



Therapeutic Approach to Anterior Open Bite Using Molar Intrusion on Miniscrews: A Clinical Case Study

Laila Lazrak, François Tonamou, Amadou Oury Diallo, Meriem Bellamine, Ihsane Ben Yahya

Orthodontics Department, Faculty of Dentistry, University Mohamed VI of Health Sciences (UM6SS), Casablanca, Morocco
Email: ftonamou@um6ss.ma

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Abstract

Introduction: Anterior open bite is a therapeutic challenge in orthodontics, often associated with a high recurrence rate. While orthognathic surgery remains an option, posterior tooth intrusion using temporary anchors has emerged as an effective non-surgical therapeutic approach. The aim of this article was to present the non-surgical management of anterior open bite in an adult patient with hyperdivergence, using miniscrew-assisted posterior tooth intrusion. **Method:** A 28-year-old female patient with a 6 mm open bite, facial hyperdivergence and lingual dysfunction was treated with a fixed vestibular multi-attachment appliance. The intrusion mechanism was based on double skeletal anchorage in the vestibular and palatal areas of the posterior maxilla to achieve pure molar intrusion. Tongue re-education was carried out in parallel to correct the tongue dysfunction. **Results:** The 18-month treatment resulted in complete correction of the open bite. Cephalometric analysis confirmed mandibular anterior rotation and a reduction in lower facial height. The result remained stable after 2 years of orthodontic treatment, with Class 1 occlusal relationships. **Conclusion:** Posterior tooth intrusion using miniscrews is an effective and non-invasive alternative to surgery for moderate to severe anterior open bites. Long-term stability is dependent on the concomitant correction of lingual dysfunction, emphasizing that the combination of orthodontic mechanics and functional therapy is a determining factor for success.

Subject Areas

Dentistry

Keywords

Anterior Open Bite, Molar Intrusion, Miniscrews, Temporary Anchorage

1. Introduction

Anterior open bite is a complex vertical anomaly. It is characterized by a lack of contact between the maxillary and mandibular anterior teeth when the posterior teeth are in occlusion [1]. This anomaly, which affects both the aesthetics of the smile and essential orofacial functions such as phonation and swallowing, represents a major therapeutic challenge for orthodontists [2]. Its prevalence varies from 1.5 to 11% depending on gender, ethnicity and type of dentition [3]. Its etiology is multifactorial, involving a complex interaction between skeletal, dentoalveolar and functional factors [1] [4].

The choice of treatment strategy depends on the severity of the malocclusion, its etiology and the patient's age. In growing patients, treatment mainly aims to eliminate parafunctional habits through tongue re-education and orthopedic appliances, and to control the vertical dimension [4]. For adult patients, traditional approaches include incisor extrusion and/or molar intrusion. Incisor extrusion is often unstable and can compromise periodontal health and smile aesthetics. Molar intrusion, although stable, is difficult to achieve with conventional mechanics such as reverse curve arches [5]-[7]. For severe skeletal cases in adults, orthognathic surgery remains the treatment of choice. Although effective, this option is invasive, costly and carries surgical risks that may deter many patients [7]. Given the limitations of conventional treatments and the cost and invasiveness of orthognathic surgery, the introduction of temporary skeletal anchorage devices or miniscrews has revolutionized the management of anterior open bites. These miniscrews, inserted into anatomical sites in the alveolar bone or palate, provide absolute skeletal anchorage. They allow direct and controlled forces to be applied to achieve effective molar intrusion without the side effects of traditional mechanics [7]-[10].

This article describes the treatment of a patient with an extensive anterior open bite from the right first premolar to the contralateral premolar, successfully corrected using posterior tooth intrusion mechanics on miniscrews.

2. Diagnosis and Treatment Plan

2.1. Patient Presentation

A 28-year-old female patient sought orthodontic consultation with chief aesthetic and functional concerns. She complained of a smile that she considered unattractive due to the lack of contact between her incisors and her inability to cut food. The patient reported no medical history and was in good general health. Locally, she reported having undergone dental and prosthetic treatment.

