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Comparison between basal and conventional implants as a treatment modality in atrophied ridges

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Implant placement in severely atrophic jaws is especially challenging because of the poor quality and quantity of the future implant bed. Although various bone augmentation procedure like ridge augmentation, sinus lift these procedures are possible today but it may lead to surgical morbidity they increase the risks and costs of dental implant treatment as well as the number of necessary operations. Also sometimes the patient is not agreeing for such extensive surgical procedures, according to the well-known implantological rules for dental restorations, crestal implants are indicated in situations when an adequate amount of bone is present but basal implant a viable treatment option derives 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 using basal implants and the differences that exist between basal implants and crestal implants in rehabilitation of atrophied edentulous jaws. (JOURNAL OF DENTAL IMPLANT RESEARCH 2019;38(2):48-54)

Key Words: Basal implants, Crestal implants, Orthopedic implants, Atrophied alveolar ridge

INTRODUCTION

Rehabilitation the edentulous of maxilla or mandible with implants has become a normal predictable treatment today but successful implant placement need sufficient bone (at least 13～15 mm length and 5～7 mm width)[1,2]. Implant placement in severely atrophic jaws is especially challenging because of the poor quality and quantity of the future implant bed[3]. Calvarial or iliac bone grafts, mental nerve displacement, all on four, nerve by pass and sinus lift procedures are often used to overcome the initially unfavorable anatomical and mechanical conditions[4-6]. Despite acceptable success rates, these approaches involve unpredictable degrees of morbidity at the donor and/or recipient sites[7]. Furthermore, patients are sometimes reluctant to undergo such procedures[8].

The conventional crestal implants are indicated when an adequate vertical and horizontal bone must be available if not the prognosis is not good as soon as augmentation 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[9]. To avoid these procedures the other viable option for replacement in atrophic jaws is to change the implant design. Two very successful implant designs and protocols have been demonstrated in the past few decades for replacement in atrophic jaws which are Mini Dental Implants and Basal Implants[10] (Table 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

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Table 1. Comparison of crestal with basal types dental implants

Implants	Basal implant	KOS implant	Conventional implant
Indication	Used for multiple unit restoration especially in extraction socket allow placement in bone deficient in height and width.	Used for multiple unit restoration need adequate bone tissue, good D1 / D2 bone.	Used for single or multiple unit restoration in adequate bone tissue.
Mechanism	Cortical anchorage of thin screw implants (bicortical screws, BCS). Excellent primary stability can be obtained along the vertical surfaces of these implants with no need for corticalization only Osseoadaptation occure.	Screw implants of this type can result in lateral condensation of spongy areas. Implant stability is greatly increased by a mechanism that could be regarded as “corticalization” of the spongy bone.	Osseointegration: "the formation of a direct interface between an implant and bone, without intervening soft tissue".
Basic design	Immediate loading 72 hours	Immediate loading 72 hours	Delayed loading 3～6 months
Implant procedure	Single sitting surgical procedure and very often flapless (no open surgical procedures are necessary). Implant procedures are less time consuming than that required for bridgework.	Single sitting surgical procedure and very often flapless (no open surgical procedures are necessary). Implant procedures are less time consuming than that required for bridgework.	Very often more complex surgical procedures are necessary, spread over 2 or 3 sittings in a period of 3～6 months (Implant placement, Healing Screw placement & Abutment Placement)
Armamentarium	Simple – the implant surgery kit is very simple with very few instruments	Simple – the implant surgery kit is very simple with very few instruments	Complex – a wide array of instruments are required for placement of two piece implants
Cost	Very cost effective	Very cost effective	Expensive
From the patient point of view	Less complex placement procedure	Less complex placement procedure	More complex placement procedure
Long term maintenance	Single piece, strength provided by implant is excellent	Single piece, strength provided by implant is excellent	Two piece some time the relation between them make problem
Eligibility to patient	Almost every one	Almost every one	No suitable for diabetic, smoker and patient with uncontrolled periodontitis
Size and design	Wide range of size and design are available	Wide range of size and design are available	Limited range of size and design are available
Bone used	Basal bone more dense, mineralized and less prone to bone resorption	Basal bone more dense, mineralized and less prone to bone resorption	Crestal alveolar bone, bone is less quality and is more prone to resorption
Additional surgery	No need bone augmentation sins lift…	No need bone augmentation sins lift …	Most time need another additional surgery
Prosthodontic procedures	Very simple. Conventional impressions of the implants can be made just as is the case with routine bridgework. Very less chairside time.	Very simple. Conventional impressions of the implants can be made just as is the case with routine bridgework. Very less chairside time.	Requires more complex procedures and chair side time.

