ORIGINAL RESEARCH PAPER

Dentistry

KEY WORDS: Atrophic ridges, Cortical implants, Immediate loading, Prosthetic consideration.

BICORTICAL IMPLANTS: GRAFT-LESS APPROACH TO RESTORE RESORBED RIDGES

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ABSTRACT

Patients with severely atrophied jaws present a serious clinical challenge for the fabrication of removable dentures or the surgical implant placement. They may require extensive surgical interventions to increase vertical bone height with or without sinus lift. Bone augmentation and long period of time for bone healing is an additional enigma. Basal implantology, a new category of treatment with new broad indications and almost low degree of limitations are considered the first therapy of choice in patients with moderately and severely atrophic jaw bone. They are used to restore single or multiple unit restoration in both the jaws. These use the anchorage from basal bone, thus allowing the immediate loading of the prosthesis which helps the patient in quickly resuming their normal life. Through this article we examine in subtleties about basal implants.

INTRODUCTION-

Dental implantology is a very broad field; the most widely accepted treatment modality for the prosthetic rehabilitation of the missing teeth. One of the significant factors affecting this field is the age of patients. When teeth are lost or extracted alveolar atrophy occurs. The reduction of the alveolar bone occurs at the buccolingual as well as apico-coronal dimension of the alveolar ridge at the edentulous site ultimately resulting in a short and narrow alveolar ridge.[1]

Interestingly, we have different school of thoughts in implantology; Swiss, French, German and Italian school of thought. Conventional (two-piece) implants according to the original Branemark's Protocol (Swiss school of thought) following the delayed loading; i.e., fabricating the supra structure and prosthesis after a sufficient healing of fixture being engaged in alveolar/cancellous bone of the jaws.[2]

Bicortical implantology refers to lateral insertion of the disk form implants into the basal bone. [3] The concept follows Italian protocols where fixture is engaged in the cortical/ basal bone and thus making it possible to immediately provide the prosthesis and fabricate the fixture in function. These implants work on the basic principle of Orthopaedic Surgery or Traumatology i.e., immediate functional loading therefore also known as Orthopaedic implants. [4] Basal cortical bone provides main anchorage in these implants as it is known to be free of infection and is least prone to resorption. [1] Lateral implants differ from conventional root form implants in the way of insertion, transmission of the forces and most important factor that is Osseo-fixation. [3] Also these provide excellent retention and primary stability therefore allowing early or immediate fixed prosthesis restoration. Additionally, the properties of basal implantology have made maxillofacial Prosthodontist around the world to utilize it for replacing eyes, ears and nose within an irradiated bone. [5] This article will audit the unique structures of these implants and a better understanding of Cortical Implantology.

Historical Evolution-

Since ancient time the pursuit for rehabilitation of severely resorbed ridges or thin and narrow ridges has captivated humanity. With long historical perspectives, humans have worked and done a lot of research studies to bring dental implants into acceptance to restore missing teeth.

Basal implants were developed in account to rehabilitate atrophic ridges. The French and German dentist studied and improved it in various stages as described in Table-1.[6]

Table-1 Evolution Of Basal Implants

PERIODS	TIME
1972	Jean-Marc Julliet developed and used first single piece implants.
1980's	Dr. Gerard Scortecci improved basal implant system and surgical tools Disk implants with internal and external connectors attached to prosthetic superstructure.
Mid 1990's	Disk implants system and armamentarium was introduced.
1997	Dr. Stefan Ihde introduced Lateral Basal implants
2002	Fracture proof base plate was fabricated and bending zoned were developed in the vertical shaft of implant.
2003	Basal implants with Polished surface were produced.
2005	Basal Compression Screw implants was introduced.

Classification-

A generic terminology has been developed to facilitate communication among implant team members. Regardless of the implant system used, the generic term is descriptive of the function of the component. The morphology and design of the implant should be compatible with the biologic tissues such that the load transferred on the bone is dissipated and distributed equally to prevent the failure of implant supported prosthesis. These single-piece implants are designed in unique and a specific manner so that they could take the anchorage directly from the basal cortical bone which is stronger, resistant to infection and less resorption occurs. These are classified based on the shape, design, morphology, surface characteristics, and chemical composition or mode of insertion [Figure. 1].[3,4]

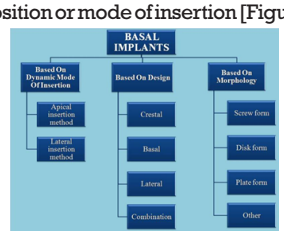

Figure 1: Classification of Basal Implants

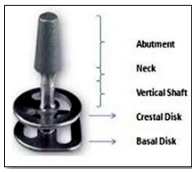

Figure-2: BOI Implant

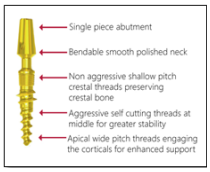

Figure-3: BCS Implant

Surgical Techniques-

A different surgical approach is used for preparing the osteotomy site to place the basal implants, which is simpler and easier to execute without extensive drilling thus preventing thermal injuries. An implant bed is created using osteotensors which is accordant with the design of implant placed. In the recent trends implant are featured with a self-tapping thread which leads to compression of the bone while positioning the implant in the osteotomy site. For BOI [Figure.2] implant generally a T- Shaped osteotomy site is created while for BCS [Figure.3] implant a straight apical osteotomy is prepared which is practically left unobturated after immediate insertion of implant. [4, 7] Before the preparation of the site a wide flap is raised so that it does not hinder placement of Disk-implants, while BCS implants are generally placed flapless. To engage a BOI, implant the minimum vertical height should be 3mm and the ridge should be wide enough, in contrast the BCS implants are placed in the narrow ridges. To restore maxilla, with a pneumatized sinus either a sinus section technique is used or the support is gained by pterygoid or zygomatic implant. [8]

