

Review Article

Advanced Orthodontic Mini Implants for Anchorage: A Review

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ABSTRACT:

Orthodontic anchorage is a requisite of successful orthodontic treatment. Skeletal anchorage with the use of mini-implants as Temporary Anchorage Devices (TADs) is of particular importance in treatment of patients with open bite as well as intrusion or extrusion of teeth. The mini implants are minimally invasive, provide conservative treatment and require very little patient compliance. They are versatile and can be used in the treatment of a myriad of orthodontic malocclusions as well in the correction of facial deformities. The present paper highlights the utilization of various types of mini implants as orthodontic anchorage devices.

Key words: Orthodontia, Implants, Anchorage.

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INTRODUCTION:

Anchorage in orthodontics is defined as a resistance to unwanted tooth movement.¹ Newton's third law, i.e. 'very action has an equal and opposite reaction' applies invariably to all objects in motion including teeth undergoing orthodontic treatment. In other words, tooth/ teeth which are supposed to undergo orthodontic movement apply a reactive force in the opposite direction to that of the orthodontic appliance.² Anchorage in orthodontics is a collection of clinical approaches to minimize the undesirable effects of this

reactive force which can be termed as 'anchorage loss'.² Fortunately, implants offer 'absolute anchorage', which is, zero movement of the anchorage unit.¹ This anchorage provided by dental implants is derived from the alveolar bone.³ Anchorage provided by devices, such as implants or miniscrew implants fixed to bone, may be obtained by enhancing the support to the reactive unit (indirect anchorage) or by fixing the anchor units (direct anchorage), thus facilitating skeletal anchorage.⁴

MINI IMPLANTS:

Titanium implants get embedded in the bone by a process known as ‘osseointegration’. Osseointegration has been defined as “the direct anchorage of an implant by the formation of bone directly on the surface of an implant without any intervening layer of fibrous tissue.”⁵ Because osseointegration offers necessary conditions for load and transfer bearing, the use of dental implants as orthodontic anchorages has increased progressively over the years.^{6,7} conventional implants usually require edentulous spaces with sufficient bone density for their placement. This is a limitation to the use of implants as anchorage devices because majority of patients undergoing orthodontic treatment are young and do not have edentulous sites. To overcome this limitation, titanium screws with smaller dimensions (miniscrews) were introduced and were referred to as orthodontic mini implants.⁸ They do not require edentulous areas for placement and also do not need time for osseointegration.⁹⁻¹¹

TYPES OF MINI IMPLANTS:

Many types of mini implants are available for anchorage, mainly palatal plates, onplants, miniplates, and miniscrews.¹²

1. Palatal plates:

These type of implants are placed on the hard palate of the maxilla. They are fabricated from titanium alloy. They are screw shaped. Most palatal implants are made of titanium alloy and are screw-like with a cylindrical surface. After placing the implants in the mouth, a trans-palatal arch is constructed so that the maxillary teeth on both sides are connected and better anchorage is achieved. They require only a single surgery.¹³ (Figure 1)

2. Onplants:

These are similar to palatal plates and are placed in the median palatal suture. They are button shaped. The onplant has the same role as the palatal plate and is implanted in the median palatine suture. They are placed between the maxilla and the periosteum. Onplants are button shaped and implanted between the periosteum and jaw. They require secondary surgeries.¹³ (Figure 1)

Figure 1: Types of Osseointegrated Orthodontic Mini Implants



3. Miniplates:

Orthodontic anchorage using a bone plate was first introduced by Jenner and Fitzpatrick¹⁴ in the year 1985. The miniplate skeletal anchorage was introduced by Umemori et al.¹⁵ for the treatment of open-bite. Later miniplates were successfully used in the treatment of skeletal Class III malocclusions as well as in the management of severely impacted mandibular second molars.^{16,17} They have also been reported to be effective in the retraction of anterior teeth.^{18,19} Miniplates can be placed on either the maxilla or the mandible in the apical buccal area. They are made of titanium alloy. They can be placed immediately following implantation and have good retention. They also possess better capability to withstand orthopedic forces than other implants.¹³ (Figure 2)

Figure 2: Types of Non- Osseointegrated Orthodontic Mini Implants



4. Miniscrews:

They are screw shaped and are made of either pure titanium or titanium alloy. Miniscrews are simple in placement and can be placed at almost all locations in either jaw. The use of miniscrew implants (MIs) controls the movement of teeth in the mesial, distal, and vertical directions, without the need for additional anchorage.¹³ The most common indication for treatment with miniscrew implants is molar protraction followed by indirect anchorage for space closure, intrusion of supraerupted teeth, intrusion of anterior open bite, anterior en-masse retraction, molar uprighting, intrusion of maxillary cant, molar distalization, traction on impacted canine, and attachment of protraction facemask.²⁰ (Figure 3)

Figure 3: MI System



INDICATIONS OF MINI IMPLANTS:

1. **Intrusion and Extrusion of Molars:**

Skeletal mini implants as anchorage devices offer the perfect solution for achieving the complex movements of intrusion and extrusion of teeth. They are usually implanted between the roots for treating such cases.²¹

2. **Tooth movement before placement of restorations:**

They can be used in the uprighting of tilted abutment teeth. They are effective in long edentulous cases.²¹

3. **Closure of edentulous spaces:**

They can be used for closure of edentulous spaces in patients with congenitally missing teeth. In such cases, they are placed in the retromolar pad area.²¹

4. **Orthopedic Anchorage:**

They have been used effectively to evoke palatal expansion and can be used effectively in patients with congenital facial defects as well.²¹

COMPLICATIONS:

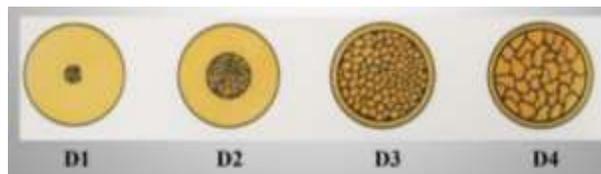
The following complications can occur during the placement of mini implants:

1. Periodontal ligament trauma or trauma to the tooth root
2. Failure of stationary anchorage: It has a rate of 11 to 30% in mini screws during orthodontic loading. It occurs more in maxilla than in the mandible.
3. Coverage of implant head and its attachments by soft tissue: It often occurs in mini screws that are placed in the alveolar mucosa.
4. Peri-Implantitis: Inflammation and minor infection around the implant are common occurrences.⁴

DISCUSSION:

Mish described four bone densities found in the edentulous regions of the maxilla and mandible: (D1) Primarily dense cortical bone; (D2) dense to thick porous cortical bone on the crest and coarse trabecular bone underneath; (D3) thinner porous cortical crest and fine trabecular bone within; (D4) almost no crestal cortical bone; the fine trabecular bone comprises almost all of the total bone volume. Bone classified as D4 is unfavorable for use in obtaining primary stability, but almost 40% of the posterior alveolus consists of D4 bone. (Figure 4)

Figure 4: Bone Density



CONCLUSION:

Mini implants can serve as excellent substitutes to conventional molars as orthodontic anchorages.

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