situations when several teeth are missing or have to be extracted.
2. When the procedure of 2-stage implant placement or bone augmentation has failed.
3. All kinds of bone atrophy i.e.,
 - In cases of very thin ridges- i.e., deficiency of bone in buccolingual thickness.
 - In cases of insufficient bone height.

These two situations develop due to the following reasons.

- using removable dentures for so many years will resorb the bone and reduce the height available.
- after extraction of teeth, not replacing the teeth, living without teeth for many years will also resorb the bone.
- untreated periodontal disease (especially in diabetics) will resorb the available bone.
- trauma to jaw which damages not only the teeth but also the alveolar bone.

CONTRAINDICATIONS¹⁰

1. Special Cases: Cases where bilateral equal mastication cannot be arranged, e.g. when chewing muscles or their innervations are partly missing (these cases may lead to problems under immediate load protocols).
2. Medical conditions: There are a number of medical conditions that preclude the placement of dental implants. Some of these conditions include: Recent myocardial infarction (heart attack) or cerebrovascular accident (stroke), Immunosuppression (a reduction in the efficacy of the immune system).
3. Medicines: A dentist will need a complete listing of all of the medicines and supplements that their patient takes. Drugs of concern are those utilized in the treatment of cancer, drugs that inhibit blood clotting and bisphosphonates (a class of drugs used in the treatment of osteoporosis).

ADVANTAGES OF BASAL IMPLANTS⁹

1. **Immediate Loading** – prosthesis is fixed within 72 hours of implant surgery saving time and costs considerably. In case of conventional implants associated with bone augmentation / grafting

procedures, the total treatment time will be about 6 months to 1 year. The need for interim dentures / provisionals is totally eliminated.

2. **One piece implantology** – Basal implants are one piece implants in which the implant and the abutment are fused into one single piece. This minimizes failure of implants due to interface problems between the connections which exist in conventional two and three piece implants.
3. **Basal – cortical bone support** – most of these implants take support from the basal bone which is a lot more resistant to resorption, very much unlike the conventional implants which mostly take support from the crestal bone. Basal cortical bone also has a much faster and stable repairing capacity.
4. **Minimally invasive, minimal surgical complications** – in most edentulous situations, the single piece screw type implants can be inserted in a minimally invasive fashion – often flapless and involving minimum bone cutting. Being minimally invasive, they are also associated with minimum post operative edema and healing at the procedure sites are rapid and often non-eventful.
5. **Works well in compromised bone situations** - Avoidance of bone augmentation / grafting, sinus lifts and nerve trans-positioning – These implants are unique in that they can be made to utilize the available bone in the best possible manner to avoid bone augmentation procedures. With conventional implants, the available bone is modified (by using bone – grafts, bone substitute grafts etc.) to suit the implants.
6. **Better distribution of masticatory forces** – As basal implants are anchored in high quality basal bone, the biomechanical loads (masticatory forces etc.) are distributed to the cortical bone regions which are highly resistant to resorption and have very high repairing capacity.

7. **Peri-implantitis incidence** – Peri-implantitis is the single most common cause for failure of conventional implants. This happens mostly because of the rough implant surface as well as the interface problems between the multiple parts of the implant. Judicious use of monobloc,

smooth surface basal implants eliminate the threat of peri-implantitis by almost 98%.

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

COMPARISON OF CRESTAL WITH BASAL DENTAL IMPLANTS

CRITERIA	CRESTAL (AXIAL / SCREW) IMPLANTS	BASAL IMPLANTS
Shape and structure	Root form – designed to imitate roots of a tooth.	The implants look like an inverted T.
Endosseous section	Screw shaped with machine / HA coated surfaces.	Flat / blade like surfaces with spaces permitting bone in growth. No one of them equipped with any kind of prepared surface for the enhancement of bone. Regeneration.
Technique	Insertion through crestal bone and communication with oral cavity much more than basal implants.	Insertion through lateral aspect of basal bone. Load bearing area of implant has no communication with the oral cavity.
Bone requirement	Vertical bone – both crestal and rarely a small portion of basal bone.	Basal bone is what is needed. Horizontal aspects of the bone are fully utilized along with the inner and outer cortices.
Armamentarium	A large number of instruments are necessary for procedures.	Instrumentation relatively a lot simpler.
Bone grafting procedures	Essential in cases of deficiency in bone height. Grafting procedures give unpredictable results.	Not essential.
Bone displacement	Considerable bone substance displacement / loss occur and vary with size and length of implant. Crestal bone is more susceptible to resorption.	Displace up to 60% less bone substance. Basal bone - highly resistant to resorption.
Mucosal penetration diameter	Larger. Chances of Periimplantitis, vertical bone loss, crater like bone loss and infections are relatively high.	Smaller (1.9 – 2.3 mm. only). The whole vertical implant part is polished – hence, chances of problems seen as in the case of crestal implants relatively very low.
Loading	Two piece crestal implants often require delayed loading & two surgical phases at times.	Immediate loading.
Healing	Prolonged healing time – clinically significant.	Bone healing time not clinically significant.
Masticatory forces	They act in the vertical direction along the sides of the screw structure.	Transferred to the basal plate deep into the cortical bone areas which are able to accept large loads and have great capacity for regeneration.
Applications in destructive periodontitis & after multiple extractions of teeth	Their placement in such cases is nearly impossible and success is unpredictable.	Placement of implants very much possible and results are excellent.
Smoking patients	Failure rate is close to 100%.	Best option for smoking patients.
Controlled diabetic patients	Crestal implants have a risk of failure in cases where there are blood sugar variations.	Blood sugar variations may not affect the survival of the implant at all.

