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Standard Edgewise Technique and Its Relevance in Contemporary Fixed Appliance Therapy Part 3: Overbite Control and Space Closure

Abstract: The first two papers in this series looked at the development of the edgewise appliance, the use of first-, second- and third-order bends, and the construction of arch forms. This third and final paper will examine the methods that can be used for overbite control and space closure using standard edgewise and other techniques.

Clinical Relevance: Overbite control is important in orthodontic treatment as good treatment results (especially correct incisor positioning) cannot be achieved without it. Space closure is often accomplished by sliding mechanics, but friction in the appliance may prevent this occurring and methods are shown how to overcome this.

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Overbite control

Overbite control has always been problematical in the edgewise technique. The Begg technique[1] has a reputation for opening deep bites and reducing big overjets quite rapidly, especially in the early stages of treatment, but at the expense of a final finish that often cannot match that achieved in edgewise appliances. With the development of the Tip-Edge appliance, which incorporates the Begg technique in its early stages and straight-wire in later stages, this problem

Figure 1. Reverse curve of Spee in the lower archwire (dotted line). While bite opening is achieved, the point of force application is such that proclination of the lower incisors occurs, which is undesirable.

Figure 2. Utility arch from molars to incisors, bypassing premolars and canines. There is a stabilizing section from the molars to the premolars and canine on each side. This sectionalized (segmented) approach allows easier intrusion of the lower incisors.

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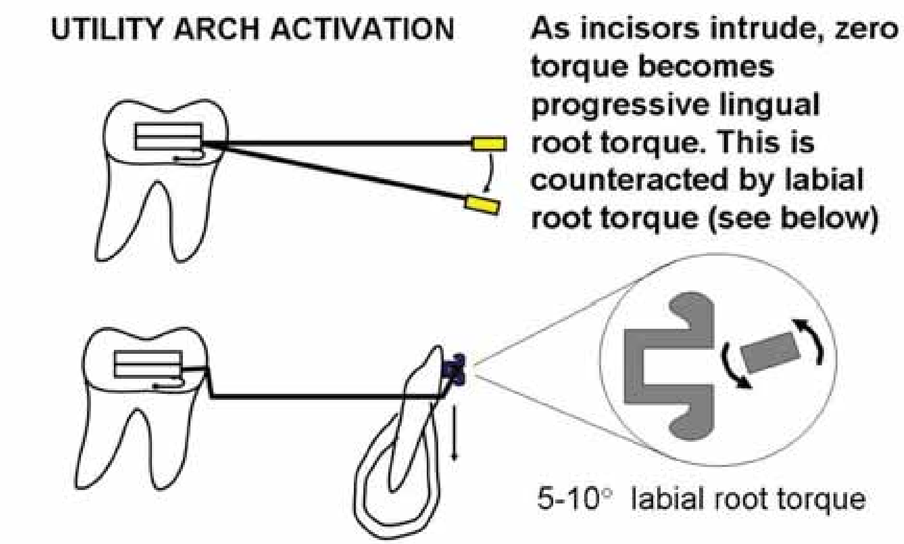

Figure 3. Labial root torque placed in lower incisal area of the utility arch to counteract the proclination effect of intrusion.

Figure 4. Utility arch from molars to intrude lower incisors. Note the extrusion of the canines attached to the buccal stabilizing sections.

has now been overcome.

Bite opening in the edgewise appliance can be achieved by placing a reverse curve of Spee in the lower archwire (or a positive curve of Spee in the upper). By including the second molars in the archwire, anchorage for bite opening is increased. However, unwanted effects include proclination of the lower labial segment (Figure 1) and many attempts to counteract this have been tried in the past, for example, tiebacks to the canines, placing buccal root torque in the lower labial segment, J-hook headgear to the lower labial segment, and using intrusion bends with loops to the lower labial segment.

It was these observations that led Robert Ricketts (1920–2003) to develop the utility arch. This sectional appliance was originally created to allow individual retraction of the canines while utilizing the maximum number of teeth for anchorage. The utility arch consists of a 'bypass' archwire directly from the molars to the incisors, with a rectangular wire section from the molars to the canines on both sides (Figure 2). This requires two rectangular slots in the molar bracket – the gingival slot for the utility arch and the occlusal slot for the section to the canines. Ricketts noticed that this arch worked not only by retracting the canine efficiently, but a useful side-effect was that the incisors intruded under a constant gentle force.[2] By splitting the wire into more than one section, greater flexibility resulted in the ability to move one section of the arch against another. The original utility arch was constructed in Elgiloy (cobalt-chrome) wire, which is relatively soft and which, over a long wire span, tends to exert light forces compared to the equivalent wire in stainless steel. By utilizing such light forces, the upper or lower incisors could be intruded relative to the other teeth in the arch. Torque control in the lower labial segment can be placed to counteract the proclination effect of the utility arch during incisor intrusion (Figure 3).