Extraoral photographs: Frontal examination revealed facial symmetry, pro-

nounced nasolabial folds, and mentalis muscle strain (**Figure 1(A)**). Profile analysis showed a pronounced facial convexity, an increased lower facial height relative to the mid-face, and an obtuse nasolabial angle (**Figure 1(B)**). It is noteworthy that this convexity was fully embraced by the patient, who identified it as a defining element of her cultural identity; consequently, preserving this profile was integrated as a fundamental component of the treatment plan. Smile analysis revealed an anterior interdental space exposing the tongue resulting in an unesthetic appearance (**Figure 1(C)** and **Figure 1(D)**). Lip incompetence was observed at rest.

Intraoral photographs: Presence of a 6 mm anterior infraclusion, extending from the first right premolar to the contralateral premolar. Occlusal analysis revealed class 2 right and left canine relationships, class 3 left molar relationships, while the molar relationship was indeterminate on the right due to significant coronal destruction of the first maxillary molar (**Figures 1(E)-(G)**). The dental arches were generally harmonious in shape, with the mandibular arch being much wider than the maxillary arch. In the maxilla, we noted the right first molar in root form and two crowns replacing the left first and second premolars. In the mandibular arch, the occlusal plane was disturbed with two levels indicating a low tongue position associated with anterior crowding (**Figure 1(H)** and **Figure 1(I)**).

Occlusal-functional examination: we observed atypical swallowing characterized by anterior lingual interposition at rest. This lingual dysfunction was considered a major etiological factor and a significant risk of recurrence.



Figure 1. Extraoral and intraoral photographs before orthodontic treatment: Frontal view (A); Profile view (B); Frontal smile (C); Three-quarter smile (D); Right lateral occlusal view (E); Frontal occlusal view (F); Left lateral occlusal view (G); Maxillary arch (H); Mandibular arch (I).

The panoramic radiograph (Figure 2) revealed a complete permanent dentition; however, the maxillary right first molar was reduced to a retained root. Additionally, the maxillary first and second premolars, as well as the mandibular left second premolar, exhibited both coronal and radicular radiopacities.



Figure 2. Panoramic X-ray before orthodontic treatment.

2.2. Lateral Cephalogram

Cephalometric analysis (Figure 3 and Table 1) revealed a Class II skeletal relationship in the sagittal plane ($ANB = 9.5^\circ$) with maxillary protrusion and mandibular retrusion ($SNA = 85.8^\circ$, $SNB^\circ = 76.3^\circ$). In addition, in the vertical plane, the patient presented with hyperdivergence (GoGn to SN = 46.2° and $FMA = 36.4^\circ$). Finally, the maxillary incisors were normoclininated (I to NA = $22.6^\circ/5.7$ mm) while the mandibular incisors were proclined (i to NB = $49.4^\circ/13.4$ mm and $IMPA = 103.8^\circ$)

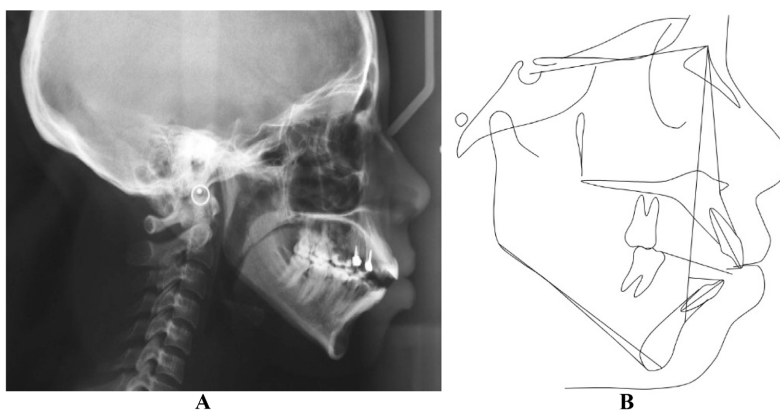


Figure 3. Pre-treatment lateral cephalogram (A); Cephalometric tracing before treatment (B).

Table 1. Cephalometric measurements before treatment.

