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It is not so difficult to straighten crooked teeth, to get the dental system into a position acceptable to your patients and yourself, but to hold it there until it becomes permanently settled, is a much more serious problem. It is the one important consideration in all your prognosis, and the success of orthodontia as a science and as art lies in the [retainer]. Do not discharge the case or abandon retainers until there is a reasonable expectation of permanence. You may rightfully ask of that experience; how long will that be? Your patient will pester you with the same query. Out of the same observation and experience I can only answer, I don't know.

Norman Kingsley (1908).

Retention planning at the beginning of treatment and the continued focus during treatment

Most clinicians agree that retention should be considered right from the beginning of diagnosis and treatment planning. In so doing, the potential factors considered for long-term stability will be kept in mind throughout treatment. Moreover, as important is the orthodontic biomechanical objectives of tooth

movement in the craniofacial environment. Setting goals early also aids retention considerations during the process of active orthodontic treatment.¹

It is imperative that patient expectations are established at the outset of treatment. After fixed appliance orthodontic treatment, retainers are routinely fitted by the orthodontist and are worn by the patient for at least 6–12 months while the soft and hard tissues remodel around the teeth.² Al Yami et al.³ studied the stability of orthodontic treatment after 10 years post-retention. They evaluated dental casts of 1016 patients to determine the long-term treatment outcome using the Peer Assessment Rating (PAR) index. The PAR index was measured at the pretreatment stage, directly post-treatment, post-retention, 2 years post-retention, 5 years post-retention, and 10 years post-retention. The results indicate that 67% of the achieved orthodontic treatment result was maintained 10 years post-retention. About half of the total relapse (as measured with the PAR index) takes place in the first 2 years after retention. All occlusal traits relapsed gradually over time but remained stable from 5 years post-retention with the exception of the lower anterior contact point displacement, which showed a fast and continuous increase even exceeding the initial score. The results of this type of studies enable clinicians to inform their patients about treatment limitations in order to better meet their expectations.

Long-term observations of untreated and treated dentitions have provided factors, occlusal keys,^{4–6} hypotheses and theorems,⁷ to consider in the pursuit to a physiologic stable occlusion.¹ Factors requiring consideration during treatment include lower incisor alignment,

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correction of rotations of anterior teeth, changes in the anteroposterior lower incisor position, correction of deep overbite, correction of anterior open bites, patients with a history of periodontal disease or root resorption, growth modification treatment, correction of posterior and anterior cross bites, adult patients with often their mutilated occlusions and spaced dentitions. Thus, treatment planning with retention in mind is imperative for ultimate success.

Treatment planning should take the following in consideration:

- i. The impact of etiological factors on malocclusion has been well documented in the literature.⁷⁻¹² Eliminate these factors as soon as possible. Also, maintain a healthy periodontal environment as periodontal breakdown has possible long-term stability consequences.
- ii. *Teeth that have been moved tend to return to their former positions*⁷: Studies assessing the changes that occur following the treatment show to a minor or major extent that the teeth have a tendency to undergo rebound or settling changes. Minor changes fall into the category of physiologic stability^{13,14} and unacceptable changes can be considered as relapse. It is fortunate for the clinician to note that these changes appear to decrease in tempo with age.¹⁵
- iii. If the lower incisors are planned to be upright over basal bone, they are more likely to remain in good alignment.^{16,17} Moreover, if there is any tendency for teeth to return to their original positions and in this instance, a tendency to procline slightly, additional space, albeit minor, will be created to assist in maintenance of the tooth alignment.¹⁷
- iv. *Lower incisor position in respect to the Point A—Pogonion (Apo) line*^{6,18}: The incisal edge of the lower incisor should be placed on the APo line or 1 mm in front of it as recommended by Ricketts (1 ± 2 mm). This recommendation is the optimum position for lower incisor stability.¹⁸ It also creates, according to Williams,¹⁹ optimum balance of soft tissues in the lower third of the face for all the variations in apical base differences within the normal range. Appliance control is required to achieve optimal positioning of

the lower incisor at the end of treatment as shown by Williams and Hosila²⁰ and Woodside et al.²¹ This is especially important in contemporary orthodontics, as we practice clinical orthodontics in an era where prescription appliances are used as the norm. It is thus imperative to treat each patient as a unique individual as all prescriptions may not be appropriate for all, the same as we all do not wear the same size shoes. It is proposed that if the lower incisor is advanced too far beyond the APo line, relapse and crowding will occur. Lower incisors that are overly proclined in treatment (beyond one standard deviation) can only be maintained in such a position with a fixed retainer. The incisors will move lingually and become crowded when the retainer is removed according to Mills.^{22,23} Lower incisor position also dictates when teeth need to be extracted and which ones would be ideal. Moreover, a literature review by Blake and Bibby²⁴ showed that the most stable positions of the teeth are their pretreatment positions.

- v. *The mesiodistal inclination of the lower incisor or second-order position*: The lower incisor apices should be positioned distally to the crowns more than is generally considered appropriate, and the apices of the lower lateral incisors must be more than those of the central incisors.⁴⁻⁶ Modern day appliances have this tip (second-order prescription) included in the design of the appliances. When the lower incisor roots are left convergent, or even parallel, the teeth tend to become irregular again following treatment as a natural phenomenon of uprighting; that is, roots distal to crowns, according to Andrews.^{4,5} In addition, the contact points are higher in this situation. A fixed lower retainer is usually needed to prevent such posttreatment relapse.
- vi. *Lower cuspid inclination (mesiodistal/second order) and angulation (labiolingual/third order) position*: Similarly, to the incisors, the apex of the lower cuspid should be positioned distal to the crown. Williams⁶ recommends the occlusal plane, rather than the mandibular plane as reference line for this assessment. This angulation of the lower cuspid is important in creating posttreatment incisor

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