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Basal Implants A Review on Its Classification, Techniques and Methods

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Abstract

Statement of the Problem

For atrophic maxilla and mandible restoring of function, esthetics etc., becomes challenging by using conventional implants where major surgeries are required and the success rate is less Whereas no need for comprehensive procedures for basal implants.

Purpose

To determine the success rate of implants in severely atrophied maxilla and mandible rehabilitated with basal implants in different situations. These basal implants can be immediately loaded. The maxilla and mandible can be rehabilitated fully using fixed prosthesis.

Materials and Methods

Articles from various databases were collected and relevant articles were selected which were included in this review others were excluded.

Conclusion

In this article we have discussed about basal implants, its classification, surgical techniques, treatment plans etc that can be used in most atrophic mandible and maxilla.

Keywords

Atrophic jaws, BOI implants, KOS implants, Screw implants, surgical techniques.

Introduction

For atrophic jaws the usual treatment options mostly involved to reconstruct the lost alveolar dimensions through various procedures such as grafting, sinus lift, nerve repositioning etc., over which

conventional implants were placed. But this method had a very low success rate. These procedures were extravagant and had its own advantages and disadvantages. Inorder to overcome the drawbacks alteration in design of implant there evolved basal implants.

Basal implantology is an advanced technology. It is considered to be a revolutionary method for fixing the teeth which are uniquely designed to be accommodated in the basal – cortical bone areas. This basal implantology is also known as cortical implantology.

Now a day's crystal implants have become most commonly used implants placed in maxillary and mandibulararches, the transmission of load occurs in vertical direction. They are available in different forms. But these implants were not indicated in resorbed maxilla and mandible. There evolved basal implants that were engaged to the basal cortical bone that provided good retention for these basal implants. These implants are also called biocortical implants / disk, lateral implants[1]. In orthopaedic surgeries the basal implants play an major role. These basal implants provide the primary implant stability through multi cortical support.

History

German and French scientists were the 1st scientist to introduce the basal implants. In 1972 Dr. Jean Marc julliet. But there were few drawbacks. Dr. Gerard scortecci in 1980 has enhanced the surgical tools with internal and external connections, called disk implants. Based on the disk implants many advancement of implants were made such as basal osseo-intergrated implant BOI which is also called lateral implant. In these implants the load is transmitted both in nasal and vertical part. Dr. Stefan hide developed lateral basal implant in year 1997 with certain limit in size and shape as well as the surface of implants was roughened. Later Dr. Stefan Ihde developed round base plate with edges has a modification in basal implant in order to prevent rotation of implants before bone integration. A fracture proof base plate was developed and got patent in late 2002. Basal implant with screw design such as BCS and GBC were introduced in year 2005

In 2003 the surface of the basal implants were polished and so that there was low possibility of sterile screw loosening, inflammation and it also enhanced the bone stimulation.

Justification for Basal Implant

There were various concepts of basal implantology that were used for resorbed alveolar ridges. Mostly pathology is less in basal bone due to its corticated nature so there is decreased resorption. The crestal bone is usually more prone to tooth borne pathologies, infections so the rate of resorption is more. Due to the ability of basal bone to withstand high load transmission the placement of crestal implant were successful. Butin-case of cortical bone the success rate of implants is less. In-order to overcome this basal implants were developed. This basal implant concepts evolved form the field of orthopaedic surgery were the mostly used cortical bone region.

Classification[2] (Fig 1)

Based on morphology

1. Screw form
2. Disk form
3. Plate form

Fig1: Types of implants

4. Other forms

These types have further classified into:

SCREW TYPE	DISK FORM
1. Compression screw design(KOS)	1. Trans-osseous implant
2. Bicortical screw design(BCS)	2. Basal osseointergrated implant
3. Compression + Bicortical screw design(KOS plus)	3. Lateral implants

A. Based on abutment connection

(i) Single piece implant

(ii) External threaded connection

(iii) Internal threaded connection

Internal hexogon

External hexogon

B. Based on base plate design

(i) Basal disk with angled edges

(ii) Basal disk with flat edges s- types

C. Based on number of disk

(i) Single disk

(ii) Double disk

(iii) Triple disk

D. Plate form

(i) BOI- BAC implants

(ii) BOI- BAC2 implants

E. Others

(i) TPG implant

(ii) ZSI implant

Basically the basal implant such as BOI and BCS possessed the polished surfaces. since they are less susceptible for inflammation. But for KOS implants the neck region alone is polished whereas the other regions are surface treated. Whereas the cortical screw and neck is highly polished in KOS plus implants.