Parameters	Norms	Pre-treatment
SNA ($^\circ$)	82°	85.8°
SNB ($^\circ$)	80°	76.3°
ANB ($^\circ$)	2°	9.5°

Continued

AoBo (mm)	-2 mm to +2 mm	4 mm
I to NA (°)	22°	22.6°
I to NA (mm)	4 mm	5.7 mm
i to NB (°)	25°	49.4°
i to NB (mm)	4 mm	13.4 mm
I to i (°)	131°	98.6°
Po to NB (mm)	mm	-5.7 mm
Occl to SN (°)	14°	26.5°
GoGn to SN (°)	32°	46.2°
FMA (°)	25° ± 3°	36.4°
FMIA (°)	67° ± 3°	39.8°
IMPA (°)	88° ± 3°	103.8°

2.3. Treatment Objective

The objectives of treatment were to respond the patient's reason for consultation, improve lip relationships and smile esthetics, control vertical dimension and close the anterior open bite to restore coverage, overjet and anterior guidance, restore Class 1 canine and molar relationships, improve swallowing and phonation, and eliminate parafunctions. In addition, extract the upper right first molar and replace it with an implant.

2.4. Treatment Plan

To achieve these objectives, we proposed two treatment options to the patient. The first option involved a combined orthodontic-surgical approach, comprising a six-month de compensation phase with the extraction of the mandibular first premolars, followed by orthognathic surgery to achieve mandibular advancement and counter-clockwise rotation. The second option consisted of orthodontic camouflage using a fixed multibracket appliance without extractions. This strategy utilized temporary anchorage devices (TADs) to achieve posterior segment intrusion. Given the patients' ethnic background, where a moderate profile convexity in clinically acceptable, the camouflage approach was selected. The primary therapeutic objective was vertical control through maxillary molar intrusion, facilitating mandibular counter-clockwise rotation to close the anterior open bite. It was explicitly determined that the sagittal skeletal relationship (ANB angle) would remain largely unchanged, as the treatment focus was directed toward vertical correction rather than sagittal repositioning of the skeletal bases.

Concurrently, myofunctional therapy was initiated, incorporating maxillary tongue cribs and nocturnal lingual envelope to enhance long-term stability. Furthermore, the non-restorable maxillary right first molar was extracted and subsequently replaced with a dental implant following the completion of orthodontic therapy.

2.5. Treatment Progress

During the alignment-levelling phase, passive self-ligating 0.022" × 0.0275" (Damon™) multi-attach vestibular appliances were bonded to both arches. Initial alignment was achieved with 0.014-inch and 0.014 × 0.025-inch copper nickel titanium arches. After three (3) months of levelling and alignment, we progressed to 0.018 × 0.025 inch copper nickel titanium archwires to initiate the mechanics of progressive intrusion of the maxillary and mandibular posterior teeth using miniscrews. In the maxilla, in the vestibular region, 8 mm × 1.4 mm titanium alloy miniscrews with bracket heads were placed interradicular on the left side (**Figure 4(B)** and **Figure 4(C)**) and in the edentulous area of the first molar on the right side (**Figure 4(A)** and **Figure 4(B)**). We used 10 mm × 2 mm miniscrews in the palatal region (**Figure 4(D)**). In the mandible, we also inserted 8 mm × 1.4 mm miniscrews to help us level the Spée curve (**Figure 4(A)**, **Figure 4(C)** and **Figure 4(E)**). In the maxilla, a total insertion force of 300 g, measured using a dynamometer, was applied on each side: 170 g by elastics (Ormco™, 6 oz, 3/16 inch) in the vestibular region (**Figures 4(A)-(C)**) and in the palatal region, chains delivering 130 g, stretched from the miniscrew heads to the orthodontic buttons bonded to the palatal surfaces (**Figure 4(D)**). On the mandible, we used continuous chains stretched from the head of the miniscrew to the archwire (**Figure 4(A)**, **Figure 4(C)** and **Figure 4(E)**)

