Long-term stability—It begins with the treatment plan

James L. Vaden

The dentition is exposed to continuous forces albeit mastication, maturational changes, muscular, or habits. These potential changes influence the outcome of the orthodontic treatment result and mostly exhibits as an increase in lower incisor irregularity. However, with meticulous planning and following proven clinical guidelines during treatment long-term stable results seem to be a realistic clinical goal even with minimal retainer wear. (Semin Orthod 2017; 23:149–165.) © ***2017 Elsevier Inc. All rights reserved.***

Introduction

In Tweed's classic two volume text[1] there is a chapter entitled Retention. In the second paragraph of this Retention chapter, Tweed mentioned that a friend of his, also a prominent orthodontist, said to him, "*I would gladly pay someone half my fee if he would relieve me of the responsibilities of successfully carrying my patients through their retention periods.*" Fast forward to 1981 when Little et al.[2] published the results of a study of retention patients who had been treated in the graduate clinic at the University of Washington. They found that only 30% of the patients in the study had a mandibular incisor irregularity index of 3.5 mm or less. Their conclusion: only 30% of the patients in the study had a "successful" result. How can orthodontics give each patient a treatment result that has reasonable stability? This is THE question in orthodontics.

Instability of tooth alignment and occlusal relationships occurs to some extent in practically every patient.[3] The fact that most orthodontic patients are treated during adolescence leaves opportunity for subsequent growth of the maxilla, mandible, and mid face. These skeletal changes may effect movement of the teeth. Sinclair and Little[4] did an interesting study in which they reported on a sample of 65 patients with normal occlusions who had no treatment. These people were studied from the mixed dentition through the early permanent dentition and on into adulthood. They found that arch length decreased from the mixed dentition into early adulthood. Along with this arch length decrease from 13 to 20 years of age there was an increase in incisor irregularity. Richardson and Gormley[5] also did a study of the same age group of patients and found that between the ages of 13 and 18 the patients had exhibited 2.3 mm of mandibular incisor crowding. Other studies[6-8] have reported the same finding. Therefore, it is incumbent upon the orthodontist to understand that arch length decreases throughout life and that tooth positions change throughout life.

Long-term stability of the treatment result MUST BEGIN with the treatment plan. The treatment plan and the subsequent treatment have a tremendous impact on the stability of the treatment result. When one talks of stability, one must consider stability of facial esthetics, stability of tooth alignment, and the stability and health of the periodontium. Stability of the treatment result without permanent retention should be every clinician's goal.

A fundamental treatment planning concept which impacts stability is the concept of dimensions of the dentition.[9-15] This concept dictates that (1) there is an anterior limit of the dentition, (2) a posterior limit of the dentition, (3) a lateral limit of the dentition, and (4) a vertical limit of the dentition.

Quite probably, the two limits of the dentition that are most critical to stability of the treatment result are the anterior limit and the lateral limit. If the posterior limit is violated, second molars are impacted or are not able to function.[10] It is not wise to leave the second molars in such a state. To have a pericoronitis issue with second

Private Practice, Cookeville, TN.

Address correspondence to James L. Vaden, DDS, MS, Private Practice, 308 East 1st Street, Cookeville, TN. E-mail: jlvaden@frontiernet.net

1073-8746/17/1801-$30.00/0

http://dx.doi.org/10.1053/j.sodo.2016.12.004

molars is not in the patient's best interest. If the posterior limit of the dentition is compromised, one has to consider extraction of, quite probably, second premolars so that the first molars can be moved mesially. This first molar mesialization will allow the second molars to erupt and be in occlusion.

If the vertical limit of the dentition is violated, poor facial esthetics is quite often the consequence. The patient generally has a longer anterior facial height than necessary due to the fact that molars were extruded and point B drops down and back.[11-15]

The anterior limit of the dentition

Charles Tweed's diagnostic facial triangle[16] defined the anterior limit of the dentition for the specialty of orthodontics. Tweed did not like the protrusive faces that he created during his early days as an orthodontist.[17,18] Stability was not the primary consideration because he had not been in practice but 6 years when he decided to reduce protrusions with extraction. It became a consideration, however, as Tweed realized that his patients whose incisors were upright over basal bone seemed to have more tooth alignment stability than those whose mandibular incisors had been proclined.

Artun et al.[19] found that treatment increases of intercanine width and post-retention decrease of intercanine width and arch length were associated with relapse. In another University of Washington study[20] intercanine width and arch length decreased in 29 or the 30 patients by the time the patient was studied post-retention. These studies should not be interpreted to mean that mandibular incisors and canines can be expanded. They confirm the fact that the anterior limit of the dentition must be respected. Because there are no studies of patients who have been treated with excessive expansion who have been recalled 25 or more years after treatment, what should the orthodontic clinician do? To treatment plan with Strang,[21] Nance,[22] Tweed,[23] Merrifield,[24,25] Blake and Bibby,[26] Boley et al.,[27] and Johnston[28] would be not a bad idea.

During the treatment planning process, one must ask the question, does anterior tooth position matter to the face and to the long-term stability of tooth alignment. The answer is an unequivocal yes! When a patient is examined, the decision must be made as to whether or not the face needs to be changed or maintained. If the face is protruded (Figs. 1 and 2) and protrusion reduction is desired, the incisors must be retracted for the face to have balance and harmony (Figs. 3 and 4). If the face needs to be maintained and yet there is a significant tooth/arch discrepancy (Figs. 5 and 6), teeth probably need to be extracted. The face, however, must remain unchanged. (Figs. 7 and 8) If the patient is not crowded and has a balanced face

Figure 1. Pretreatment protrusive face.