Volume 9, Issue 8, August – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG1462

A Comprehensive Overview of Basal Implants

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Abstract: Basal implants represent a relatively recent advancement in dental implant technology, providing numerous benefits compared to traditional implant systems. These implants are strategically positioned in the basal bone, which possesses greater density and stability than the conventional jawbone. Specifically designed for fixed rehabilitation in cases of significant jaw atrophy, various designs of basal implants are currently available. This review seeks to detail the characteristics of basal implants and to highlight the distinctions between them and conventional implants.

Keywords:- *Basal Implants, Bicortical Anchorage, Osseoadaptation, Immediate Loading, Single Piece Implants.*

I. INTRODUCTION

The restoration of an edentulous maxilla or mandible using implants has evolved into a standard and reliable treatment option in contemporary dentistry. For the successful and uncomplicated placement of implants, it is crucial to ensure the availability of adequate bone, specifically a minimum length of 13-15 mm and a width of 5-7 mm.[1,2] If these criteria are not met, the treatment planning for implant placement must be comprehensive, taking into account the restoration of lost alveolar dimensions to achieve a predictable and successful treatment outcome. Such procedures may include inlay or onlay alveolar grafts, nerve repositioning, sinus lifts, and even nasal lifts; without these interventions, the success of conventional implant treatments may be significantly compromised.[3] An alternative to these procedures for replacing implants in atrophic jaws is to modify the design of the implants. Over the past few decades, two highly effective implant designs and protocols have been established for this purpose: Mini Dental Implants and Basal Implants.[4]

Basal implantology, often referred to as bicortical or cortical implantology, represents a contemporary approach to dental implant systems. This technique leverages the basal cortical regions of the jawbone to secure dental implants that are specifically engineered for placement within these basal cortical areas.[5] The basal bone offers superior quality cortical bone, ensuring optimal retention for these innovative and advanced implants.[1]

Basal implants were primarily designed for immediate loading applications, particularly in cases where there is insufficient vertical bone height, such as in atrophied ridges. These implants are also referred to as lateral implants or disk implants. The distinction between these two types lies not only in their insertion techniques but also in the manner in which forces are transmitted.[6]

This article explores the various types of basal implants, the limitations of conventional implants, and associated advantages of basal implants.

II. DRAWBACKS OF CONVENTIONAL IMPLANTS: [7]

- Usually require large and dense bone.
- Requires wide bone at crest to accommodate the implant neck, which many patients lack. Also this bone is more prone to resorption.
- Prosthesis cannot be loaded immediately if it is placed in less dense bone, might take from 3 to 6 months.
- Limited sizes and designs available, cannot be used in complex cases.
- Additional bone augmentation surgeries required which increase the cost and timespan of treatment.
- Not suitable to patients who are smokers, diabetics and have uncontrolled gum disease.
- As they are rough surfaced, more prone to periimplantitis.

III. REASON FOR BASAL IMPLANTS / CORTICAL BONE ANCHORAGE

Basal implants utilize cortical bone anchorage to ensure stability and support. The denser and stronger nature of cortical bone, as opposed to cancellous bone, facilitates improved osseointegration and minimizes the likelihood of implant failure. These implants are strategically positioned to make contact with the cortical bone, thereby enhancing their stability and anchorage. [4]

Basal implants represent a distinct category of dental implants, differing from conventional implants in their placement and reliance on cortical bone anchorage. This anchorage involves securing the implant within the cortical bone, which is the robust outer layer encasing the softer, spongy bone. [8]

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Cortical bone anchorage is a pivotal characteristic of basal implants, believed to offer superior stability and support compared to traditional implants that are anchored in spongy bone. Numerous studies indicate that implants anchored in cortical bone achieve higher success rates and enhanced stability relative to their traditional counterparts. For instance, research conducted by Ihde et al. (2010) reported a remarkable success rate of 97.8% for basal implants secured in cortical bone, surpassing the success rates typically associated with traditional implants. [5]

In addition to providing enhanced stability, cortical bone anchorage permits the immediate loading of the implant, allowing for the placement of a crown or bridge shortly after the implant's insertion. This capability arises from the higher density of cortical bone, which exhibits greater resistance to stress compared to spongy bone, thus making it more suitable for immediate loading. [1]

Nevertheless, there are certain drawbacks associated with cortical bone anchorage. A significant challenge is the limited availability of cortical bone in specific regions of the jaw, particularly in the posterior mandible. Bicortical anchorage technique is used to overcome this, which involves anchoring the implant in both the cortical and spongy bone layers for increased stability. [9]

➢ *Types*

There are two categories of basal implants: [7] [10]

- BOI (Basal Osseo Integrated) - This type is inserted from the lateral side of the jawbone and necessitates a minimum bone height of 3 mm.
- BCS (Basal Cortical Screw) - This implant features a screwable design with a thread diameter of up to 12 mm and is positioned in sockets right after tooth extraction. It is inserted similarly to a traditional implant; however, it directs loads exclusively into the opposing deep cortical bone.

