Skeletal open bite Class III compensatory treatment with biofunctional therapy

Fabricio Pinelli Valarelli, Nayara Thiago Semenara, Mayara Paim Patel, Jéssica Ferreira de Almeida, Karina Maria Salvatore Freitas

ABSTRACT

Introduction: Class III skeletal malocclusion in adult patients presents mainly two treatment options: the surgical-orthodontic approach or compensatory treatment.

Case Report: In the present report, it was described the case of a 23-year-old male patient who presented skeletal Class III malocclusion associated with anterior open bite. The patient refused surgical-orthodontic treatment. Thus, the compensatory orthodontic treatment was performed with the biofunctional technique, consisting of preadjusted brackets with accentuated palatal torque on the maxillary incisors and accentuated buccal torque on mandibular incisors. This prescription aims to minimize the effects of Class III intermaxillary elastics, promoting more bodily movement than tipping of the anterior segments and improve bone remodeling. The anterior open bite was treated with lingual spurs, differentiated bonding of the accessories and early intermaxillary elastics. After 23 months of treatment, a functional occlusion was observed with bilateral Class I canine and molar relationships, overbite correction, and satisfactory smile esthetics.

Conclusion: The great outcomes indicate that compensatory orthodontic treatment is possible in skeletal discrepancies, with the correct diagnosis and considering patient compliance. The biofunctional technique provided a favorable dental positioning for Class III correction.

Keywords: Angle Class III malocclusion, Corrective orthodontics, Esthetics, Open bite

INTRODUCTION

Class III is a malocclusion characterized by the mandibular first molar’s mesial position related to the maxillary first molar. When there is skeletal involvement, due to a prognathic mandible, retrognathic maxilla, or combination of both, the treatment in adult patients presents mainly two options: the surgical-orthodontic approach or compensatory treatment [1–4]. The greater the skeletal discrepancy, the greater the chance of the patient chooses orthognathic surgery. However, many patients do not undergo surgical intervention due to the risks involved, the postoperative period’s difficulties, and the high cost of this procedure [3, 5]. Moreover, compensatory treatment represents a more acceptable and viable option for patients who do not complain about the profile, providing satisfactory results [3, 6].

Many techniques have been improved for the Class III malocclusion compensatory treatment, and one of the
alternatives is the use of brackets with the Biofunctional prescription [7]. In this prescription, the preadjusted brackets present a buccal contact in the mandibular incisors and palatal contact in the maxillary incisors. There is a force resistance in the rectangular archwires due to the association with intermaxillary Class III elastics, resulting in a greater bodily movement of the anterior teeth. Since the Class III elastics apply a contrary movement in relation to the prescription, they decrease the incisors’ inclination, favoring their positioning on their bone bases [3].

The skeletal anterior open bite is a malocclusion that also allows orthodontic camouflage through several strategies. Among the techniques, we can highlight the brackets’ differentiated bonding for the extrusion of the anterior teeth when there is little exposure during smile, bonding of lingual spurs and the use of early vertical anterior elastics [8].

When there is an association between different skeletal malocclusions, the treatment represents a great challenge to the orthodontist. This article aims to present a treatment of skeletal Class III malocclusion associated with anterior open bite with compensatory treatment, using the biofunctional prescription and some strategies to correct the vertical discrepancy of the anterior teeth.

**CASE REPORT**

A 23-year-old male patient presented the chief complaint of dissatisfaction with his occlusion. He was already treated orthodontically during childhood, and in that time, his orthodontist warned about the possible future need for retreatment when his growth phase finishes.

The clinical examination verified a vertical growth pattern, increased lower anterior face height (LAFH), and anterior open bite. He presented a convex profile, increased nasolabial angle, absence of passive lip sealing, and a short chin-neck line due to the mandibular clockwise rotation (Figure 1).

Intraoral examination revealed a negative overbite. Dental midlines presented deviated, with the mandibular midline deviated 3 mm to the left in relation to the midsagittal plane. In the sagittal relationship, he presented ¾-cusp Class III on the left side and full-cusp Class III on the right side (Figure 1). Occlusal views showed teeth alignment, absence of third molars, and a 3 x 3 bonded retainer in the mandibular arch (Figure 1).

Panoramic radiograph showed the normality of the teeth, adjacent structures, and absence of the third molars (Figure 2). In addition to that, the 3 x 3 bonded retainer in the mandibular arch and the presence of a radiopaque image at the left mandibular second premolar apex were consistent with bone sclerosis. Lateral cephalogram showed maxillary retrusion and mandibular protrusion with a clockwise rotation (Figure 2). The anterior open bite was also evident.

