IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 1 Ser.2 (January. 2024), PP 04-08
www.iosrjournals.org

Dental implants in compromised Bone -Review article

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Abstract:
Despite the developing variety of publications in the field of implant dentistry, there are limited studies that investigate the biology and metabolism of bone healing around dental implants and their implications in compromised bone. The purpose of contemporary dentistry is to restore the tooth to normal contour, function, comfort, aesthetics, speech, and health by removing a disease process from a tooth or replacing teeth with a prosthesis. Teeth are designed for a lifetime but often patients lose teeth completely because of causes such as dental caries, periodontal problems, accidental trauma, etc.[1] Dental implants can be considered as one of the treatment options which has gained more popularity nowadays because of their positive, long - term results and better osseointegration with underlying bone. They provide excellent support for fixed as well as removable prosthesis, which increases function, compared with conventional complete and partial denture prosthesis.[2] The loss of teeth results in resorption of the surrounding alveolar bone and leads to atrophic edentulous ridges. Initially, there will be a loss of bone width, and height, and then height and width eventually. Sometimes disease, trauma, or atrophy due to the aging process also leads to this compromised quantity or quality of bone. So to overcome this some procedures are carried out to manage these patients which include bone augmentation procedures like guided bone regeneration, direct sinus lift, alveolar ridge split, and non - augmentation procedures like zygomatic implants, mini and tilted implants. Alternative methods for treating patients with compromised bone include zygomatic and lateral basal implants, neither of which typically require bone augmentation procedures[3]. This review article aims to provide a thorough understanding of the biological events and treatment modalities to be considered before placing implants in compromised bone.

Keywords: *dental implants, compromised bone, osseointegration, bone density*

Date of Submission: 25-12-2023 Date of Acceptance: 05-01-2024

I. INTRODUCTION:

The goal of modern dentistry is to restore the patient to normal contour, function, comfort, aesthetics, speech and health by removing a disease process from a tooth or replacing teeth with a prosthesis. Teeth are designing for the lifetime but often patients lose teeth partially or completely because of causes such as dental caries, periodontal problems, accidental trauma etc .[1]

Prosthetic options for lost teeth include fixed partial denture, removable partial denture and dental implants. Off the late dental implants has gained more popularity because of its unique advantages. Dental implants can be considered as a treatment option, which can provide patients with positive, long – term results.

Implants have developed into a viable alternative to conventional prosthetic reconstruction of edentulous areas. They provide excellent support for fixed as well as removable prosthesis, which increases function, compared with conventional complete and partial denture prosthesis. [2]

The success rate depends on factors like bone density, bone volume, force factors, osseointegration of bone around implant, and also depend on the treatment plan, and skills of a dentist. bone plays very important

role in success of implant. the bone can be analysed in terms of quality and quantity I,e., bone height, bone width.[3]

The loss of teeth results in resorption of the surrounding alveolar bone and leads to atrophic edentulous ridges. Bone loses width and then height, width and height eventually. Lack of adequate bone structure is a common indication for placing an implant and sometimes it a most common cause for failure of implant. so, bone plays a major role in both osseointegration phase as well as restoration phase.[2]

But patients with reduced quality and quantity of bone present a significant challenge, for example in case of trauma, disease, atrophy due to aging process leads to compromised quality or quantity of bone. So here are some methods for managing patients with compromised bone that includes bone augmentation procedures (onlay bone graft, guided bone regeneration, direct sinus lift, alveolar distraction osteogenesis, alveolar ridge split, enamel matrix derivatives, bone morphogenic proteins), and non augmentation procedures like (mini-implants, zygomatic implants, tilted implants).

II. DISCUSSION :

Bone is a highly specialized connective tissue with a mineralized extracellular matrix which provide support to human skeleton[1]. Bone matrix composed of collagen fibres with mineral salts. It consists of three types of bone cells like osteoblast, osteoclast, osteocyte which involved in bone metabolism and physiology. Bone is the primary reservoir of calcium and maintains serum calcium level by bone metabolism.

Human skeleton composed of two distinct kinds of bone namely dense cortical bone and spongy cancellous bone. Both of these are seen at every bone site. Generally cortical bone comprises of 85% and cancellous bone of 15% of total body bone.

