



## Ultra Short Dental Implants-A Review

<sup>1</sup>Dr.K.Sheela,MDS,Dr.A.T.Dinesh Kumar,MDS

<sup>1</sup>Senior Lecturer <sup>2</sup>Reader

<sup>1</sup>Department of Prosthodontics crown and Bridge,

<sup>2</sup>Department of conservative dentistry and Endodontics

<sup>1</sup>Sri Ramakrishna Dental College and Hospital, Coimbatore,Tamil Nadu.

<sup>2</sup>Sri Venkateshwara Dental College and Hospital,Chennai,Tamil Nadu

**Abstract:** Dental implants are widely used in the restoration of lost dentition either in fully edentulous or partially edentulous patients. A very high success rate of implant therapy has been observed over the years. In some sites, it is very difficult to obtain the amount of bone height to place these implants. Many techniques have been used to augment the alveolar ridge, especially in the posterior mandibular region. These approaches are highly technically demanding and a longer healing period is required, and can result in further complications. The use of short implants appear to be a valid alternative with reasonable evidence of a high success rate to bone augmentation procedures in the treatment of atrophic alveolar ridges.

**Keywords:** Short Implants,Biomechanics,Implant design.

### I. INTRODUCTION

Recent reviews indicate that short implants achieve the same survival rate as regular implants. Previously, any implant shorter than 10mm was considered a short implant. However, advancements in implant technology have shown that implants less than 6mm in length can also provide a high success rate. Over the last five years, the use of extra-short and short implants has become a widely accepted and viable treatment option for clinicians. Major companies like Straumann, Global D, and Bicon have introduced extra-short implants measuring 6mm or less to the market. These implants have demonstrated very high success rates in recent years. A retrospective study involving 1,287 short implants that were less than 8.5mm long reported success rates between 98.8% and 99.3%. This study confirms that short implants are a predictable treatment option. The favourable outcomes associated with short implants may be attributed to their high primary stability and the effective use of residual bone volume, resulting in a high primary bone-to-implant contact in dense bone structures.[1]

A study conducted by Misch involved the placement of 745 implants, measuring 7-9mm in length, in 273 patients. After following these patients for 1 to 5 years, he reported a survival rate of 98.9%, which is slightly higher than the results of the aforementioned study, despite the longer observation period, suggesting that longer implants might yield more successful outcomes. However, Renouard et al. discussed that the failure rate of short dental implants is often linked to the operator's skills and the routine surgical preparation, regardless of bone density.[2] They indicated that proper surgical preparation and the use of textured-surface implants could result in comparable survival rates between short and longer implants. Nonetheless, a longer follow-up period is necessary to obtain results that are more comparable to those of longer implants.

The choice of implant length, along with the quality and quantity of available bone and the biting force exerted, plays a crucial role in the success of dental implants and the durability of the prosthesis. While longer implants have traditionally been deemed more favorable, their placement in patients with advanced alveolar bone resorption presents significant challenges due to anatomical constraints. In the resorbed maxilla, these anatomical limitations include the maxillary sinus posteriorly, the nasal floor, and the naso-palatine canal

anteriorly.[3] Conversely, in the resorbed mandible, the inferior alveolar canal serves as the primary constraint. To address these challenges, advanced surgical techniques such as guided bone regeneration, block grafting, maxillary sinus floor grafting, distraction osteogenesis, and nerve repositioning can be employed to increase alveolar height and facilitate the placement of longer implants. However, these procedures can be complex, costly, time-consuming, and may lead to increased surgical morbidity. As an alternative, short implants represent a less invasive treatment option for cases involving resorbed ridges. There is, however, no consensus on what constitutes a short implant; most authors agree that implants measuring less than 10 mm are considered short implants (see Figure 1).[2]



