**Scholars Journal of Dental Sciences**

OPEN ACCESS

Abbreviated Key Title: Sch J Dent Sci
ISSN 2394-4951 (Print) | ISSN 2394-496X (Online)
Journal homepage: https://saspublishers.com

# Tads in Orthodontics

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**DOI:** 10.36347/sjds.2021.v08i07.009 | **Received:** 30.06.2021 | **Accepted:** 01.08.2021 | **Published:** 16.08.2021

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**Abstract** **Review Article**

Anchorage is one of the important aspects of orthodontic treatment TAD have gained profound applications in contemporary orthodontic protocol. To treat almost every genre of malocclusion be it arising from dentoalveolar component, skeletal component or combination of both Various skeletal anchorage devices were introduced in the 20th century which includes prosthetic implants, palatal implants and implants, mini-plates and screws. This article reviews their classification, indications, contraindications, safety zones for TADs, their advantages, complications.

**Keywords:** Mini implants, Tads.



## INTRODUCTION

For more than 100 years, orthodontists have searched for ideal anchorage that fits two criteria: absolute resistance to unwanted tooth movement and independence from patient compliance. Conventional intra- and extraoral anchorage systems often fall short of providing absolute anchorage [1]. The extraoral forces cannot be used on 24 × 7 basis to resist the continuous tooth moving forces and are also taxing on patient's compliance. On the other hand, strict reliance on intra oral areas, usually dental units does not offer any significant advantage, except the fact that patient cooperation is less critical; therefore, it is important to have absolute anchorage to avoid reactive forces which might incur undesirable tooth movements [2, 3]. This deficiency has spurred interest in skeletal anchorage systems, which appeal to practitioners because they have the potential to provide absolute anchorage and do not depend on patient compliance Skeletal anchorage has been the subject of study for more than 60 years in orthodontics.

A temporary anchorage device (TAD) is a device that is temporarily fixed to bone for the purpose of enhancing orthodontic anchorage either by supporting the teeth of the reactive unit or by obviating the need for the reactive unit altogether, and which is subsequently removed after use. They can be located transosteally, subperiosteally, or endosteally; and they can be fixed to bone either mechanically (cortically stabilized) or biochemically (osseointegrated). It should also be pointed out that dental implants placed for the ultimate purpose of supporting prosthesis, regardless of the fact that they may be used for orthodontic anchorage, are not.

Considered temporary anchorage devices since they are not removed and discarded after orthodontic treatment. Importantly, the incorporation of dental implants and TADs into orthodontic treatment made possible infinite anchorage, which has been defined in terms of implants as showing no movement (zero anchorage loss) as a consequence of reaction forces [4]. Mini-screws are also known as TAD'S Temporary Anchorage Device or Micro-implants or Ortho-implant which has brought about the significant revolution in the field of clinical Orthodontics.

### Historical background

The concept of metal components inserted into maxilla and mandible to enhance the orthodontic anchorage was first published in 1945 by Gainsforth and Higley, with use of vitallium screws to effect tooth movement in dog ramus. Despite some success, the resultant tooth movent was limited due to implant

loosing within one month of commencing toth movement [5].

Two decades later, lincow (1969, 1970) used endosseous mandibular blade-vent implants in a patient to apply class II elastics, but did not report on long term stability. Vitreous carbon implants showed failure rate of 67%, when undergoing orthodontic loading and atempt at using bioglass coated ceramic implants for orthodontic anchorage were almost as disappointed. All the above materials are compatible with bone but none of them showed consistent long term attachment of bone to implant surface, which means they did not achieve true osseointegration [6].

In 1964, Branemark et al. observed a firm anchorage of titanium to bone with no adverse tissue response. In 1969, they demonstrated that titanium implants were stable over 5 years and osseointegrated in bone under lightmicroscopic view. Since then, dental implants have been used to reconstruct human jaws or as abutments for dental prostheses [7].

The first clinical report in the literature on the use of TADs appeared in 1983 when Creekmore and Eklund used a vitallium bone screw to treat a patient with a deep impinging overbite by intruding upper incisors [8].

