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CASE REPORT

Orthodontic management of buccally erupted canines using segmental t-loop mechanics – A case report

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Abstract

A 14-year-old female sought orthodontic treatment presenting with buccally displaced upper and lower canines with molars in Class I relationship bilaterally. On extraoral examination, profile was found to be straight, straight divergence, competent lips, ideal Nasolabial angle, and Class I skeletal base. Extraction of all the 1st premolars was decided to correct the buccally displaced canines and to obtain ideal overjet and overbite. Segmental arch retraction was employed using T loop. T loop in Titanium Molybdenum Alloy wire was fabricated to retract the canines in both upper and lower arch. Post treatment findings showed well aligned canines with improved incisor inclination and properly maintained bilateral Class I molar relationship. Post fixed orthodontic therapy; the subject exhibited an improved, acceptable, and pleasing smile.

Introduction

A major contribution in orthodontics during fixed orthodontic appliance therapy is anterior retraction phase. The triad structural balance, aesthetic harmony, and functional efficiency are considered as the long-term objective which can be efficiently achieved through various mechanics in orthodontic space closure. An extensively contributed concept in the field of research in orthodontics is "friction" particularly during space closure. Friction is defined as "the resistance to motion when object moves tangentially against another." This friction reduces the rate of orthodontic tooth movement there by prolonging the treatment period. There are various attributing factors to frictional properties of the archwire as such at microscopic level along with other elements namely, bracket material, slot size, medium, ligation type, and other biological factors such as masticatory effect and periodontal apparatus.[1,2] Dr. Charles Burstone proposed the segmented arch mechanics in the year 1962 which was further experimented for refinement and application in orthodontics. T –Loop is one such versatile component that is used in frictionless mechanics favoring precise and controlled orthodontic tooth movement.[1,3,4] Space closure after first premolar extraction as generally the treatment plan, can be performed through canine retraction or En-masse retraction. Retraction of canine into the first premolar extraction spaces is performed for alleviating the anterior crowding and thereby aligning the anterior segment with maximum anchorage while En masse retraction has potential compromise on anchorage.[5-7] Hence, clinical scenarios that require resolution of anterior crowding generally are subjected to canine retraction as in segmental mechanics with a greater degree of tridimensionally controlled tooth movement.[8,9]

Case Report

A 14-year-old female patient reported with a chief complaint of irregularly placed teeth in the upper and lower front teeth region with mesocephalic head pattern and mesoprosopic facial form. The patient exhibited straight profile with competent lips. Bilateral Angle's Class I molar relationship was evident. Cephalometrically, patient had orthognathic maxilla and orthognathic mandible with retroclined maxillary and mandibular anterior on a Class I skeletal base and also displayed horizontal growth pattern. Clinically, buccally erupted upper and lower canines were evident alongside palatally placed 22. Overjet was 1 mm and overbite was 3 mm. Maxillary midline had shifted 2 mm toward left from the facial midline [Figures 1 and 2].

A comprehensive clinical and database analysis was done followed by a treatment plan involving first premolar extraction in both maxillary and mandibular arch. Maximum anchorage

