IP Indian Journal of Orthodontics and Dentofacial Research 2022;8(2):127–131

Content available at: https://www.ipinnovative.com/open-access-journals

IP Indian Journal of Orthodontics and Dentofacial Research

Journal homepage: https://www.ijodr.com/

Case Report

T loop mechanics for effective space closure in bimaxillary dentoalveolar protrusion - A case report

CA Prachodh[1,*], Muhammed Shaloob K M[1], Muhammed Naxaz VP[1], Muhammed Raheesh[1], Fathima Arzu T P[1]

[1]*Dept. of Orthodontics, MES Dental College, Perintalmanna, Kerala, India*

ARTICLE INFO

Article history:
Received 20-04-2022
Accepted 29-04-2022
Available online 30-05-2022

Keywords:
T Loop
Space closure
Bimaxillary Dentoalveolar Protrusion

ABSTRACT

This case report intends to highlight the space closure with continuous T-loop mechanics for bimaxillary protrusion. Loops can be fabricated in a sectional or full arch wire, and closing loops are usually used in loop mechanics for extraction space closure. The major advantage of loop mechanics is the lack of friction between the bracket and arch wire during space closure. A 21-year old adult male patient with bimaxillary protrusion and spacing reported to the clinic. The patient was treated successfully by maximum retraction of maxillary and mandibular anterior teeth after extraction of all first premolars. Space closure was achieved using a moment differential between posterior and anterior segments created by a T-loop. A stable result with normal over jet and overbite was achieved with retraction of maxillary and mandibular anterior teeth and no loss of anchorage.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Friction is the force that resists the movement of one surface against another and that acts on the opposite direction of the desired movement. High levels of friction can limit the effectiveness of orthodontic tooth movement, complicate the anchorage management hence the orthodontists often face a clinical dilemma.

Treatment modalities involving the extraction of the have been followed for successful orthodontic treatment. At least six goals should be considered for any universal method of space closure:

1. Differential space closure.
2. Minimum patient cooperation.
3. Axial inclination control.
4. Control of rotations and arch width.
5. Optimum biologic response
6. Operator convenience.[1]

The space closure stage of orthodontic tooth movement is achieved through two types of mechanics. Sliding mechanics is the first form, and it entails either moving brackets along an archwire or sliding the archwire through brackets and tubes. Friction occurs, resulting in unfavourable rotational movements and decreased tooth mobility, as well as an increase in anchor requirements, or both. In the second type, frictionless mechanics, i.e. loops can be fabricated in a segmental or full archwire and closing loops are usually used in loop mechanics for the extraction of space closure. The major advantage of loop mechanics is the lack of friction between the bracket and archwire during space closure. The disadvantages associated with this technique are the undesired tooth rotations in the transverse, sagittal planes and are time-consuming in fabricating the loops.[2]

The optimal force level for retracting anterior has been indicated to be in the range of 150 to 250 grams.[3]

* *Corresponding author*.
E-mail address: drprachodhca@gmail.com (C. A. Prachodh).

https://doi.org/10.18231/j.ijodr.2022.022

This case report intends to highlight the space closure with continuous T-loop mechanics for the treatment of bimaxillary dentoalveolar protrusion.

2. Case Report

A 23-year-old male patient reported to the Post-graduate clinic complaining of spacing and forwardly placed upper front teeth. There was no considerable medical or dental history for the patient. On extraoral examination, the patient presented with convex profile, posterior divergence, incompetent lips with deep mentolabial sulcus and an acute nasolabial angle (Figure 1). Intraoral examination (Figure 1) revealed an Angle's Class I malocclusion with upper and lower anterior proclination. The maxillary labial frenum showed low frenal attachment. The overjet and overbite were 3 mm and 2mm respectively and midline diastema of 3mm was present in the upper arch.

Cephalometric analysis revealed bimaxillary protrusion with horizontal growth pattern (Figure 2). The maxillary and mandibular incisors were proclined with respect to their bases. Panoramic radiographs revealed the presence of all the teeth except 38. Carey's and Arch perimeter analysis showed 3mm of spacing in maxillary arch and 2 mm of spacing in lower arch.

2.1. Treatment objectives

1. Closure of midline diastema.
2. Correction of proclination and spacing of maxillary and mandibular anteriors.
3. Maintain Class I canine and molar relation.