➢ *Indications: [1] [7] [11]*

- Conditions such as the absence of multiple teeth or the necessity for tooth extraction.
- Complications arising from a two-stage implant placement or bone augmentation procedure.
- Various forms of bone atrophy, including extremely narrow ridges (such as high knife ridges, where the thickness of the crestal buccopalatal bone is less than 2 mm, and pencil mandible) and inadequate bone height.

➢ *Contraindications: [12]*

- *Absolute Contraindications*

✓ Patients receiving high doses of intravenous bisphosphonates for conditions such as osteoporosis or cancer, as well as those on anticoagulant therapy.
✓ Individuals with epilepsy.
✓ Patients currently undergoing radiotherapy for cancer treatment.
✓ Those with severe cardiovascular disease or who have experienced a stroke within the past six months.
✓ Individuals with a known allergy or hypersensitivity to titanium alloy.
✓ Patients diagnosed with acquired immunodeficiency syndrome (AIDS).
✓ Individuals under the age of 15.

- *Relative Contraindications*

✓ Patients exhibiting bruxism, teeth clenching, malocclusion, or a history of dental fractures linked to psychological issues.
✓ Individuals with facial or trigeminal nerve neuropathy.
✓ Patients with poorly controlled diabetes.
✓ Lesions present in the oral mucosa.
✓ Individuals who smoke.
✓ Patients with inadequate oral hygiene.
✓ Infections affecting adjacent teeth, including periodontal pockets, cysts, or granulomas.

➢ *Advantages: [1] [11] [13] [14]*

- Prosthesis Loading - The prosthesis can be secured within 72 hours following implant surgery, significantly reducing both time and costs. This approach eliminates the need for provisional prostheses entirely.
- One Piece Implants - Being single-piece constructs, these implants reduce the likelihood of failure associated with interface issues that are common in traditional implants.
- Cortical Bone Support - These implants derive support from the basal bone, which exhibits greater resistance to resorption compared to conventional implants.
- Minimally Invasive - Typically, these implants are placed using a flapless technique that requires minimal bone removal, resulting in reduced postoperative swelling and facilitating rapid, uncomplicated healing at the surgical sites.
- Indicated in Compromised Cases - Basal implants are particularly advantageous as they can effectively utilize existing bone, thereby minimizing the need for bone augmentation procedures, sinus lifts, or nerve repositioning.
- Better Distribution of Functional Loads - Anchored in high-quality basal bone, basal implants ensure that biomechanical loads, such as masticatory forces, are evenly distributed to the cortical bone areas, which are highly resistant to resorption and possess excellent repair capabilities.
- Occurrence of Periimplantitis - The smooth surface of basal implants significantly reduces the risk of peri-implantitis by nearly 98%.
- Systemic Compromised Cases - Basal implants are effective for patients with controlled diabetes, smokers, and individuals suffering from chronic destructive periodontitis.

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➢ *Disadvantages: [7] [12] [15]*

- Skill- The successful execution of the surgical procedure is contingent upon the skills of a properly trained operator. In contrast, if performed by individuals lacking experience or training, complications are likely to arise.
- Excessive reduction of sound bone in instances where there is adequate bone support.
- Overload osteolysis may occur if the distribution of load is not managed appropriately.

IV. COMPLICATIONS: [6] [16] [17]

- Functional Overload Osteolysis - The phenomenon of overload osteolysis surrounding a singular implant, attributed to excessive cuspal contact, has been noted. An occlusal adjustment was performed to address this issue. To mitigate the risk of overload osteolysis, it is advisable to implement a bilateral balanced occlusion, group function, mutually protected occlusion, and a lingualized occlusion.
- Infection - According to Shahed et al., basal implants have the potential to cause submucosal infections. Such infections may lead to the involvement of the vertical components of the implants if they are positioned beneath the mucosal level over time, thereby obstructing the necessary pathway for drainage as the entry point becomes sealed with scar tissue. Inflammation of this nature can propagate similarly to a submucosal abscess and is managed through analogous treatment methods.
- Temporary Symptoms - Symptoms may include pain, swelling, difficulties in phonation, and inflammation of the gingival tissue.
- Persistent Symptoms - Chronic complications associated with implants may manifest as ongoing pain, persistent paraesthesia, dysesthesia, resorption of maxillary or mandibular ridge bone, localized or systemic infections, the formation of oro-antral or oro-nasal fistulae, adverse effects on adjacent teeth, implant fractures, issues related to the jaw, bone, prosthesis, or aesthetics, nerve damage, exfoliation, and hyperplasia.

