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Clinical case

Distalization with Miniscrew in Class III Malocclusion and Anterior Open Bite: A Case Report

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ABSTRACT

Introduction: Class III malocclusions can be treated through various approaches depending on their etiology and treatment objectives. The use of miniscrews for distalization of the mandibular arch has been previously reported with favorable outcomes. **Objective:** To correct a unilateral Class III malocclusion and anterior open bite using a mandibular shelf miniscrew with asymmetric force application. **Case presentation:** A 23-year-old female patient presented with Class III malocclusion on the left side, Class II on the right, an anterior open bite, and a dental midline deviated to the right. She had a history of previous orthodontic treatment. Conventional metal brackets were placed, and distalization of the lower left segment was performed using a mandibular shelf miniscrew, sliding jigs, and power chains. The total treatment duration was 1 year and 8 months.

Conclusions: The distalization mechanics were effective in establishing bilateral Class I molar and canine relationships, correcting the anterior open bite, and achieving midline coordination. Unilateral miniscrew anchorage in the mandibular shelf represents a reliable option for managing Class III malocclusion with anterior open bite and midline deviation, while reducing the need for patient cooperation and avoiding extractions.

Keywords: Miniscrews, Class III, mandibular shelf, distalization, orthodontics

INTRODUCTION

Class III malocclusion is relatively uncommon, with prevalence varying among different populations and ethnic groups. Globally, in permanent dentition, Class III malocclusion accounts for approximately 5.93% of Angle's malocclusions[1]. As with most malocclusions and dentofacial deformities, the etiology of Class III malocclusion is multifactorial, resulting from interactions between genetic and environmental factors. Environmental contributors include prolonged oral habits such as sucking or resting the tongue against the teeth, atypical swallowing, nasal airway obstruction, mouth breathing, functional mandibular shifts due to respiratory needs, tongue size, altered size and shape of the pharyngeal airway, hormonal imbalances, disorders such as gigantism or pituitary adenomas, trauma, premature loss of primary teeth, congenital anomalies such as cleft lip and palate, and muscle dysfunction[2].

The reported prevalence of anterior open bite ranges from 1.5% to 11%, depending on age group and population studied[3]. This tendency is associated with hyperdivergent growth patterns, increased gonial angle, reduced mandibular projection, posterior vertical excess of the maxilla and mandible, and increased facial height. When Class III malocclusion occurs in combination with an anterior open bite and a hyperdivergent growth pattern, achieving optimal orthodontic outcomes becomes increasingly challenging.

In the context of dental esthetics, symmetry is a primary goal of orthodontic treatment. Various asymmetries in dental and skeletal relationships, particularly those resulting in deviations from the midline, can compromise both facial and smile aesthetics, as well as occlusal function. For asymmetric molar relationships, several treatment strategies have been proposed, including asymmetric extractions, intraoral and extraoral appliances, and elastics. While these approaches may yield successful results, many rely heavily on patient compliance, which tends to decrease over time, making treatment outcomes less predictable.

Treatment options for adult Class III malocclusion depend on factors such as skeletal discrepancy, facial profile, and the patient's primary concern. Orthodontic camouflage may be appropriate for mild discrepancies, whereas severe cases typically require combined orthodontic and surgical approaches. The extraction of lower premolars has traditionally been the most common camouflage strategy. However, anchorage loss is a frequent complication in these cases, leading to unwanted mesialization of posterior teeth. In the present case, unilateral miniscrew anchorage was used to distalize the mandibular dentition, establish a bilateral Class I molar relationship, correct the anterior open bite, and center the midline.

CLINICAL CASE PRESENTATION

A 23-year-old female patient, in good general health, presented for an orthodontic consultation with the chief complaint of an anterior open bite. She reported previous orthodontic treatment. Medical history and clinical examination revealed no systemic conditions contraindicating orthodontic therapy and no evidence of temporomandibular joint disorders.