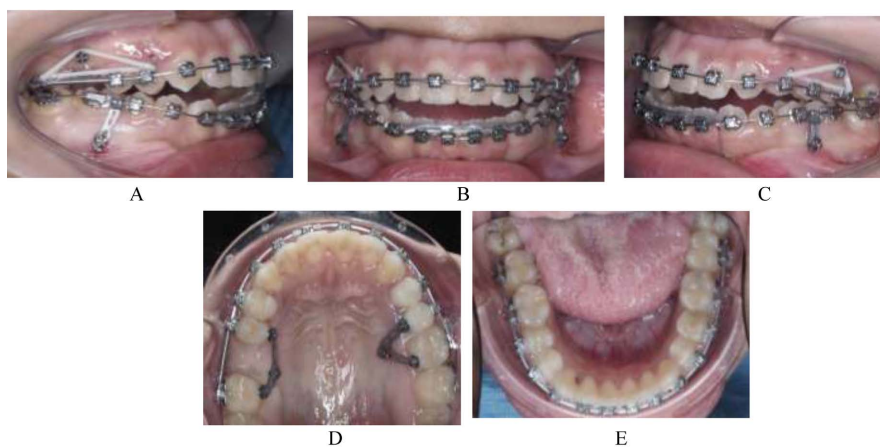


Figure 4. Intraoral photographs during treatment and the start of posterior tooth intrusion mechanics. Right lateral occlusal view (A); Frontal occlusal view (B); Left lateral occlusal view (C); Maxillary arch (D); Mandibular arch (E).

We performed mixed passive lingual re-education using tongue cribs that we bonded to the palatal surfaces of the maxillary incisors (**Figure 5 (D)**) and active re-education sessions. Active myofunctional therapy consisted of monthly 30 minutes sessions over a six-month period, supervised by a specialist orthodontist trained in orofacial myofunctional re-education techniques. Subsequently, the patient performed a daily home exercise regimen (three times daily, 10 minutes per session), which included tongue tip positioning on the incisive papilla at rest,

strengthening of the posterior tongue against the hard palate and lip seal exercises. Clinical success was defined by the achievement of a mature swallowing pattern, validated by the water swallow test, and the establishment of a correct resting tongue posture. After 12 months of active treatment, we successfully intruded the posterior teeth. We placed a stainless-steel coil spring to maintain the space of the right maxillary first molar after its extraction (**Figure 5(A)** and **Figure 5(D)**). The elastomeric chains were maintained passively during the stabilization phase (**Figures 5(A)-(E)**).

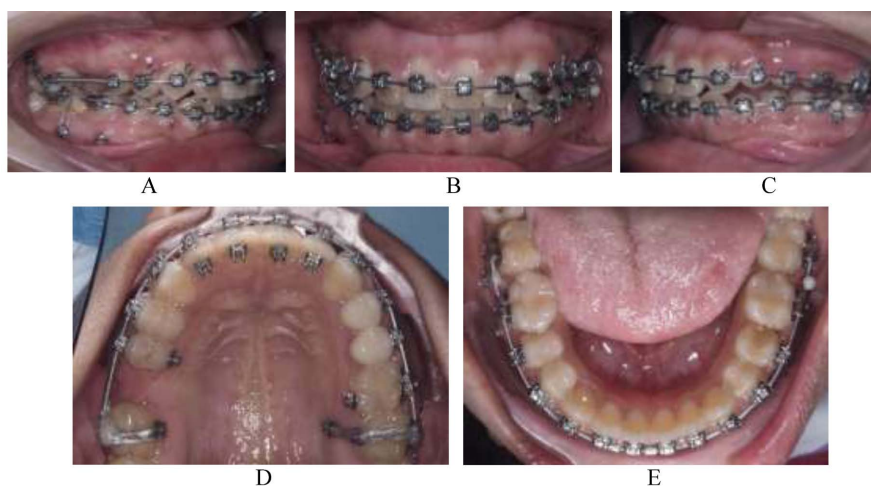


Figure 5. Intraoral photographs during treatment/mechanics of posterior tooth intrusion and placement of tongue pegs. Right lateral occlusal view (A); Frontal occlusal view (B); Left lateral occlusal view (C); Maxillary arch (D); Mandibular arch (E).

After intrusion of the posterior teeth, which enabled correction of the anterior open bite, the miniscrews were removed. During the finishing phase, which lasted three months, we used a TMA wires on the maxilla and on the mandible, along with intercupidating elastics (**Figure 6**).