In 1984, Roberts et al. corroborated the use of implants in orthodontic anchorage. 6 to 12 weeks after placing titanium screws in rabbit femurs, a 100-g force was loaded for 4 to 8 weeks by stretching a spring between the screws. All but 1 of 20 implants remained rigid. Titanium implants developed osseous contact, and continuously loaded implants remained stable. The results indicated that titanium implants provided firm osseous anchorage for orthodontics and dentofacial orthopaedics [9].

**CLASSIFICATION**

1. According to shape and size
a. Conical (cylindrical)- miniscrew implants
- Palatal implants
- Prosthodontic implants
b. Miniplate implants
c. Disk implants (onplants);
2. According to implant bone contact
a. Osseointegrated
b. Nonosseointegrated
3. According to the application
a. Orthodontic implants
b. Prosthodontic implants[10]

Classification Implants can be classified under the following headings:

4. Based on the Location
a. Subperiosteal: Implant body lies over the bony ridge.
b. Transosseous: Implant body penetrates the mandible completely.
c. Endosseous: Partially submerged and anchored within the bone-endosseous implants are most commonly used for orthodontic purposes.

5. Based on the Configuration Design
a. Root form implants: These are the screw typeendosseous implants and the name has been deriveddue to their cylindrical structure.
b. Blade/plate implants: Flatter and can be used in resorbedand knife-edge ridges.

6. According to the Composition
a. Stainless steel
b. Cobalt-chromium-molybdenum (Co-Cr-Mo)
c. Titanium
d. Ceramic implants
e. Miscellaneous, such as vitreous carbon and composites.

7. According to the Surface Structure
a. Threaded or Nonthreaded

The root form implants are generally threaded as this providesfor a greater surface area and stability of the implant.

b. Porous or Nonporous

The screw type implants are usually nonporous, whereas the plate or blade implants (nonthreaded) have vents in the implant body to aid in growth of bone, and thus a better interlocking between the metal structure and the surrounding bone [11].

**Parts of implant**

- Implant head – It serves as the abutment and in the case of an Orthodontic implant, could be the source of attachment for elastics/ coil-springs.
- Implant body- It is the part embedded inside bone. This may be a screw type or a plate type .Thescrew and plate design that has been used in Orthodontics as the skeletal anchorage system varies from these conventional plate implants.
- Implant Neck- It is the part of the implant which connects the Head and the Body. Implant head Threads in the Implant body.

**Device design**

Miniscrews or TADs are generally made of titanium or titanium alloy to ensure they are bioinert (i.e., they will not elicit an inflammatory tissue response or discharge corrosive by-products into the bone or surrounding tissue) [12]. Ranging from 4 to 20 mm in length (6 to 12 mm being the most common) and 1.0 to 2.3 mm in width, TADs will have a male-type head that fits into a female socket on a handheld driver for insertion (Figure 1). Almost all miniscrews commercially available are both self-drilling (no pilot hole necessary) and self-tapping (meaning, they

produce the space for their threads by compression or cutting as they are inserted) [13].

**Fig-1: Insertion of a temporary anchorage device into alveolus with a manual driver for pontic support**

Two thread types are utilized in TADs. The first is a cutting-type thread outline that is used on screws of larger diameter and length for placement into dense cortical bone. These threads will cut and remove small amounts of bone as the screw is inserted. The second type has a thread-forming outline which compresses less-dense bone as it is inserted through a smaller amount of cortical bone during TAD placement.

**PLACEMENT SITES**

In Maxilla: Inter radicular alveolar areas like the width of buccal cortical bone on the entire maxillary alveolar process is limited (3mm to 4mm), so longer screws are needed. Most commonly used sites are –

- Between second premolar and first permanent molar
- Between the first and second permanent molar
- Between the two central incisors, which is particularly good for intrusion
- Infrazygomatic region – zygomatic buttress
- Palatal areas where the thickness and quality of cortical bone are excellent.
- Maxillary tuberosity region
- Mid palatal area

In Mandible: Inter radicular alveolar area – as the cortical bone on the buccal area in the mandible is very dense, so the screws are smaller in size, so the possibility of root contact is remote. Most common sites are –

- Between second premolar and first permanent molar
- Between first and second permanent molar
- Between two central incisors
- Between mandibular canine and premolar buccally
- Retromolar area
- Mandibular symphysis facially

The sites that should be avoided are: Some of the anatomical and vital structures that should be kept care of during micro-implant placement include- inferior alveolar nerve, artery, vein, mental foramen, maxillary sinus and nasal cavity.

