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Case Report **Orthodontics**

Molar Intrusion in the Management of Anterior Openbite and 'High Angle' Class II Malocclusions: About a Case Report

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Abstract

Anterior open bite is a complex malocclusion that often requires comprehensive treatment due to its multifactorial etiology and high relapse potential. Conventional treatment options such as orthognathic surgery or extraction therapy may have limitations. Recent advancements in skeletal anchorage have introduced miniscrews as a minimally invasive and reliable alternative. This case report illustrates an 18-year-old female with sagittal skeletal Class II pattern, hyperdivergent facial type and class I molar and end-on Class II canine relationship, with an anterior open bite. The treatment plan consisted of using miniscrews placed bilaterally in the posterior maxilla to facilitate molar intrusion. A transpalatal arch was used to maintain transverse stability during the intrusion phase. The approach resulted in effective molar intrusion, closure of the open bite, and an improved facial profile.

Keywords: Anterior open bite, molar intrusion, miniscrews, skeletal anchorage, orthodontic treatment, hyperdivergent patients, skeletal class II.

INTRODUCTION

Anterior openbite is defined as a lack of anterior overlap of the incisors and can be considered as one of the most challenging malocclusions to treat. Numerous etiologic factors contribute to the development of this malocclusion, including heredity, functional disorders, unfavorable growth patterns, functional habits, and trauma [1].

Traditional treatment modalities for AOB include orthognathic surgery, tooth extractions, and conventional orthodontic mechanics. However, these approaches may be limited by their invasiveness, side effects, and varying degrees of long-term stability.

In recent years, the advent of skeletal anchorage systems, has revolutionized the management of AOB. Molar intrusion with miniscrews has emerged as a less invasive and highly effective alternative for treating AOBs, providing a promising option for both adolescent and adult patients.

This article presents a clinical case report that demonstrates the successful correction of an anterior open bite using molar intrusion with miniscrews. The treatment approach, outcomes and stability are discussed, highlighting the advantages and limitations of using skeletal anchorage in managing AOB cases.

PRESENTATION OF THE CASE

Clinical Examination and Diagnosis

An 18-year-old woman presented herself at the Dento-Facial Orthopedics Department of dental clinic of Monastir, Tunisia. Her demands were both esthetical and functional. She had a chief complaint of a palatal displaced maxillary laterals and mandibular crowding. She was in good general health; she reported no contraindications to orthodontic treatment in her medical history and no history of TMJ disorder.

*Extraoral examination from the frontal revealed a symmetric face with parallelism of the horizontal lines of the face and a straight medial sagittal

plan, a nasolabial folds faded, forced labial closure, and increased lower anterior facial height

The profile analysis showed a convex profile. A normal nasolabial angle, and an extended "S" shaped labiomental groove with significant retrogenia. When smiling, more then 4 mm of gumline is exposed (Figure 1A).

Intraoral examination showed an unsatisfactory oral hygiene. Furthermore, an oval maxillary arch with deep ogival palate and palatoposition of the lateral incisors. The mandibular arch was U shaped with ectopic lower left canine (Figure 1B).

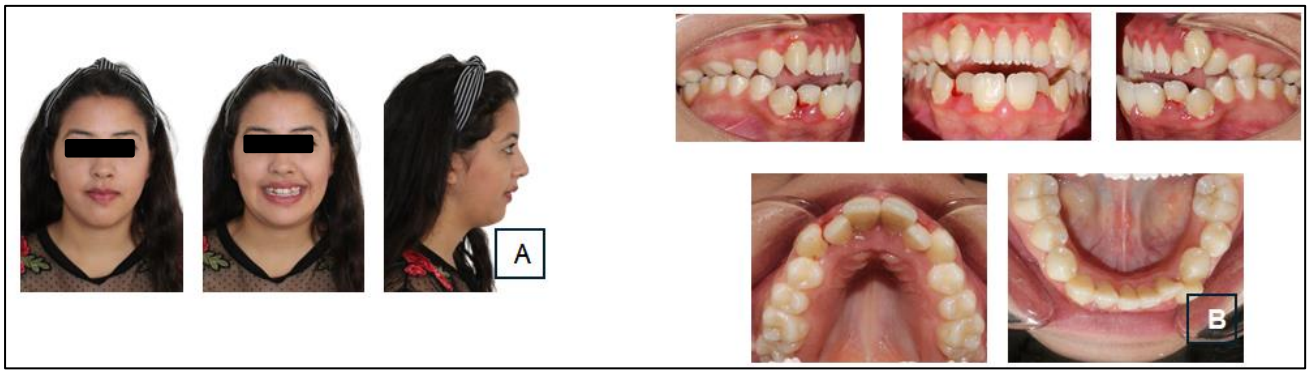

Fig 1: Pretreatment photographs. A) Facial photographs. B) Intra-oral photographs

Moreover, the occlusal examination show that the patient had Class I molar and end-on Class II canine relationship, with overjet of 2 to 4mm. The patient had an anterior open bite, a reverse bite between the upper left premolar (tooth 25) and the second lower left premolar (tooth 35), as well as a deviation of the lower inter-incisal midpoint of 3 mm to the left of the midsagittal plane.