2.2. Treatment plan

The main criteria in determining the applicable treatment plan was the severity of dental proclination and correction of spacing. Extraction of four first premolars was planned to correct dental proclination and reduce lip incompetency. Group A anchorage was needed to retract incisors and prevent mesial movement of maxillary molars. To enhance anchorage, transpalatal arch in maxilla and lingual arch in mandible was considered and frictionless mechanics was planned to accomplish differential space closure. Following space closure, Frenectomy was done for the low-attached maxillary labial frenum.

2.3. Treatment progress

MBT appliance (Ormco Mini 2000 brackets) 0.022×0.028″ slot was used. A transpalatal arch in maxilla and a lingual arch in mandible were soldered on to the banded first molars to enhance anchorage. Alignment and leveling was accomplished with following sequence of arch wires:

1. 0.014" NiTi
2. 0.018" NiTi
3. 0.016 x 0.022" NiTi
4. 0.017 x 0.025" NiTi

Fig. 1: Pre-treatment photographs.

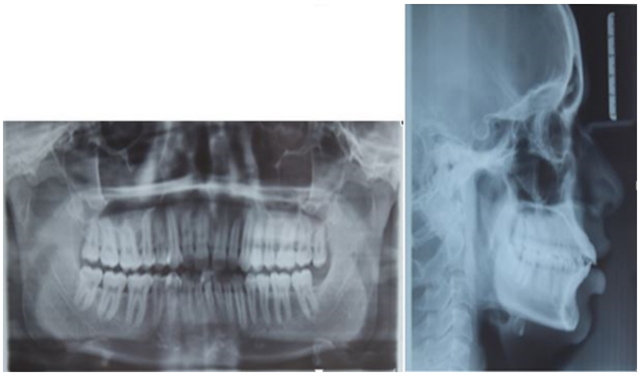

Fig. 2: Pre-treatment panoramic and lateral cephalograms

Fig. 3: T-loop in maxillary and mandibular arch.

The arch wires were cinched distal to molar to avoid maxillary and mandibular incisor proclination. After aligning and levelling, the en-masse retraction was accomplished by the continuous T-loop, which was fabricated with 0.017×0.025″ TMA wire. The loop was activated by 2 mm every six weeks. 15° of α bend and

Table 1: Comparison Between Pre-Treatment and Posttreatment Cephalometric Values

Variable	Normal range	Pre-Treatment Values	Post Treatment Values
Skeletal Variables			
SNA	82° ± 2	83^{0}	82^{0}
SNB	80° ± 2	80^{0}	80^{0}
ANB	2°	4^{0}	4^{0}
Wits Appraisal	-1 mm	-3mm	2mm
Go- Gn –SN	32°	22^{0}	22^{0}
Dental Variables			
Upper Incisor to NA (mm)	4 mm	11mm	3mm
Upper Incisor to NA (^{0})	22°	30^{0}	21^{0}
Lower Incisor to NB (mm)	4mm	11mm	4.5mm
Lower Incisor to NB (^{0})	25°	40^{0}	26^{0}
Upper Incisor to SN Plane	102°±2	115^{0}	93^{0}
IMPA	92°±5°	118^{0}	102^{0}
Soft tissue variables			
Nasolabial Angle	90-110	99^{0}	105^{0}
Upper lip – S line	0mm	4mm	2mm
Lower lip – S line	0 mm	3mm	1mm

Fig. 4: Space closure complete with T-loop in maxillary and mandibular arch

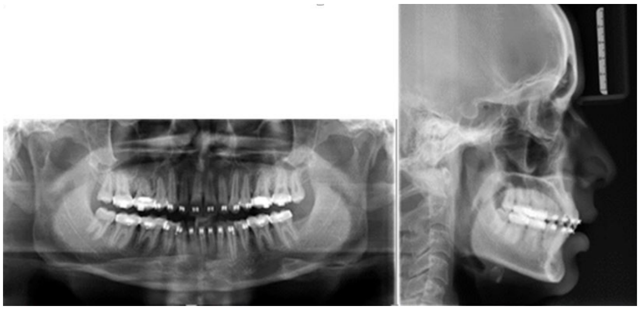

Fig. 6: Posttreatment Panoramic and Lateral cephalogram.

