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Versatile loop - T loop

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Abstract: *After extraction, space closure is an essential part of orthodontic treatment which needs thorough understanding of biomechanics used for space closure. Orthodontic appliances are being refined with passage of time. This refinement has reduced the physical effort put forth in treatment, but does not eliminate the need for an orthodontist to think, understand and apply basic principles of biomechanics in a common sense manner.*

I. Introduction

Space closure is achieved either with frictional or frictionless mechanics. Retraction in frictionless mechanics is accomplished with loops or springs, which offer more controlled tooth movement than sliding mechanics. Loop mechanics is friction free and can produce pure tooth translation if a moment to force ratio of 10:1 can be maintained.[1]The type of movement produced by spring depends on moment to force ratio. Small differences in moment to force ratio can produce different clinical results.[2,3]The inability to control the orthodontic force system can result in undesirable tooth movement. The moment to force ratio can be altered by various factors like vertical height of loop, horizontal length of loop, positioning of loop, extent of activation, properties and thickness of wire.[4-9]

The force of a retraction spring is applied by pulling the distal end through the molar tube and cinching it back. Various loops are used in frictionless mechanics for retraction of teeth. These are: P.G. spring, Burstone's T loop, opus loop, keyhole loop, tear drop shaped loop, compound loops etc. This article includes discussion on T loop.

T Loop

T-loop is one of the most versatile space closure device. This was developed by Charles Burstone in 1962. It has been recognized as an effective means to achieve desired tooth movement by differential moments between the anterior and posterior segments. It is used for segmental space closure and en-masse space closure, anterior retraction, symmetric space closure and posterior protraction. Desired tooth movement can be achieved by:

- Changing the angulation of the preactivation bends.
- By altering the dimensions of the spring.
- By changing the position of the T-loop.[10]

The moments and forces generated by a T-loop spring are functions of its geometry and gable bend combined with heat treatment. In general, increasing its vertical or horizontal dimension reduces the load-deflection rate and the M/F ratio. Gable preactivation and stress relieving heat treatment has the opposite effect[11].

Design and fabrication

T-loop is made of 0.017''X0.025'' Titanium molybdenum alloy (TMA). Advantages of TMA over stainless steel: Low modulus of elasticity, generate low force and high range of action.

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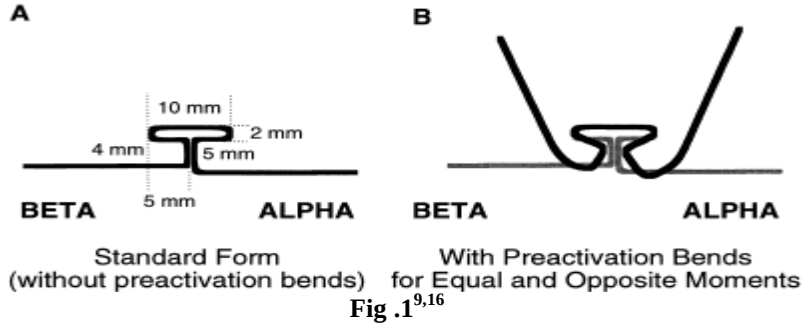

Fig .1[9,16]

Phases of movement at 6mm activation of T loop:

1. Initial tipping at 0mm retraction (M/F – 6:1)
2. Translation at 2mm of deactivation (M/F-10:1)
3. Root uprighting at 4mm deactivation (M/F-12:1)

Loop should not be reactivated too soon, if reactivated too frequently, the teeth will undergo only controlled tipping. In order to produce TRANSLATION, the M/F ratio must be allowed to increase.[12]

T-loop position and anchorage control: Andrew and Burstone concluded that A centered T-loop produces equal and opposite moments with negligible vertical forces.This position is used in type B anchorage cases. Off-center positioning of a T-loop produces differential moments. More posterior positioning produces an increased beta moment and used in type A anchorage cases. More anterior positioning produces an increased alpha moment and used in type C anchorage cases. So a standard shaped T-loop can be used for differential anchorage requirements by altering mesial-distal position of the loop.[13]

