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Case Report

Two simple yet efficient biomechanics for correction of retroclined maxillary central incisors

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ABSTRACT

Angle's class II division 2 malocclusion is characterized by retroclined maxillary central incisors and increased overbite. The first step in the treatment of such cases involves the correction of incisor inclination and their intrusion. Conventional techniques for intrusion are taxing on the anchor teeth like molars and adjacent teeth like lateral incisors. Appropriate biomechanical use of temporary anchorage devices (TADS) will enable the clinician to avoid undesirable tooth movements. The following are two cases in which simple and efficient biomechanics have been performed with the use of TADS for the correction of incisor inclination and deep overbite. The case-specific use of single vs two mini implants as well as round vs rectangular wire for intrusion and proclination of central incisors has also been explained.

1. Introduction

The classic features of Angle's class II division 2 malocclusion are distocclusion, retroclined maxillary central incisors and deep overbite. The most common treatment approach is to correct the axial inclination of maxillary incisors before engaging in a continuous archwire. This is essential as engaging a continuous archwire may lead to a "Raw-boat effect" and anchorage loss at the stage of levelling and alignment. The correction of deep overbite is one of the major challenges in the treatment of this type of malocclusion. The conventional methods used for correction of increased overbite are Rickett's utility arch, burstone intrusion arch, Connecticut intrusion arch, incorporating reverse curve of Spee in the wire, etc.[1–3] K sir loop is also one of the treatment modality for simultaneous intrusion and retraction of maxillary anterior teeth.[4] According to Newton's third law of motion, any of these mechanics generates equal and opposite reactive force which may cause unwanted tooth movement of posterior teeth and adjacent teeth like lateral incisor. The advent of Temporary anchorage devices (TADS) has proved to be a boon for orthodontists. TADS provide absolute anchorage, a determinate, controlled tooth movement which is biomechanically advantageous and a varied range of placement sites thus, avoiding iatrogenic side effects.[5] Two simple and efficient biomechanics for the correction of retroclined incisors and deep overbite are presented below. Informed consent of the patient has been obtained and approval of ethical committee is not applicable.

2. Case 1

A 23-year-old male patient presented with a class II skeletal base and Angle's class II division 2 malocclusion with 100% deep bite and reduced overjet of 0.5mm (Figure 1 a). Pre-treatment cephalogram shows the inclination of upper incisor to the SN plane (U1-SN) of 75° and the distance of upper incisor edge to the NA plane (U1-NA linear) of -4mm. The treatment plan was firstly aimed at correction of the incisor inclination followed by levelling and alignment.

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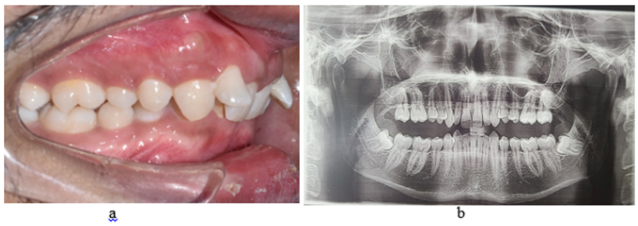

Figure 1: a: Pre-treatment intra-oral right buccal occlusion view **b:** Pre-treatment Orthopantomogram

Figure 2: a: Assembly for intrusion along with elastomeric chain showing line of forceapplication **b:** Measurement of forcewith dontrix gauge

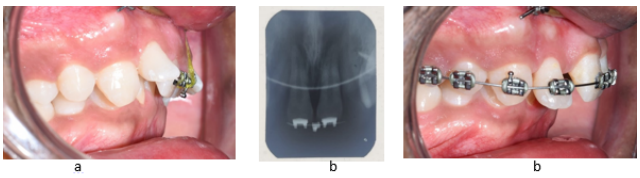

Figure 3: a: Intrusion at the end of 3 months **b:** Intra-oral periapical radiograph at theend of three months of incisor intrusion showing no evident root resorption **c:** One month of leveling and alignment

Figure 4: Pre-treatmentintra-oral right buccal occlusion view

Figure 5: Assembly for intrusion along with elastomeric chain showing line of force application

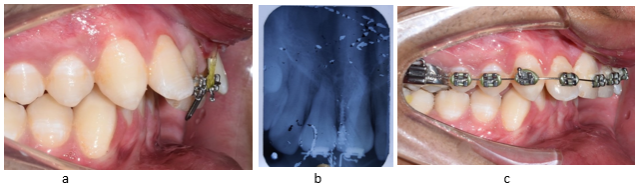

Figure 6: a: Intrusion at the end of 3 months **b:** Intra-oral periapical radiograph at the end of three months of incisorintrusion showing no evident root resorption **c:** One month of leveling and alignment

In this case, TADS (1.5 * 8 mm - SK surgical) were placed between the maxillary lateral incisor and canine bilaterally as placement of a mini-implant in the midline was not possible due to convergent roots of maxillary central incisors and sufficient amount of space was available in between lateral incisor and canine (Figure 1 b). A rigid bar was made from 19 * 25 SS wire covered by a protective sleeve which was passed through the implant head. Brackets were bonded on both the central incisors such that a straight 19 * 25 SS wire can be passed through it. A crimpable hook was attached to this wire segment facing incisally to enhance the intrusive component of force (Figure 2 a). The elastomeric chain was tied through the rigid segment and the crimpable hook through which 40gm of force was applied which was measured using a dontrix gauge (Figure 2 b). The elastomeric chain was changed after a four-week interval. At the end of three months, 3mm of intrusion was achieved (Figure 3 a). As the force was applied buccal to the centre of resistance 3mm of overjet was also achieved. A periapical radiograph was taken at the end of 3 months which showed no evident root resorption (Figure 3 b). After achieving sufficient intrusion, the entire arch was bonded (AO Minimaster MBT 0.022 appliance) for levelling and alignment (Figure 3 c).