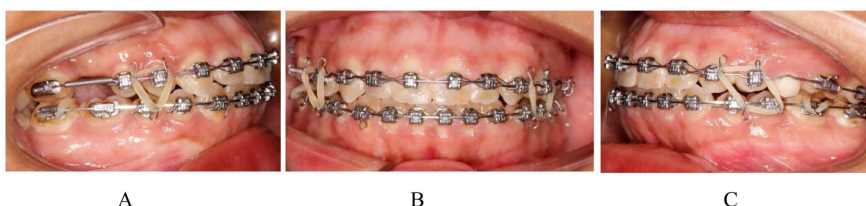


Figure 6. Finishing phase, intercupidation.

The total duration of treatment was 18 months. At the end of orthodontic treatment, the multi-attachment appliance was removed. We placed fixed retention using a bonded wire from canine to canine in the maxilla and mandible to maintain anterior alignment (**Figure 7(G)** and **Figure 7(H)**).

In addition to the fixed retainer, a night-time lingual retainer was fabricated (**Figure 8**). This removable appliance, worn at night, was designed to reinforce

correct lingual posture, thus playing a role in preventing functional relapse.



Figure 7. Post-treatment extraoral and intraoral photographs.



Figure 8. Night-time lingual retainer.

3. Result

After 18 months of active orthodontic treatment, we addressed the patient's esthetic and functional concerns. The establishment of a stable functional occlusion, which contributed to the improvement of the smile (**Figure 7(C)**), was considered very satisfactory by the patient, which constitutes a major success of this treatment.

Clinically, the most significant change was the complete closure of the anterior open bite (**Figures 7(D)-(F)**). This correction was achieved through a combination of biomechanical movements and lingual re-education. Controlled intrusion of the posterior maxillary sectors, achieved by bilateral skeletal anchorage (vestibular and palatal), allowed for counterclockwise mandibular rotation. Concerning the dental outcomes, a final overbite of 1.5 mm and an overjet of 2 mm were achieved. Consequently, the overbite improved from -6 mm to $+1.5$ mm. This anterior rotation was the main driver of the reduction in anterior open bite and the decrease in the height of the lower face (**Figure 7(A)**), thus improving the vertical harmony of the profile (**Figure 7(B)**). The treatment of lingual dysfunc-

tion, carried out in parallel, enabled the patient to adopt an adult swallowing pattern, which is essential for the stability of the result. The final occlusion is characterized by Class 1 canine and molar relationships and functional anterior guidance (**Figures 7(D)-(F)**).

Post-treatment radiographic examinations confirm the integrity of the dental and periodontal structures. No signs of pathological root resorption or damage to the supporting tissues were detected, and root parallelism was achieved (**Figure 9**). Cephalometric superimpositions and analysis demonstrated a closure of the mandibular plane angle, with the FMA decreasing from 36.4° to 29.1° and the GoGn to SN angle reducing from 46.2° to 38.6° . Furthermore, the normalization of the incisal overbite was achieved through a combination of posterior molar intrusion and mandibular incisor extrusion during the leveling of the occlusal plane (**Figure 10, Table 2 and Figure 11**).



Figure 9. Panoramic radiograph after treatment.

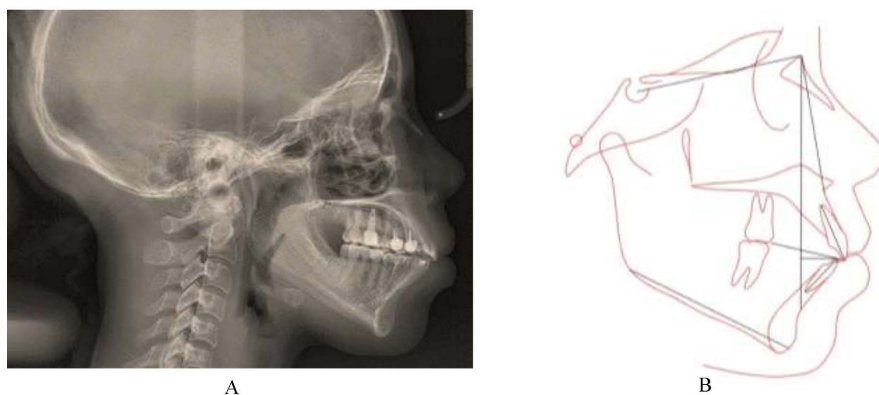
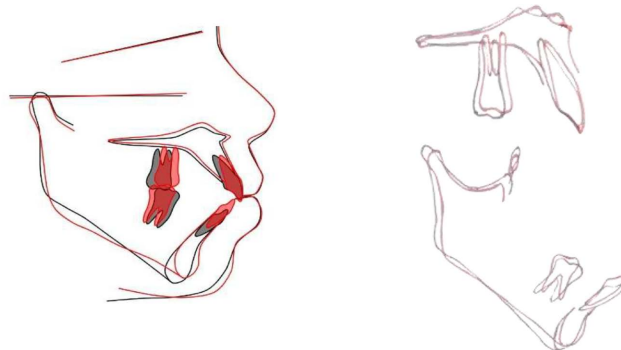


