Applications and Benefits of Fixed Anchorage in the Palate

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Introduction
What next? You’ve attended almost every course on Temporary Anchorage Devices (TAD), and Mini-Screw Implants (MSI). You’ve read the numerous publications in the AJO/DO, JCO and other orthodontic journals about the benefits of incorporating MSI in to your orthodontic practice. You’ve decided on a manufacturer, purchased the kit, the necessary anesthetics and accessories. Finally, you’ve met the patient that in your best clinical judgment requires MSI anchorage to assist you in obtaining the desired clinical result. The next question: Where is the best place to place my first MSI?

Many sites have been advocated by numerous clinicians and academics as the “sites of choice” for placing MSI. Recently, with the advances in maxillofacial imaging, many publications have documented the bone quantity and density in the most popular interdental sites for MSI placement. However, for the clinician new to the world of MSI anchorage, the idea of placing a mini-screw in between tooth roots may be quite intimidating.

Soon after placing my first MSI interdentally, I started searching for the ideal alternate site for mini-screw placement, not due to fears of accidental root contact, but because all too often, interdental MSI placement limit tooth movement as they would inevitably be in the path of moving teeth. This is especially problematic when moving the entire arch in the AP direction. Sites such as the retromolar area, maxillary tuberosity, infrazygomatic region and the palate all provide a placement location away from teeth, with limited potential damage to the dental roots and other vital anatomical structures. However, only the palate provides a versatile location that could be used for most anchorage sensitive cases. The purpose of this publication is to review anatomical and biomechanical factors that confirm the palate as an optimal location for efficient, effective, and predictable site for mini-screw placement.

Anatomical Factors
A common concern for many clinicians using mini-screw implants interdentally is the potential complications that can arise during MSI placement. Limitations of interradicular bone, deviations in placement angle, impingement of the PDL space, and potential cementum contact have all been reported as potential complications of mini-screw placement. In addition, there are concerns about the stability of the MSI in certain interdental sites. Areas such as the mandibular incisor region and the maxillary tuberosity have reduced bone density, and minimal cortical bone thickness, not to mention limited interdental space in the mandibular incisor areas, leading to reduced stability and success rates for MSI placed in these regions.

The palate on the other hand, presents with thick, dense cortical bone levels, making it one of the most suitable sites for successful MSI placement. Other than the incisive foramen, the palate provides a site of limited potential for nerve and blood vessel damage from MSI placement. Furthermore, the palate is covered with keratinized tissue of ample thickness, which presents an environment that naturally limits tissue irritation and inflammation. In addition, access for mini-screw placement is simple if proper contra-angled drivers are utilized. However, the clinician should always aim to place the MSI in the paramedian region,
Palatal Placement Protocol

For the most part placing a MSI in the palate is similar to placement in any other intraoral site. Upon the application of a compound topical anesthetic, the tissue thickness should be measured. In cases that the tissue is more than 2 mm thick, local infiltration or a Madajet™ spray is indicated to allow for profound anesthesia. Generally, for tissue thicker than 2mm, a tissue punch would allow for removal of excess soft tissue before placement the MSI (Fig. 2).

My personal MSI brand of choice for palatal anchorage is the 6 mm IMTEC™ Ortho Implant, as it is one of the most versatile mini-implant systems available. The Ortho Implant has a tapered designed with a diameter of 1.8 mm (Fig. 3). In a study of various common brands of orthodontic mini-implants, the Ortho Implant was the only mini-implant that did not fatigue and fracture during placement, recording the highest peak torque values during placement7. This finding is of great significance when placing MSI in dense palatal cortical bone, which can lead to higher insertion torque values. The kit includes all required armamentarium required for palatal mini-screw placement, including, a soft tissue punch, a contra-angled (LT) driver (Fig. 4) and healing O-cap8. The O-cap is made of stainless steel, making it an invaluable part of an indirect anchorage system, where the MSI can be connected via a soldered connecting bar to a tooth. This tooth can then be used as the anchorage unit to move other teeth (Fig. 5a, 5b, 5c)
Biomechanical Factors
When a MSI located at a distance away from the archwire is loaded with a nitinol coil spring or a chain, it introduces a force vector in the vertical dimension (Fig. 6a, 6b). This vertical force often causes a bowing in the archwire, leading to an exaggerated curve of Spee along with increased friction during space closure. Though this side-effect is simply overcome during the final stages of treatment, it can be worrisome to the orthodontist new to using MSI in conjunction with conventional orthodontic mechanics.

The main advantage of the indirect anchorage system attainable by palatal MSI-TPA combination is that they rarely require any alterations in treatment mechanics. Consequently, the clinician can continue to use the same conventional orthodontic mechanics to which they are accustomed. Depending on the design of the MSI-TPA appliance, a palatal mini-implant can be used for en-masse retraction of anterior teeth (Fig. 7, Fig. 8a, 8b, 8c), or distalization of the entire maxillary arch (Fig 9a, 9b, Fig. 10a, 10b). A single MSI in the palate can also be used for the intrusion of supraerupted teeth (Fig. 11), or the entire maxillary arch in order to correct an anterior openbite (Fig. 12), as intrusion mechanics are more favorable when performed from the palatal aspect. In addition, the use of palatal anchorage can also reduce the number of mini-screw implants required per patient. In most cases, the same MSI can be used for distalization, retraction, or intrusion of teeth, simply by altering the design of the TPA attached.

Conclusions
Since the time of Edward Angle, the control over the position of the maxillary molar has been a major key for successful treatment of any orthodontic case. Many appliances have been devised over the years for this purpose, including a transpalatal arch, Nance appliance, headgear, and the pendulum appliances, to name a few. However, most of these appliances either depend on patient compliance, or have some form of anchorage loss, as none can defy Newton’s third laws. However, MSI located in the palate can predictably control not only the maxillary molar position, but also the position of almost every tooth in the mouth. The palate offers a safe haven for orthodontists, novice and experienced, to maximize efficiency of orthodontic treatment, in an effective manner.

References