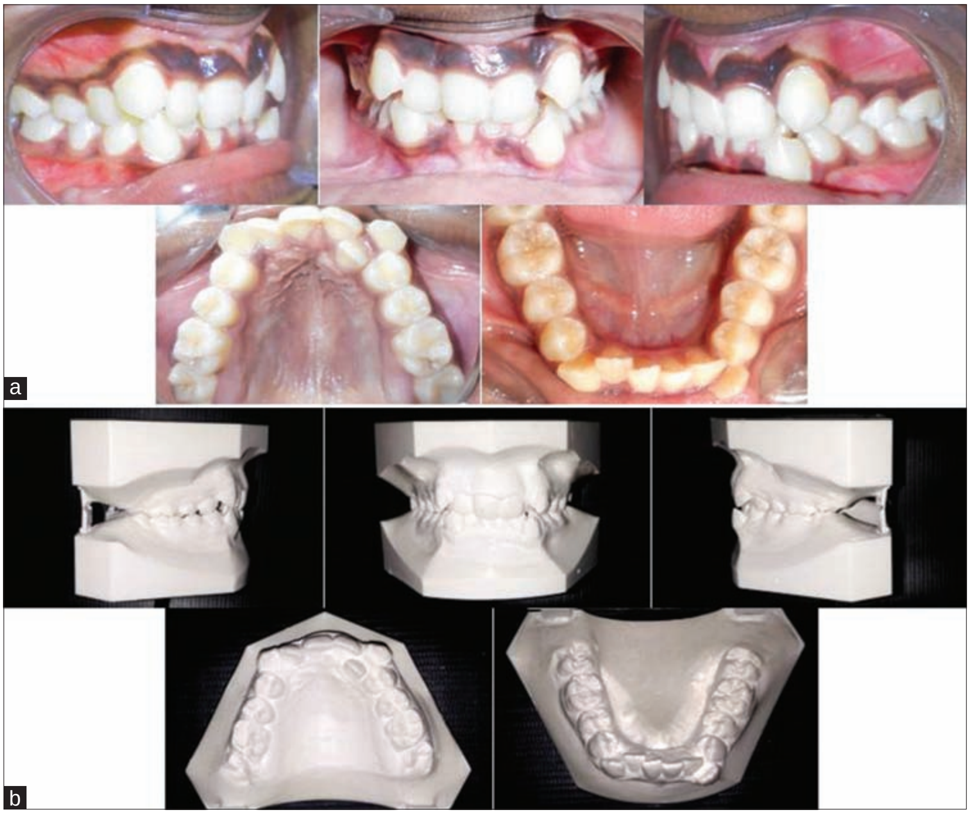

Figure 1: Pre-treatment photographs (a) intraoral photographs (b) model photographs

Figure 2: (a) Retraction using sectional T-Loop mechanics (b) continuous arch

Figure 3: Post-treatment photographs (a) intraoral photographs (b) model photographs

was planned to achieve uniform bilateral buccal occlusion, ideal overjet, and overbite with coinciding upper and lower midline. To improve anchorage Segmental T loop was planned with transpalatal arch.

T-Loop Segmental arch mechanics was considered for this case in both maxillary and mandibular arches with transpalatal arch to enhance anchorage. MBT appliance with 0.022 × 0.025" slot was used. 0.017 × 0.025" Segmented TMA archwires were used at the brackets placed on canines and molar buccal tubes for retraction of canine. T Loop was activated by pulling the distal arm 3 mm distal to the 1st molar at subsequent visits and cinching it. Complete retraction of canines into the extraction space was achieved in 5 months period. Bite was opened and the palatally placed 22 was brought in alignment using continuous arch mechanics. After individual canine retraction, the following sequence of arch wires was used for leveling and alignment: (1) 0.014 NiTi (Both arches), (2) 0.016 NiTi (Both arches), (3) 16 × 22 NiTi (Both arches), (4) 17 × 25 SS with 0.012 NiTi (piggyback in Maxillary arch), 17 × 25 SS (Mandibular arch), (5) 19 × 25 SS (Both arches), and (6) 0.014 SS (Both arches) with settling elastics.

Post-treatment exhibited acceptable and appreciable outcome with improved smile [Figure 3]. Maxillary and mandibular crowding was corrected with proper buccal occlusion. The Class I

Figure 4: The post-treatment 3-year follow-up (a) lateral cephalogram (b) OPG

molar relationship on both the sides was maintained throughout the treatment [Figure 4]. Proper alignment of incisors was