application of the rules of orthopedic surgery, the basal implants are also called as “orthopedic implant” Dental implants when placed in this bone can also be loaded with teeth restoration or prosthesis immediately. This science is already proved in orthopedic implants (Hip/Knee replacements). Once the patient is fitted with the artificial joint patient is asked to start using it immediately[11].

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[9].

1. History of dental implants

➢ The safety and efficiency of titanium implant “fixtures” go as far back as 1952 when a Swedish physician (Dr. Per-Ingvar Brånemark) serendipitously discovered the bone bonding properties of this metal. His ongoing clinical research and experimentation led finally to extraordinary applications in dental medicine and the

first dental patient was treated with titanium dental implants in 1965.

➢ 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.

➢ In 1997, lateral basal implants were introduced by Dr. Ihde in the way the "Disk implants" were developed. These implants were round in design and the surface was initially roughened.

➢ 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 (BCS, GBC) designs.

➢ In 1999 vertical shaft surfaces were polished, from 2003 the whole basal implant was produced with polished surface, as polished surfaces show no tendency to inflammation, and in case of sterile loosening, reintegration of the implant was possible if the load was adjusted in time. Roughened osseous surfaces were found to lack this ability. The design was developed to leave enough elasticity for the development and functional stimulation of bone[10,12-14].

2. Classification of Basal Implant Based on Morphology[10]

There are four basic types of basal implants available now a day:

1) Screw Form
2) Disk Form
3) Plate Form
4) Other Forms

1) Screw Form (Fig. 1)

A. Compression Screw Design (KOS Implant)
B. Bi-Cortical Screw Design (BCS Implant)
C. Compression Screw+Bi-Cortical Screw Design (KOS Plus Implant)

2) Disk Form

A. Basal Osseo-integrated Implant (BOI)
B. Trans-Osseous Implant (TOI)
C. Lateral Implant (Fig. 1)

3) Plate Form

A. BOI-BAC Implant
B. BOI-BAC2 Implant

4) Other Forms

A. TPG Implant (Tuberopterygoid)
B. ZSI Implant (Zygoma Screw)

Morphology of basal implant: The BOI (Basal Osseo Integrated) and BCS (Basal Cortical Screw) implant being produced today has a smooth and polished surface as it was found that polished surfaces are less prone to inflammation (mucositis, periimplantitis) than rough surfaces. 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[13-15].

BOI (lateral basal implants): is inserted from the lateral aspect of the jaw bone and it requires minimum bone height of 3 mm and that means virtually every patient can be treated without bone grafting. Because bone grafting is avoided, risk groups, such as smokers and diabetics, can successfully receive these implants. Wide basal disk of the implant is stabilized into both facial as well as lingual strong cortices deep into the resorption and infection resistant zone (well deep from the crest) which guarantees safe load transmission and osseointegration.

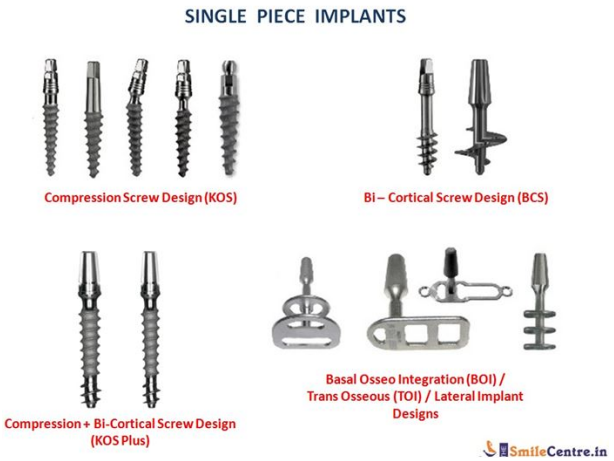

Fig. 1. Types of basal implants.