FIGURE 1:ULTRA SHORT DENTAL IMPLANTS

### ADVANTAGES OF ULTRA-SHORT IMPLANTS

1. Bone grafting to address compromised height is not necessary.
2. The process is cost-effective, painless, and less time-consuming compared to various surgical procedures that precede implant placement.[1]
3. Complex surgical techniques often lead to complications during the procedure, such as bleeding, perforation of the Schneiderian membrane, or nerve injury. Additionally, post-operative issues may include transient or permanent changes in mandibular sensation, graft or membrane exposure, infections, and increased peri-implant bone loss, all of which can be avoided.[3]
4. Osteotomy preparation is made simpler since a shorter bone preparation is required at the implant site, allowing for direct access to water irrigation and minimizing the risk of overheating the bone.[3]
5. The insertion of implants is more straightforward. [4]
6. The angulation of the load is enhanced with a shorter osteotomy site, as the basal bone beyond the original alveolar ridge does not always align with the long axis of the missing tooth.[2]

### BIOMECHANICAL CONSIDERATIONS

They have been categorized as follows

#### 1) DIAGNOSTIC:

**A) IMPLANT DIAMETER:** The diameter of the implant is more efficient than its length for dissipating stresses. This is because the area that experiences the most force is the bone crest, with very little stress being transferred to the apical portion. While increasing the length may enhance primary stability, a wider implant not only improves primary stability but also increases the functional surface area at the crestal bone level, leading to better distribution of occlusal forces. Finite element analysis supports this idea, indicating that implant length may not be the primary factor influencing the transfer of occlusal loads to the bone-implant interface.[4]

**B) CROWN/IMPLANT RATIO:** A higher crown-to-implant ratio can create a vertical cantilever, resulting in crestal bone loss and potential implant failure. However, advancements in surface treatments and implant systems, along with proper force orientation and load distribution, have allowed for the successful use of high crown-to-implant ratios.[2]

**C) BONE QUALITY:** Bone quality is a key factor in the success of short implants. Areas with type III and type IV bone exhibit higher failure rates, regardless of the implant's surface treatment. The combination of short implant length and poor bone quality diminishes implant stability during both placement and the healing period[.2]

**D) LACK OF CANTILEVERS:** Cantilevers magnify forces in direct proportion to the height of the crown, creating six potential rotation points on the implant body. Eliminating cantilevers enhances biomechanics and increases treatment predictability.

**E) NUMBER OF IMPLANTS:** Utilizing multiple implants increases the functional surface area, helping to better resist occlusal forces.

**F) IMPLANT DESIGN:** The implant surface area can be increased by:

I. Thread number: The more the number of threads per unit length in the same axial plane, the more is the implant surface area, in contact with the bone.

II. Thread depth: Deeper threads provide more implant surface area.

III. Thread shape: The square thread design has a higher bone-implant contact percent as compared to the v shape and reverse buttress thread designs.

IV. Implant surface: As compared to the turned smooth surface, rough micro-topography of the implant surface increases the bone-implant contact surface area and accelerates osseointegration. It also compensates for an inadequate crown/implant ratio (Ref Fig 2).[5]



FIGURE 2: IMPLANT DESIGN

## 2) SURGICAL

**A) Two-Step Surgical Protocol:** A two-stage surgical approach is recommended for short implants, as it ensures good primary stability during the healing phase. The recommended time between the surgical and loading stages is 4-6 months for the maxilla and 2-4 months for the mandible.

**B) Adapted Surgical Protocol:** Improved initial implant stability can be achieved by modifying the standard surgical protocol, such as omitting the countersink drill or the final drill in the drilling sequence. For poor quality bone, a soft bone drilling protocol should be followed, and the final drilling should be performed with narrow drills instead of standard size drills.[3]

## 3) PROSTHETIC

**A) Implant to Abutment Connection:**

The Morse taper connection reduces marginal bone loss compared to the external hex abutment connection and encourages bone growth over the implant shoulder. The internal hex implant-abutment connection offers a wider distribution of forces compared to the external hex connection. Platform switching helps maintain the crestal bone along the entire length of the implant, up to the collar level (Refer to Figure 3).