Available bone is measured in terms of height, width, length, angulation and crown to root ratio. Ideally 1.5 mm of bone is maintained between implant and adjacent tooth. The height is measured from crest of edentulous ridge to opposing landmark. The denser bone may accommodate a shorter implant, and the least dense bone weaker bone requires a longer implant. Once adequate height is available for implants the primary criteria affecting long term survival is the width of available bone. The width is measured between buccal and lingual plates at the crest of implant site. For bone more than 5mm wide a minimum M-D length of 7mm is usually sufficient for each implant.

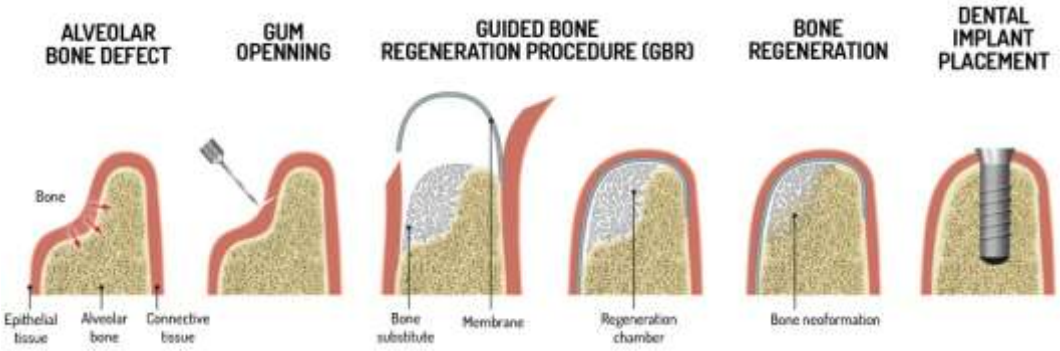
Compromised bone which is associated with poor regenerative property. For placing implants bone quality is the determinant of the success of osseointegration and retention of implant in alveolar bone[4]. So, for the success of implant in compromised bone, factors like cellular, vascular, morphologic which are responsible for osseointegration should be considered. A bone volume of atleast 10mm vertically and 5mm horizontal is needed for successful implant placement.

Implant placement, including position, angulation, and selection of appropriate length and width is crucial for allowing aesthetic, functional and biomechanically sound implant prosthesis. The implants can no longer be placed just where the bone is, but that bone grafting should be done in situations where fixture position otherwise would compromise the final prosthesis. If the bone graft is not done, then the fixtures should not be placed in a compromised bone.

Bone augmentation materials can be judiciously incorporated or stimulate bone growth in areas where it is lost as a result of pathologic, traumatic, or physiologic processes. They are further classified into osteoconductive and osteoinductive materials. Osteoconductive materials are biocompatible made up of HA, beta- tricalcium phosphate. Most common osteoconductive bone graft materials used are alloplasts and allograft. The most commonly used osteoinductive materials are allografts and autografts.

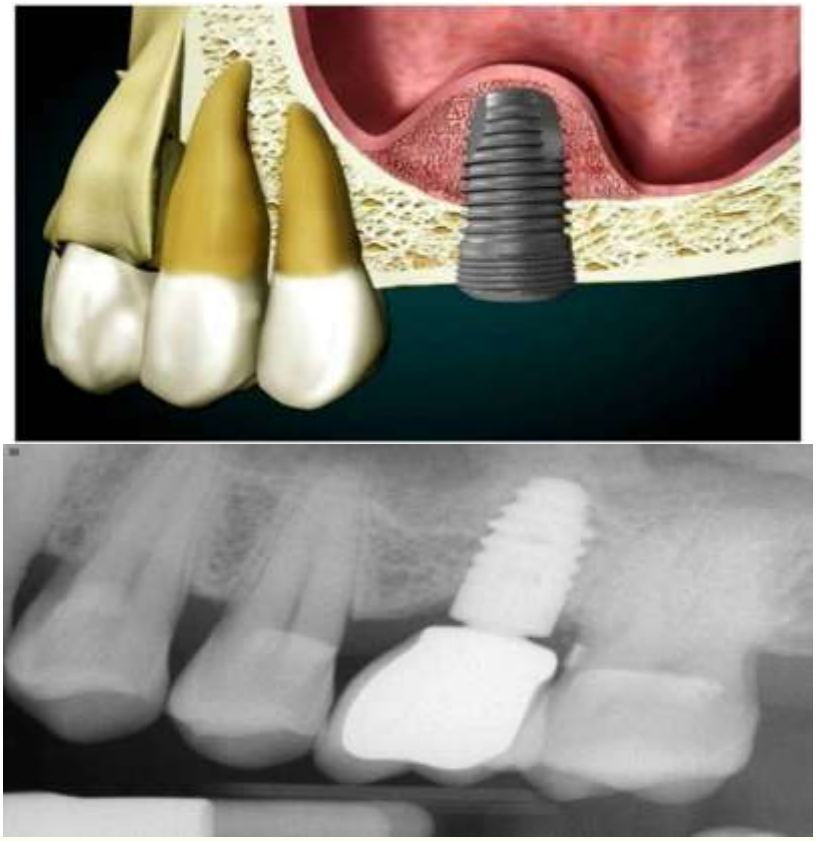
Bone augmentation procedures:

Guided bone regeneration: surgical technique which involves the use of barrier membranes with particulate grafts or/and bone substitutes. The rationale of alveolar augmentation by guided bone regeneration is primarily based on migration of pluripotent and osteogenic cells and also prevents migration of undesired cells within first 24hours. later graft material which is filled inside blood releases growth factors and cytokines to attract neutrophils and macrophages. The clot is then replaced by granulation tissue. Mesenchymal cells of granulation tissue form the mineralised and then forms woven bone(figure-1).



[Table/Fig-1]:
Guided bone regeneration

Direct sinus lift: It is a ridge augmentation procedure which helps in increasing the amount of bone in posterior maxilla i, e,. premolar and molar by lateral window approach by lifting Schneiderian membrane followed by placement of graft materials like autogenous, allografts, etc. The procedure is recommended when residual bone is less than 5-6mm. only membrane elevation done by lateral sinus wall which was described by Boyne. Later implants are placed into their positions through created window. Then the elevated Schneiderian membrane is allowed to rest over implant base along with bone graft material inside the cavity. Significantly greater bone height is achieved through this technique(figure 2).



[Table/Fig-2]:
Direct sinus lift technique

Alveolar ridge split technique: this technique is also called as split crest technique which was described by simon et al 1992. This technique by creating a 4-wall defect provides an adequate width for implant support, protects the interpositional graft from exposure and displacement and vascularisation from both the buccal and lingual cortices and basal bone during healing phase. Minimum ridge width required for this technique is 3-4mm and an height of > 10mm is required to achieve primary stability during immediate implant placement. Most common complication is that malfracture of buccal plate (figure-3).

[Table/Fig-3]:
Ridge split technique

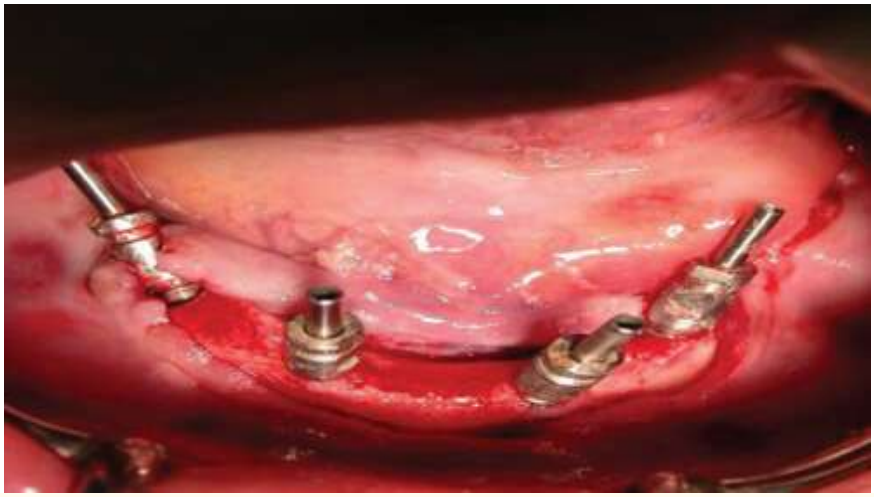
Non augmentation procedures:

Mini/short implants: dental implants of length <10mm are considered as short implants. Because of its positive clinical results, it has been accepted technique to avoid invasive bone graft surgery. In order to increase the osseointegration, use of wider diameter and rough surface along with shorter implant is advised. short implants may be splinted to each other or longer implants in fixed partial dentures to enhance force distribution (figure-4).

