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Case Report

Lower incisors decompensation by torque auxiliary spring for an adult high-angle Class III extraction camouflage with preadjusted lingual appliance: A case report

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Keywords
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Summary

This case report describes a complex Class III high-angle case in an adult patient treated with preadjusted lingual appliance and premolar extractions. With the twofold aim of obtaining aesthetic improvement and ideal occlusal relationship, accurate set-up planification and linear biomechanical strategies, including lower incisors torque control, are needed to achieve the planned results. An auxiliary torque spring was inserted in order to obtain lower central incisors decompensation, for better occlusal and periodontal outcome. This case report demonstrates the possibility of solving successfully Class III malocclusion in adult patient by means of a completely invisible technique, with an orthodontic camouflage treatment by an ideal control of lower incisors torque, improving at the same time the patient facial aesthetics.

Introduction

The correction of a dental Class III malocclusion with anterior cross-bite in an adult patient is often challenging, when accompanied with an underlying anteroposterior skeletal discrepancy. Since not all patients are willing to undergo surgical treatment, an orthodontic camouflage is a viable option if excessive dental compensations are not present: several research reported that if either upper incisors show excessive proclination or lower incisors excessive retroclination a camouflage treatment is not indicated [1,2]. When premolar extractions are necessary, excessive retroclination of mandibular incisors would be a cause of concern [3]. When the patient requests a completely invisible appliance, the complexity is further increased. Indeed, lingual tipping or loss of torque control of the incisors during space closing stage is observed more frequently in lingual orthodontics [4,5]. Preserving the torque of lower incisors during retraction is a critical factor in lingual orthodontic treatment of skeletal Class III patients, since they present insufficient periodontal hard and soft tissues when compared with other types of malocclusions. The thin gingival thickness, with narrow keratinized gingival width, especially in the mandibular anterior teeth [6,7] may increase the risk of periodontal complications (gingival

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recession, aesthetic problems, fenestration, dehiscence, and root resorption) [8].
Lingual orthodontics allows one to plan the result in the set-up, inserting individualized overcorrections for every single case, limiting the necessity of final adjustments. However, torque control is difficult to achieve in a consistently predictable manner. In some cases, extra-slot auxiliaries are required in order to obtain an ideal control over a single or group of teeth.
In this article, an adult Class III patient is treated by a combination of preadjusted lingual appliance and premolar extractions, with the addition of an auxiliary torque spring for the control of lower central incisors torque.

Diagnosis and aetiology

The patient presented at 27 years of age with a request to have his teeth aligned by means of an aesthetic appliance.
The face, from a frontal view, evidenced the presence of dark circles under the eyes in combination with an increased lower third; a slight mandibular symphysis deviation towards the right side was highlighted, combined with a different height of the mandibular angles (*figure 1*). From a lateral view the profile appeared protruded, with a balanced nose, a reduced nasolabial angle, upper retrocheilia and lower procheilia, a flat labio-mental sulcus and a protruded mandibular position (*figure 1*).
The orthopantomography revealed the presence of all teeth, third molars included (*figure 2*). From the cephalometric values, a skeletal Class III (ANB = 1°; Wits = −2.0 mm) with mandible in protruded position (SNB = 83°) could be detected (*figure 2*, *table I*). The skeletal pattern resulted hyperdivergent (SN/MP = 42°), with a counter-clockwise oriented occlusal plane. The upper incisors appeared proclined (114°) while the lower turned out to be slightly retroclined (86°), but considering the vertical skeletal pattern the inclination was appropriate.
At frontal intraoral vision the midlines did not appear coincident (deviation of the lower towards right); a negative torque of buccal and posterior sectors in lower arch was noticeable (*figure 3*). Anterior crossbite of the lower canines and a flat lower curve of Spee were highlighted. The lateral photographs