3. Case 2

A 16-year-old male patient presented with a class II skeletal base and Angle's class II division 2 malocclusion with 100% deep bite and reduced overjet of 0mm (Figure 4). Pre-treatment Cephalogram shows the inclination of upper incisor irt to SN plane (U1-SN) of 68° and the distance of upper incisor edge to the NA plane (U1-NA linear) of -5mm. The treatment plan was firstly aimed at correction of the incisor inclination followed by levelling and alignment.

In this case, a mini screw (1.5 * 8 mm - SK surgical) was placed between the roots of the central incisors following the frenectomy. A 'U' loop 5 mm in length was formed using 0.018 AJ Wilcock wire which was ligated to the brackets of the central incisor such that the 'U' loop was facing incisally. An elastomeric chain was attached from the implant to the 'U' loop for intrusion and proclination of maxillary central incisors (Figure 5). A 40gm of force was applied which was measured using a dontrix gauge and the elastomeric chain was changed after a four-week interval. At the end of 3 months, 3mm of intrusion and 8mm of overjet were achieved (Figure 6 a). Root resorption was not evident on a periapical radiograph (Figure 6 b). After achieving sufficient intrusion and proclination, the entire arch was bonded for levelling and alignment (AO Minimaster MBT 0.022 appliance) (Figure 6 c).

4. Discussion

Orthodontists always aim to achieve appropriate treatment outcomes with easy and efficient biomechanics. The usage of TADS has uncomplicated orthodontic biomechanics. Karlsen in 1994 reported that the cephalograms of class II division 2 malocclusion indicated a vertical discrepancy between maxillary incisal and molar height.[5] Thus intrusion and proclination of incisors is required which may also unlock the mandible. The conventional methods used for intrusion cause extrusion of molar would cause clockwise rotation of the mandible which would further worsen the class II profile. Another drawback of correction of deep bite via posterior extrusion is the high chance of relapse especially in class II division 2 patients who generally exhibit horizontal growth patterns with strong musculature.[6]

With the use of stationary absolute anchorage, mechanics can be individualized for every patient and improvised according to the tooth movements required. Patients with Angle's Class II division 2 malocclusion requiring functional appliance treatment, needs correction of incisor inclination in the pre-functional phase. Alignment of the entire maxillary arch makes the force system indeterminate and delays the functional phase. In such cases using TADS for inclination and overbite correction by intrusion of incisors saves time. In certain situations like Angle's Class I with retroclined maxillary incisors and increased incisor exposure, the maxillary incisors require pure intrusion without flaring. Al-Falahi BA et al also discussed that true incisor intrusion can be achieved using miniscrew anchorage.[7]

The biomechanics presented here used mini-implants as anchorage thus there were no iatrogenic effects on the molars and adjacent lateral incisors. Two different sites for TADS placement were selected based on the root angulation of maxillary incisors.[8] In the first case, the roots of maxillary incisors are convergent which didn't allow the TADS placement at the desired site. In order to pass the force vector near the center of resistance of maxillary central incisors the mechanics was modified and the elastomeric chain was tied to the rigid bar.[9,10]

In both cases, the intrusive force was labial to the centre of resistance, so a moment is produced that flares the crown labially while roots move lingually. Thus, some amount of proclination was seen in both cases. In the first case, the crimpable hook was placed facing incisally and in the second case, the 'U' loop was also placed incisally. This enhanced the application of intrusive force. Moving away from the centre of resistance of the tooth a greater moment was produced on the incisors which caused labial crown movement and lingual root movement.

In the first case a 19 × 25 SS wire was used whereas in the second case, 0.018 AJ Wilcock wire was used, rectangular wire provides better torque control and prevents unwanted tipping as compared to a round wire. Thus, the first mechanics can be used in cases where more amount of intrusion is required compared to proclination and the second mechanics can be used where more amount of proclination is required compared to intrusion. Root Resorption was not evident in any of the cases.[10] The precautions to be taken during placement of mini screw in the midline is high frenum attachment suggesting a need to perform labial frenectomy before placement of mini-implant, as well as convergent roots of maxillary central incisors thus not providing enough inter radicular space for mini-implant placement.

5. Conclusion

Correction of retroclined maxillary incisors using TADS reduces the need for complicated mechanics and avoids the side effects on posterior dentition as well as adjacent teeth in contrast to conventional methods. Also, the site of mini-implant placement can be varied based on the root convergence of maxillary incisors apart from a biomechanical advantage. Thus, patient-specific treatment needs can be addressed with greater ease and better predictability of outcomes.

6. Source of Funding

None.

7. Conflict of Interest

None.

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