Time-Saving Closing Loops for Anterior Retraction

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In extraction treatment with preadjusted appliances, the anterior segment is usually retracted with sliding mechanics, using open-coil springs or elastomeric chain. Little or no wire bending is required. With the standard edgewise technique, however, treatment generally proceeds in four stages: leveling, canine retraction, incisor retraction, and detailing.[1] Because each stage usually needs several archwire changes, if the incisor retraction space is large, a number of looped retraction, or "contraction", archwires may have to be bent.

We have developed a technique whereby a single contraction archwire can be used to close a wide space simply by modifying the loop.

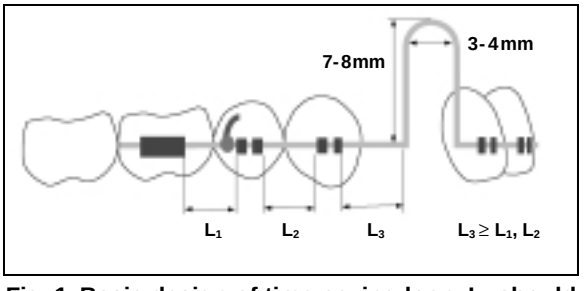

Fig. 1 Basic design of time-saving loop. L_3 should be longer than either L_1 or L_2 to permit effective activation.

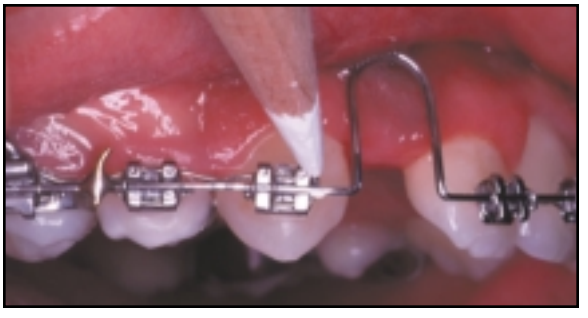

Fig. 2 Marking archwire to monitor amount of activation.

Design of Time-Saving Loops

We use .018" × .025" stainless steel archwires for bending what we call "time-saving loops" (Fig. 1). Although these loops are relatively wide (3-4mm), their height is fairly standard (7-8mm). Each loop should be bent sufficiently distal to the lateral incisor bracket to allow proper oral hygiene. The distance from the loop to the canine bracket should be greater than

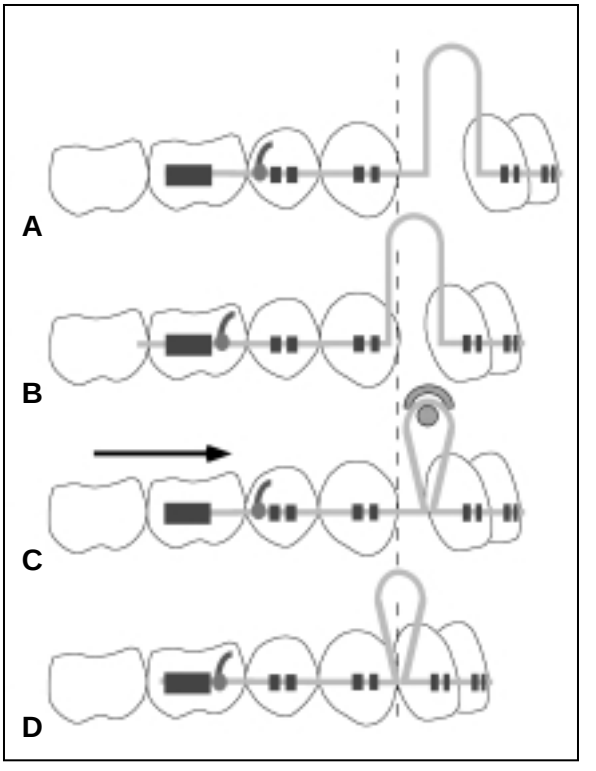

Fig. 3 A. Mesial leg of loop should be sufficiently clear of lateral incisor bracket to allow toothbrushing. B. Space closure from initial activation with vertical loop. C. Squeezing loop advances tieback to its initial position. D. Completion of space closure.





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that between the second premolar bracket and the first molar tube, as well as that between the premolar and the canine. This allows continuous activation to take place. Although the tieback shown here is soldered to the wire, it can also be welded, crimped, or bent.