*The functional examination revealed a mixed ventilation with mouth breathing predominance, atypical swallowing due to tongue thrust and a disturbed phonation.

*The analysis of plaster models showed negative dentoalveolar discrepancy in the mandibular arch and confirmed the mandibular midline shift 3 mm to the left. The overjet was irregular (2 to 4 mm).

Initial panoramic radiographic evaluation showed no missing teeth including the third molars under development. There were no supernumerary teeth. The crown-root ratios were normal with good alveolar bone levels, no bone pathology and no root resorption. In addition, the mandibular condyles, nasal floor and maxillary sinuses appeared normal. However, we note the convergence of the roots of the lower anterior teeth (Figure 2).

The lateral cephalometric radiograph examination indicated a skeletal class II base (ANB = 6∘), with mandibular retrognathia (SNB = 68°). In addition, we noted a severe high vertical dimension GOGN/SN= 50 with an increased mandibular plane angle and a hyperdivergent growth pattern. The mandibular incisors presented decreased axial inclination (IMPA=84°).

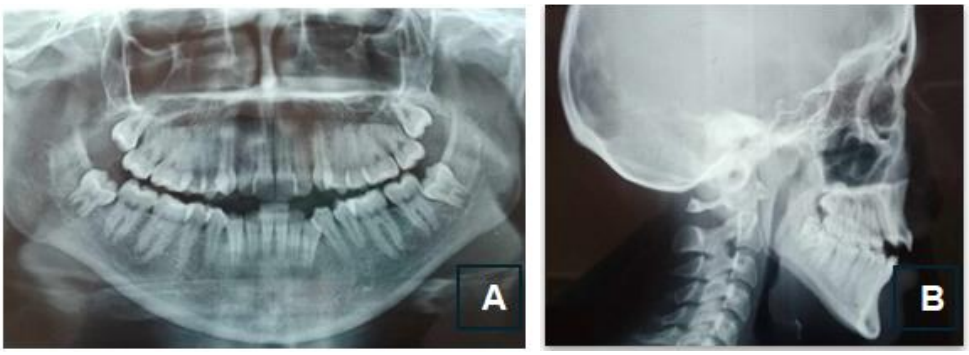

Fig 2: Pretreatment radiographs. A) Panoramic radiograph; B) Lateral cephalometric radigraph

Treatment Objectives

The treatment goals for this patient were as follow: (1) To obtain functional swallowing (2) To establish normal Class I canine and molar relationships with normal overjet and overbite (3) To resolve the dental crowding (4) To correct the mandibular dental midline deviation (5) To Improve facial esthetics and smile (6) obtain stable results.

Treatment Plan

The following treatment plan was discussed with the patient considering the treatment objectives and correlating with the patient's requirements.

Therefore, to achieve these treatment goals, selected treatment plan for correction of the anterior open bite was a nonextraction orthodontic treatment with combination of intrusion of the posterior teeth and extrusion of anterior teeth. The treatment was planned for continuous leveling and alignment of the upper and mandibular arch. Intrusion of the maxillary molars using TADs was planned after alignment and leveling was complete, with the use of a transpalatal arch (TPA) to counter the transverse forces, to achieve the overjet correction, to improve the facial convexity, and to correct the anterior open bite with a combination of intrusion of posterior teeth and extrusion of anterior teeth.

Treatment Progress

After obtaining the patient's consent, bands and preadjusted 0.022*0.028-in brackets were placed to the maxillary teeth up to the second molars. A 0.014-in nickel-titanium wire was engaged as the initial arch wire to start leveling and aligning. Then, .018 NiTi, was used successively.

During the second appointment, a maxillary .018 NiTi was used and the orthodontic fixed appliances with Roth prescription brackets (slot 0.022" x 0.028") were placed to the mandibular teeth up to the first molars (Figure 3).

Fig 3: Progress photographs: maxillary and mandibular leveling

Then, dental leveling and alignment of the maxillary and the mandibular dental arches were performed using the following orthodontic arch wire sequence: 0.014", 0.016", 0.018" and 0.017" x 0.025" Nickel Titanium arch wire followed by 0.017" x 0.025" and 0.018"x 0.025"stainless steel arch wire.