As these implant sites are reasonably close to archwire plane, the force applied to move the teeth and control of resultant counter forces are much easier. The screws used for orthodontics anchorage purpose must be thin (1.3mm to 1.5mm) and tapered to prevent accidental root contact.

Generally, for maxilla length should be 8mm to 10mm and for mandible length should be 6mm to 8mm because of dense bone [14].

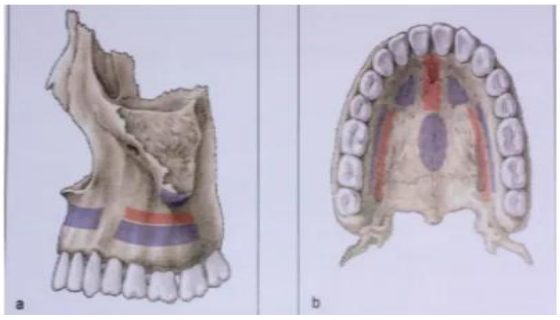

**Fig-2: Sites of implant placement in maxilla and mandible**

**Clinical indications for use of tads**

- Insufficient number of dental elements and / or lack of occlusion drive anchor, for example patients with partial edentulism or agenesis.
- Extrusion or intrusion of individual teeth or groups of teeth without antagonists (ie in the absence of vertical opposing forces that act on them, for the need to maintain or restore proper occlusion and to avoid the establishment of functional disorders)
- Asymmetric tooth movement
- Shrinking and / or intrusion of anterior teeth with insufficient anchorage reactive unit
- Moving mesial of the molars where the front sector cannot be moved.
- Proclination of the front teeth is not available if a rear anchors.
- Closure of spaces.
- Moving in distal direction of molars.
- Correction of an open-bite.

Since the anchoring devices have decisive role in orthodontics modern careful assessment of patient is essential to assess existence of any health conditions or factors that contraindicate use of mini-implants. Local risk factors such as bone quality and oral hygiene, general risk factors related mainly to overall health status of the patient. Best treatment plan must include the fewest number of TADS needed to deal with the case. Excessive use cannot be considered prudent.

**CONTRAINDICATIONS**

- Patients with metabolic bone diseases
- Patients taking suppressive therapy of the immune system
- Patients on chronic therapy with steroids or bisphosphonates
- Patients with severe neurological or psychological problems
- Patients with poor quality or quantity of bone tissue for the primary stability
- Patients with infections or circulatory problems
- Patients with allergic reactions to specific materials
- Patients receiving radiotherapy in the head and neck region or recurrent disease of the oral mucosa
- Patients with insulin-dependent diabetes, being more susceptible to infections
- Patients with poor oral hygiene
- Patients who have not completed skeletal growth [15-19].

**ADVANTAGES**

- Reduces need for patient compliance
- Eliminates need for ocular damage associated with headgear use
- Relative ease of insertion
- Good acess to various placement sites
- Ease of removal
- Minimal discomfort and no residual surgical defects
- Versatile placement ie buccal or palatal [20].

**COMPLICATIONS**

**1) Complications During Insertion**

- Trauma to the periodontal ligament or the dental root
- Miniscrew slippage
- Nerve involvement
- Air subcutaneous emphysema
- Nasal and maxillary sinus perforation
- Miniscrew bending, fracture, and torsional stress

**2) Complications Under Orthodontic Loading**

- Stationary anchorage failure
- Miniscrew migration

**3) Soft-Tissue Complications**

- Aphthous ulceration
- Soft-tissue coverage of the miniscrew head and Auxiliary
- Soft tissue inflammation, infection, and peri implantitis

**4) Complications During Removal**

- Miniscrew fracture
- Partial osseointegration

## CONCLUSION

Implants for the purpose of conserving anchorage are welcome additions to the armamentarium of a clinical Orthodontist. They help the Orthodontist to overcome the challenge of unwanted reciprocal tooth movement. Placed in either alveolar or extra-alveolar bone for the purpose of providing orthodontic anchorage, temporary anchorage devices (TADs) are removed once they complete their function in the treatment regimen. While they do not necessarily increase the rate of orthodontic correction. They helped converting many borderline surgical cases to non-surgical and extraction cases to non-extraction and even bringing about esthetic impact which was difficult to achieve by conventional mechanics.

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