The amount of activation can be monitored by marking the archwire mesial or distal to the canine bracket (Fig. 2). Once the space has closed enough that the tieback meets the molar bracket (Fig. 3B), the loop is squeezed with an optical or How plier, moving the tieback forward (Fig. 3C) and providing the space for further activation (Fig. 3D). Squeezing enables the molar offset and canine curve to return to their original positions (Fig. 4).

Mechanical Properties of Time-Saving Loops

Either an open loop or a closed loop can be used (Fig. 5). The closed type makes wire adjustment slightly more difficult, but because of the Bauschinger effect—which states that the range of activation of a loop is always greatest in the direction of the last bend— it is conceivable that the closed design would produce a smaller degree of wire deformation.[2]

If the legs of a closed loop are too close together, however, an activation of as little as 1mm could apply a retraction force so excessive that even an anterior labial crown torque would not be enough to counteract the tendency of the

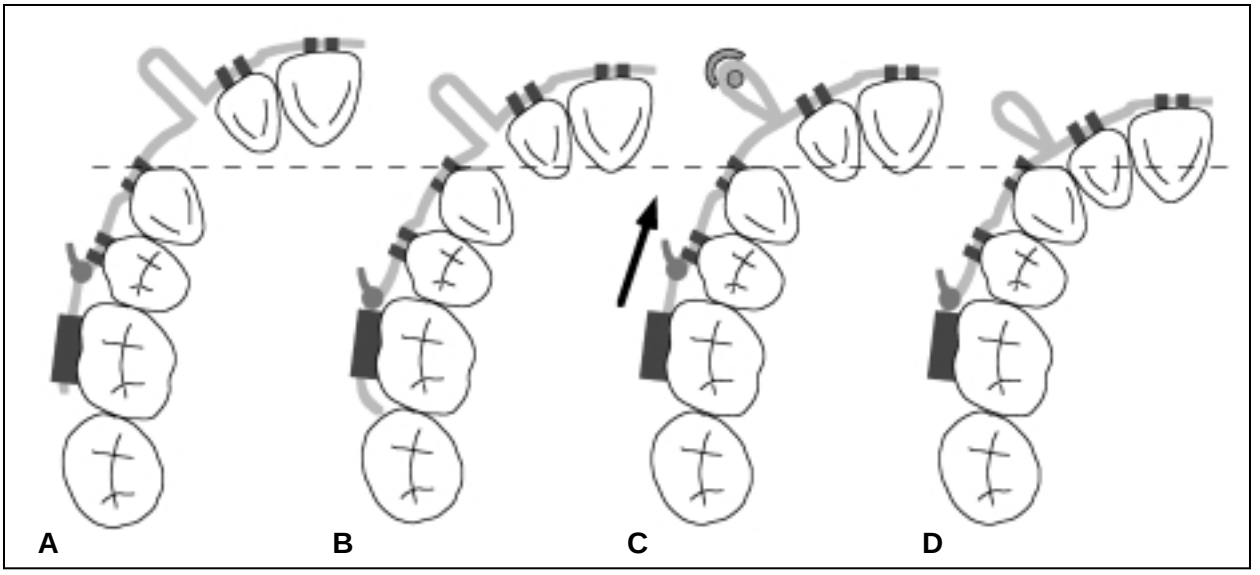

Fig. 4 A. Before activation. B. Space closure from initial activation with vertical loop. Distal end of wire bent inward to avoid injury. C. Squeezing loop advances tieback to its initial position, shortening archwire without altering 1st-order bends. D. Completion of space closure.

anterior teeth to tip lingually or extrude. This phenomenon does not occur with open loops, but when using a closed type, the clinician must be careful to maintain a minute space in the loop.

We used a planar frame and truss program to analyze the changes caused by the activation of each type of loop in .018" × .025" stainless steel wires[3] (Fig. 6). Of the six force components at the left end of the wire, the *x*-, *y*-, and *z*-forces and the moments around the *x*- and *y*-axes were fixed. A traction of 300g was added in the *x*-direction at the opposite end of the wire. The wire deflection at the bottom of the loop was –1.2mm for both the open and closed types, with no significant difference between the two. The traction strength at both ends of the wire was 300g. The moment around the *z*-axis was –145.0g-mm for the open type and –149.6g-mm for the closed type, with no significant difference.

