



TEMPORARY ANCHORAGE DEVICE - IS IT THE ULTIMATE ANCHORAGE SYSTEM IN ORTHODONTICS? - A REVIEW.

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ABSTRACT

Anchorage control is one of the main aspects of orthodontic treatment plan. Mini-screw implants, often referred to as temporary anchorage devices, have become an accepted component of orthodontic treatment. A temporary anchorage device is defined as that device which aids in augmenting orthodontic anchorage, it sometimes even eliminates the need of anchor teeth. It is temporarily inserted into bone and can be subsequently removed after use. By using temporary anchorage devices for orthodontic purposes we are able to obtain zero anchorage loss.

KEY WORDS: Mini-screws, Temporary anchorage, Dental implants



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INTRODUCTION

Mini-screw implants, which is often called as temporary anchorage devices (TAD'S), are the small titanium alloy or stainless steel surgical bone screws placed either into buccal or palatal alveolar bone for the purpose of enhancing orthodontic anchorage by supporting the teeth of the reactive unit or by obviating the need for the reactive unit altogether and it is subsequently removed after use¹. They can be located transosteally, subperiosteally or endosteally and they can be fixed to bone either cortically stabilized or osseointegrated. It should 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 as temporary anchorage devices since they are not removed and discarded after orthodontic treatment. By using dental implants and temporary anchorage devices for orthodontic purposes we are able to obtain zero anchorage loss². The success of orthodontic treatment hinges on the anchorage protocol planned for a particular case. Mini implants have revolutionized the field of anchorage in orthodontics³.

HISTORIC REVIEW

In 1945, Gainsforth and Higley suggested using metallic screws as anchors. He placed metallic vitallium screws in dog ramus. Following the successful use of conventional prosthodontics implants, osseointegrated implants were used for intraoral orthodontic anchorage². Branemark and co-workers (1965) reported the successful osseointegration of titanium implants in bone; Linkow in 1969 and 1970 used mandibular blade-vent implants in a patient to apply class2 elastics⁴. Sherman' (1978) placed the first orthodontic implants. Block and Hoffman (1995) introduced the on plant to provide orthodontic anchorage³. In 1990's surgical screws which are also known as mini-implants, mini-screws and micro-screws were

increasingly used to provide anchorage for orthodontic tooth movement. Creekmore and Eklund in 1983 reported on the use of a surgical vitallium screw placed in the region of the anterior nasal spine as a source of anchorage to elevate the maxillary incisors a distance of 6 mm^{1, 5}. In 1997, using mini screw implants, Kanomi described the intrusion of mandibular anteriors^{1, 6}. Gelgor et al. Reported as much as 88% success in molar distalization when the first and second molars were present following immediate loading⁷. The Spider Screw was developed in Italy by Maino and co-workers which helps in immediate loading of mini-screw implants⁸. All these temporary anchorage devices have become an accepted component of orthodontic treatment. The simple technique for the placement of these mini-screws is described with emphasis on the importance of correct site selection as well as an understanding of the possible complications that may arise².

DESIGN CHARACTERISTICS & ITS ADVANTAGES

Implants for orthodontic anchorage are classified depending on their size and shape as⁵:

1. Cylindrical:
 - a. Miniscrew Implants
 - b. Palatal Implants
 - c. Prosthodontic Implants
2. Mini plate Implant
3. Onplants (Disc Implants)

Dr.Cope, in a case presentation described some of the characteristics of an ideal anchorage device which includes the following: simple to use, inexpensive, immediately loadable, immobile, small dimensions, can withstand orthodontic forces, biocompatible, does not require compliance and provides good results. A minimum requirement is that TAD's after placement have good stability and ability to withstand

orthodontic forces. When compared to integrated implants which maximum load is proportional to the quantity of osseointegration where as for non-integrated (TAD's) implants the maximum load is proportional to the surface area contact of the bone to the implant⁹.