- **Diabetes Mellitus** – The conventional dental implants are generally contraindicated in diabetes patients, since diabetes is associated with increased susceptibility to infection, impaired wound healing and gum diseases (gingivitis, periodontitis etc.) However, basal implants work absolutely well in controlled diabetic patients because they are smooth surface implants which do not permit bacterial colonization on the implant surfaces.⁹
 - **Smoking** – Smoking habit negatively affect the implant procedure because it cuts down the blood flow to the oral tissue like the gums, teeth and bone, which in turn results in slower healing of the implant site. Smokers have a high risk of gingivitis and gingival recession which in turn will lead to infection around the implant (peri-implantitis) leading to their failure. In case of basal implants, since the load bearing areas are far away from the areas of the mouth affected by smoking, they take up well. However, it should be borne in mind that smoking immediately after implant surgery will be unfavorable for wound healing even in the case of basal implants.⁹
 - **Acute Destructive Periodontitis** – Conventional dental implants are contra indicated in patients with acute periodontitis. This is because of the high risk of the patient to contract gingival infections leading to failure of the implants. These patients often present with multiple mobile teeth and painful, inflamed gums which bleed easily. However, smooth surface basal implants work wonderfully well in such patients owing to the fact that they are less prone to bacterial attack (the load bearing area is far away from the area prone to infections in the gum regions and the smooth surface implants do not permit bacterial colonization and multiplication).⁹
9. **Cost savings** – Avoidance of the bone grafts and second stage surgery, in addition to the phenomenal reduction in the total treatment time helps save costs in a big way.

DISADVANTAGES OF BASAL IMPLANTS¹⁰

For **BOI** implants open flap surgery is needed. Gum incision and suturing are necessary, unlike **BCS** implants, as **BCS** implants may be inserted without a flap procedure.

Only a properly trained prosthodontist can accomplish the surgical procedure without any complication. If placed by inexperienced or untrained hands, problems are bound to come.

COMPLICATION OF BASAL IMPLANTS¹¹

Functional overload osteolysis: Masticatory forces transmitted through the basal implants may create local microcracks in the cortical bone. These microcracks are repaired by a process called remodelling. This, however, will temporarily increase the porosity of the affected bone region and temporarily reduce the degree of mineralization additionally. Basal implants in this status have a good chance of getting reintegrated at a high degree of mineralization, if loads are reduced to an adequate amount.

CONCLUSION: Basal implants are used to support single and multiple unit restorations in the upper and lower jaws. They can be placed in the extraction sockets and also in healed bone. Their structural characteristics allow placement in bone that is deficient in height and width. They can be placed with flap or flapless technique. A thorough understanding of the maxillofacial anatomy is recommended so that bi-cortical engagement is achieved. They can be used to bypass the mandibular nerve in the mandible and for engagement of the cortical bone at the fusion of the pterygoid with the maxilla.

The direction of abutments can be adjusted up to 15° relative to the implant axis. Also with respect to the accepted principle "*primum nihil nocere*", i.e., limiting treatment, basal implants are the devices of first choice, whenever (unpredictable) augmentations are part of an alternative treatment plan. The technique of basal

implantology solves all problems connected with conventional (crestal) implantology. It is a customer oriented therapy, which meets the demands of the patients ideally.

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How to cite this article: Yadav RS, Sangur R, Mahajan T, Rajanikant AV, Singh N, Singh R
An Alternative to Conventional Dental Implants: Basal Implants. *Rama Univ J Dent Sci* 2015
June;2(2):22-28.

Sources of support: Nil

Conflict of Interest: None declared