Direct vs Indirect

by Dr. Mohammad R. Razavi

Dr. Razavi received his dental training at Case Western Reserve University – DDS (‘02), orthodontic certificate (‘05), and MSD (‘05) in Tooth-size and congenital absence of teeth. Upon completion of his orthodontic training, he was invited to join the department as an adjunct assistant clinical professor. He is the Director of the Skeletal Anchorage Clinic at Case, and has integrated various TAD systems into the training program. He is a member of the craniofacial team at the Cleveland Clinic Foundation. Dr. Razavi is a diplomate of the American Board of Orthodontists, a Fellow of the Royal College of Dentists in Canada, and an ad hoc reviewer for the American Journal of Orthodontics. Dr. Razavi’s private practice is located in Mentor, Ohio.

Introduction

Orthodontic anchorage is defined as the resistance to unwanted tooth movement.¹ Traditionally, anchorage in orthodontics is classified as minimal, moderate and maximum based on the extent of incisor retraction versus molar protraction. In recent years a new classification of anchorage has been defined as absolute anchorage for situations where the anchorage units are completely stationary in response to reaction forces applied to move teeth.

Historically, endosseous implants have been used to achieve absolute anchorage. These implants usually osseointegrate into the bone and are used through either a direct or an indirect fashion. Direct anchorage with these endosseous implants describes implants placed in the dental arch with the intent for future restoration of a missing tooth, while indirect anchorage is used for implants placed purely for orthodontic purposes and not future dental restoration.² The introduction of mini-implant temporary anchorage devices (TAD) has made this definition of direct and indirect anchorage obsolete, as these devices are rarely placed with the intention of future dental restoration.

Direct anchorage with such TADs describes situations where the teeth desired to be moved are pitted directly against the TAD. Indirect anchorage on the other hand, refers to the stabilization of certain teeth in the dental arch, and subsequent use of these stabilized anchors to move other teeth in the dental arch. The purpose of this review is to familiarize readers with various uses of mini-implant TADs, and review indications of direct or indirect anchorage.

Placement Sites

The recent increase in popularity of TADs is due to the significant treatment advantages they provide. It is now possible to move teeth in directions previously unattainable, such as movement of teeth in the anteroposterior and vertical directions. Posterior teeth can be mesialized through narrow atrophic ridges (Figures 1 and 2), distalized to correct class II molar relations and create space in the dental arches, intruded to aid in correction of anterior openbite malocclusion (Figure 3), while incisors can be intruded to improve excessive overbites (Figures 4 and 5). In addition, TADs can aid in the corrections of canted occlusal planes without surgical intervention, and preprosthetic orthodontics for the mutilated dentition. The highly polished surfaces of these mini-implant TADs do not osseointegrate, making their placement and removal dramatically simpler compared to their endosseous predecessors.

Figure 1: Mandibular molar desired to move mesially through a narrow atrophic ridge.
Selecting the ideal location for TAD placement is dependent on the amount and quality of bone available at the selected site, as well as the desired tooth movement. Commonly they are inserted interradicularly, in the attached gingival, away from moveable tissues such as frenum. Other common locations include the paramedian region in the palate, retromolar area and the infrazygomatic crestal bone.

Direct Anchorage

Mini-implant TAD’s can be a direct source of anchorage when they directly receive the reactive forces of a moving tooth or group of teeth. Commonly, the segment of dentition desired to move is connected to the TAD through an elastic chain module, or a coil spring. Site selection for the implant can vary from sites away from the dentition, such as retromolar area, the zygomatic crestal bone, mandibular symphysis, and the anterior nasal spine, to sites between dental roots.

At times, alterations in treatment mechanics may be required, as there is both a vertical and anteroposterior discrepancy between implant site and site of force application. Posted archwires provide a useful tool in minimizing the vertical discrepancy (Figure 6). On the other hand, the direct anchorage force systems are easy to design, and require no laboratory appliance fabrication. Though most published reports have concentrated on interradicular use of direct TAD anchors, this form of anchorage can be very useful to intrude posterior teeth in the treatment of openbite cases, when placed in the infrazygomatic crest (Figures 7 and 8), and in retraction of the entire arch in the treatment of Class III dental malocclusion, when placed in the retromolar region.