Fig. 5: Posttreatment intraoral and extraoral photographs

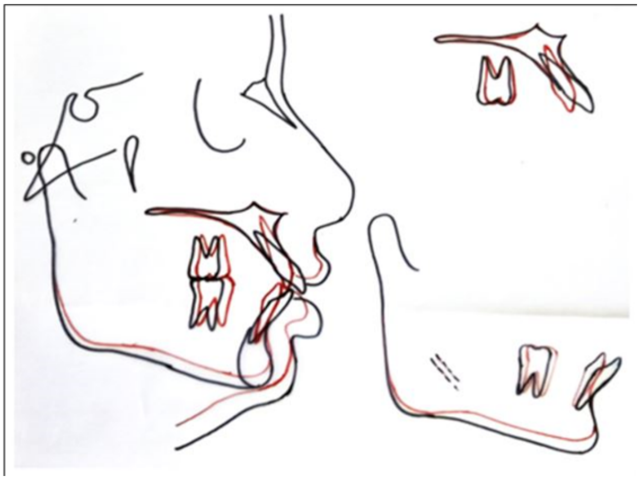

Fig. 7: Cephalometric superimposition

25° of β bend was given in the T-loop which generated differential moment to accomplish differential space closure (Figure 3). The space closure was completed 14 months after commencement of orthodontic treatment (Figure 4).

2.4. Treatment results

There was an impressive change in the patient's facial appearance and smile towards the end of treatment. With extraction of the first premolars, retraction of maxillary and mandibular anteriors were achieved. Post treatment extraoral photographs (Figure 5) shows that lip incompetency and convexity of face has reduced. Post treatment intraoral photographs and lateral cephalogram (Figures 5 and 6) showed that the maxillary incisors and mandibular incisors are inclined appropriately were over basal bone (Table 1). Panoramic radiograph (Figure 6) showed adequate root parallelism in both upper and lower arch.

3. Discussion

Bimaxillary protrusion is often characterized by protrusive and proclined upper and lower incisors and an increased procumbency of the lips. Facial aesthetics is the primary concern of these patients. Successful treatment depends on a thorough evaluation and understanding of this dentofacial deformity. Typical orthodontic treatment includes retraction and retroclination of maxillary and mandibular incisors after extraction of the four first premolars.

When premolars are extracted to address a malocclusion, the treatment plan must take into account the extraction space closure. The main issues that orthodontists face are anchorage maintenance, since mesialization of the posterior segment may compromise retraction of anterior teeth. Any extraction site management must therefore be under the authority of the clinician to guarantee that the teeth end up in predetermined positions. Burstone[1] has established three forms of controlled extraction site closures to achieve this goal: The anterior teeth will occupy most or all of the extraction space in Type A; the anterior and posterior teeth will occupy the extraction space equally in Type B; and the extraction site will be closed by the posterior teeth occupying most or all of the extraction space in Type C.

In order to deliver forces that can provide space closure, orthodontists bend closing loops in a continuous archwire or a segmented arch. With its outstanding predictability and versatility, the loops give the required M/F ratio. Closing loops encourage a continuous type of movement, and often there are numerous configurations to choose from.[4]

The T-loop has been recognized as an effective means to achieve desired tooth movement by differential moments between the anterior and posterior segments. With the introduction of beta-titanium wire (TMA), it has been possible to simplify the design so that a T-loop by itself will have a relatively low load-deflection rate and a large maximum springback.[2] Incorporating adequate alpha and beta bends to the loop can give rise to ideal moment to force ratio required for the tooth movement.

Application of T-loop continuous archwire in en-masse retraction delivers a regulated force system to the teeth and allows for more predictable tooth movement when done correctly. Its use necessitates a high level of control over the force mechanism activated by it. The anchorage value while using a T loop is dependent on the control of the two moments applied to the anterior and posterior teeth (alpha and beta moments) via different positioning of the T-loop between the two segment.[5]

The orthodontist generally puts closing loops directly distal to the lateral or canine when retracting the anterior segment because this approach allows for recurrent activation of the loop as the space closes. The loop position, on the other hand, has been demonstrated to affect the degree of anchor loss. The shorter piece of the closing loop provides greater moments, encouraging root tipping (raising anchoring), whereas the longer section creates smaller moments, encouraging translation.[6] In this case the loops were placed off –centered, being more close to the posterior segments which promotes the translation of the anterior segments as well as aids in anchorage control.

The alpha/beta moment differential obtained by eccentric positioning underscores the importance of careful clinical placement of the position of the loop. Even 1 mm of eccentricity produces a marked difference in the alpha and beta moments.[5] Several of the parameters of the T-loop including the height, the placement within the interbracket distance (clamping position), and the amount of preactivation and axial activation can be changed to appreciably alter the force/moment system delivered to the arch segments.[7]

The moments and forces generated by a T-loop springs functions of its geometry and gable angle. In general, increasing its vertical or horizontal dimension reduces the load-deflection rate and the moment-to-force ratio.[8] Rose et al[9] in thier study concluded that all preactivated TMA and NiTi closing-loop specimens produced an M:F 10:1 at some point in their deactivation range, irrespective of the force delivered.

