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Case Report

Anterior Open Bite Correction by Molar Intrusion using Temporary Anchorage Device: A Case Report

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Abstract

Open bite is a malocclusion in which there is lack of vertical overlap between upper and lower teeth. It may occur in a single tooth or in a group of teeth. Its severity varies from an almost edge to edge relationship up to a severe open bite. Molar intrusion by means of temporary anchorage devices (TADs) or mini-implants have become the key to resolving anterior open bite. Compared to other orthodontic anchorage devices, TADs are relatively simple to insert, less traumatic, require almost no patient's cooperation, more secure under optimal force loads and a low cost alternative to treat anterior open bite.

This case report describes a case of 22 years old male patient having chief complaint of inability to close his teeth in the front region of jaw. This case was treated on non-extraction basis using 0.022 slot MBT preadjusted edgewise appliance. Molars intrusion were performed for open bite correction with the use of two 1.6 x 8 mm size temporary anchorage devices bilaterally.

Temporary anchorage devices are efficient in causing molar intrusion for open bite correction as they provide more options to correct malocclusions without needing patient's co-operation.

Keywords: Open Bite; Temporary Anchorage Device; Molar Intrusion; Malocclusion

Introduction

Overbite is defined as the overlap of the incisors in which the incisal edges of the lower teeth are in contact with the incisal and middle thirds of the palatal surface of the upper incisors, slightly below the cingulum. In open bite, vertical overlap does not occur [1]. The term "open bite" was coined by Caravelli in 1842. The "Glossary of Orthodontic Terms" defines open bite as a developmental or acquired malocclusion whereby no vertical overlap exists between maxillary and mandibular anterior or posterior teeth. This condition may occur in a single tooth or in a group of teeth [2]. Its severity varies from an almost edge to edge relationship up to a severe open bite [3].

Anterior open bite has been considered a complex malocclusion to treat because of the initial difficulty in closing the bite and the subsequent challenge of retaining bite closure [4]. Proper diagnosis is necessary to develop an effective treatment plan with appropriate retention of the newly established bite [5].

Open bite incidence varies depending on age and ethnic group being more common in African and Afro-Caribbean populations [6]. Although the majority of patients with anterior open bite seek treatment only for aesthetic reasons, several problems may occur such as lack of anterior and canine guidance, difficulty for tearing food, language problems (lisp) and temporomandibular disorders among others [2,6,7].

Anterior open bite may be divided into two categories- Dental open bite and skeletal open bite. In Dental open bite, the vertical skeletal pattern does not contribute to the malocclusion and is usually present in the anterior region, from canine to canine; the maxillary incisors are protruded and proclined and commonly results from a habit. Whereas in Skeletal open bite, the skeletal pattern does have an influence in the malocclusion and is characterized by an elongation of the lower third of the face, rotation of the mandible in a clockwise direction, a hyperdivergent growth pattern and occlusal contacts only in molars [2,3,8].

Development of anterior open bite is the result of the interaction of several factors such as: skeletal disharmonies in which an excessive vertical grow this present, lack of muscular balance, habits such as digital sucking, abnormal function of the tongue, airway obstruction or iatrogenic treatments [3,7-9].

The majority of orthodontists are consistent with the fact that anterior open bite is one of the most difficult malocclusions to treat and the one with the largest percentage of relapse even when the patient is treated with orthognathic surgery. Identifying the etiology of the problem provides a greater percentage of success at the end of treatment [2,7,9-13].

The literature describes different treatment modalities with the purpose of reducing relapse including myofunctional appliances, fixed appliances, lingual cribs, elastics, wires, molar intrusion, extrusion of the upper anterior teeth, aligners with elastics, orthognathic surgery, extractions, partial glossectomy or orofacial myofunctional therapy [12,13].

Among the surgical and nonsurgical approaches proposed for treatment of open-bite malocclusion- including miniplates, multiloop edgewise arch wire therapy, passive posterior bite blocks, functional appliances, active vertical correctors, vertical-pull chin cups, and glossectomy—most are incapable of achieving substantial bite closure [14,15]. Although it has been postulated that every 1 mm of intrusive vertical movement of the molars results in about 3mm of bite closure by means of counterclockwise mandibular rotation [16], the actual amount of bite closure is less than 3mm in some clinical cases.

