IMPLANTS FOR ORTHODONTIC ANCHORAGE - REVIEW

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ABSTRACT

Maintaining anchorage in orthodontics has been a challenge for the orthodontists for centuries. In the recent past several different appliances have been introduced, which are claimed to be the replacement of extra-oral anchorage appliances. But time has shown that they all have failed to provide the anchorage needs. Currently micro implants have been introduced for use in orthodontics. They claim to provide absolute anchorage during orthodontic treatment. The purpose of this article is to review the history and current concepts of implants in orthodontics.

Key words: Anchorage, Implants, Orthodontics.

INTRODUCTION

The term "IMPLANT" is used for any material, retained for more than one month in the body according to CE/MDD norms. Orthodontic treatment planning has always revolved around one key factor of 'anchorage requirements', many conservative methods have been used over years to achieve best treatment goals. These modalities consisted of extra-oral and intra-oral enhancements. Extra oral methods suffered due to poor patient compliance and the intra oral ones failed to achieve the absolute anchorage. Also, there is an increase in the number seeking orthodontic treatment due to consciousness about esthetics and function, it must be noted that not all have adequate dentition for orthodontic anchorage.

The primary advantage of implants over the fixed appliances is that implants provide skeletal anchorage, which is undoubtedly more predictable and stable than methods requiring patient compliance. The dental elements that may provide such anchorage are generally limited to ankylosed teeth. However, they are more often than not, in undesirable positions and should be moved, there by making their use for orthodontic anchorage is very limited. Nevertheless, with the advent of the Osseo-integrated implants, the possibility of functional absolute anchorage is realized.

IMPLANTS — A HISTORICAL PERSPECTIVE

In 1945, Gainsforth and Higley used vitallium screws and stainless steel wires in dog mandibles to apply orthodontic forces. However, the initiation of force resulted in screw loss.

In 1960s, Branemark et al noticed the biocompatibility of titanium screws in bone tissue. Light microscopic examinations showed bone-to-implant contact; thus, the concept of "osseointegration" developed. In 1964, they observed a firm anchorage of titanium to bone with no adverse tissue response. In 1969, they demonstrated that titanium implants were stable over 5 yrs.

In 1984, Roberts et al corroborated the use of implants in orthodontic anchorage.

CLINICAL APPLICATIONS

- Reinforce anchorage
- Provide orthopedic anchorage
• Intrusion
• Extrusion
• Distalization
• Mesialization
• Repositioning malposed teeth
• Treat partial edentulism

**Reinforce anchorage**

Titanium screws have been shown to provide a simple means of anchorage to obtain en masse retraction without anchorage loss. An endosseous orthodontic implant anchor system (Orthosystem, Straumann, Waldenburg, Switzerland) was designed and used in Angle Class II malocclusion patients in whom extraction of maxillary first premolars and retraction of anterior teeth were planned. Implants were placed in anterior palatal areas and attached to posterior teeth.

**Provide orthopedic anchorage**

Palatal implants can be used for palatal expansion. Without the use of implants the forces are transmitted to the bone through the tooth, which implies a skeletal as well as dental effect, which in some cases is desirable, but in others, compromises the result. Implants can overcome the limitations by guiding forces directly to the bone. Implants in congenital anomalies can promote orthodontic and orthopedic therapy and accelerate jaw movement by sutural distraction.

**Intrusion / Extrusion**

Upper molar intrusion is one of the most difficult movements to achieve with conventional orthodontics, particularly when there is no tooth distal to the molar. High pull head gears can be used but the resulting is heavily dependant on patient compliance. Intruding force can be achieved by one or two implants in the palatal area, implant in the vestibular area or a combination between fixed appliances and implants. With Skeletal anchorage, intrusion of molars is no longer one of the most difficult movements in orthodontics.

**Distalization / Mesialization**

Elastics, headgears or palatal acrylic buttons are required to increase anchorage when teeth are required to move in antero-posterior direction with conventional orthodontics. But these movements cause some extrusion of the teeth used as anchor units.

Skeletal cortical anchorage using micro implants is a simple approach for any kind of distal or mesial movement of teeth. Just a connection with a spring coil or elastic chain between the micro implant and the tooth is needed.

However it is imperative to decide the site for placement, to avoid a root contact with the micro implant during the distalization.

**Repositioning malposed teeth**

Pre-prosthetic corrections of abutments are not unusual. In such cases where there are several missing teeth, adequate anchorage for tooth movement is often impossible.