While bite opening can be achieved with a utility arch, it must be remembered that, for every action, there is an equal and opposite reaction. Part of the intrusion of the lower incisors is due to the relative extrusion of the premolars and canines attached to the stabilizing section (Figure 4). However, the correct use of utility arches will allow bite opening to be achieved during the course of treatment (Figures 5–7) and allow the treatment goals to be achieved.

Ideally, rectangular stainless steel should be avoided for utility construction because it is difficult to control the level of forces applied to the teeth. Elgiloy wire is now rather difficult to obtain and is very expensive, so some clinicians recommend using TMA (titanium-molybdenum alloy) wire which can be bent to the shape required. It should be noted, however, that TMA work hardens very rapidly and will fracture if more than one bend is made at the same site.

If the utility arch is used without stabilizing sections in the buccal segments, there is a risk that, instead of the incisors intruding, distal tipping of the molars will occur, which may be undesirable (unless it is desired to upright the molars).

The use of the utility arch overcame the inherent stiffness of the stainless steel wires which are the mainstay of the edgewise technique. Several other utility arches have been developed by other orthodontists over the years – most notably by Professor Charles Burstone (University of Connecticut) who has developed torquing and intruding utilities using TMA and stainless steel.[3,4] An example of a Burstone intruding utility is shown in Figure 8, while a torquing utility is shown in Figures 9a, 9b and 10.

In more recent years, the use of microscrews and orthognathic surgery have greatly improved our ability to deal with very deep overbites that cannot be adequately treated by orthodontic means alone.

Space closure

In contemporary orthodontics, most space closure is usually accomplished by sliding mechanics, using space closing springs or elastics. The problem with this is that there is a considerable amount of friction between the wire and the bracket. Andreason and Quevedo[5] found that up to 50% of applied force could be dissipated owing to friction in an edgewise appliance, while Tidy[6] found this percentage to be somewhat greater. Self-ligating appliances have low friction but sometimes cannot completely overcome the problem of slow space closure with sliding mechanics. One way to close space is to incorporate a space closing loop within the wire. The simplest space closing loop is shown in Figure 11

5a b c

6a b c

7a b c

Figure 5–7. (a–c) Bite opening in a patient using an 0.016″ x 0.022″ Elgiloy utility wire in the upper arch to intrude the upper incisors. In this case, the bracket size is 0.018″ x 0.030″ (the Ricketts 'Bioprogressive' system). **Figure 5. (a–c)** Before treatment; **Figure 6. (a–c)** During treatment; **Figure 7. (a–c)** After treatment.

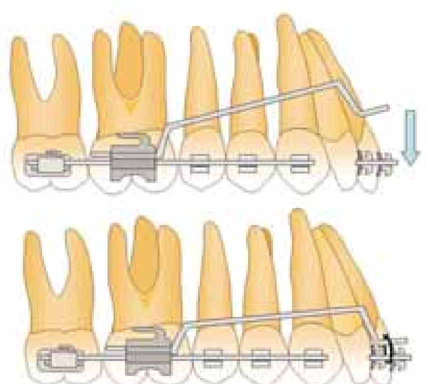

Figure 8. Schematic diagram of a Burstone intrusion utility. There is a stabilizing section in the buccal segments and a sectional rectangular stainless steel wire placed in the brackets on the upper incisors. Assuming a slot size of 0.022″, the largest possible wires should be used. The utility is constructed in rectangular TMA and is activated by tying it to the upper labial segment sectional wire. The effect is to intrude the upper incisors.

a b

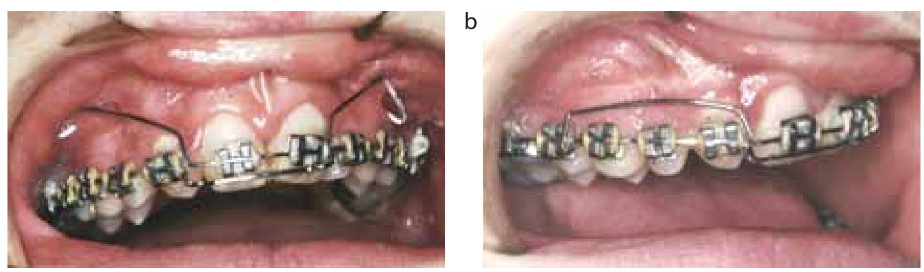

Figure 9. (a, b) Burstone torquing utility. This is constructed in either stainless steel or TMA. The base wire is constructed in 0.018″ x 0.025″ stainless steel and bypasses the upper central incisors (but contacts the labial surface incisal to the brackets). The utility itself engages the bracket slots of the upper central incisors and is activated by bringing the buccal arms occlusally to attach around the base wire in the region of the molars.