In recent years, molar intrusion by means of temporary anchorage devices (TADs) has become the key to resolving anterior open bite [17]. Compared to other orthodontic anchorage devices, TADs are relatively simple to insert, less traumatic, and more secure under optimal force loads [18,19]. Moreover, intrusion of the posterior teeth with skeletal anchorage has been shown to be stable- a critical advantage in treatment planning because of the high frequency of relapse in adults [18-20]. Several authors have also proposed that orofacial myofunctional therapy [21] or other muscle training and habituation exercises [22] can contribute to the closure of open-bite malocclusions and help prevent relapse.

Case Report

Diagnosis and etiology

A 22 year old male patient was referred for orthodontic consultation. His chief complaint was inability to close his teeth in the front region of jaw. He had no relevant family history, no significant prenatal, postnatal and medical history and no history of parafunctional habits (Figure 1).

Figure 1: Pretreatment intraoral and extraoral Photographs.

On clinical examination, he had a straight profile with a symmetric face and competent lips. Intraoral examination revealed Class III molar (super Class I = 1 mm) relationship bilaterally and lack of vertical overlap between the upper and lower front teeth with bilateral posterior cross bite.

The both maxillary and mandibular arch were U-shaped and had moderate crowding in the maxillary arch and mild crowding in the mandibular arch.

The cephalometric analysis showed a skeletal Class I pattern with an ANB angle of 3.5° and vertical growth pattern, as shown by an FMA of 34° and SN-GoGn of 38°, proclined and normally placed maxillary incisor and nearly normally inclined and normally placed mandibular incisors. On soft tissue examination, lips were normal with no lip strain and obtuse nasolabial angle (Figure 2).

Figure 2: Pretreatment lateral cephalograms and tracing.

The panoramic radiograph showed the presence of all third molars. The overall alveolar bone level was within normal limits (Figure 3).

Figure 3: Pretreatment orthopantamogram.

Treatment objectives

The treatment objectives were to correct crowding, anterior open bite, posterior cross bite and also to establish class I canine relation with normal overjet and normal overbite.

Treatment plan

Patient had skeletal class I pattern but vertical growth pattern, as the patient had already crossed the active growth phase hence orthodontic camouflage was planned.

Treatment Progress

Maxillary teeth were bonded initially followed by mandibular teeth with fully programmed preadjusted 0.022 slot MBT prescription brackets. The arches were aligned using the following sequence of arch wires; 0.012" NiTi, 0.014" NiTi and 0.016" NiTi (Figure 4). Later, 0.018" ss wire was placed in both arches. Placement of miniscrew (size =1.6 mm x 8 mm) on both sides in upper arch between 2nd premolar and 1st molar (Figure 5). Second maxillary molars were also banded later. In this case, highly placed canine was engaged with continuous arch of 0.012" arch wire as to flare upper anterior to create positive overjet and bucally flare posterior for correction of crossbite. E-chain was placed by engaging upper 2nd premolar, 1st molar and 2nd molar for posterior intrusion for correction of open bite. Buccal flaring during intrusion is desired in this case for crossbite correction so palatal control of molar was not considered during intrusion.

Figure 4: Mid treatment photographs.

Box elastics in Class III pattern were placed bilaterally in posterior region and anterior box elastics in anterior region to correct vertical relation (Figure 6-8).

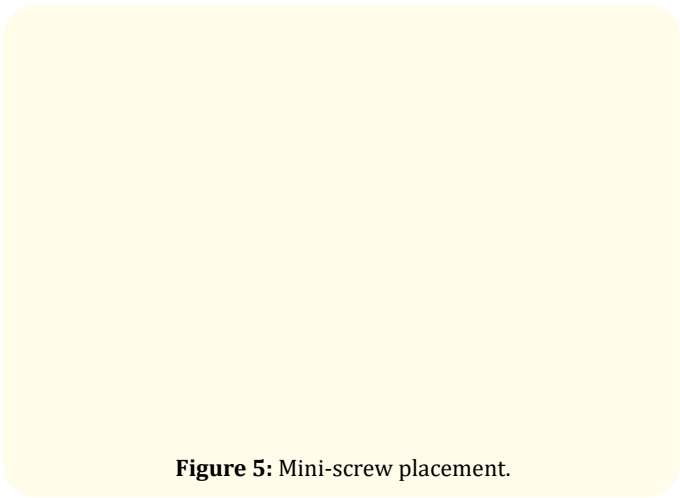

Figure 5: Mini-screw placement.