To assist the treatment planning, another complimentary exam requested was the cone-beam computed tomography (CBCT) to evaluate the bone thickness of maxillary and mandibular incisors (Figure 3).

Treatment objectives included teeth alignment and leveling, correction of the dental midline deviation, normalization of the overjet and overbite and the establishment of Class I canine and molar relationships, with proper functional occlusion.

Considering the objectives, two treatment options were proposed. The first option was the alignment and leveling of maxillary and mandibular arches and orthognathic surgery to correct the skeletal Class III discrepancy and the anterior open bite, improving the facial profile.

The second option involved the compensatory orthodontic treatment, which consisted of the use of biofunctional prescription and intermaxillary 3/16” (medium) Class III elastics to correct the sagittal discrepancy and use of lingual spurs and anterior elastics to correct the anterior open bite.

Since the profile was not the main complaint of the patient, the compensatory orthodontic treatment was chosen.

Initially, molars were banded, and brackets were bonded (biofunctional prescription, slot 0.022” x 0.030”, Morelli, Sorocaba, São Paulo, Brazil) (Figure 4).

The mandibular second molars were also included in the mechanics. To assist the correction of the anterior open bite, lingual spurs were used on the maxillary and mandibular incisors to conditionate the lingual posture more posteriorly (Figure 4).

For the alignment and leveling phase, the following archwires sequence was used: 0.012”, 0.014”, 0.016”, 0.016” x 0.022”, 0.017” x 0.025”, and 0.019” x 0.025” NiTi. After six months, the use of bilateral 3/16” medium force Class III intermaxillary elastics was started for 24 hours and daily change of the elastics (Figure 5).

After five months of the elastics’ mechanics, the left side was in a Class I relationship. Therefore, the elastics were used as retention at night on the left side, while at the right side, it was still being used for 24 hours a day. The Class I relationship on the right side was obtained after nine months.

With the Class I relationship established, use of bilateral 3/16” medium force intercuspatation anterior elastics was initiated, 24 hours a day (Figure 6). The elastics were used for six months for correction and two additional months, at night, as retention.

After 23 months of treatment, the fixed appliances were removed, obtaining a bilateral Class I canine and molar relationship. The anterior crossbite was corrected, and the anterior open bite was closed, obtaining satisfactory overjet and overbite (Figure 7). As retention, in the maxillary arch, was installed a Hawley plate with an orifice in the interincisive papilla region to keep the tongue in the ideal position and in the mandibular arch, a fixed canine to canine bonded retainer.
The facial profile did not present significant changes, and the radiographic exams presented aspects of the normality of teeth and adjacent structures (Figure 8).

The patient also performed the CBCT at the end of treatment to compare the bone thickness in the maxillary and mandibular incisor regions with the beginning of treatment. In the CBCT exams, it was observed that there was no significant change in maxillary and mandibular buccal bone thickness (Figure 9).

At the end of treatment, it was observed that the maxillary and mandibular skeletal components did not present significant changes and the maxillomandibular relationship. The vertical component variables increased, showing a clockwise rotation of the mandible and an increase of the lower anterior face height (Table 1, Figure 10).

The major treatment changes were found in the dentoalveolar components. There was extrusion, labial inclination, and protrusion of the incisors in the maxillary arch, while the maxillary molars presented mesial angulation, extrusion, and a slight mesial movement. In the mandibular arch, the incisors presented extrusion, lingual inclination, and a slight retraction. In the mandibular molars, there was distal angulation. Regarding anterior dental relationships, the overjet and overbite presented correction at the end of treatment, with significant increases (Table 1, Figure 10).

There was a decrease in the nasolabial angle and slight protrusion of the upper and lower lips (Table 1, Figure 10).

**DISCUSSION**

Compensatory treatment of skeletal malocclusion is always challenging. In this case, there was an association of Class III malocclusion with a skeletal anterior open bite. The skeletal anterior open bite is a complex and multifactorial malocclusion, including abnormal growth patterns and a tongue involvement in the function [9, 10]. At the initial clinical exam, an inadequate lingual posture was observed, favoring the anterior open bite's development. The hereditary factor was also observed.
For the correction of the lingual interposition, lingual spurs were applied on the maxillary incisors' palatal surface and the lingual surface of mandibular incisors, establishing a new lingual position more posteriorly [11]. The skeletal anterior open bite's main morphological characteristics are the clockwise rotation of the mandibular plane, increased LAFH, absent or forced lip sealing, and convex profile [9, 10, 12–14], characteristics observed in our patient by the increase in the vertical component measures.
At the end of the treatment, there was the correction of the dentoalveolar discrepancies (Table 1) [15]. Considering the skeletal involvement, an orthognathic surgery would probably provide a better occlusal and aesthetic result. Even so, the compensatory treatment provided satisfactory results [3]. The major changes observed were in the maxillary and mandibular incisors and the correction of the sagittal relationship. These changes also resulted in a good functional occlusion and a very aesthetic smile.