Figure 10. Post-treatment lateral cephalogram (A); Cephalometric tracing after treatment (B).

Check-ups carried out two years after treatment confirm the remarkable stability of the correction (**Figure 12**). The occlusion has remained unchanged and there are no signs of recurrence of the open bite, thus validating the effectiveness of the therapeutic approach combining posterior intrusion mechanics and functional re-education.

Table 2. Cephalometric measurements after treatment.

Parameters	Norms	Post-treatment
SNA (°)	82°	85.8°
SNB (°)	80°	78.5°
ANB (°)	2°	7.3°
AoBo (mm)	-2 mm to +2 mm	3 mm
I to NA (°)	22°	13.7°
I to NA (mm)	4 mm	3.7 mm
i to NB (°)	25°	43.7°
i to NB (mm)	15.1 mm	4 mm
I to i (°)	131°	112.9°
Po to NB (mm)	mm	-5.4 mm
Occl to SN (°)	14°	25.5°
GoGn to SN (°)	32°	38.6°
FMA (°)	25° ± 3°	29.1°
FMIA (°)	67° ± 3°	50.7°
IMPA (°)	88° ± 3°	100.2°

**Figure 11.** Cephalometric superimposition, pre-treatment (black), post-treatment (red).**Figure 12.** Occlusal stability after 2 years of post-treatment follow-up.

4. Discussion

The management of anterior open bite in adults is a considerable therapeutic challenge in orthodontics, as it requires reconciling esthetic and functional objectives with, above all, long-term stability. The case presented here illustrates this complexity due to its multifactorial nature, marked hyperdivergence, skeletal Class II malocclusion and lingual dysfunction. Such a clinical presentation requires treatment planning based on the exhaustive identification of all its etiological components, an approach whose importance is highlighted in the study by Lone IM *et al.* [11].

To correct the vertical dimension, we opted for miniscrew-assisted posterior tooth intrusion, an approach validated in the literature as a non-invasive, effective and reliable alternative. Indeed, Park YC *et al.* [12] report that this technique is capable of producing skeletal results similar to those achieved with surgery. However, the success of this mechanism depends on the rigorous application of biomechanical principles, as highlighted in the study by Heo S *et al.* [13].

To achieve pure ingression and control the vestibular version, we opted for double maxillary anchorage (vestibular and palatal), a configuration demonstrated by Bharadwaj *et al.* in their finite element analysis study [14] and also used by Choi YJ *et al.* in their study [15]. Compared to the intrusion mechanics used by Bharadwaj *et al.*, we applied a continuous and controlled force of 300 g (170 g vestibular and 130 g palatal) to the maxilla, which not only allowed for effective intrusion of the posterior teeth, but also preserved the integrity of the dentoalveolar structures. Our findings are consistent with the most recent scientific evidence for the correction of anterior open bite in adult patients. The selection of a 300 g force level is corroborated by the study of Akl *et al.*, which emphasizes that controlled forces ranging from 200 to 400 g facilitate effective molar intrusion [16]. The effectiveness of this mechanism resulted in a significant skeletal effect. The intrusion of the maxillary posterior teeth induced a mandibular counter-clockwise rotation, objectified by a decrease in the FMA angle from 36.4° to 29.1° and a reduction in the lower facial height. These results are consistent with the conclusions of Kim K *et al.* [17], who report that a 1 mm molar intrusion results in an average reduction of 2° in the mandibular plane angle.