and consists of a simple loop bend in the wire, with sufficient length to allow it to flex in the antero-posterior dimension. Numerous variations on this basic design are shown in Figure 12, but the principles remain the same. The wire is activated by pulling the wire through the buccal tubes and this activates the wire to reduce the overjet or close space.

In designing such loops, it must be remembered that the more vertical the loop, the more horizontal in direction the activation. However, with loops such as the T-loop (Figure 13), which have significant horizontal components, the action will be horizontal but there will also be considerable flexibility in a vertical dimension.

The space closing loop can, in theory, be positioned in almost any area of the arch, but traditionally is usually placed in the space that one wishes to close. This has one disadvantage in that it allows the wire to flex in the vertical dimension and the result may be extrusion of the upper incisors in, for example, overjet reduction. In order to counteract this, sometimes it is useful to place the space closing loop

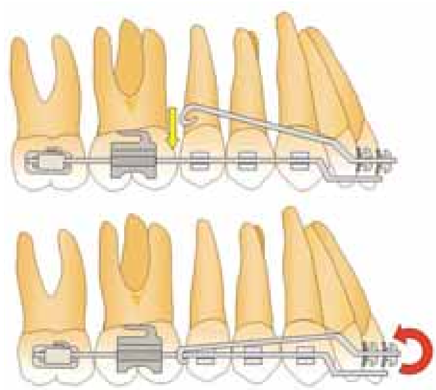

Figure 10. Schematic diagram of a Burstone torquing utility arch. The utility is activated by engaging the ends of the arms around the base wire mesial to the molars. The incisal edges of the upper incisors are prevented from moving forward by the base wire. The net effect is to move the roots of the incisors palatally.

Figure 11.The simplest form of space closing loop.

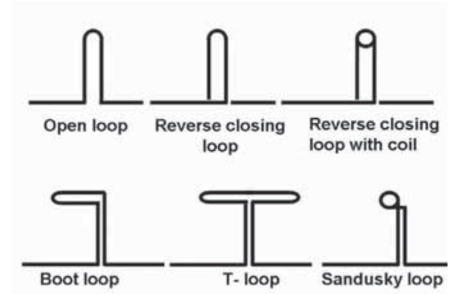

Figure 12. Examples of space closing loops.

Figure 13. A T-loop constructed in 0.018" x 0.025" rectangular stainless steel wire.

Figure 14. Reverse closing loop with tieback loop immediately distal to the canine.

Figure 15. Space closure in upper left quadrant using reverse closing loop (note position of loop between UL1 and UL2).

Figure 16. Space closure accomplished.

between two teeth that are in contact with each other (Figure 14). This will help to reduce vertical flexing of the archwire. Another point should be made in relation to activation of the wire: if space closing activation is done by pulling the end of the wire through the distal end of the molar tubes on each side, and cinching it back, this means that the end of the wire will become distorted and may be difficult to remove through the molar tube. In some cases, the wire may have to be removed by cutting the wire mesial to the molar tubes. Obviously, this precludes using this wire again to continue space closure and another closing wire may need to be constructed.

In order to overcome this problem, a tieback loop (Figures 14–16) can be inserted into the wire distal to the closing loop. This wire is then activated by attaching a wire tie to the tieback loop from the molars. Activation should be no more than a few millimetres to avoid placing excessive force on the teeth. As the space closing spring returns to its passive state, the space will close and any overjet will reduce (if desired). At the next patient visit, the reactivation of the spring can be done by placing a new wire tieback as before. This can continue for a number of visits until space closure or overjet reduction has been accomplished.

Summary

Pure standard edgewise technique is now uncommon in orthodontics, and it is unlikely that many current orthodontic trainees will encounter such cases during their training. However, the principles outlined in these three articles will give the specialist orthodontist an insight into the development of the straight-wire technique and how to deal with a number of problems that cannot always be dealt with using prescription appliances. By using these techniques, the orthodontist will gain a greater insight into the mechanics of treatment and achieve better, and hopefully more stable, treatment results. The effort of incorporating these techniques into one's regular practice may appear initially to be tedious, but will result in better clinical outcomes in the longer term.

References

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