With the advent of titanium as a biomaterial in orthodontics, skeletal anchorage has emerged as an alternative treatment tool in solving many complex orthodontic problems. In the past, complex cases would be limited to a solution by means of a surgical procedure. Today, titanium usage benefits patients with numerous missing teeth ultimately as an esthetic finish prosthetic as well as serving as an anchor unit necessary for predictable orthodontic movement.

Titanium anchorage devices can be divided into temporary or permanent. Although the temporary anchorage devices, TADs, are currently a very popular treatment modality, adult patients who are missing numerous teeth would benefit more by utilizing a conventional endosseous dental implant. The benefits are twofold: achieving the complex orthodontic movements and serving as prosthetic dental restoration at the end of the orthodontic treatment.

In order to maximize the cost-effectiveness of these skeletal anchorage devices, the orthodontist has to properly understand the basic biomechanical principles, which are the same fundamentals that apply to conventional orthodontic treatment. The only variation is that emphasis shifts to analyzing and understanding of the force system and prediction of tooth movement primarily in the active unit. The titanium anchorage device remains essentially stable or anchored. As such, the biomechanical analysis should focus on the active unit and assume stability from the skeletal anchorage device.

Endosseous dental implants can be placed before the initiation of orthodontic treatment. This treatment approach has very little room for error in the three dimensions of space. It is important to note that there is an approximate 1 mm margin of error in the mesiodistal, occlusogingival, and buccolingual final position of the implant. Any error above this margin will more than likely compromise the outcome. Compensation of this error will then fall to the shoulders of the restorative dentist to redress. Thus, in order to achieve this ideal placement, the interdisciplinary team has to have a 5-D model of the final result depicting the objectives of treatment. All the members of the team should be in agreement and understand how the objectives are going to be met.

At the University of Connecticut, this 5-D model starts on paper by means of an occlusogram.1 The occlusogram is a diagnostic tool that enables the orthodontist to visualize the changes that will be obtained with treatment (Fig. 1). The benefit achieved by using this tool is that the original relationship can be used as a reference for the desired movements. To completely achieve the 5-D analysis, the vertical and anteroposterior movements are sketched in the conventional visualized treatment objectives (VTO) popularized by Ricketts.2 Based on the occlusogram and the VTO, which are produced uncomplicated because of the missing teeth in the partially edentulous adult patient, the orthodontist can achieve more than 4 mm of incisor intrusion. As an osseointegrated stable unit, no side effects such as extrusion and tip back are seen on the reactive unit (Fig. 2).

Endosseous implants in patients with multiple missing teeth are a very cost-effective option. A proper understanding of biomechanics enhances the possibility of using skeletal anchorage to achieve orthodontic movements in different sites around the arch. Complex orthodontic movements such as intrusion of the posterior teeth and significant intrusion of the incisors can be accomplished using endosseous implants. Furthermore, the implants can be later restored prosthetically serving as a permanent solution to the missing teeth in the partially edentulous adult patient.

References