Modified 'T' loop arch wire: Modified 'T' loop archwire was devised by **Barton H.Tayer** in 1981. In some cases, there is a need for additional maxillary intrusion (bite opening), space closure and torque toward the end of active treatment. Typically the mandibular arch is completed. It may require a small amount of space closure; but leveling, alignment and rotations have been corrected. The maxillary arch should be in class I relationship from cuspid to molar, but final space closure of the anterior section is prevented by interference of mandibular anterior brackets. The maxillary anterior teeth still require lingual root torque, and depression to gain additional bite opening to permit space closure and overjet reduction. The modified T-loop archwire achieves all these corrections[14].

T Loops for adult patients: In 1989 segmented arch technique used for space closure in adult patients. In adult patients, center of resistance changed due to different levels of bony support and periodontal loss, M/F ratio must be modified in such cases. Thus in adult patients with periodontal loss, lower magnitude of force and higher moment to force value must be attained. In T loop force and moment can be modified by changing wire cross-section, angulation and activation. . Force magnitude can be lowered by reducing the cross-section of wire or amount of activation of spring. The moment to force ratio can be increased by augmenting the angulation of T loop. In a T-loop, the amount of wire placed gingivally at the top of the loop increases the M/F ratio and reduces the load deflection rate.[15]

Asymmetric T loop: This loop allows simultaneous bite opening and space closure. It is made of .016 X .22 TMA or .019 X .025 TMA wire with 5mm vertical step, 2mm anterior loop, 5mm posterior loop and exaggerated reverse curve of spee[17].(Fig 2)

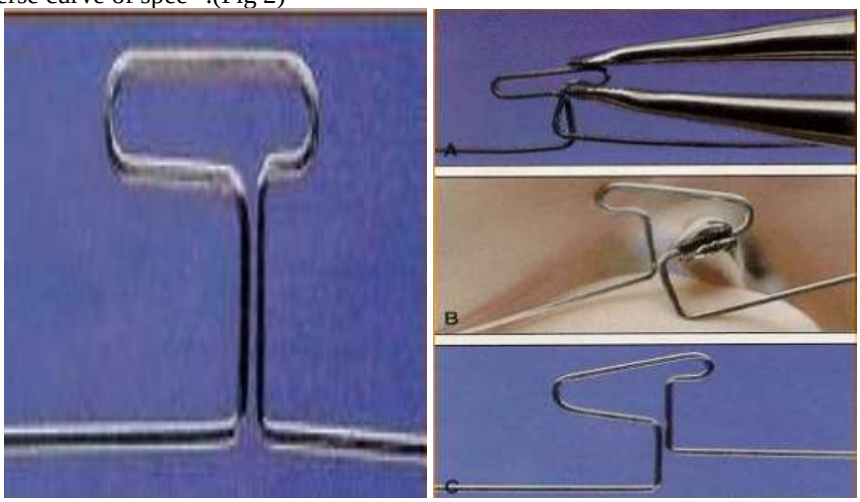

Fig. 2 Fig 3. Pre activation of asymmetric T loop.

A. Short Mesial loop compressed.
B. Long distal loop opened.
C. Loop after pre activation

Placing torque in a continuous T loop archwire: Torque can be added to T loop archwire without removing it. For this first straighten the cinched part of wire and slide it anteriorly to disengage the four incisors. Make a "V" bend in gingival portion of each T loop with an omega loop forming or three pronged plier. (Fig.4)Then retie the archwire in four incisor brackets and activate it for retraction[18]

Fig.4

II. Conclusion

T loop is versatile loop which can be used for both segmental retraction and en-masse retraction. It is used for anterior retraction, protraction of posterior teeth and bite openings. It provides a mechanism to control anchorage loss during space closure by changing its position with a uniform design.

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