The sagittal correction of the Class III malocclusion was achieved by the use of Class III elastics associated with the biofunctional prescription [4]. This also explains the vertical components’ significant changes, with extrusion and mesial angulation of maxillary molars, extrusion and distal angulation of mandibular molars, clockwise rotation of the mandibular plane, and consequent increase in LAFH (Table 1) [4].

Usually, in skeletal Class III malocclusion, patients present a dentoalveolar compensation before treatment, with buccal tipping of maxillary incisors and lingual tipping of mandibular incisors [2, 3, 16]. Previous studies demonstrated that compensated orthodontic prescriptions of Class III malocclusions presented more efficient when compared with non-compensated torque brackets [17]. However, most of the preadjusted brackets for Class III treatment have accentuated buccal torque in maxillary incisors and lingual torque in mandibular incisors to assist in overjet correction [3]. Considering these compensatory inclinations, the biofunctional prescription, attempting to provide a more satisfactory smile and facial esthetics, with good functional occlusion and minor periodontal effects, differentiated the maxillary and mandibular incisors’ torque [4].

The significant changes in the dentoalveolar component were due to the mechanics applied. The slight buccal inclination, protrusion, and extrusion of the maxillary incisors were caused by the use of intermaxillary elastics associated with the biofunctional

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prescription (Table 1) [7]. One of the major side effects of the use of Class III elastics is the buccal inclination of maxillary incisors; however, the contrary force of the palatal torque present in the maxillary incisor brackets of the biofunctional prescription, causing a resistance to the intermaxillary Class III elastics force, minimized this effect [4, 7]. The extrusion of maxillary incisors was caused by the intercuspatation anterior elastics, used to close the anterior open bite [18]. In the posterior segment of the maxillary arch, the molars had a significant mesial angulation and extrusion due to the use of Class III elastics and the differentiated bracket positioning, assisting in molar’ uprighting (Table 1) [4].

The lingual inclination and the extrusion of the mandibular incisors were also a consequence of the Class III and intercuspatation elastics (Table 1). The association of the Class III elastics in the biofunctional prescription promoted the mandibular incisors’ good positioning. In most Class III cases treated with camouflage, the mandibular incisors tend to finish with accentuated lingual inclination because of the high lingual torque of the preadjusted brackets [3]. This excessive lingual inclination affects the patient’ smile esthetics [4, 19]. Thus, the buccal torque (+10°) present in mandibular incisors’ brackets of the biofunctional prescription, when associated with Class III elastics that promote a lingual inclination force, generates a tendency of the forces to compensate each other, and consequently, promoting a better mandibular incisors’ position. There was also a tendency of uprighting and slight distal angulation in the mandibular molars due to the differentiated bracket positioning and use of Class III elastics (Table 1) [3, 4, 7].

The improvement of the overjet and overbite was observed due to the sagittal correction, the achievement of bilateral Class I molar and canine relationships, and the maxillary and mandibular incisors extrusion promoted the closure of anterior bite (Table 1) [7, 18].

Regarding the soft tissue, the maxillary incisors buccal inclination caused protrusion of the upper lip, promoting a significant decrease of the nasolabial angle (Table 1) [20].

The compensatory treatment of this severe Class III malocclusion and anterior open bite with the biofunctional prescription showed minimal root resorption, clinically insignificant, good root parallelism, and no periodontal injury due to the controlled biomechanics.

It is very important to emphasize that the treatment success in this compensatory treatment was the patient compliance with elastics [17]. It is indispensable that the patient is aware of the treatment objectives and the role of his compliance.

Long-term stability of anterior open bite correction is reported as moderate, regardless of the treatment protocol, including surgery or not, since 35% of the cases present significant relapse [21]. The stability is influenced by the musculature, especially of the tongue [22]. Therefore, for greater stability and more appropriate treatment, the correct diagnosis must be applied.

CONCLUSION

The present case results were satisfactory with good esthetics and functional occlusion, improving the face harmony and establishing an adequate occlusion. Therefore, the compensatory treatment of skeletal Class III malocclusion associated with the anterior open bite is viable, considering the correct diagnosis, with great patient compliance. Biofunctional prescription represents a great alternative, providing Class III correction with proper dental positioning.

REFERENCES


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**Author Contributions**

Fabricio Pinelli Valarelli – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Mayara Paim Patel – Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Jéssica Ferreira de Almeida – Design of the work, Acquisition of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Karina Maria Salvatore Freitas – Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Authors declare no conflict of interest.

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