Once a 0.017" x 0.025" maxillary arch is used, a vertical elastic is placed on the left side to correct the tilt of the occlusal plane (Figure 4). After the correction of the occlusal plane, a palatal arch distant from the palate was placed to maintain the transverse width between the upper first molars during intrusion, and two mini screws were placed between the second premolar and the first molar to begin the intrusion of the posterior maxillary sectors (Figure 5).

Fig 4: Progress photographs: Correction of the tilt of the occlusal plane

Fig 5: Progress photographs: Intrusion of the posterior maxillary sectors

Once sufficient intrusion was achieved, the TPA was removed and continuous 018“x 0.025“stainless steel arch wires were used along with anterior vertical elastics to begin the extrusion of anterior teeth (Figure 6).

Fig 6: Progress photographs : Upper and lower 018“x 0.025“stainless steel archwires with anterior vertical elastics

At the end, minor bends were placed in .018*.025 SS arch wire for detailing both alignment and occlusion.

After finishing and detailing, the appliance was debonded, retention was performed with a bonded stainless steel lingual canine-to-canine fixed retainer in both the maxillary and the mandibular arches along with a Hawley retainer with an anterior cutout and final records were taken.

Treatment Results

The final results showed that the patient had a satisfactory and pleasing esthetic outcome, with resolution of her chief complaint. All the predefined objectives were fulfilled: a significant improvement in the soft tissue profile indicated by a passive lip competence. Her smile esthetics were significantly improved (Figure 8A).

Fig 8: Post-treatment photographs. A) Facial photographs. B) Intra-oral photographs

Intraorally a Class I bilateral Angle canine and molar relationship relation was achieved with good interdigitated occlusion, crowding was corrected, and an adequate overjet and overbite were achieved. The upper and lower dental midline coincidence was obtained (Figure 8B).

Additionally, functional dynamic occlusion was procured with lateral movement guided by the canines and protrusive movement by the incisors.

Moreover, the post treatment cephalometric evaluation and superimposition confirmed a positive change in the profile in addition to a significant improvement in the widening of the aerodigestive junction. There was also a significant change in skeletal measurements in both sagittal and vertical dimension.

Final cephalometric analysis showed a class I relationship with a change in values of the ANB angle from 6° to 3° and of the GoGn/SN angle from 50 to 44°. The maxillary incisors were retruded, and the mandibular incisors were protruded and had their axial inclination increased (Figure 9). Total and partial superimposition of initial and final cephalometric tracings revealed the changes occurred with the treatment (Figure 10).

Cephalometric values	Initial values	Final values
SNA	74°	72°
SNB	68°	69°
ANB	6°	3°
AoBo	4mm	1mm
FMIA	56°	50°
IMPA	84°	92°
FMA	40°	38°
GoGn/SN	50°	44°
I/i	123°	113°
I/F	111°	116°

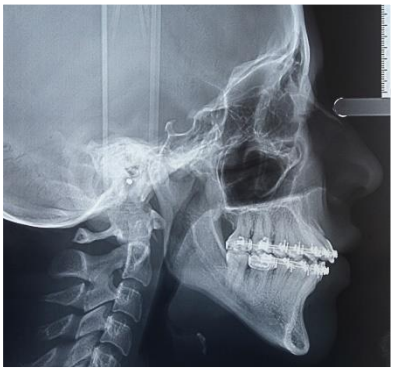

Fig 9: Final cephalometric analysis

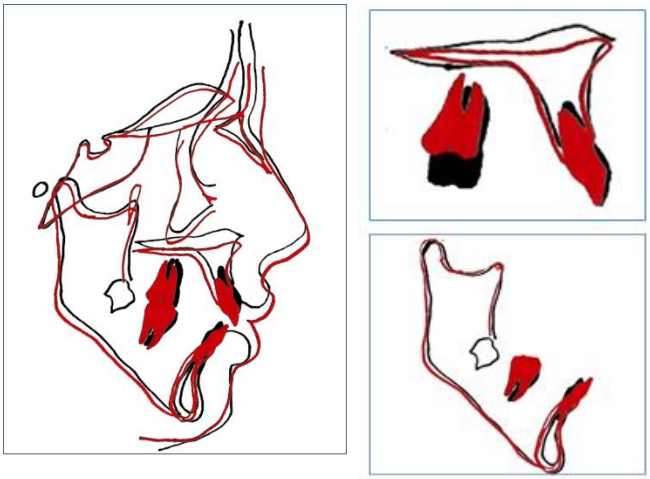

Fig 10: Total and partial superimposition of initial and final cephalometric tracings

The final panoramic (Figure 11) showed good root parallelism, without significant root shortening or development of other pathologies. The patient reports no development of signs or symptoms of TMJ disorder.