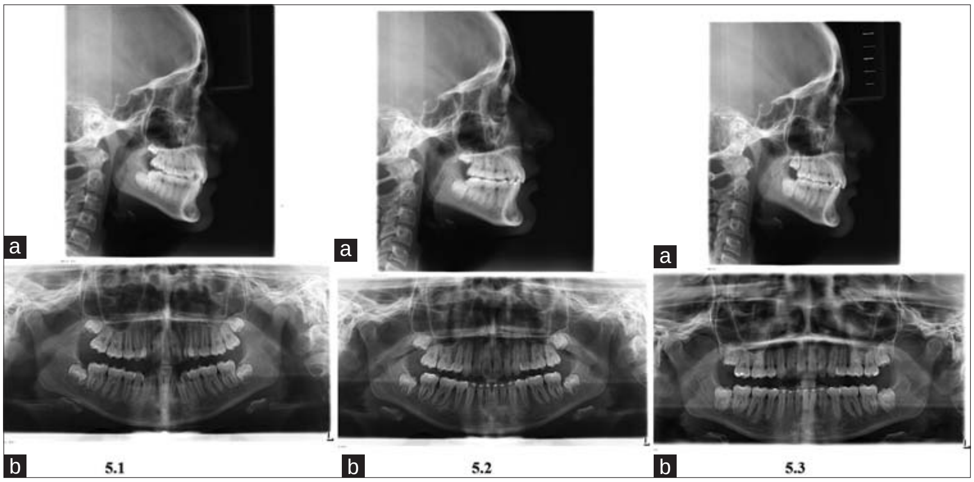

Figure 5: 5.1: Pre-treatment radiographs (a) lateral cephalogram (b) OPG; 5.2: Post-treatment radiographs (a) lateral cephalogram (b) OPG; Figure 5.3: The post-treatment 3-year follow-up (a) lateral cephalogram (b) OPG

evident on intraoral photograph and lateral cephalogram with proper root parallelism in panoramic radiograph [Figure 5.2]. The maxillary and mandibular arch was then stabilized with beggs wrap around retainer and fixed lingual retainer. Three years post-treatment revealed proper retention and stability [Figures 5.1-5.3].

Discussion

The anchorage is orthodontics is of three main types, namely, Types A, B, and C, The Type A, maximum anchorage where the posterior segment needs to be maintained in the same position. The second is the Type B where in moderate anchorage where both the anterior and posterior units are in equal magnitude to occupy the extraction space. The third is Type C, with minimum anchorage where posterior segment required mesialization.[10] The variables involved in delivering the required force are M/F ratio that aids in evaluating the center of rotation of a tooth or that segment, deciding on the type of orthodontic tooth movement, the force constancy that maintains the constant force levels during the complete therapy and the magnitude of force that diminish patient discomfort, pain with little or no tissue damage.[10,11]

The space closure phase in orthodontics involves sliding mechanics that imposes a greater challenge of space closure with the friction generated during the procedure. Frictionless mechanics on the other hand are loops or springs designed to generate force and moments for the process of controlled orthodontic tooth movement.[10,11] One such common spring used in space closure is T-Loop that can be employed in both generally used mechanics, namely, continuous and segmental mechanics. Loops are fabricated to deliver differential moments in anterior and posterior segments with the lower load deflection rate and bend that increase anchorage control. The increased inter bracket distance (canine to molar) provides longer activations thereby reducing the load deflection rate.[6,7] Burstone and Koenig, 1976, analyzed force systems in vertical loops and concluded that with increase in length of the vertical loop, moment increases with reduction in force level and greater range of activation without permanently deforming the spring or loop and not much influence of horizontal changes in the loop.[1] The "T" shape of the loop has the added component in the apical region within the loop thereby increasing the amount of wire. The other two important requisites for loop design involves preactivation and loop centricity. For cases that require anterior as well as posterior movement into the extraction space, the loop position is located at the center of the extraction space while for maximum anchorage it is positioned anteriorly in the extraction space (closer to the anterior teeth segment) and posteriorly (closer to the posterior teeth segment) in case of minimum anchorage cases.[2,3,12] Sachdeva in 1985 investigated the force system produced by T loop fabricated in TMA and concluded that springs Witt preactivation bends are highly effective for space closure. TMA wires were found to exhibit ideal properties of lowered modulus of elasticity, good formability and high resilience as studied by Szuhanek *et al.* in 2010.

Maximum anchorage is required in many of the clinical scenarios in orthodontics. For which traditional osseointegrated implants have evolved into the recent temporary anchorage devices which are of greater use in orthodontics in reinforcing anchorage. Although recent advances and skeletal anchorage system has been in use, it does present unpredictable anatomical limitations and possible failure. T loop has always served predictable controlled orthodontic tooth movement.

Conclusion

The "0.017 × 0.025" Segmented Titanium Molybdenum Alloy T-Loop was of greater aid in cases with crowding due to buccally placed canines. Precisely fabricated T-Loop delivers the required M/F ratio in all three planes and foster controlled orthodontic tooth movement.

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