Materials used for making thisimplants were titanium and titanium molybdenum alloy because these metals have a higher strength when compared to others.

Structure of Basal Implants[2]

(i) Abutment

(ii) Neck

(iii) Vertical shaft

(iv) Crestal disk

(v) Basal disk

Abutment: For BOI single piece implant abutment region is expressed outside into the oral cavity and it's conical in shape. For two-piece BOI there was internal and external threads with hexagonal and octagonal external platform which was used for restoration.

Neck

Region straight below the abutment is the neck. This part is mostly recommended to be constricted in-order it provide better emergence profile after healing.

Vertical shaft: This part of implant connects all the components. It is usually 10-13 mm long which helps in bearing the load. In order to avoid inflammation and plaque accumulation. Diameter varies along with is rigidity and elasticity

Crestal Disk

Since it lies in the crestal bone after the implant is inserted into bone its known has crestal disk. It is also the first disk of the implant. This disk provides primary stability and also aids in load bearing.

Basal Disk

This is the last part and second disk of the implant (Fig2), the surface of this region is also kept polished, it also distributes the forces[3]. There 5mm gap between the first and the second disc. This is also elastic and can bent up to 15 to 25 °

Fig2: Basal disk implants

Indications of Basal Implants[5]

1. When unsuccessful implant by conventional method
2. Where many teeth as to be extracted or in long span edentulous ridges
3. Resorbed bone with inadequate buccolingual, mesiodistal width and height.

Contraindications of Basal Implants[5]

1. Patients who take prolonged medications such as anticoagulants, bisphosphonates, anti-cancerous drugs.
2. In medical condition like cerebrovascular fluid, autoimmune condition, myocardial infraction.

Advantages of Basal Implants

1. The transmission of the infection load is less in basal implants when compared to conventional implants.
2. Due to very smooth and polished surface of dental implants the occurrence of peri-implantitis is decreased.
3. Immediate loading is possible in basal implants.

4. Basal implants use the own alveolar bone where the basal bone is used even when the height of the bone is less.

Disadvantages of Basal Implants

1. A surgeon with sound anatomy is needed.
2. It cannot be given for single tooth replacement.
3. Osteolysis happens if the load is not equally distributed.

Anteriorly when adequate vertical space is present then two disk implants are used. Basal disk of 9 to 10 mm is broader when compared to the crestal disk with 7mm. In some cases when these implants fail the single BOI were used which has 8 to 13.5 mm shaft and 7 to 9 mm diameter[4].

Posteriorly the implants used were square in shape with shaft of 10 to 13.5 mm for 9 to 10 mm disk. Depending upon the horizontal bone and the vertical dimension the implants can be decided. In maxilla more than four implants are recommended because of excessive malleability of the bone. In mandible one implant can placed distally and anteriorly up-to 3 can be placed[4].

BCS Implants

The one-piece implant[6] (fig 3)with little alteration in implant and abutment region. The abutment for these implants were of different types such as conical straight/angled and multiunit. They have cutting edge screws with larger diameter which can easily employ into the buccal and lingual cortical plates. This contributes 1° stability and load distribution. They have a minor mucosal invasion. The surface of the implants where highly polished as well.

Fig3: Bicortical screw implants(BCS)

KOS and KOS PLUS Implants

They are also one-piece implants (fig 3). When they areinserted they compress the cancellous bone to form dense compact bone surrounding the implant[6].

Abutment, neck and implants are the parts of these implants.

Abutment: It is first disclosed into the oral cavity.

They are

(1) Conical- straight/angulated abutments

(2) Multiunit abutments

(3) Ball abutments

(4) Locator abutments

Neck

This part is highly polished in-order to avoid inflammation of the gingival tissues. This part of

implant is elastic in nature which can bend up-to 15°-25°.

Implant Portion

They had an greater diameter threads which compress the cancellous bone and make to dense cortical bone. KOS plus implants were used to employ into the buccal and lingual cortical plates using basal cortical screws which is present in the apical third of the implants seen only in KOS plus implants[6].