Flapless / open key-hole placement – Most of the cases are performed with flapless insertion of implants as it is minimally invasive leading to less post-op pain and swelling. Minimal bone cutting is involved in this technique. Bone around the surface is condensed while insertion by the self-tapping property of implants. The advantage of this technique is the stimulation of rapid healing which is uneventful generally but increases the patient's comfort level. [3,9]

Restoring Atrophic Maxilla – Full mouth rehabilitation involves placement of multiple implants in the maxillary ridge with diminished vertical height. With the advancing age and bone resorption it has been seen that sinus gets pneumatized. Therefore, a Trans-Sinus approach [Figure. 4] is used by placing the BCS implants anterior and posterior the sinus wall taking the support from tubero-pterygoid bone and in the anterior region the nasal bone provides the anchorage for the implant. [3,9]

Restoring Atrophic Mandible –While inserting the implants in deficient mandible, the inferior alveolar nerve is found in very close proximity. Therefore, IAN bypass technique [Figure. 5] is used where the load transmitting disk is placed under the nerve. This is done by exposing the nerve at the planned implant site and placing the implant laterally in a proper orientation. The disk is usually positioned in the 2nd cortical which gives better Osseo-fixation and load transmission. [3]

Cortically fixed @ once – This recent protocol is developed in 2013 by Dr. Henri Diederich aiming to restore the jaws irrespective of the available bone. It is similar to mini-plate implant design with the abutment connectors which are bendable and can adapt to any surface. These implant use bone expanding mini screws for anchorage with an advantage of their iso-elastic property it mimics the bone well. [11]

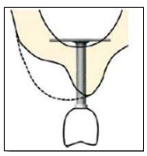

Figure-4: Trans -sinus approach

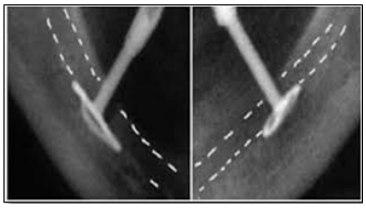

Figure-5: Infra-neural approach

Osseoadaptation-

Degree of osseointegration achieved and their permanence in functionality can be demonstrated to validate the long-term success of implant restoration. The peri implant healing in cortical implantology is simulated and preserved by an Osseo-protective mechanism and is termed as Osseo-adaptation or Osseo-fixation. [12] The remodelling of bone under the continuous functional stimulus is considered to be the 4-D in basal implantology. In the process of healing after placing basal implants it shows dual integration i.e., primary stability is achieved by Osseo-fixation and later other parts show adaptation via osseointegration. [13]

Osseo-adaptation is a process that occurs with the help of Bone Multi-cellular Unit (BMU) which consist of cone cutter with a tail containing osteoclast cells (leading to resorption) in the cone cut area and osteoblast (leading to bone formation) in the tail region with an intermediate zone known as reversal zone [Figure. 6]. [3, 14] The formation of BMU occurs when the BOI or BCS implant are inserted as it creates the micro-cracks in the bone when subjected to continuous immediate loading which initiates healing and starts bone remodelling between the implant an already present native basal bone. The Frost concept in modern bone biology comprises of bone resorption followed by bone formation. The following phases are appreciated in the cascade: Activation, Resorption, Reversal, Progressive, and Mineralization, Dormant phase. [1,3,and15]

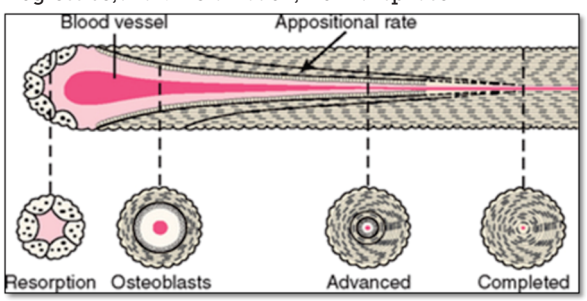

Figure-6: Bone Multi-Cellular Unit (BMU)

Prosthesis Design-

Basal implants are used almost exclusively to support fixed prosthetic restoration. These implants can be combined with natural abutments or enossal implants for better anchorage. Depending on the condition the question arises that whether a rigid or elastic implant restoration should be established. Particularly in cases where implant placement, tooth extraction or flap reflection is performed in aesthetic zone, the patient should wear a long-term temporary bridge.

A. Single Tooth Restoration-

There are two techniques for single-tooth restorations, each with its advantages and drawbacks:

1. Screw-retained restoration directly on the Diskimplant®, when gingival thickness is less than 4 mm, or on a cylindrical transgingival titanium Monobloc abutment (ref. PLM-3.5).
2. Cement-retained restoration on a two-piece hex abutment post that is screw-secured directly onto the DiskimplantR or to a transgingival cylindrical Monobloc abutment.

B. Full-mouth Restoration-

There are two main protocols to obtain temporary immediate loading full-arch prosthesis, the chair-side or direct

technique, in which a conventional denture is adapted immediately after placing the implants, and the laboratory or indirect technique, in which impressions and bite registrations are obtained after implant placement and the laboratory fabricates the immediate loading prosthesis within several days.

CONCLUSION –

Cortical implantology has paved the way for rehabilitation of severely atrophic ridges along with easy and immediate prosthetic restoration and is a viable modality as there is no involvement of extensive augmenting procedure. It is a customer-oriented therapy, which meets the demand of patients ideally. Also, the missing teeth can be replaced with the minimum invasive procedure leading to less post-operative pain. The management of complete edentulous arches can be achieved safe and reliable as best alternative to augmenting procedure.

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