Its iso-elastic (flexible) design make it possible to connect its prosthesis to the firm and healthy natural teeth in selective cases which avoid the necessity of extraction of healthy teeth and also save the cost of the treatment. The neck of this implant can be bended to make multiple implant heads parallel for passive seating of the prosthesis and also to seat the prosthesis in the most suitable occlusion line[1]. Masticatory load transmission is confined to the horizontal implant segments and, essentially, to the cortical bone structures[16] (Fig. 2).

BCS (screw basal implant): is inserted like a conventional implant, but it transmits loads only into the opposing deep cortical bone that means virtually every patient can be treated without bone grafting. Because bone grafting is avoided, also risk groups, such as smokers and diabetics, can successfully receive these implants. Strictly cortical anchorage of the implant guarantees for safe load transmission and osseointegration. Minimal invasive implant placement (Mostly without any flap and suture) the neck of this implant also can be bended to make multiple implant heads parallel for passive seating of the prosthesis and also to seat the prosthesis in the most suitable occlusion line. These implants are also heavily polished and are flapless implants with a very small mucosal penetration diameter[11].

Compressive implant (KOS): Is a single-component one piece Screw type basal implants with a compression thread, it is used for multiple unit restoration with immediate loading in the upper and lower jaw, it can be used in combination with other BCS basal implants (KOS Plus Implant) and allows flap and flapless placement[13]. The first approach relies on the compression screw principle.

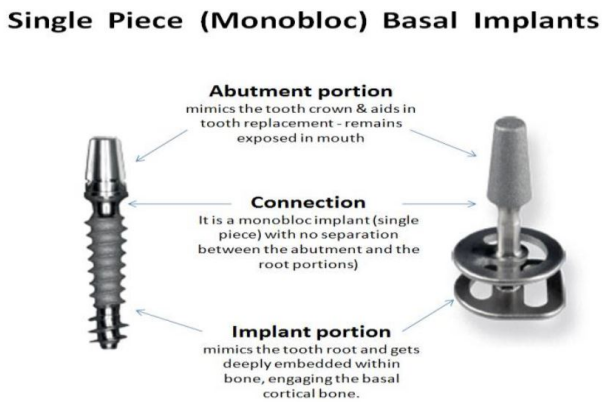

Fig. 2. Parts of basal implants[20].

Screw implants of this type can result in lateral condensation of spongy areas. Implant stability is greatly increased by a mechanism that could be regarded as "corticalization" of the spongy bone (KOS)[13].

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 the failure of implants due to interface problems, the connections which exists in conventional two and three piece implants[1] (Fig. 2).

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[9].

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[1].

1. Location of classic and basal implants

The Classic Implants are positioned in the crestal alveolar bone which consists of bone of less quality and it is more prone to resorption. This type of bone is lost after teeth are removed and decreases through life.

The Basal Implants are inserted into the basal bone that is less prone to bone resorption and infections[9]. The bone is highly dense, mineralized and offers an excellent support to implants and a long lasting solution for tooth loss. The basal bone is always present throughout life.

SURGICAL TECHNIQUE

Unlike conventional implants basal implants have a different surgical approach. The technique is simple and easy to execute and does not involve extensive drilling of bone thus avoiding thermal injury[13]. 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[17,18].

Surgeon when putting basal implant 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 favorable area to receive an immediate prosthesis[13,17,18].

For the BOI implant the approach towards the bone is gained by raising a flap laterally and cutting into the bone with disk drills of required size in a lateral direction to form a "T" shaped osteotomy. The implant consequently is placed laterally and the flap is closed over it[19].

INDICATIONS[20]

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. In cases of severe bone deficiency either horizontal or vertical.