School of Thoughts for Basal Implants

There are two schools of thoughts in case of osseointergration of these basal implants one school combines both BOI and screw implants for atrophied maxilla and mandible. Up-to 7 to 12 implants were placed. This was given by French school of scortecci. The second school of thought implies only few implants placement usually in the canine and molar region. This has high flexibility so it can be used for fixed restoration[7].

The materials used vary according to different company,

1. Screw able basal implants.
2. Lateral basal implants.
3. Compression screws.
4. Combination devices.

Techniques for Placing the Implants

The procedure is quite simple and easy it does not need a comprehensive procedure herea single pathfinder osteotomy drill can be used. This contains a drill for single osteotomy which is acceptable for BCS, KOS AND KOS plus implants (fig 5). These drills are present in the kit, which also contains many other drills for composed osteotomy procedure. Usually basal implantology does not recommend for the raising the flaps. But only for BOI the flap is raised laterally, so the implant structured along with the drill to form a T shaped osteotomy, so that implants are placed then flaps are closed and sutured.

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Fig4: Basal implants

BCS and BOI implants - PERI- implant healing.

Since these basal implants are mostly polished they have a unique healing of peri implant tissues. Osseo-adaptation is another term used for osseo-intergration in basal implantology. Because of a constant functional load the bone undergoes remodelling and adapts to the implant surface. In (fig 6) the basal osseo-intergated implants are used.

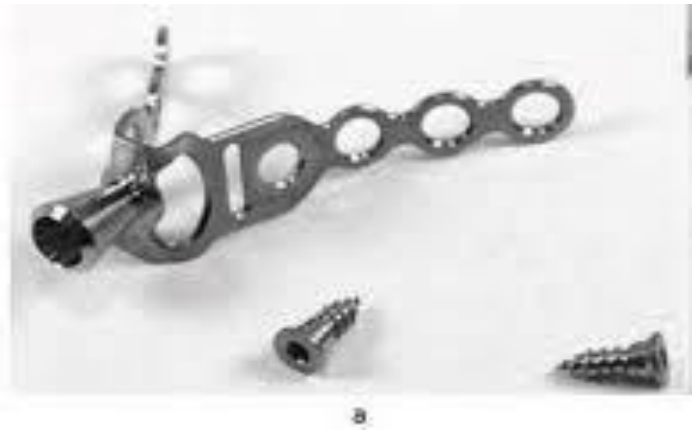

Fig5: Basal Osseo-intergrated implants

Bone multicellular unit leads to osseo-adaptation in basal implants. This has a cutting cone and tail, were cone leads to osteoclastic activity and tail leads to osteoblastic activity. When these BOI and BCS implants are immediately loaded, the BMU is formed where the formation of peri-implant bone formation and healing takes place.

This follows the phases occurs

1. Activation Phase
2. Resorption Phase
3. Reversal Phase
4. Progressive Phase
5. Mineralization Phase
6. Dormant Phase

Activation Phase

This phase last for 3 days. The human mesenchymal cells or precursor cell evolve into osteoblast and osteoclast.

Resorption Phase

Here the osteoclastic activity happens with rate of 40µm/day. This discloses the spongy bone

Reversal Phase

Here the osteoblastic lay down takes place at rate of 1-2µm/day. Where new bone is formed inside the haversian canal.

Progressive Phase

This phase last for 3 months which involves increase in bone density by formation of the concentric lamella into the haversian canal. Here the diameter of canal is reduced to 40 to 50 µm.

Mineralisation Phase

This phase has two stages primary and secondary. Where 60 percent of mineralisation takes place which initiates the hardness of bone. After which secondary phase begins and lasts for upto 6 to 12 months here the bone becomes fully osteoid/ mineralised.

All over these phases there is continuous formation of BMU were there is compact bone formed that adapts over the implant surface this leads osseo-adaptation. This is the 4^{th} dimension remodelling.

In terms of peri-implant healing bone compression and micromotion takes place in the overall healing process so they are also known as orthopedics implants

Whereas in KOS AND KOS PLUS implants the surface treatment is done and process of bone remodelling and osseo-integration takes place.

In Atrophic Ridges

Mostly atrophic ridges needs a comprehensive treatments. But basal implants nullifies all these surgeries. In augmentation procedure also the combination of this Basal Implants and conventional implants can be used. Before reconstruction of atrophic maxilla and mandible there are certain things to analyzed.