Table 1: Differences Between Basal & Conventional Implants: [1] [11]

	BASAL IMPLANTS	CONVENTIONAL IMPLANTS
INDICATIONS	Extraction sockets and regions with diminished bone height and width	Requires adequate bone height and width for proper placement
LOADING	Can be subjected to immediate loading within 72 hours	The loading process may be delayed for a period of 3 to 6 months
BONE DISPLACEMENT	This approach results in minimal to no bone displacement and demonstrates increased resistance to resorption	Significant bone displacement and loss can occur, which varies depending on the size and length of the implant
MECHANISM OF INTEGRATION	Osseoadaptation	Osseointegration
ARMAMENTARIUM	Simple	Complex
SURGERY	These procedures are generally flapless and are more time-efficient as compared to traditional bridgework	These procedures are generally more complicated and often require 3-4 sittings over an extensive period of 3-6 months
COST	Cost effective	Expensive
CRITERIA	There are no specific criteria necessary for the placement of basal implants	Sufficient bone density and overall physical well-being are essential for the successful placement of conventional implants
COMPLICATIONS	Less frequent	More common
BONE QUALITY	Basal implants are positioned within the basal bone, which is characterized by its high mineralization, significant density, and reduced tendency for bone resorption.	Traditional implants are inserted into the crestal alveolar bone, which typically exhibits inferior bone quality and a higher tendency for resorption
MAINTENANCE	This approach necessitates less maintenance effort from the patient	This approach necessitates greater maintenance efforts from the patient
SINUS LIFT	Eliminates the need for supplementary sinus-lift surgery.	In cases where conventional implants are to be positioned in the atrophic posterior maxilla, sinus-lift surgeries may be required
SIZE & DESIGN	Wide range of sizes and designs	Limited designs
ANCHORAGE	Basal implants are firmly anchored in the dense, mineralized basal bone, which exhibits a lower tendency for resorption	Embedded within the crestal alveolar bone, which exhibits inferior quality and a higher susceptibility to infection
TECHNIQUE	They utilise bi-cortical anchorage	Engages to a single cortex
IMPLANT STRENGTH	Basal implants derive their strength from single-piece implants	Traditional implants consist of two components, and the relationship between these parts frequently leads to complications

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG1462

ELIGIBILITY OF PATIENT	Suitable for all patients	Individuals who smoke and those with diabetes are contraindicated
IMPRESSIONS	These procedures are straightforward and utilize standard impressions of the implants, which can be created using typical bridgework techniques	These procedures necessitate various types of impressions, such as open tray and closed tray, and typically entail a longer duration of chair time
PROSTHETICS	An uncomplicated prosthesis designed for immediate loading, resulting in reduced chairside time	A complex prosthesis that can only be loaded after a designated duration, requiring additional time at the chair side.
ENDOOSSEOUS SECTION	Flat or blade like surfaces with spaces to permit	Screw shaped with machine or HA coated surfaces
MUCOSAL PENETRATION	The smooth and polished surface of the vertical implant body minimizes penetration, thereby decreasing the likelihood of postoperative complications	Larger than basal implants, these devices present an increased risk of peri-implantitis, vertical bone loss, crater-like bone loss, and various other infections
MASTICATORY FORCES	They are transferred to the basal plates within the cortical bone, which possesses the ability to support substantial loads and demonstrates an enhanced capacity for regeneration.	Forces exert their influence in the vertical direction along the edges of the screw structure.

V. CONCLUSION

Basal implants serve to provide support for both single and multiple unit restorations in the upper and lower jaws. They can be inserted into extraction sockets as well as into healed bone. Their unique structural properties facilitate placement in areas where bone height and width are insufficient. These implants can be positioned using either a flap or flapless technique. A comprehensive understanding of maxillofacial anatomy is essential to ensure bi-cortical engagement is successfully achieved. The approach of basal implantology addresses all issues associated with traditional (crestal) implantology. It is a patient-centered therapy that effectively meets the needs and expectations of individuals.

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