[Table/Fig-4]:
Mini implants

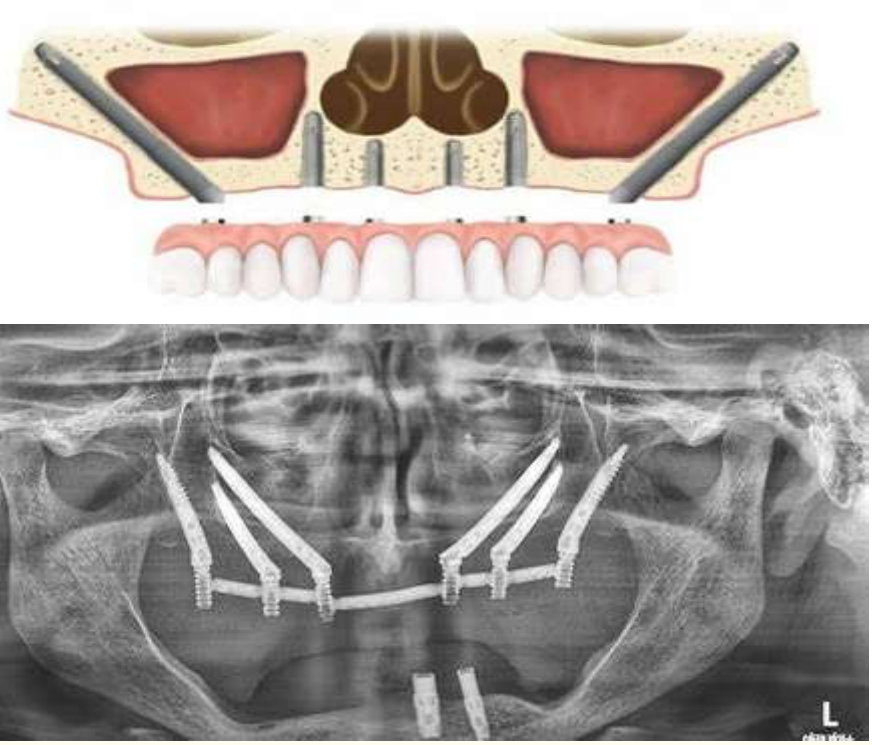
Tilted implants: Implants with an inclination greater than 15 degrees towards occlusal plane are considered as tilted implants. The rationale for using tilted distal implants is based on reduction of cantilever length and also helps in better load distribution of prosthesis support. Clinical evidence supports that use of

tilted implants gave adequate primary stability, and increased cortical anchorage, compared to axial implants (figure-5).



[Table/Fig-5]:
Tilted implants

Zygomatic implant: This technique involves the positioning of two bilateral implants of length between 35-55mm which is anchored to zygomatic bone followed by intrasinusal trajectory.These implants are alternative to bone augmentation and thus used in the rehabilitation of resorbed maxilla. Most frequent complication involved with these implants is palatal emergence which leads to prosthetic difficulties (figure-6).



[Table/Fig-6]:
Zygomatic implants

III. Conclusion:

For the success of implant the most important factors that determine the prognosis and aesthetics for every case are quality and quantity of available bone. A thorough medical and past dental history is most Important in success of implant treatment. Some medical conditions such as diabetes, bone diseases, and any pathological conditions associated with it should be carefully evaluated because they affect the volume of bone. The size, surface texture, thread pattern of implant should also be considered along with the type of bone graft material used for the success of implant. The amount of bone compression and the level of osseointegration required are more important factors in terms of compromised bone. so, in case of compromised bone, it is the responsibility of a dentist to make best use of available bone, and proper technique for the success of implant.

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