Properties

Systemic Properties

The patient who has a history of chemotherapy, cerebrovascular injury, myocardial infarction and patient under immunosuppressant therapy should be considered. Other than that patient with diabetes controlled under medication can undergo basal implant surgery.

Biomechanical Properties

The bone density, implant placement and drilling array of BI is totally contrasting from that of conventional implants. So there also no stress shielding phenomena to be considered in basal implants.

Does these implants get immediately loadeds??:

In BI constant state of torsion is present with perpetual lateral stress applied on to cranial bone. There is constant lateral forces act onto implant which is not loaded. Usually these BI can be loaded immediately after 3 days to 8 weeks of implant placement which is followed by temporary restoration.

Maxilla or mandible 1st reconstruction?

Mandible is first restored since maxilla is static and mandible is motile unit. So mandible is restored 1st by fixed restoration. So that the drawbacks due to conventional removable prosthesis can be avoided.

Treatment

Atrophic Mandible

There are two schools of thoughts for rehabilitation of atrophic ridges

(i) Strategic implants- German school

(ii) Multi implants- French school German school for strategic implants:

This strategic implant positioning was introduced by Dr. Ihde, where he has placed a total of four implants in the mandible in canine and second molar region so that the forces are redirected and torsion also occurs that was can regained by the flexile prosthesis.

French School for Multi-Implant

Scortecci proposed this concept here basal and crestal implants were used in combination. Accordinglysevento twelve implants were placed in mandible. This combination technique provides rigidity without torsion and re-direction of forces this leads to failure of implants because of occurrence of osteolysis

Surgical Technique

At 1st the site to be operated is anesthetized using the lignocaine. Then the tooth was extracted and the region was debrided. Then by drill from the cortex of the alveolus till the basal cortex. Implants where placed in

Infra - Nerval Technique

Mostly in atrophic mandibular ridge the inferior alveolar nerve is near to crest of the mandible so placement of crestal implants were difficult. To overcome this BOI are used where osteotomy is done 2-3mm below the nerve. So that BOI basal disk can be seated into it. Placement of implants in the maxillary anterior region mostly the nasal floor is engaged, for premolars the buttress of naso-maxilla was engaged. Then for the molar the pterygoid plates where engaged.

In case of mandible the implants are placed in the infra-foraminal region. Basically the length of the implants was estimated from the dip from the basal bone engagement[9].

Atrophic Maxilla

Since maxilla has spongy and pneumatic bones few techniques are followed for both,

(i) Spongy bone – compression screw implants.

(ii) Pneumatic bone- sinus section technique.

Zygomatic screw.

Pterygoid screw.

Cortically fixed- once.

Sinus section technique: The wall was segmented to 2 to 3 inch such a way that basal disk of implant were seated into sinus. In this method only one implant in each sinus can be placed. Sinus membrane was lifted and grafting was done in-order to attain a bi-cortical anchorage.

Zygomatic Screw

They have cortical screw with sharp edge that provide abi - cortical anchorage. It engages into the zygomatic bone.

Tubero - pterygoid screw: This technique is combined along with sinus section technique at an angulation of 20˚-45˚. The angle between BOI and TPG should be less than 90◦ so that prosthesis placement is easy[12].

Cortically fixed - once: Dr. Henri Diederich proposed this protocol in the year 2013. These properties are similar to basal cortical implants without any need for extensive augmentation surgeries. They consist of mini-plates with abutment screw. Here the plates are adapted to the bone and stabilized by the abutment screw this mimics the fracture reduction procedure. This can enable the elasticity similar to bone and reduces the number of bone cavity needed[17].

Complications

When the chewing or mastication forces were transmitted through basal implants which produce microcracks in cortical bone. But this can be compensated by the formation of 2˚osteon which is the process of remodelling but this for short duration. There is formation of porosity in the bone. The microcracks which are formed between the bone and implant interface leads to osteolysis. There are rare complication such as hemolaria and eptaxis[25]. Radiographically this was revealed as diffuse border. But basal implants as ability to inter-grate to bone again if the amount of load and microcracks are reduced.

Conclusion

For construction of atrophic maxilla and mandible the newer implants known as Basal Implants were introduced, So these implant placement procedure were not that extensive as conventional. BI can be used in combination with crestal implants for success of treatment. BI involves principle *"Primum Nihil Nocere"*, i.e., "First Do No Harm". In this review the different BI, concepts, techniques, design, procedures complications were discussed for better knowledge on BI.

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