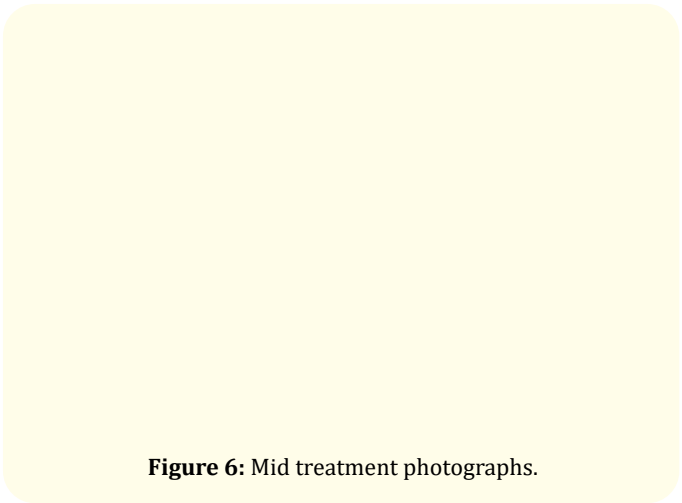

Figure 6: Mid treatment photographs.

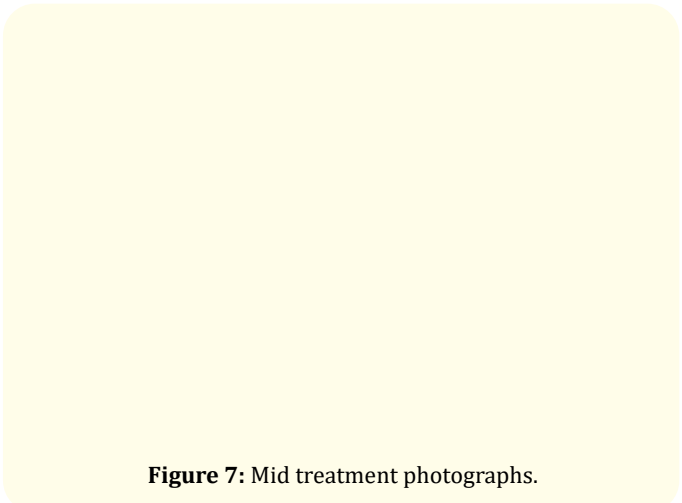

Figure 7: Mid treatment photographs.

Later, 0.019 x 0.025" ss wire was placed to level and express the prescription of the bracket. Finishing and detailing was done, and the appliance was debonded. The total treatment time was 23 months. In retention phase, modified Hawley's retainers were placed in both the arches and additional lower modified Hawley's with posterior bite plane for night time wear to prevent eruption of intruded maxillary molars for stability.

Figure 8: Mid treatment photographs.

Treatment results

The post treatment facial photographs showed a remarkable improvement in patient profile and facial esthetics (Figure 9).

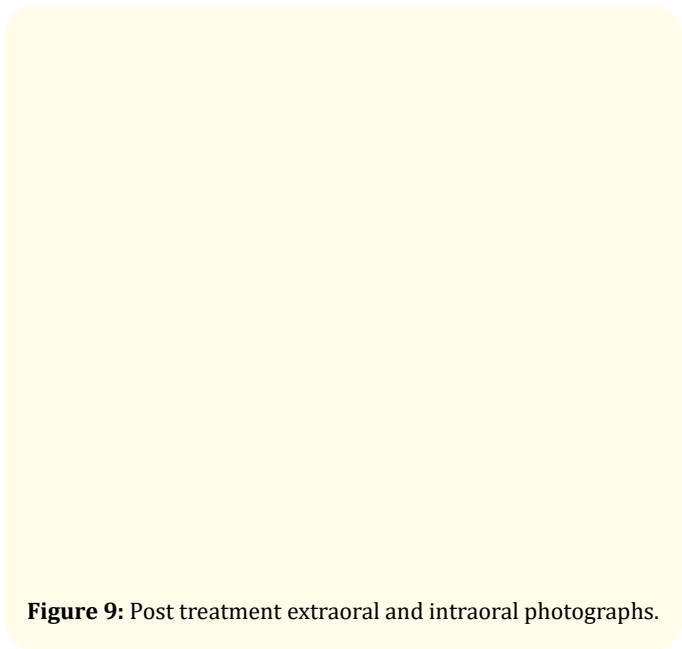

Figure 9: Post treatment extraoral and intraoral photographs.

Intraorally, a well interdigitated buccal occlusion with Class I molar, Class I canine relationship on both sides and normal overjet

and overbite was achieved. There was canine guidance in lateral excursion with proper anterior guidance without balancing side interferences.