These results indicate that there is no major

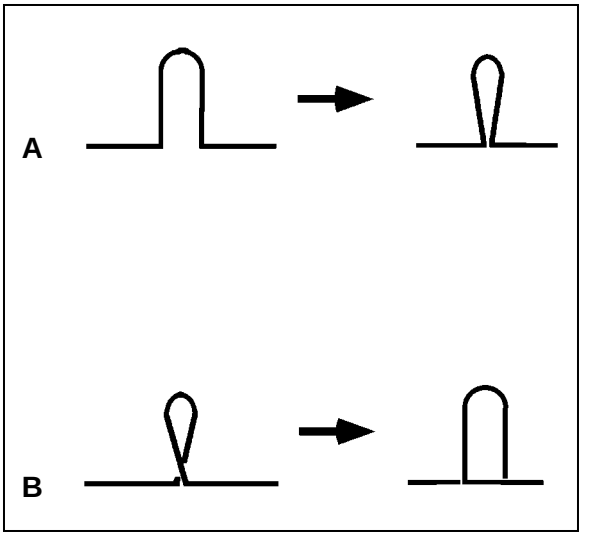

Fig. 5 A. Open loop design. Archwire is shortened by squeezing loop together. B. Closed loop design. Archwire is *lengthened* by grasping ends of wire. In either case, wire returns to its original length when passive.

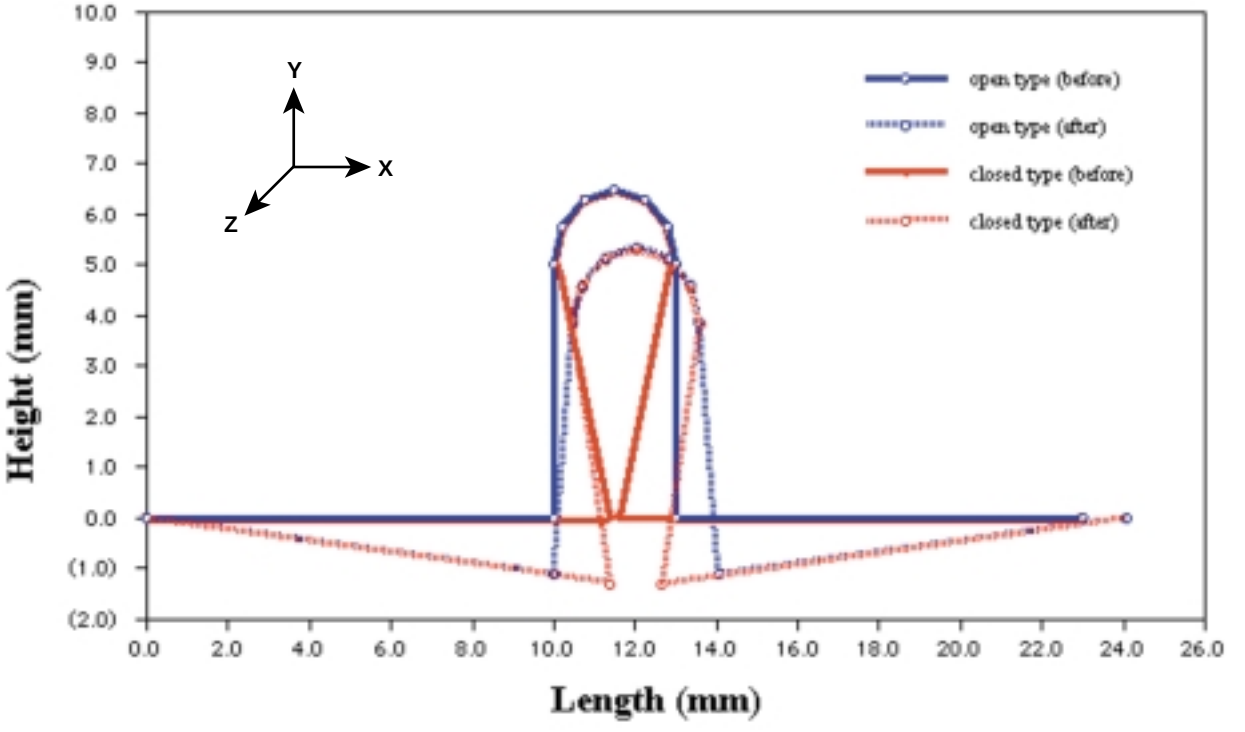

Fig. 6 Deflection of open and closed loops in .018" × .025" stainless steel wires.