Miniscrew Implants

Of all orthodontic implants, miniscrews have gained importance due to easy installation and less surgical procedure also simple to insert and remove³. The implant comes in various lengths ranging from 6 mm to 12 mm in length and 1.2 mm to 2 mm in diameter. The optimal diameter to use is about 1.5 mm according to the author's experience. Thicker implants make root contact more probable and thinner implants tend to break easily. In the mandible, where the bone is generally denser, a 6- 8 mm length can be used which is optimal whereas in the maxilla, 8-10 mm length is preferred¹.

Osseous implants

These implants have been the most popular and widely used one. Endosseous are the interdental implants of smaller diameter partially submerged and anchored within the bone. These rely more on mechanical retention than complete osseointegration. In this, the placement is very simple and be done under local anesthesia. This can be used in all types of tooth movement.

Threaded or non-threaded implants

The root form implants are generally threaded as this provides stability and greater surface area. The root form implants are the screw type endosseous implants. The screw types are usually non-porous whereas the blade implants i.e, non-threaded have vents in the implant body to aid in growth of bone and thus a better interlocking between the metal structure and surrounding bone¹⁰. Trans-alveolar screw: (TAS) Freudenthaler et.al reported the use of bicortical titanium screws for critical orthodontic anchorage in the mandible. The screws were used to protract molars through extraction sites. To get a

translator movement of the tooth, orthodontic force was applied but however, only the vestibular head of the screw was loaded¹¹. Brettin et al. in vitro study, found that bicortical screws provides orthodontic superior anchorage resistance, reduce cortical stress and superior stability compared with monocortical screws¹². TAS has been designed by the authors and manufactured by Tekka s.l. which consists of a nut and screw system, the nut being a machined shaft 2 mm in diameter and of variable lengths-10mm, 12mm, 16mm and 20mm. In one end, a 3mm hex head with two crossed grooves and a tunnel which allows for engagement of orthodontic wires and elastics. The screw has the same head and is twisted into the nut from the palatal side. Basically the use of TAD is to intrude an over erupted maxillary molar. Due to its bicortical anchorage and ability to withstand bilateral loading as vestibular and palatally, it might bear heavier orthodontic forces and low rate of failure¹³.

Miniplate Implants

Mini-plates that are used for orthodontic anchorage are very similar to maxillofacial plates. These are comprised of bone plates and fixation screws made of titanium which are suitable for osseointegration. The shape and size can differ, and the number of fixations can vary from 2 to 5 screws. It has 3 components-the head, the arm and the body. The head does not interfere with the tooth movement as it is exposed intraorally and positioned outside of the dentition. Here the recommended sizes are 2 mm in diameter and 5 mm length⁵. 'L'-shaped miniplates are most commonly used ones whereas 'T'-shaped used for intruding anterior teeth.

Onplants

Onplants are button type implants used in the palatal region for maxillary protraction and expansion¹⁴. These are the subperiosteal implants where the implant body lies over the bony ridge. The recommended sizes are about 10 mm in diameter and 2mm in thickness. It consists of circular disc 8 to 10

mm in diameter with a provision for abutments in the center of superficial surface. The under surface of titanium disc is coated with hydroxyapatite and this being bioactive, helps in stabilization of the implant by improving integration with the bone¹⁵.

CONCLUSION

The scope of orthodontics is expanding. Implants have revolutionized the field of anchorage in orthodontics. The concept of TAD is a relatively new application of more established clinical methodologies. TAD's have allowed the orthodontist to overcome

anchorage limitations and perform difficult tooth movements predictably and with minimum patient compliance. Careful treatment planning involves radiographic examination. Consultation with an oral surgeon is advisable if a soft tissue flap is required. Successful use of TAD for absolute anchorage depends on good technique and avoidance of inflammation around the implant. Mouthwashes and herbal preparations with anti-bacterial property like tea tree oil (TTO) can be prescribed to the patients after the placement of implant to avoid inflammation and maintain healthy oral environment¹⁶.

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