The posttreatment cephalometric radiograph (Figure 10) and superimposed tracings (Figure 11) showed significant changes in the dental and skeletal measurements after treatment and there was slight anticlockwise rotation of mandible due to upper molar intrusion.

The posttreatment panoramic radiograph showed good root parallelism (Figure 12).

Figure 10: Post treatment cephalogram and tracing.

Figure 11: Superimposed tracing.

Figure 12: Post treatment orthopantamogram.

Discussion

Harmonious facial growth is characterized by a balance between increment A and increments I, II, III, and IV [23].

Hyperdivergency develops when Growth of condyle less than Vertical growth of corpus of maxilla, Vertical growth of maxillary 1st molar and Vertical growth of mandibular 1st molar (Figure 13).

There are two types of vertical excess- vertical excess with anterior open bite and vertical excess with normal anterior overbite. In vertical excess with anterior open bite, molar intrusion itself is

Figure 13: Harmonious facial growth (Schudy).

enough for correction because the opened anterior teeth will be automatically seated down by the closure of the mandibular plane. While in vertical excess with normal anterior overbite, molar intrusion induces traumatic anterior bite in patients with normal overbite. To solve this problem, intrusion of both the molars and anterior teeth is necessary, eventually resulting total intrusion of the whole dentition. This phenomenon can be named "slow impaction", because the result is achieved orthodontically and yet similar to that of the impaction osteotomy surgery [24].

It is important to decide which side of the molar to intrude either upper or lower or both. Because of the efficiency and stability, upper molar intrusion is usually preferred. However, lower molar intrusion should be considered to preserve upper incisor display in the patients with insufficient amount of upper incisor showing. Double intrusion is treatment of choice in the more severe cases where maximal closure of the mandibular plane angle is needed.

In open bite cases, buccal screws between 1st and 2nd molars fail very frequently as inter-radicular space is very less and with intrusion implants are encroached. Intrusion from buccal side with TAD, tend to intrude posterior teeth along with buccal flaring of molars. To prevent this, TPA or LHA or TADs on opposite side or arch wire with negative torque should be provided.

In this case, non-extraction plan was executed by considering the profile of the patient. Excessive buccal flaring of the posterior teeth during intrusion was controlled by putting excessive negative torque in the posterior part of the 0.019x0.025" ss wire and box elastics.

The retention protocol is one of the most important factors ensuring long-term stability of a severe open-bite correction. The preferred method to control relapse toward anterior open bite is an appliance with bite blocks between the posterior teeth that creates several millimeters of jaw separation (an open bite activator or bionator). This stretches the patient's soft tissues to provide a force opposing eruption. High-pull headgear to the upper molars, in conjunction with a standard removable retainer to maintain tooth position, also can be effective, but the intraoral appliance is better tolerated and controls eruption of lower as well as upper posterior teeth. Excessive vertical growth and eruption of the posterior teeth often continue until late in the teens or early twenties, so retention also must continue well beyond the typical completion of active treatment [1].

A patient with a severe open bite problem is particularly likely to benefit from having conventional maxillary and mandibular retainers for daytime wear and an open bite bionator as a night time retainer from the beginning of the retention period.

Although high-pull headgear can be quite effective in a cooperative patient, a removable appliance with bite blocks is a better choice for most patients for two reasons: it controls eruption of both the upper and lower molars, and usually it is better accepted because it is easier to wear.

Masticatory muscle exercises and orofacial myofunctional therapy have been shown to be helpful in maintaining closure of an open bite by means of a reduction in the ratio of lower-anterior to total facial height and in the gonial angle, as well as an increase in true mandibular rotation [25]. The masticatory muscle exercise regimen involves clenching at 80% of maximum force for five seconds, followed by five seconds of rest, for a total of six cycles, five times a day [22]. Orofacial myofunctional therapy includes selective exercises for normalizing oro-facial muscles during rest, swallowing, eating, and drinking, along with exercises similar to the remedial tongue-thrust program of Weiss and van Houten [26]. Although such exercises require considerable time and patient compliance, they are an important adjunct to the effective treatment of anterior open bite [27].

Conclusion

The important factors that are involved in open-bite treatment with TADs are a proper diagnosis of the etiologic factors causing the malocclusion and a complete assessment of the underlying dental and skeletal manifestations. The clinician must first determine

whether the molar intrusion should be performed in the mandible or in the maxilla, or, in both. The retention protocol is one of the most important factors ensuring long-term stability of a severe open-bite correction.

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