Burstone[1] idealized a composite TMA T-loop for anterior retraction (anterior region and loop: 0.018-in TMA; posterior region: 0.017x0.025-in TMA), with a height of 7mm, apical length of 10mm, preactivated with an alpha (anterior) angulation at 105 degrees and a beta (posterior) angulation of 25 to 35 degrees. This loop produces an initial force of 200 grams in a 6-mm activation, with anterior M/F of 5.6 and posterior M/F of 12.8. Viecilli[10] stated that the effect of steps, angles, and vertical forces was combined to produce an ideal T-loop design, which provide a more determinate force system.

While analysing the cephalometric values a marked change has been seen in the dental variables. The cephalometric angular parameters like upper incisor to NA has decreased from $30^0$to $21^0$and lower incisor to NB has decreased from 40^0 to 26^0, indicating a significant change in the inclination of incisors. The linear measurements like upper incisor to NA has decreased from 11mm to 3mm and lower incisor to NB has decreased from 11mm to 4.5mm indicating sufficient retraction of the incisors. While considering the soft issue parameters a 7mm of incisor retraction in the present case has contributed to a concomittant increase in the nasolabial angle from $99^0$to 105^0.However evident changes have not been seen in skeletal parameters. Cephalometric superimpositions shows minimal changes in the vertical dimensions (Figure 7).

4. Conclusion

Bimaxillary dentoalveolar protrusion was treated successfully by extracting four first premolars followed by retracting anterior with continuous T-loop. T loop augment the anchorage by producing differential moment in anterior and posterior segment and by reducing friction. Upper and lower anteriors was retracted by 7 mm. There was also a significant change in inclination of the incisors. Thus with a continuous T-loop mechanics, effective space closure with desirable biomechanical responses were achieved successfully in a patient with bimaxillary dentoalveolar protrusion.

5. Declaration of Patient Consent

The authors certify that all necessary patient permission have been acquired. The patient has consented in the form for his photos and other clinical information to be published in the Journal. Patient is aware that his name and initial will not be published, and that every effort will be taken to keep his identity hidden, but anonymity cannot be guaranteed.

6. Conflict of Interest

The authors declare no relevant conflicts of interest.

7. Source of Funding

None.

References

1. Burstone CJ. The segmented arch approach to space closure. *Am J Orthod*. 1982;82(5):361–78.
2. Burstone CJ, Koenig HA. Optimizing anterior and canine retraction. *Am J Orthod Dentofacial Orthop*. 1976;70(1):1–19.
3. Sonis AL. Comparison of NiTi coil springs vs. elastics in canine retraction. *J Clin Orthod*. 1994;28(5):293–5.
4. Ribeiro GL, Jacob HB. Understanding the basis of space closure in Orthodontics for a more efficient orthodontic treatment. *Dental Press J Orthod*. 2016;21(2):115–25.
5. Kuhlberg AJ, Burstone CJ. T-loop position and anchorage control. *Am J Orthod Dentofacial Orthop*. 1997;112(1):12–8.
6. Viecilli RF. Self-corrective T-loop design for differential space closure. *Am J Orthod Dentofacial Orthop*. 2006;129(1):48–53.
7. Faulkner MG, Fuchshuber P, Haberstock D, Mioduchowski A. A parametric study of the force/moment systems produced by T-loop retraction springs. *J Biomech*. 1989;22(6-7):637–47.
8. Chen J, Markham DL, Katona TR. Effects of T-loop geometry on its forces and moments. *Angle Orthod*. 2000;70(1):48–51.
9. Rose D, Quick A, Swain M, Herbison P. Moment-to-force characteristics of preactivated nickel-titanium and titanium-molybdenum alloy symmetrical T-loops. *Am J Orthod Dentofacial Orthop*. 2009;135(6):757–63.
10. Viecilli AF, Freitas M. The T-loop in details. *Dental Press J Orthod*. 2018;23(1):108–17.

Author biography

CA Prachodh, Post Graduate

Muhammed Shaloob K M, Professor

Muhammed Naxaz VP, Senior Lecturer

Muhammed Raheesh, Senior Lecturer

Fathima Arzu T P, Post Graduate

Cite this article: Prachodh CA, Muhammed Shaloob K M, Muhammed Naxaz VP, Raheesh M, Fathima Arzu T P. T loop mechanics for effective space closure in bimaxillary dentoalveolar protrusion - A case report. *IP Indian J Orthod Dentofacial Res* 2022;8(2):127-131.