Indirect Anchorage

Mini-implant TAD’s can also be connected via a bar or a wire to a stabilized tooth, which receives the reactive forces of tooth movement. The simplest indirect anchorage system is derived from a transpalatal bar connected to a TAD placed in the midsagital regions. Figures 9A and 9B demonstrate a transpalatal arch soldered to the comfort cap of the IMTEC® Mini Ortho Implant. This arch is then used to stabilize the maxillary first molars via fluoride releasing band cement (Transbond™ Plus Light Cure Band Adhesive) (Figure 10). The main advantage of such systems is that they rarely require any alterations in treatment mechanics. However, they require an additional step for appliance fabrication. The use of palatal anchorage also reduces the number of mini-implant TADs required per patient. For instance, to aid in anterior tooth retraction in figure 10, only one palatal implant was needed, while with direct anchorage bilateral interradicular TADs would be required.

Figure 2: Mandibular molar moved mesially 5 mm, using the Imtec Ortho Implant as anchor.

Figure 3: Closure of anterior openbite using Imtec Ortho Implant placed in the infrazygomatic crest.

Figure 4: Adult patient with 100% overbite, and palatal impingement.

Figure 5: Overbite reduced to 50% using TADs placed in anterior maxilla and mandible.

Figure 6: Posted archwires to reduce the vertical vector of force application.

Figure 7: DM, Initial measurement of anterior openbite: 2.5mm, June 06, placement U 2/07.

Figure 8: DM, Openbite reduced to 1.5 mm after a 6 week activation period.

Figure 9A-B: Fabrication of TPA using the Imtec Comfort Cap.

Figure 9A: Fabrication of TPA using the Imtec Comfort Cap.

Figure 9B: Fabrication of TPA using the Imtec Comfort Cap.

Figure 10: Space closure using indirect anchorage.
IMTEC® Ortho Implant

During the past four years, I have experimented and experienced the ups and downs of 6 mini-implant systems. My personal preference is the Imtec Ortho Implant, as it is one of the most versatile implants systems available. The Ortho Implant has a tapered designed with a diameter of 1.8 mm. There is a 0.7 mm hole in the head to allow for ligation. They are fabricated from titanium alloy and are available in 6, 8, and 10mm lengths. The Imtec Kit includes a soft tissue punch, drivers, pilot drill and healing caps. Though included in the kit, soft tissue punch and pilot drilling are rarely indicated, making the placement procedure a simple, blood-free process. In fact the use of tissue punch is only advocated when the implant is to traverse thick fibrous gingival tissue, such as in the palate. Auxiliaries to the kit include a contra-angle driver, essential for implant placement in the palate and retromolar areas, and Nitinol springs for tooth movement. For placement, generally topical anaesthetic is sufficient tissue preparation. This allows for patient feedback if the mini-implant approaches vital tissues and nerves during the placement procedure. No pilot hole is necessary, as the Ortho Implant belongs to the self-drilling/self-tapping group of mini-implant TAD’s, which have a cutting end on the implant allowing self-advancement through the bone.

The most common complication is implant loosening and failure, occurring in as many as 10% of cases. Other complications involve damage to adjacent tissues, and implant fracture. The later is unlikely to occur with the Imtec Ortho Implant due to its tapered design. In a recent study of various common brands of orthodontic mini-implants, the Ortho Implant was the only mini-implant which did not fatigue and fracture during placement, recording the highest peak torque values during placement.

These orthodontic mini-implants have revolutionized orthodontic treatment. They have led to a paradigm where we have had to alter our approach to treatment planning our cases and executing our mechanics. They are powerful aids in the correction of complex malocclusions and are well on their way to becoming a mainstay in the modern orthodontic offices.

References

Transbond™ Supreme LV

by Author

Body copy here