Fig 11: Post-treatment panoramic radiograph

DISCUSSION

Management of anterior open bite could be addressed with surgical and non-surgical treatment approaches Proper diagnosis and treatment planning are essential for selecting the best treatment method to achieve optimal facial esthetics along with restoring functional occlusion. The treatment option selected for the patient depends on the esthetic and functional considerations [2].

Premolar or molar extractions have traditionally been recommended as a method for addressing mild anterior open bites (AOBs). This extraction strategy is largely based on the assumption that removing posterior teeth results in the mesial movement of the molars, which would theoretically reduce the mandibular hinge axis and thereby increase the overbite. However, studies have challenged this so-called 'wedge-effect' theory [5, 6]. In reality, the extrusion and excessive mesial tipping of molars may counteract the desired overbite correction by increasing lower facial height and the mandibular plane angle (MMPA). Rather than achieving overbite improvements through molar repositioning, extraction therapy actually promotes overbite closure by inducing incisor retroclination and extrusion [5-7]. Unfortunately, these dental movements may not be aesthetically pleasing or provide long-term stability.

Orthognathic surgery is considered the gold standard for treating moderate to severe anterior open bites (AOBs), particularly in cases with associated skeletal discrepancies and/or excessive upper incisor exposure. The surgical approach generally consists of an impaction of the maxilla (Le Fort I osteotomy) associated or not to a mandibular osteotomy allowing the increase of the overbite, the harmonization of the face and the profile and ensuring a functional and stable occlusion. However, orthognathic surgery carries significant costs, not only in terms of patient morbidity but also in financial implications. Additionally, it cannot be performed until late adolescence, when facial growth is mostly complete.

With the advent of skeletal anchorages, the use of temporary anchorage devices (TADs), such as miniscrews, has emerged as a reliable and minimally invasive alternative. In this case report, the utilisation of miniscrews for molar intrusion proved to be an effective strategy for correcting a skeletal open bite and achieving a stable occlusion. Miniscrews offer the advantage of providing absolute anchorage, enabling precise control over tooth movements without exerting reciprocal forces on the adjacent teeth. The simultaneous use of a transpalatal arch (TPA) contributed to maintaining transverse stability, preventing any unwanted buccal flaring of the molars during intrusion

This intrusion treatment works in a similar fashion to surgical correction of AOB in the sense that superior and inferior repositioning of the maxillary and mandibular molars, respectively, causes the mandible to auto-rotate in a counter-clockwise direction, i.e. upwards and forwards. The incisor relationship improves as an indirect consequence of these molar and mandibular changes [3].

The molar intrusion treatment also improves the vertical skeletal and soft tissue parameters, e.g. FMPA, LAFH and lip competence, with minimal incisor extrusion [5, 8, 9].

Biomechanically, the controlled intrusion of the molars with the support of miniscrews has contributed to an improved lip seal and reduced anterior facial height. The aesthetic outcome in this case was notable, as the patient's smile line and lip competency were enhanced, resulting in improved facial harmony.

It is important to highlight that while miniscrew-supported molar intrusion is highly effective, it is not devoid of complications. Potential risks include screw mobility, inflammation of peri-implant tissues, and screw loosening. Meticulous planning of the screw position relative to the root anatomy and careful monitoring throughout the treatment period are essential to mitigate these risks. In the present case, these complications were avoided by precise placement of the

miniscrews in the attached gingiva and implementing good oral hygiene protocols.

Post-treatment stability is a primary concern in open bite cases, as these malocclusions tend to relapse. Several factors contribute to the long-term stability of molar intrusion, including the patient's growth pattern, muscle function, and occlusal stability.

The systematic review conducted by Bueno-Médeiros *et al*., [4] examined the long-term stability of various treatment approaches for hyperdivergent patients with associated anterior open bite. The study reported a long-term stability rate of up to 89% following maxillary surgical impaction, which is comparable to the 84% stability rate achieved with orthodontic treatment involving molar intrusion using skeletal anchorage [4].

Maintaining post-treatment stability is dependent on achieving a balance between the neuromuscular forces acting on the dentition and the stability of the skeletal framework.

In this case, bonded retainers and a modified Hawley retainer were used to maintain the corrected tooth positions and minimize the potential for relapse.

CONCLUSION

In conclusion, the treatment of an anterior open bite using miniscrew-supported molar intrusion is a promising approach that minimizes the need for more invasive surgical interventions and provides an effective means of achieving functional and aesthetic correction. The case presented highlights the efficiency of this method in correcting vertical discrepancies and achieving a stable, long-lasting occlusal outcome. This approach should be considered as a first-line option in managing adult patients with anterior open bite, particularly when skeletal growth has ceased, and other treatment modalities are limited.

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