



Mini Implants - “Maximizing Smiles in Pediatric Dentistry” - A Review

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ABSTRACT:

A significant portion of children experience tooth loss at different stages of their development. The lack of teeth leads to a reduction in functionality, inadequate alveolar growth, and aesthetic issues that can hinder the psychosocial development of young children. Paediatric dentists have faced the ongoing challenge of finding the best solution to address tooth loss in children. Mini implants have surfaced as a modern approach in the field of paediatric dentistry for the purpose of replacing missing teeth.

1. Introduction

Dental implant is defined as a prosthetic device made up of alloplastic material(s) implanted into the oral tissue under the mucosal or periosteal layer, and on or within the bone to provide retention and support for a fixed or removable prosthesis⁷. Since a decade, dental implants have revolutionized the face of dentistry¹. Dental implants have provided excellent relief in terms of function, esthetics, and psychological advantages to the majority of the population that has lost teeth. A substantial number of children lose teeth at various ages. Congenital hypodontia, trauma, caries are the most common reasons of tooth loss in children. Conservative methods of treating tooth loss in children have included space maintainers, removable dentures, and occasionally fixed prosthesis. Unfortunately, there are several drawbacks to these treatment options, including the prosthesis having to be replaced frequently due to arch shape/space mismatches, being aesthetically incorrect, and recurring prosthesis loosening. In order to overcome this, researches have done many researches and found that implant could be a solution for growing children⁴.

2. Mini Implant: What Is It?

Mini dental implants are a substitute to traditional dental implants whose size is small³. Early in 1985, Dr. Victor I. Sendax of New York created the first mini implants. Mini implants have a diameter ranging from 1.8mm to 2.7mm available in one piece design with ball shaped design. These are offered in various tip, thread, body, and head options. The length, form, and thickness of mini-implants are determined by the height and anatomic

characteristics of the bone. Mini implant is a temporary anchorage device made up of pure titanium or titanium alloys. They are biocompatible and highly inert. By promoting the alveolar ridge and preventing the surrounding roots from sliding into the edentulous area, the mini screw implant helps avoid ridge atrophy².

3. Parts of Mini Dental Implants

Mini implants consists of Head, Neck and Body².

Head: Head portion of the mini implant is in contact with oral environment and is mainly designed to receive attachments like elastics or wire.

Neck: The portion that joins the head and body It has three distinct heights—1 mm, 2 mm, and 3 mm—to accommodate varying soft tissue thicknesses at various implant locations.

Body: The implant body is uniform in shape. It is either the self-tapping or the self-drilling variety. For improved interlocking of the mini implant with the bone, it features threads and grooves.





4. Mini Implants in Pediatric Patients

Mini implants offer a psychological benefit to children as a prosthetic replacement because they feel like their natural teeth. Their relatively small diameter permits fixture placement even in cases of transverse bone loss. Furthermore, due to their limited osseointegration, these implants allow for the preservation of soft and bone tissue volumes until the child reaches adulthood. Lastly, their removal is non-traumatic and does not result in any additional deficits².

Children and adolescent are basically divided into three groups based on their condition of having partial and complete anodontia.

Group 1: Children who have congenitally missing single tooth and have adjacent permanent teeth.

Group 2: Children who have more than a few teeth missing but have permanent teeth adjacent to the missing site.

Group 3: Children who are completely edentulous in one arch or have one or two teeth in poor positions in the arch⁵.

Indications:

- Children with Ectodermal dysplasia
- Implants that are combined with the bone graft are used in patients with cleft of the palate and alveolus
- Children and adolescent having congenitally missing tooth, anodontia, partial anodontia and teeth lost as a result of trauma
- Children who finds difficulty in wearing removable appliance⁵

Contraindications:

- Individuals having pubertal growth spurts
- Children with inadequate mesiodistal space
- Pre-pubertal age group⁵

The Insertion Site Selection:

When selecting a location for the insertion of a mini-implant, the practitioner ought to take into account specific elements. They are:

- **Fail-safe area:** Areas where there is a high risk of irreparable injury to essential anatomic structures should be avoided.
- **Accessibility:** It enables for proper surgical procedures and sufficient stability.
- **Hard tissue characteristics (cortical bone quality and quantity):** The cortical bone needs to possess sufficient thickness to provide the necessary stability, particularly mechanical stability right after the implantation.
- **Usability:** The implant's placement should be in a biomechanically advantageous position, enabling the application of the required orthodontic force.
- **Discomfort:** Implants should be placed into regions that provide the patient the least amount of discomfort³.