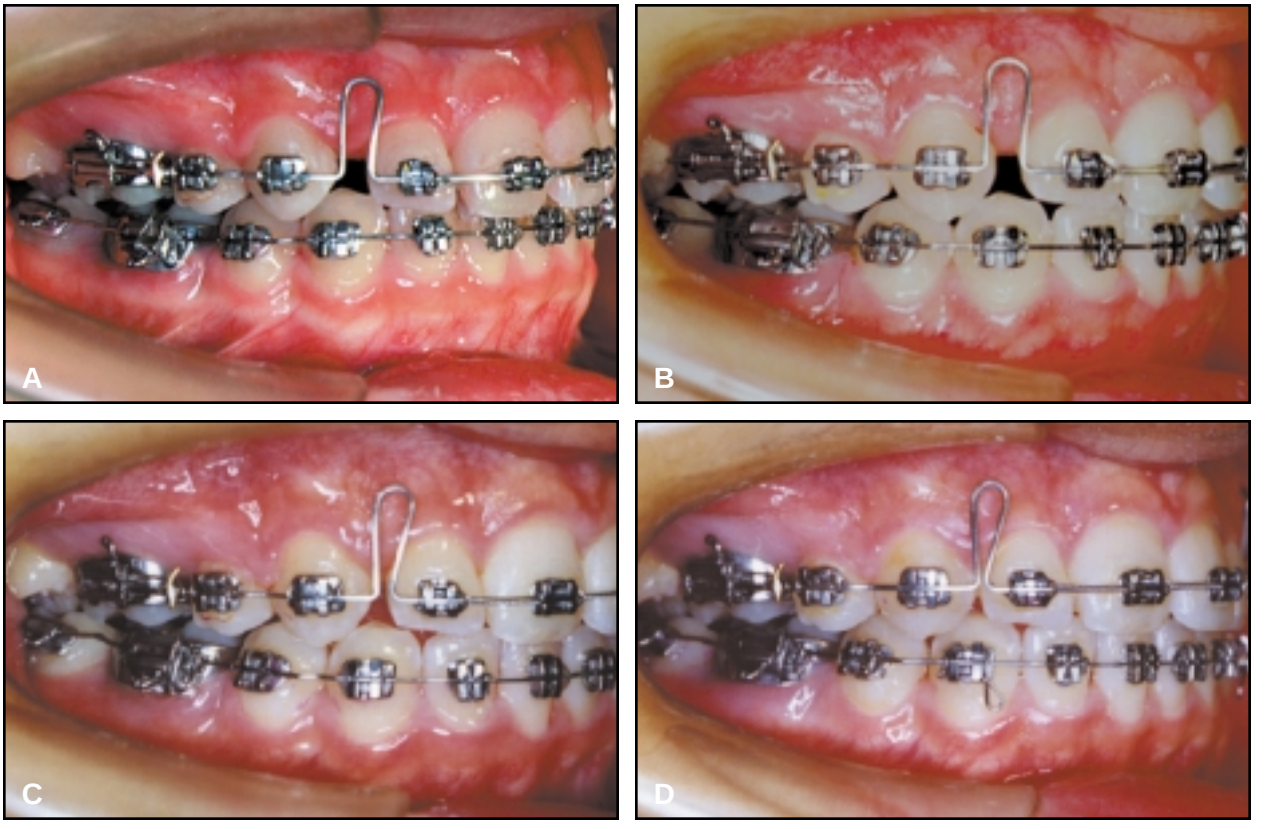

Fig. 7 A. Initial placement of time-saving loop in maxillary arch. B. Tieback activated, opening loop 1mm. C. Loop squeezed to advance tieback. D. Completion of incisor retraction.

difference in terms of dynamics between the two types of loops, either before or after squeezing. Therefore, there is no need to make distinctions for different types of bends, such as gable bends.

Conclusion

Anterior space closure with conventional contraction arches usually requires archwire changes, resulting in loss of valuable chairtime and possible jiggling of teeth. Some clinicians solve the problem by resoldering the tiebacks more anteriorly, but this may entail rebending the posterior segment of the archwire to maintain the torque. The resultant loss of rigidity may lead to wire deformation.

The time-saving loops shown here resolve these difficulties—even closing large residual spaces—without causing any changes in the physical properties of the wire (Fig. 7). As long as there is no wire deformation or bracket disengagement, the chairtime required for one adjustment is no different from that of a simple wire activation.

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