FIGURE 1
Initial frontal, lateral and submental extraoral photographs

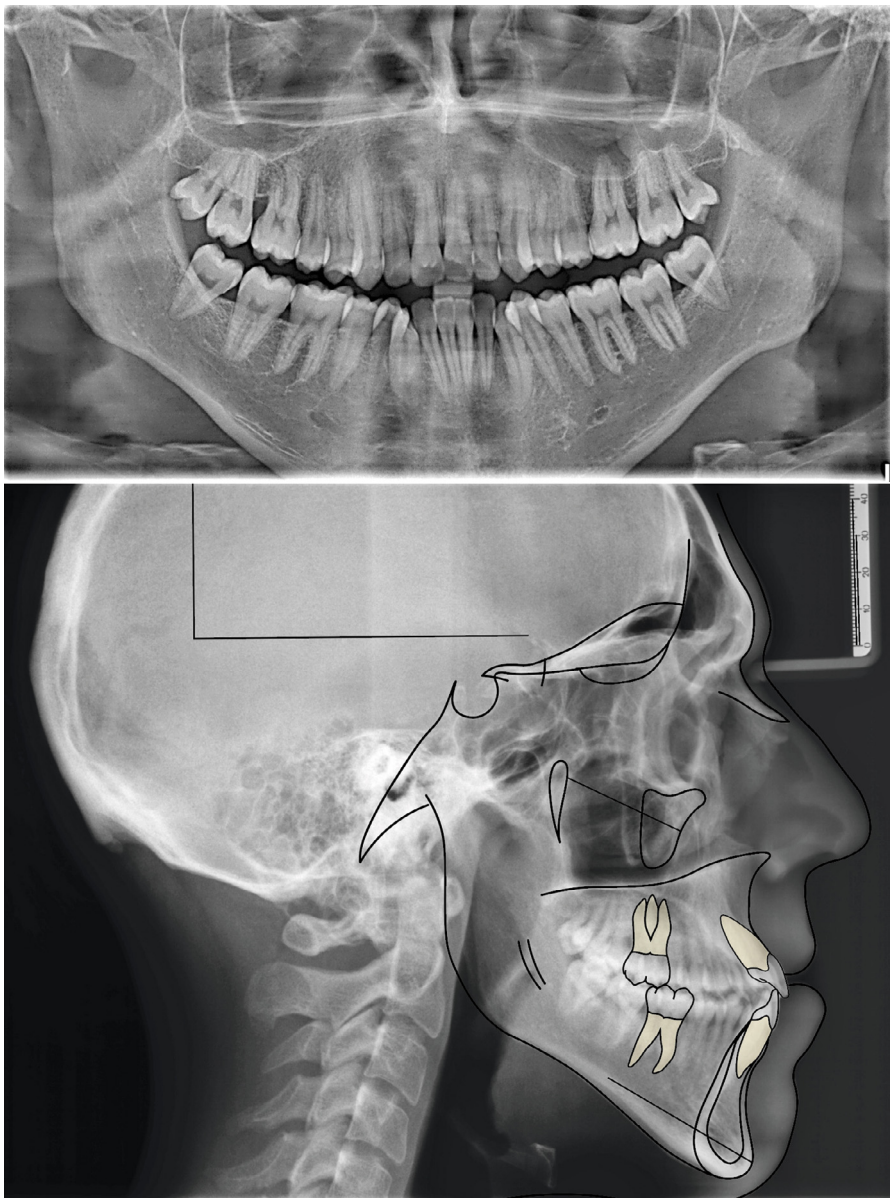

Figure 2

Initial radiographs: orthopantomography and lateral-lateral teleradiography cephalometric analysis

evidenced bilateral canine and molar Class III relation with slightly retroclined lower incisors (with the exception of the left central incisor), while the occlusal photographs evidenced a slight crowding in the upper arch and a significant crowding in the lower arch. The upper arch was also slightly contracted from a transverse point of view, while the lower curve of Wilson was accentuated.

The periodontal biotype turned out to be thin.

FIGURE 3
Initial intraoral photographs

Treatment objectives

The primary objectives were profile improvement, dental Class III correction, crowding resolution, anterior crossbite correction. Additional goals were ideal overjet and overbite achievement and curves of Wilson normalization.

Treatment alternatives

The ideal orthodontic-surgical treatment which would have allowed mandibular set-back and asymmetry correction of the maxillo-mandibular complex was illustrated to the patient without success.

Considering the profile features of the patient (decreased naso-labial angle, dento-alveolar protrusion, lower lip eversion) and the vertical hyperdivergent pattern, an extraction treatment was chosen. This choice was moreover driven by Merrifield Z-angle that resulted correct (76°) and needed to be slightly increased [9].

