INTRODUCTION

Anchorage, if inadequate, can be the most limiting factor of therapy, no matter which technique or philosophy the clinician follows. Traditionally, orthodontists have used teeth, intraoral appliances, and extraoral appliances, to control anchorage—minimizing the movement of certain teeth, while completing the desired movement of other teeth. However, the main drawback was that it relied on patient compliance to be successful.¹

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 is subsequently removed after use. They can be located tranosteually, subperiostealety, or endosteally; and they can be fixed to bone either mechanically (cortically stabilized) or biochemically (osseointegrated).

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.

CLASSIFICATION OF IMPLANTS FOR ORTHODONTIC ANCHORAGE

According to site ²
(Subperiosteal, Endosseous, Transosseous)

According to the configuration of head² -
Button, Bracket

According to insertion technique³

Self –tapping- These screws require a a pilot hole before insertion, Self-drilling - Can be inserted directly

According to surface characteristics:

(a) – Threaded, Non-threaded
(b) – Porous, Non-porous

According to implant material³:

Bioactive (Vetro ceramic apatite Hydroxide)
Bioinert (Titanium) ,Biotolerant (Stainless Steel, Chromium Cobalt Alloy)
According to implant degradation:
- Biodegradable (Polylactide, polyglycolide), Non-biodegradable (Titanium)

**Primary versus secondary stability** Immediately after the mini screw implants are inserted their retention is entirely mechanical, due to primarily the characteristics and amount of the bone contacting the implant especially the cortical bone. This mechanical type of retention is known as primary stability.

For orthodontists this is very important as it allows the implant to be immediately loaded. Primary stability is the key for any implant or TAD procedure.¹

Following the placement of an endosseous implant, primary mechanical stability is gradually replaced by biologic secondary stability as the osteoclasts remove old, damaged bone and osteoblasts form new bone. This second phase of increased stability is referred to as secondary stability. It is due to the osseointegration that occurs around the implant.

The stability observed clinically is the net or overall stability composed of both primary and secondary stability¹

**PLACEMENT OF TADS**
The insertion sites for mini-implant is based on⁴:

1. soft tissues
2. adequate amounts of cortical bone,
3. the angulation
4. the size of the mini-implant

The sites most often utilized for miniscrew insertion in the maxilla include⁴

1. Inter-radicular spaces, both buccal and lingual.
2. Extraction spaces.
3. Inferior surface of the anterior nasal spine.

The CBCT study suggested that the best available position for a miniscrew is in the posterior maxilla as follows⁴:

1. Mesial to the first molar,
2. The best angulation is 30° apically to the long axis of the tooth,
3. The safest length is 6 mm of bone contact with a diameter of 1.3 mm.

An alternative site is the palate, it has good quality of bone no interference with the roots of the teeth.

In the mandible, the most common miniscrew placement sites are⁴:

1. Interradicular spaces, both buccal and lingual
2. Lateral to the mentalis symphysis
3. Extraction spaces.

**Uses**
1. Anterior retraction
2. Posterior protraction
3. Molar or posterior arch intrusion
4. Molar distalization for class II correction
5. Molar uprighting
6. Anterior intrusion for deepbite correction

**Discussing some of cases treated in our department with the aid of TADS to bring about various tooth movement**

**1) Anterior retraction**
A patient came with an class I on molar relation on the both side (bimaxillary dentoalveolar protrusion) figure 1(a), (b)
PRETREATMENT (Figure 1)

(a)  
(b)  
(c)

DURING TREATMENT (Figure 2)

A TAD was placed in between the mandibular 2nd premolar and 1st molar as seen in figure 2a and 2b. With the aid of it we retracted the mandibular anterior teeth

(a)  
(b)  
(c)

POST TREATMENT (Figure 3) Here we can appreciate complete space closure in the mandible by anterior retraction with the aid of TAD as seen in figure 3(a) and 3(b)

(a)  
(b)  
(c)

(2) Molar Distalization

Molar distalization can be done without reactionary orthodontic tooth movement

A patient came with an end on molar relation on the right side figure 4(a)

PRETREATMENT (Figure 4)

(a)  
(b)  
(c)

DURING TREATMENT (Figure 5) Distalization of molars was done using indirect anchorage with the help of TADS as seen in figure 4a.