CONTRAINDICATIONS

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 IMPLANTS[20]

1. Safe load transmission in basal bone - Load transmission is deep in the infection free basal bone. In conventional root form implant, load transmission is near the area of bacterial attack. Cortical bone is resorption resistant due to higher mineralization.
2. Less incidence of peri-implant infections - Implant surface is polished in basal implants and also the mucosal penetration diameter is less as compared to conventional dental implants.
3. Patient's own alveolar bone is required - Basal implants require the patient's own alveolar bone and no bone augmentations are required. All patients have sufficient basal bone horizontally even if vertically height is reduced. Also the duration of treatment is reduced as bone augmentations require certain amount of time for healing.
4. Immediate loading - Extremely good patient acceptance is obtained with basal implants as immediate loading is possible. There is no edentulous phase and immediate dentures are not required.
5. One stage procedure - Extractions and implant placement can be carried out in one appointment even if the teeth are periodontally infected.
6. Low demand for patient compliance

DISADVANTAGES WITH BASAL IMPLANTS[21]

1. Compromised aesthetics with single tooth replacement.
2. Skilled surgeon with sound anatomic knowledge is important to carry out successful surgery.
3. Excess sound bone reduction in cases of good bone support.
4. A phenomenon called as overload osteolysis can be seen if load distribution is not done properly.

BOI-BAC implant, BOI-BAC2 implant[22]: is onlay miniplate integrated implant marketed as BAC and BAC2 (not to be confused with their classical lateral osteotomy BOI implant) used in severely atrophied area as asubper-

Fig. 3. BOI-BAC implant, BOI-BAC2 implant.

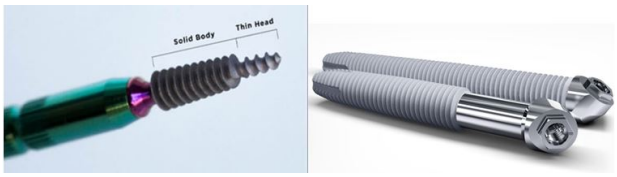

Fig. 4. Pterygoid implant and zygomatic screw implant.

iosteal implant retaining by screws (Fig. 3).

Tuberopterygoid (TPG) screws: These implants are placed in the pterygoid bone and aid in providing additional support to the prosthesis. These are used in conjunct with Sinus Section technique and are placed at 20°~45° in the bone and the angulation between BOI implant and TPG screw should not exceed 90° otherwise prosthesis placement becomes difficult (Fig. 4).

Zygomatic screw implant (ZSI): These are zygomatic implants that are placed in the zygomatic bone and like the BCS implant these also have sharp edged cortical screws that gain bicortical support (Fig. 4).

Cortically fixed @ once[23,24]: (Fig. 5)

This is a very recent protocol introduced by Dr. Henri Diederich in 2013; this protocol is based on basal cortical implantology and is specifically aimed at rehabilitating atrophied jaws irrespective of the amount of bone available without any need for augmentations. This is basically a plate form implant, which looks like mini plates (used for fracture reduction) with an abutment platform, this unique design allows them to be bent and adapt to any surface and is anchored to bone using bone expanding mini screws. The number of holes required can be reduced; another advantage is their isoelasticity enabling them to mimic bone. These implants are sub-periosteal implants and so far this protocol has shown good results but more clinical research is required.

Fig. 5. Cortically fixed @ once concept dental implant.

CONCLUSION

The research and development these implants have gone through have made them a viable option for restoring atrophied jaws as they don't require extensive augmentation and allow for immediate loading, also more than 90% of the available Implant system all around the world follows system of crestal Implants. Advocates of Basal Implant systems call it to be a better alternative to Crestal Implants in terms of ability to restore almost any type of case, shortened treatment time, less chances of failure. However, the long term results are yet to be proven. The whole concept is based upon the fact that basal bone is the most stable of all the bones available for Implants and that its resorption rate is virtually nil. Also to add is the chances of failure due to infection is also greatly reduced since the Implant takes its primary retention from the site which is very far from the surgical area. Despite of the data available on their success in treating a variety of cases these implants have gained little trust among conventional implantologists, it seems furtherresearch and development and more concrete data on clinical cases is required to prove their efficacy as a replacement to conventional implants.Technique of placing Basal Implants definitely requires a skillful operator with a sound knowledge of anatomy. Complications are rare but can be fatal if the procedure is not performed properly.

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