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# Skeletal Implant Anchorage in the Treatment of Impacted Teeth—A Review of the State of the Art

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The surgical-orthodontic approach is the most commonly used modality in patients with impacted teeth. It is also the most challenging. The prognosis of treatment is uncertain, treatment takes much longer and is more painful, and the enhanced biomechanical efforts required to bring the tooth to its ideal position frequently cause deleterious side effects to the remainder of the dentition. Skeletal anchorage is a useful aid in these cases. It can be judiciously exploited to assess the prognosis of canine movement, open adequate space for the canine, and build up a reliable anchorage unit that will allow the application of controlled directional forces with fewer side effects on the anchorage teeth. Treatment is facilitated and shortened because the resolution of the impaction may be performed separately before or even simultaneously with treatment of the remainder of the dentition, as 2 distinct force systems. The present article reviews some of the main indications for implant anchorage in treatment of impacted teeth. (Semin Orthod 2010;16:234-241.) © 2010 Elsevier Inc. All rights reserved.

The ability to predict the prognosis of a proposed treatment plan and the length of time needed to achieve it are arguably 2 of the most important factors that face the orthodontist in clinical practice.

## The Prognosis of Treatment for Impacted Teeth Is Uncertain

In routine orthodontic treatment, an extremely high proportion of the patients turning to practitioners for correction of misalignments and

malocclusion of the erupted dentition may be assured, with confidence, of a good outcome. However, when an impacted tooth is present, many new factors are introduced into the equation that are not usually part of routine orthodontics and that may complicate the course of treatment, seriously undermining the clinician's confidence of an optimal outcome. Presentation of the treatment plan to the patient in these situations will often include a verbal or written clause preparing the patient for the possibility of failure.

Because the tooth is not visible, accurate positional diagnosis is often difficult, and mistakes may be made even by experts.<sup>1</sup> A tooth in an intractable position may be thought to have a good prognosis, and an inappropriate course of treatment may be prescribed or, alternatively, traction may be applied in an inappropriate direction and the tooth may then be incorrectly misdiagnosed as ankylosed. Underestimation of the anchorage needs may lead to inappropriate biomechanical planning. Inadequate use of imaging techniques may lead to a missed diagnosis of resorption of the adjacent roots. Moreover,

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successful outcomes of treatment may founder in the long term because of a poor periodontal condition or inadequate torque.<sup>2</sup>

A recent study that analyzed a sample of patients who had been referred for a second opinion and/or retreatment after failure of orthodontic treatment for impacted maxillary canines revealed that the practitioner had most commonly ascribed the problem to ankylosis. However, a critical reevaluation of the reasons for failure showed that the main reasons were poor biomechanical planning of anchorage and an incorrect diagnosis of location and resorption. Ankylosis was only the third factor for failure. In this particular sample of failed cases, the extremely high incidence of ankylosis could have been caused by iatrogenic factors, such as trauma, radical surgery, instrumentation or etchant spillage on exposed root surfaces, or excessive orthodontic forces.<sup>3</sup>

Increased incidence of ankylosis has also been reported with advancing age.<sup>4,5</sup> In particular, mechanical eruption of palatal canines in patients older than 30 years of age had only a 41% success rate, with most of the failures being found in patients older than 40 years of age.<sup>5</sup>

### **Duration of Treatment of Patients With Impacted Teeth Is Longer**

As an important part of their decision process, a patient needs to know how long orthodontic treatment will take before treatment begins. Treatment not completed “on time” is a possible source of friction between the patient and the orthodontist, which may become an additional factor leading to treatment failure. Timely completion of treatment allows more accurate prediction of the number of treatment visits and therefore of costs.<sup>6</sup>

Treatment of a malocclusion in which there is an impacted canine will take longer and will be more painful<sup>7</sup> than treatment of a similar malocclusion, in which all the teeth are erupted.<sup>8,9</sup> The reason for this is that the biomechanics involved in the resolution of an impacted tooth are difficult to combine with the more routine types of movement obtaining in the overall malocclusion and the 2 cannot usually be performed concurrently. In addition, a surgical exposure procedure is necessary at some point,

resulting in some considerable discomfort to the patient.

The average treatment duration for a case with impacted canines is at least 2 years for the unilateral-impacted group and almost 3 years for the bilateral-impacted canine group.<sup>5,8-10</sup> Baccetti et al<sup>11</sup> found slightly lower values for treatment duration (average, 22.1 months); however, their sample included only those “easier” canines in which direct traction of the impacted tooth towards the center of the ridge was possible.

A number of studies have examined the influence of different factors on treatment duration. As mentioned above, the risk of failures increases with age but, even in the successful cases, the length of orthodontic treatment in adults is significantly increased. The reason for the prolonged overall treatment was an increased number of visits required for the canine resolution in the adults in comparison with the young patients.<sup>4,5</sup> Stewart et al<sup>9</sup> found that younger patients within their sample had more severely impacted canines, requiring longer orthodontic treatment. However, the older patients in the sample were all younger than 20 years of age, which may not qualify them for comparison as an adult group.

Other factors implicated in increased treatment duration are the height of the impacted canine relative to the occlusal plane and its mesiodistal location and inclination. Alignment of canines positioned higher relative to the occlusal plane, or more mesially relative to their normal place in the arch will take longer to resolve.<sup>9,10</sup>

A factor that significantly influences the duration of treatment but is frequently ignored relates to the additional period needed to correct deleterious effects created by canine eruption on the adjacent teeth, ie, loss of anchorage. The eruption of an impacted canine is very taxing on dental anchorage and may cause deterioration in the positions of the anchor teeth. Thus, in a fully banded case, the reactive forces incurred in erupting a palatally located canine cause intrusion and flaring of the anterior teeth. The labially directed traction of the canine towards its place in the dental arch creates lingually directed forces on the adjacent teeth and may generate a buccal crossbite on the opposite side of the arch, expressed as asymmetric skew-

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