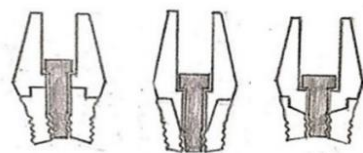


FIGURE 3: a) External Hex b) Morse Taper c) Internal hex

**B) OCCLUSAL TABLE:** A smaller occlusal table reduces the offset loads on the implant.

**C) INCISAL GUIDANCE:** Implants should adopt a biomechanical approach similar to that of natural teeth to accommodate the greater bite forces in the posterior regions of the mouth. Proper incisal guidance from the anterior teeth helps to eliminate lateral forces on the posterior teeth during all mandibular excursions.

**D) SPLINTING:** Splinting the implants increases the functional surface area of support and distributes less force to the prosthesis, cement, abutment screws, and the implant-bone interface, especially when placed in soft bone.

**CLINICAL GUIDELINES FOR PLACING SHORT IMPLANTS:** Nisand and Renourd have proposed guidelines for the placement of short implants and other therapeutic options based on the available bone height, bone quality, and various risk factors such as smoking, a history of periodontal disease, and advanced age. These guidelines are summarized in [Table 1] and apply to situations where the residual alveolar ridges are sufficiently wide to support the placement of implants with a diameter of at least 5 mm.[5] With improvement in the implant surface geometry and surface texture, there is an increase in the bone implant contact area that provides a good primary stability during osseointegration. Six short implants are used to support a fixed prosthesis, or four short implants are used to support an overdenture in the treatment of a severely resorbed edentulous mandible. Two additional short-length implants are placed in the distal region of the edentulous maxilla, in addition to longer implants in the premaxilla, to support a fixed prosthesis or maxillary overdenture

| Maxillary ridge bone height and its treatment  |                  |                             |
|------------------------------------------------|------------------|-----------------------------|
| Ridge Height                                   | Bone Type        | Treatment                   |
| <5 mm                                          | Type I,II,III    | Sinus lift                  |
|                                                | Type IV          | Sinus lift                  |
| 5-6 mm                                         | Type I,II,III    | Short Implants              |
|                                                | Type IV          | Sinus lift                  |
| ≥ 6mm                                          | Type I,II,III    | Short Implants              |
|                                                | Type IV          | Short Implants              |
| Mandibular ridge bone height and its treatment |                  |                             |
| Ridge Height                                   | Bone Type        | Treatment                   |
| <8mm                                           | Type I,II,III,IV | Advanced Surgical procedure |
| ≥8mm                                           | Type I,II,III,IV | Short Implants              |

TABLE 1: GUIDELINES FOR PLACING SHORT DENTAL IMPLANTS

### INDICATIONS FOR SHORT IMPLANTS:

Short implants can be utilized in nearly all types of dental replacements, whether fixed or removable.

These applications include:

1. Single and multiple fixed prostheses in the posteriors.[11]
2. In the treatment of a severely resorbed edentulous mandible, four short-length implants can support an overdenture, or six short implants can be used to support a fixed prosthesis.[10]
3. In an edentulous maxilla, two short-length implants can be placed in the distal area, in addition to longer implants in the pre-maxilla, to support either a maxillary overdenture or a fixed prosthesis.[12]

### CONCLUSION:

The use of short-length implants provides treatment options for patients who may not be able to undergo complex surgical procedures due to medical, anatomical, or financial reasons. By minimizing the need for intricate surgeries, short implants help to reduce morbidity, lower costs, and decrease treatment time. When placed with consideration of all critical biomechanical factors and following strict clinical protocols, short implants can be a successful treatment option for atrophic ridges. However, there is still limited data on the

long-term success and survival of these short implants, particularly in relation to occlusal loading, crown-to-implant ratio, and situations involving less optimal bone quality.

## II. ACKNOWLEDGMENT:NIL

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