Clinical evaluation showed an oval facial shape, mesofacial biotype, and a straight facial profile (Gl–Sn–Pg angle 172°), with deviation of the dental midline from the facial midline. Mini-esthetic analysis revealed asymmetrical and reduced exposure of the maxillary incisors, adequate smile width, appropriate lip support, a non-consonant smile arc, open bite, and no gingival display (Figure 1).

Figure 1. Pre-treatment facial photographs.

Intraoral assessment showed healthy gingival tissues and normally positioned frenula. A Class I molar relationship was present on the right side, and a Class III relationship on the left. Canine relationships were Class II on the right and Class III on the left. The curves of Spee were not accentuated. The upper midline was deviated approximately 1 mm to the left, and the lower midline 2.5 mm to the right. Overjet measured 0 mm, overbite -1 mm, associated with the anterior open bite, and mild lower arch crowding (-1 mm). Both arches were oval and asymmetric (Figure 2).

Panoramic radiography revealed adequate bone quality, 32 teeth, several restorations, and a crown-to-root ratio of 1:2, except for the maxillary right central incisor (11), which had a shortened root without apparent pathology (Figure 3).

Steiner cephalometric analysis indicated a skeletal Class I relationship (ANB 1.5°) with proper maxillary and mandibular positions relative to the cranial base (SNA 80.3°, SNB 78.8°). The patient exhibited a hyperdivergent growth pattern with a high mandibular plane angle (36.1°), proclined maxillary incisors, and appropriately positioned mandibular incisors (U1–SN 113°, L1–GoGn 89°). Lip position was harmonious, with both lips passing through Steiner's S-line (Table 1).

Figure 2. Pre-treatment intraoral photographs.

Figure 3. Pre-treatment radiographs.

Table 1. Comparison of cephalometric measurements before and after treatment

Measurement[a]	Pre-treatment	Post-treatment	Norm
SNA	80.3°	80.1°	82°
SNB	78.8°	78.8°	80°
ANB	1.5°	1.3°	2°
GoGn–SN	36.1°	35.2°	32°
FMA	25°	25°	25°
U1–SN	113°	111°	103°
L1–GoGn	89°	94°	90°
LS	0 mm	0 mm	0 mm
LI	0 mm	0 mm	0 mm

[a]S refers to sella; N, nasion; A, point A; B, point B; Go, gonion; Gn, gnathion; FMA, angle of the Frankfurt plane to the mandibular plane; U1, upper incisor; L1, lower incisor; LS, S-line to the upper lip; LI, S-line to the lower lip.

Based on these findings, the patient was diagnosed with skeletal Class I, vertical growth pattern, anterior open bite, Class I molars on the right and Class III on the left, and proclined upper incisors. The treatment objectives were to close the anterior open bite, achieve bilateral Class I molar and canine relationships, and center the midlines. Three treatment options were

proposed: (1) extraction of four premolars; (2) placement of four miniscrews (two infrazygomatic and two in the mandibular shelf) with extraction of all four third molars; or (3) placement of one miniscrew in the left mandibular shelf with extraction of the left mandibular third molar (38). The patient elected the third option.

Prior to orthodontic treatment, the referring dentist restored carious lesions and replaced metal fillings on teeth 36, 37, 46, and 47. The lower left third molar (38) was extracted. Fixed appliances (0.022" Roth prescription brackets, TD, Monterrey, Mexico) were bonded in both arches. Alignment and leveling were performed using nickel-titanium archwires (0.014", 0.016", 0.016" × 0.022", 0.017" × 0.025"). During this phase, the anterior open bite increased, and an anterior crossbite developed due to decompensation (Figure 4. A). Stainless steel archwires were then introduced for continued leveling and stabilization.

Once archwires were stabilized, a temporary anchorage device (2 × 12 mm, TD) was placed on the left mandibular shelf. Distalization was performed with 0.017" × 0.025" stainless steel archwires using sliding jigs for molar movement (36, 37), and elastic chains sequentially applied to premolars (34, 35) and canine (33), with approximately 50 g of force per tooth (Figure 4. B). After distalization, the anterior segment was retracted to correct overjet, overbite, and midline deviation using a crimpable hook between teeth 32 and 33, initially anchored to the miniscrew, and later to the second molar (37) after miniscrew removal (Figure 4. C). Space closure was consolidated with omega-shaped stops and continuous ligation in both arches. Additional mechanics included extrusion of teeth 33 and 34 using second-order bends, and bilateral box elastics (13,14–43,44; 23,24–33,34) to optimize bite settling.