Stability:

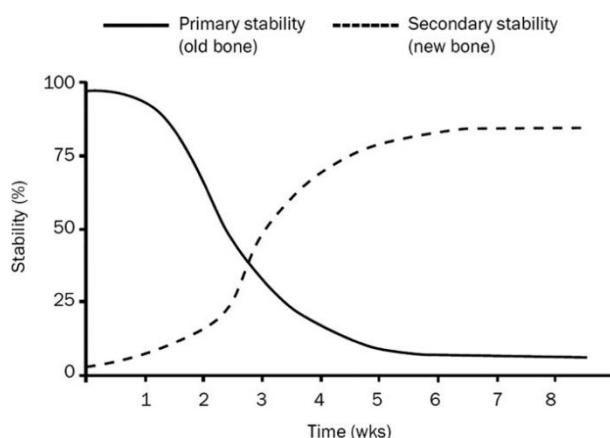
Stability refers to the lack of movement within the bone structure following the placement of a mini implant. The effectiveness of mini implants in a clinical setting hinges on their ability to maintain stability once they are inserted at the implantation site. Implant stability is classified into two distinct phases: primary stability and secondary stability. Primary stability is the measure of mechanical interlock established immediately after the placement of mini implants, and it holds a crucial role in the clinical performance of mini implants over both short-term and long-term periods. Primary stability can be influenced by various factors, including the design of the mini implants, the technique used for insertion, as well as the quality and quantity of bone and the specific bone type found at the implantation site. Secondary stability, in biological terms, pertains to the extent of osseointegration between the implant and bone. This term was introduced by Branemark and signifies the direct structural and functional bonding between living bone and the surface of an implant designed to bear a load².

Stability Curve:

The stability curve illustrates the correlation between primary and secondary stability, and this interplay is evident in characteristic curves. The overall stability is a combination of both primary stability and secondary stability.



Immediately following the placement of mini-implants, all observed stability can be attributed to primary stability, with no secondary stability present. Initially, overall primary stability experiences a rapid decline as secondary stability takes over. The point where the primary and secondary stability curves intersect marks the moment when mini-implants are at their least stable, indicated by a dip in the stability curve. The pace at which secondary stability increases begins to slow down around the 4-5 week mark during the healing process². After the healing process and bone remodeling, the primary contributor to the overall stability of mini-implants is typically secondary stability⁶.



These implants come in two variants: the self-tapping (ST) type and the self-drilling (SD) type. The self-tapping variety features a non-cutting tip and necessitates a pilot hole of the same length as the implant. Once the pilot hole is drilled, this type can be inserted with ease, causing minimal harm to the tissue; however, they are relatively more intrusive in nature. The self-drilling type has a cutting tip and doesn't necessitate a pilot hole, but it does require substantial pressure to penetrate cortical bone. However, this approach comes with drawbacks such as bone compression, patient discomfort, resorption, and diminished tactile sensitivity².

Procedure for Insertion:

- Mini-implants should be chosen based on the specific location.
- A gentle anesthetic is applied to the tissues at the designated area.
- Mini implant placement is typically performed without the need for a full flap incision. However, in situations involving a narrow ridge or significant soft

tissue, it is advisable to make a minimal crestal incision. This approach ensures precise implant placement at the correct angle within the bone.

- To position each mini implant at its designated spot, a small hole is drilled into the bone.
- The implant is affixed and secured at its designated location by screwing it in place and then using a winged wrench to ensure it is tightly fastened.
- The implants will be inserted transmucosally, positioned at the occluso-gingival level
- Acrylic resin is employed to mimic the qualities of the missing tooth and conform to the existing gum line structure.
- The temporary crowns serve a dual purpose by preserving space and assuming the final retention function.
- Ensuring an unobstructed transmucosal profile region was of utmost importance.
- The ultimate connection was established by partially filling the cavity approximately 1mm below the alveolar ridge with acrylic resin while it was still in its malleable state. This allowed for mechanical interlocking between the crowns and the heads of the mini-implants once the resin had set.
- In nearly all instances, sutures are unnecessary, and patients typically experience minimal discomfort post-procedure. Following this stage, adjustments were made to the occlusion to promote natural contacts during both normal biting and side-to-side movements^{2,3}.

Advantages:

Mini-implants offer a range of advantages similar to standard implants, despite their smaller size and minimally invasive nature. They tend to induce less inflammation at the implant site, leading to quicker healing and enabling immediate loading. These implants involve straightforward surgical procedures, causing minimal discomfort for the patient. Moreover, they exhibit reduced linear or circumferential percutaneous exposure, making them less susceptible to bacterial attacks around the implant-gingival attachment. In cases of narrow residual ridges, mini-implants have become a preferred treatment choice. Their introduction has



reduced the need for grafting procedures and ridge augmentation, offering an economical alternative compared to standard implants. If a situation leads to implant failure, mini-implants can be easily removed with minimal surgical trauma⁸⁻¹⁰.

5. Limitations

Mini-implants should not be positioned in ridges with insufficient vertical height or in individuals with parafunctional habits, as well as in cases with limited inter-arch space¹¹. The risk of implant fracture during placement is higher due to their slender diameter⁹. The absence of parallelism between implants is due to their one-piece design, necessitating the placement of multiple implants due to the unpredictability of failure, as there are no established scientific guidelines and limited understanding in this regard¹¹. Furthermore, there is a lack of substantial scientific data regarding the long-term survival of these implants. Achieving clinical success with mini-implant-supported fixed restorations relies on a comprehensive comprehension of biomechanics, precise treatment execution, and appropriate case selection^{9,11}.

6. Conclusion

A toothless smile may appear charming in an infant, but its continued presence raises significant worries for both parents and the child. In the realm of oral rehabilitation for developing patients, mini-implants are emerging as a promising alternative for anchoring crowns, particularly in the anterior region, owing to their excellent biocompatibility and straightforward application. Notwithstanding its restrictions, this procedure stands out as a straightforward, single-appointment, and technically superior solution. It delivers favourable aesthetic and functional outcomes that enhance the patient's quality of life, social integration, and self-esteem.

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