However, mechanical correction alone is insufficient to guarantee lasting results. The scientific literature is unanimous: the most common etiological factor implicated in the recurrence of anterior open bite is persistent tongue dysfunction [18]. Aware of this major challenge, our strategy combined the correction of the form with the normalization of function. Simultaneously with the intrusion of the posterior teeth, myofunctional therapy was undertaken. This synergistic approach is supported by Burgos-Lancero P *et al.* [19] who reported a faster correction of malocclusion by combining tongue re-education and molar intrusion.

For the management of lingual function, our approach combined passive and active methods. The passive approach, using tongue picks, served as a physical barrier and proprioceptive reminder. At the same time, active myofunctional re-

education aimed to correct the dysfunctional motor pattern and automate correct lingual posture. The crucial importance of this approach is highlighted by the study by Smithpeter J *et al.*, [20], which demonstrated a significantly lower recurrence rate in patients who underwent orthodontic treatment and myofunctional therapy compared to a control group who underwent orthodontic treatment alone., Zhang J *et al.* [21] confirm that the addition of lingual re-education significantly reduces the risk of recurrence. The remarkable stability of our results two years post-treatment is, in our opinion, proof that correction of form and normalization of function are inseparable.

The systematic review by Espinosa *et al.* demonstrates that miniscrew-assisted molar intrusion exhibits stability rates comparable to orthognathic surgery, with a mean long-term relapse of only 10% - 30% [22].

Finally, respect for biological integrity and patient cooperation are key to success. The value of our approach is confirmed by the absence of significant root resorption on the final X-ray, demonstrating that light, controlled forces can preserve root integrity. While this miniscrew approach offers undeniable advantages for the patient, including reduced cost and low invasiveness, it requires unfailing cooperation in terms of hygiene around the miniscrews [9] [23]. The favorable results obtained confirm the reliability of posterior miniscrew intrusion, a technique whose high success rate for open bite correction has been documented by Baek MS *et al.* [24]. This success highlights that the choice of this treatment option must also take into account the patient's ability to fully commit to the treatment protocol.

The clinical adoption of miniscrews as skeletal anchorage is heavily influenced by the management of potential risks and complications. In the present case, the stability of the miniscrews remained absolute throughout the loading period, with no signs of mobility or failure. Soft tissue irritation was minimal, limited to slight gingival inflammation around the miniscrews, which was promptly resolved through the local application of chlorhexidine gel and reinforced oral hygiene instructions. The patient adhered to a rigorous brushing protocol using a soft bristled tooth brush and interdental brushes. No major complications were encountered, confirming the safety of this therapeutic approach when rigorously planned.

5. Study Limitations

Despite the favorable outcomes achieved, this report presents two primary limitations.

- First, its design as a single case study limits the generalizability of the findings to a broader population with diverse skeletal patterns.
- Second, the patient's exceptional cooperation, regarding both the hygiene of the anchorage devices and adherence to myofunctional therapy exercises. These factors suggest that, while the approach is effective, it requires consistent patient motivation to ensure the long-term sustainability of the results.

6. Ethical Considerations

This clinical case was conducted in accordance with fundamental ethical principles, in line with the provisions of the Declaration of Helsinki. Informed consent was obtained from the patient for all diagnostic and therapeutic procedures, and for the use and publication of clinical, radiographic and photographic data for scientific and educational purposes.

7. Conclusion

Orthodontic treatment of moderate to severe anterior open bite in adults using miniscrew-assisted posterior tooth intrusion is a reliable and effective therapeutic approach. This clinical case, which demonstrates pure intrusion mechanics achieved through double skeletal anchorage, has made it possible to correct severe anterior open bite. The approach combining posterior intrusion mechanics and rigorous management of lingual function is the key to the stability of the result. It allows for the successful treatment of severe anterior open bite cases, pushing the limits of non-surgical orthodontics and offering a therapeutic alternative of choice for adult patients.

Conflicts of Interest

The authors declare no conflicts of interest.

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