Figure 4. Treatment progress. **A.** Alignment and leveling phase, showing an increased open bite as a result of decompensation. **B.** Distalization mechanics using a mandibular shelf miniscrew with a sliding jig and power chains. **C.** Retraction of the anterior segment to correct the open bite and midline deviation.

After 20 months, fixed appliances were removed, and bonded retainers were placed from canine to canine in both arches. The patient maintained a straight facial profile, with lips slightly retruded, resulting in a more harmonious appearance. Upper teeth were more symmetrically and adequately exposed, contributing to increased smile width and a smile arc consonant with the lower lip. The commissures were symmetrically elevated, and appropriate lip support was preserved (Figure 5).

Both dental arches were transformed into oval and symmetric forms, achieving proper alignment and leveling. Bilateral Class I molar and canine relationships were established, with an overjet and overbite of approximately 1 mm, and coinciding midlines (Figure 6). The final panoramic radiograph confirmed successful distalization of the mandibular dentition, appropriate positioning of the involved teeth, absence of the lower left third molar (38), and presence of bonded retainers in both arches (Figure 7).

Figure 5. Post-treatment facial photographs.

Figure 6. Post-treatment intraoral photographs.

Figure 7. Post-treatment radiographs.

Cephalometric superimposition (Figure 8) demonstrated distalization of the lower first molar, slight retroclination of the maxillary incisors, and uprighting of the upper first molars. The skeletal Class I relationship was maintained (ANB 1.3°), with proper positioning of the maxilla and mandible relative to the cranial base (SNA 80.1°, SNB 78.8°). The hyperdivergent pattern persisted, with a high mandibular plane angle (35.2°). Maxillary incisor inclination decreased

slightly (U1–SN 111°) but remained proclined, whereas mandibular incisor proclination increased (L1–GoGn 94°). Lip position remained tangential to Steiner's S-line, preserving facial harmony (Table 1). Overall, the patient expressed satisfaction with the aesthetic and functional outcomes.

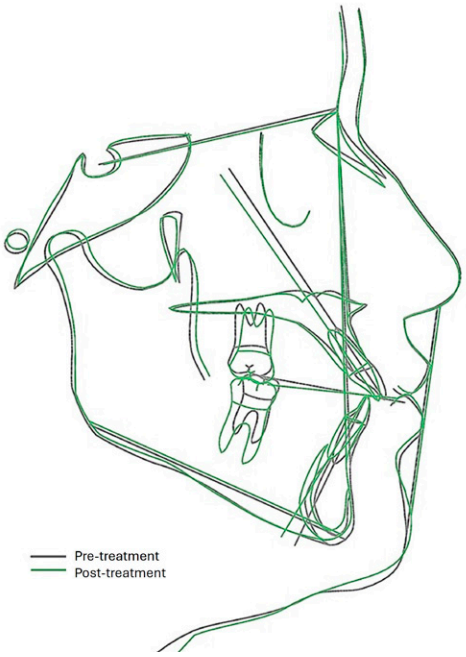

Figure 8. Cephalometric superimposition.

DISCUSSION

In the present case, the anterior open bite and midline deviation were primarily attributable to an increased posterior vertical dimension on the left side, anteriorly positioned lower left posterior dentition, and hyperdivergent growth pattern, despite an otherwise adequate skeletal relationship between maxilla and mandible. The corrective changes were predominantly achieved through dentoalveolar compensation via distal movement of the left mandibular dentition and counterclockwise rotation of the occlusal plane.