**Treating partial edentulism**

Anchorage is difficult to achieve because of limited support. Implants in edentulous areas provide anchorage and later can serve as prosthetic abutments.

**IMPLANT CRITERIA**

**Biomechanical properties**

Implant should be made of a bio-inert (e.g. titanium, carbon) or bioactive (e.g. hydroxyapatite) and not biotolerant (e.g. stainless-steel, chrome-cobalt alloy) material. It should possess excellent mechanical properties, and provide resistance to stress, strain, and corrosion. Because of titanium's characteristics (non allergic and immunological reactions and no neoplasm formation), it is considered an ideal material and is widely used. Bone grows along the titanium oxide surface, which is formed after contact with air or tissue fluid. However, pure titanium has less fatigue strength than titanium alloys. A titanium alloy – titanium-6 aluminum-4 vanadium—is used to overcome this disadvantage.

**Implant shape**

It determines the bone-implant contact area available for stress transfer and initial stability. The design must limit surgical trauma and allow good primary stability. It is difficult to identify the perfect implant shape. Screw-shaped implants have been shown
to provide the strongest immediate mechanical retention after placement.2

COMPARISION OF DIFFERENT TYPES OF IMPLANTS

Skeletal Anchorage using mini-plates, mini-screws and micro-screws, provide an absolute anchorage for tooth movement12. Skeletal Anchorage System (SAS) includes titanium mini-plates (acting as onplants) and mono-cortical screws (acting as implants), which are temporarily placed in maxilla or mandible, providing rigid anchorage through osseointegration2. Mini-plate implants have been used for a long time by the oral surgeons. They are highly predictable with regards to success after placement. Furthermore, because all portions of the anchor plates and screws are placed outside the maxillary and mandibular dentition, the SAS does not interfere with the tooth movement2. They are retained in skeletal anchorage unit by screw placement in the cortical bone. The most common areas of placement are the zygomatic strut of maxilla or the buccal aspect of body of mandible. They provide the anchorage in vertical and horizontal planes, thus are useful in cases of open bites, where they provide a true intrusion of molars in maxilla or mandible. After placement once the surrounding soft tissues heal, the anchor plate can be loaded immediately. Healing periods of four to seven days up to three months have been reported."

Their advantages are that being fixed with more than one screw; their stability is greater than only one micro implant14. But the disadvantage is that they require flap surgery8, mild infection, and the discomfort associated with the placement, maintenance, and removal of the plates2.

Mini-screw or micro-screw Implants have recently been introduced as simpler absolute anchorage alternatives to endosseous implants and onplants in orthodontics.2 They have many benefits, such as ease of placement and removal, most importantly, because of their small size, they can be placed in the intra-arch alveolar bone without discernable damage to roots of the teeth. They can be placed in the cortical bone by the orthodontist using local anesthesia and retrieved at times by just topical anesthesia. Once in place they are available for immediate loading 835. A waiting period is not necessary because its primary stability is generally sufficient to sustain normal orthodontic loading. Though it has been shown histologically that premature loading would result in the fibrous tissue interposition at the bone-implant contact, but it has been suggested that this phenomenon is favorable because it would facilitate implant removal at the end of the treatment.

These advantages have expanded the use of mini and micro-screw implants for various orthodontic problems12.

VARIATIONS IN MICRO IMPLANTS

Variations in Sizes

![Fig 1. Different types of Micro Implants](image1)

![Fig 2. Long and Short Head Implants](image2)
Long head implants are useful in posterior areas, or where there are bony depressions or defects to avoid mucous impingement when the implant is loaded.

**Variations in Slot Heads**

Different slot heads of micro-implants are available including small head, non head, circle head, fixation head, bracket head etc. Some micro implants have a double slot to permit the use of segmented wires.

Bracket head micro implant has two tie wings and one slot which give the same performance as a bracket. It is easy to place the ligature and the wire. In Bracket Head type, two kinds of screws were developed depending on the driving directions, clockwise and counter clockwise. Left Handed Screw should turn in counter-clockwise direction during driving, and vice versa. The moment of force created after fitting the wire in the slot tends to unscrew or drive the micro implant more. To avoid unscrew the correct type of thread (CW or CCW) should be chosen. This new design makes orthodontic treatment easy, and gives many possibilities for treatment without the need of a full fixed therapy.

![Image of implant types](image-url)

**REFERENCES**