PRETREATMENT and POSTTREATMENT

(a)  
(b)

Comparing pretreatment figure(a) and posttreatment figure(b) we can clearly appreciate the amount of space gained by distalizing the molar.
(3) Anterior Intrusion for Deep Bite Correction

These devices are very useful (using either a direct anchorage or an indirect anchorage) for intrusion of anterior teeth for correction of deep bite.

A patient came having a deepbite and bilateral end on molar relationship figure 6(a),(b).

PRETREATMENT (Figure 6)

(a)  (b)  (c)

DURING TREATMENT (Figure 7)

(a)  (b)  (c)

All 1st premolars were extracted as seen in figure 7(a),(b) and a TAD was placed in between the central incisors (both maxillary and mandibular) and an intrusive force was applied by elastic chain as seen in figure 7(c).

POSTTREATMENT FIGURE 8 (post treatment photographs show achievement of a proper overbite as seen in figure 8(a),(b),(c).

DISCUSSION

TADS being rigidly attached to the bone, don’t allow reactionary orthodontic tooth movement to take place. In intrusion of teeth, reactionary orthodontic force will be delivered to the TADS which won’t undergo reactionary tooth movement (extrusion) because of the absence of periodontal ligaments around them.

Headgears were traditionally used for molar distalization but, in modern orthodontics, mechanics requiring minimal patient cooperation are more desirable both for orthodontists and patients. Also, the fixed appliances produce a reaction force on anterior teeth that may lead to anchorage loss. In a study conducted by Gelgor et al. to investigate the efficiency of intraosseous screws for maxillary molar distalization it was concluded that the distalizing force resulted in 88% molar distalization and 12%.

TADS aided us in distalization of molars by 2.5mm as described above (Figure 5) For many years, dental intrusion was considered impossible or problematic especially posterior intrusion and was associated with numerous side-effects on the periodontium and cementum (root resorption). In a study conducted by Mittal et al., the upper incisors were intruded to a mean value of 2.8 mm(mean time period of 3.3 months) with no observed molar extrusion.5 Yao et al did a study to investigate the envelope of intrusive movements of maxillary molar using mini-implants.
The mean intrusive movement of the maxillary first molars was 3-4 mm, with a maximum of over 8 mm.

We were able to retract the mandibular anterior teeth by 7mm bilaterally in the case described above (figure 3)

The use of mini-implants to assist in the anterior retraction phase is likely to benefit individuals who find it difficult to cooperate by wearing headgear, intermaxillary elastics or other traditional anchorage methods and those having the need for absolute anchorage. Prior to the installation of TADs the orthodontist should understand the vertical effect that the force vector will exert upon the anterior teeth. The retractive force can have an intrusive, extrusive and intermediate force depending on the vertical implant placement.8

An RCT carried out by Sibaie et al9 concluded that:

1. En-masse retraction with mini-implants not only eases the biomechanics involved but also controls the antero-posterior and vertical movements of the anterior and posterior teeth
2. Avoidance of disto-palatal rotations and distal tipping of retracted canines, and eliminating the appearance of unsightly spaces distal to the lateral incisors following canine retraction.
3. Shortens the treatment duration significantly.

They are made up of noble metals hence don’t bring about allergic reactions

Hence various tooth movements can be brought without having to worry about reactionary tooth movement

Conclusion

The routine use of rigid endosseous anchorage is the leading technical frontier as orthodontics and dentofacial orthopedics has entered the 21st century.

The presently available implant systems are bound to change and evolve into more patient friendly and operator convenient designs.

Long-term clinical trials are awaited to establish clinical guidelines in using implants for both orthodontic and orthopaedic anchorage

References

10. Al-Sibaie S, Hajeer MY. Assessment of changes following en-masseretraction with mini-implants anchorage compared to two-step retraction with conventional anchorage in patients with class II division I malocclusion: a randomized controlled trial. Eur J Orthod. 2014 Jun;36(3):275-83