Facial and dental midline symmetry is a critical factor in achieving harmonious aesthetics, even though minor asymmetry is common in most individuals[4]. Previous studies have suggested that dental midline discrepancies up to 4 mm may be imperceptible[5,6], while others propose that deviations greater than 2 mm are aesthetically unacceptable[7]. In this patient, the dental midline was fully corrected, and the facial midline was improved but not entirely aligned. Nevertheless, the final aesthetic result was within acceptable parameters. Midline discrepancies may result from isolated dental factors, skeletal asymmetries, or functional jaw shifts, often requiring complex interventions. Treatment modalities for correcting such asymmetries include symmetrical and asymmetrical extractions, intraoral and extraoral appliances, and intermaxillary elastics. However, even with appropriate application and adequate patient cooperation, undesired effects can occur, including maxillary incisor proclination, extrusion of

maxillary molars, increased vertical dimension, and clockwise rotation of the mandible, potentially compromising both aesthetics and long-term stability.

Distalization of the mandibular arch using miniscrews has been well-documented[8-10]. The primary advantages of miniscrews include shorter treatment duration, ease of placement and removal, and minimal reliance on patient compliance. The mandibular shelf is frequently chosen for miniscrew placement, as it permits greater distalization than interradicular sites, where root spacing can limit movement. In this case, extraction of the lower left third molar (38) created sufficient space for distalizing the left mandibular segment, using a retraction force delivered via a miniscrew in the mandibular shelf. The occlusal plane underwent counterclockwise rotation because the force vector was applied above the center of resistance of the mandibular arch, favoring overbite increase while simultaneously correcting the anterior crossbite induced by decompensation and addressing the midline deviation through unilateral retraction of the mandibular teeth. This counterclockwise rotation aligns with findings reported by He *et al*.[11].

The distalization mechanics employed involved a miniscrew in the mandibular shelf in combination with a sliding jig transmitting force to the first molar, subsequently affecting the second molar. Elastic chains were used to transmit force to the first premolar and later to the second premolar, yielding favorable outcomes. Comparable approaches have been reported in the literature: Jing *et al*.,[12] achieved mass distalization with nickel-titanium springs, and Khyati *et al*.,[13] utilized elastomeric chains. Additional studies documented effective results using interradicular miniscrews in the mandibular ramus, C-shaped miniscrews, springs, and cantilevers[14-16]. In this patient, approximately 3 mm of molar distalization was achieved, similar to results reported by Aslan *et al*.[17] Reported ranges of mandibular molar distalization in other studies vary between 2 and 6 mm[12,18,19].

Within the limitations of treatment, complete settling on the right side was not achieved, likely due to premature contact of the right first molars (16, 46) and early termination of elastic use, as the patient requested appliance removal prior to childbirth. The cross-relationship between molars 16 and 46 also persisted, attributed to an overcontoured restoration on tooth 46 that was not corrected before appliance placement. Extraction of the maxillary and mandibular third molars 18, 28, and 48 was not indicated, as they did not interfere with the biomechanics of treatment. These teeth remained unaligned but presented no functional problems, given their infraocclusion. A recent systematic review[20] evaluating the potential contribution of third molars to mandibular incisor crowding after orthodontic treatment concluded that extraction should be considered only in the presence of pathology, such as nerve involvement, periodontal inflammation, or an increased risk of caries.

CONCLUSION

This case illustrates a successful approach for managing unilateral Class III malocclusion accompanied by an anterior open bite, employing asymmetric molar distalization supported by a miniscrew without premolar extractions. The approach resulted in adequate facial balance, an aesthetically pleasing smile, and an ideal occlusion. Unilateral mandibular arch retraction corrected the Class III molar and canine relationships, anterior overjet and overbite, and midline deviation. Improvements were also noted in the lower third of the facial profile, with slight lip retrusion, and frontally, through increased maxillary tooth exposure and a smile arc consonant with the lower lip. The versatility of miniscrews makes this treatment an effective option for selected patients, achieving predictable and favorable outcomes.

DECLARATIONS

Conflicts of interest: The author declare no conflicts of interest related to this work.
Consent to participate: Written informed consent was obtained from the patient for the publication of the case details and accompanying images.

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