

## Space Closure with Loop Mechanics for Treatment of Bimaxillary Protrusion: A Case Report

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### Abstract:

This case report intends to highlight the space closure with tear drop 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. An adult patient with bimaxillary protrusion 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 begun using a moment differential between posterior and anterior segments created by a Tear drop loop. Anterior teeth were moved with bodily movement, and no anchorage loss of the posterior segments was seen using a Tear drop loop spring. A stable result with normal over jet and overbite was achieved with retraction of maxillary and mandibular anterior teeth. With a Tear drop loop, individual biomechanical responses can be achieved, and it is possible to calculate force magnitude for every patient.

**Key Words:** Bimaxillary protrusion, frictionless mechanics, Tear drop loop

### Introduction

Friction is a force that resists or retards the relative motion of two objects in contact. The direction of friction is tangential to the common boundary of the contact of two surfaces.

Orthodontics is the specialty of dentistry, which deals with the alignment of the teeth in order to achieve optimal function and aesthetics. This often entails extraction of certain teeth usually first premolars in order to relieve arch length-tooth material discrepancies as well as to improve the patient's profile. Space

closure stage of orthodontic tooth movement is achieved through two types of mechanics.<sup>1</sup>

The first type is sliding mechanics and involves either moving brackets along an arch wire, which is sliding the arch wire through brackets and tubes. This leads to friction, which results in adverse rotational movements and decreased tooth movement and increase in anchor requirements or both. Therefore, the name friction is often associated with it.<sup>2</sup>

In the second type, frictionless mechanics, i.e., 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. The disadvantages associated with this technique are the undesired tooth rotations in the transverse, sagittal planes and is time consuming in fabricating the loops.<sup>3</sup>

### Case Report

A male patient, aged 22 years, sought treatment for upper and lower anterior protrusion. He had no significant medical or dental history. Pre-treatment records showed a convex profile and mentalis strain with protrusive upper and lower lip. He had a 2 mm over jet and 2 mm overbite. The maxillary and mandibular incisors were severely proclined. Molars and canines were in Class 1 relationship (Figures 1 and 2). The lower midline was shifted to the left by 2 mm.

The panoramic radiograph showed that all teeth were present. Cephalometric analysis showed a Class 1 skeletal pattern with low mandibular plane angle. The maxillary incisors were proclined by 6 mm and 14° and mandibular incisors were proclined by 12 mm and 19°. Based on these findings, the patient was diagnosed with Angle's Class 1 malocclusion with bimaxillary protrusion.

### Treatment plan

The treatment objectives for this patient were to achieve a normal soft tissue profile and to maintain ideal over jet and overbite. By correcting the protrusion of maxillary and mandibular anterior teeth, the lip incompetence would be eliminated, and the acute nasolabial angle would be improved. This would lead to better facial aesthetics and maintain the normal incisal and canine guidance.

The treatment plan to achieve these treatment objectives was established as follows: The maxillary and mandibular anterior

teeth would be retracted after extraction of maxillary and mandibular first premolars.

A maximum or a Group A anchorage was essential to maintain a Class I molar and canine relationship throughout the entire period of treatment.

### Treatment progress

The maxillary and mandibular first premolars were extracted. All teeth were sequentially bonded and banded with 0.018 × 0.025 inch pre-adjusted edgewise brackets (Roth-type prescription). Initial alignment phase was completed in 4 months.

Five months later, the maxillary and mandibular anterior teeth were retracted with a continuous tear drop loop (0.017 × 0.025 inch titanium molybdenum alloy) (Figure 3). The anterior and posterior segments were stabilized separately. The loop was activated 2 mm initially alpha 15° and beta 25° and reactivated when a space of 1.5 mm was closed every month. This procedure was repeated until the extraction space was closed. After 9 months of retraction of the maxillary and mandibular anterior teeth, the extraction space was closed.

After 16 months of treatment, the fixed appliance was removed with proper over jet and overbite and Class I molar relationship. Fixed retainers were given from second premolar to second premolar in maxillary and mandibular arches for retention.

### Treatment results

The post treatment facial photographs showed marked improvement of the facial profile, and the patient's smile improved. Maxillary and mandibular anterior teeth protrusion were corrected, and a Class I molar relationship and over jet and overbite was maintained (Figures 4 and 5). The upper incisors to SN plane had decreased from 36° to 22° and the lower incisors to SN plane decreased from 45° to 28°. The movement of the maxillary and mandibular incisors contributed to correction of the soft tissue profile, and mental is strain.

### Discussion

The Tear drop loop has been recognized as an effective means to achieve desired tooth movement by differential moments between the anterior and posterior segments.<sup>4</sup>

The increase of wire length while maintaining the wire size decreases the load-deflection rate. And also the distribution of the wire in relation to the bracket determines the moment-to-force ratio. Thus the tooth movement is achieved by the deactivation of the loop itself, friction is not an issue.<sup>5</sup> There is a greater constancy of force in the Tear drop loop.

Although TAD's have been widely used for anchorage reinforcement, there are unpredictable factors such as

anatomical limitations and the possibility of failure.<sup>6,7</sup> However, precise control of tooth movement is possible in a predictable manner with the Tear drop loop. The Tear drop loop with a symmetric shape could be used to achieve a moment differential. Maintenance of the moment differential as the extraction spaces close improves anchorage control and force system predictability.<sup>8-10</sup>



**Figure 1:** Maxillary and mandibular incisors proclined, molars and canines are in Class 1 relationship (right).



**Figure 2:** Maxillary and mandibular incisors proclined, molars and canines are in Class 1 relationship (left).



**Figure 3:** Maxillary and mandibular anterior teeth retracted with a continuous tear drop loop (0.017 × 0.025) inch titanium molybdenum alloy.





**Figure 4:** Protrusion of the maxillary and mandibular anterior teeth was corrected and a Class I molar relationship and over jet and overbite was maintained (left).



**Figure 5:** Protrusion of the maxillary and mandibular anterior teeth was corrected and a Class I molar relationship and over jet and overbite was maintained (right).

### Conclusion

A patient with protrusion of maxillary and mandibular anterior teeth was treated successfully by maximum retraction using a Tear drop loop. The treatment results were stable.

### Clinical significance

With a Tear drop loop, it is possible to calculate the required force magnitude for every patient in spite of there being are many variables like different tooth sizes, inclinations and arch size differences which affect the length of wire spans. With a Tear drop loop, individual biomechanical responses can be achieved.

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