The lower first premolars were selected in order to obtain an easier anterior tooth retraction, considering also the anterior cross-bite of the lower canines which resulted in a periodontally unfavourable situation with a very thin band of tissue and absence of keratinized gingiva. After repositioning the roots of the lower canines into the correct position, the periodontal situation could thus have a chance of normalising with an adequate mucogingival complex.

Due to the severity of the Class III, upper second premolar extraction was chosen in combination with lower first premolars. The alternative could have been represented to avoid extractions on upper arch, but this would have resulted in excessive compensatory inclination of the upper incisors, leading to an anaesthetic result [10]. In addition, this approach would result in full-cusp Class III molar relationship [11], leading to an altered occlusal pattern. Despite the excellent results of this treatment strategy demonstrated in several studies [12–15], it can be challenging in some cases to achieve ideal occlusal contacts. No other extractions combination has been considered.

Due to increased skeletal divergence, with SN/GoGN and ANS-PNS/Go-Gn angles greater than 42° and 45° respectively, it was proposed to the patient to combine extractions with vertical reduction genioplasty to reduce the divergence by at least 7° [16–18]. This option was rejected by the patient, who wished to avoid any type of surgical intervention.

Treatment progress

The orthodontic treatment was performed by lingual technique: that choice was determined by the patient's request for an invisible appliance.

The orthodontic treatment was performed by lingual "Straight-wire" technique [11,19] with Ormco Stb™ brackets, after a manual set-up (*figure 4*). Extraction case tip and torque over-corrections were included in the set-up prescriptions:

- increased anterior labial crown torque on the mandibular incisors (+5° beyond the desired outcome);
- positive extra torque (+2°) on maxillary and mandibular canines to avoid cortical bone impaction;
- distal root tipping for maxillary first premolars (3°) and mandibular canines (6°) and mesial root tipping for maxillary first molars (3°) and mandibular second premolars (3°) to facilitate the bodily movement during space closure;
- first and second molars tipping backward (2°) to increase posterior anchorage, to prevent vertical bowing effect during space closure mechanics and to achieve root parallelism;
- 2° distal root tip on maxillary central incisors and 3° distal root tip on maxillary lateral incisors to achieve root parallelism.

The brackets' bonding was carried out by "single jigs", following the "Komori system" technique, after the assembling of arches performed with "Kommon base" philosophy [20].

Upper and lower arches bonding was performed (*figure 5*). A 0.013 CuNiTi LSW Medium was inserted for the initial alignment in the upper arch. Occlusal build-ups were bonded on upper second molars with the purpose of obtaining an anterior disclusion to allow cross-bite correction during alignment and levelling phases. A 0.018*0.018 CuNiTi LSW Small was inserted between lower second premolars and second molars. After

FIGURE 4
Manual set-up

bonding of lingual buttons on lower canines, a closed elastomeric chain was added between lower canines and first molars, to allow canines retraction for anterior crossbite resolution.
Six months later a 0.018*0.018 CuNiTi LSW Medium was inserted in the upper arch for levelling and torque establishment (*figure 6*). A 0.013 CuNiTi LSW Small was inserted for the initial alignment in the lower arch. Lower canines were bonded, with the addition of a closed elastomeric chain between lower right canine and first premolar. An open coil spring was added between lower lateral incisors, in order to create space for lower incisors alignment.
Nine months after treatment start, 0.018*0.018 SS LSW Medium was inserted in the upper arch (*figure 7*). A closed elastomeric chain was inserted between upper first molars in order to start extraction spaces closure. A 0.018*0.018 CuNiTi LSW Small was inserted in the lower arch for levelling and torque establishment. 3/16'' 6 oz Class III elastics were prescribed for nighttime.
Following a two-month period, 0.018*0.018 SS LSW Small was inserted in the lower arch with slight reverse curve of Spee for obtaining a complete levelling (*figure 8*). Closed elastomeric chains were inserted both in upper and lower arches between second molars to continue spaces closure. 3/16'' 6 oz Class III elastics were prescribed full-time.
Twenty-two months after treatment start a 0.0175*0.0175 TMA was inserted in the lower arch with the addition of lower reverse curve of Spee and some refinement bends. A closed elastomeric chain was inserted between upper first premolars. 0.014 kobayashi were inserted on upper first premolars and lower left second premolar, in order to prescribe 3/16'' 6 oz right Class III/intercuspation, left intercuspation elastics. A buccal sectional was bonded on upper and lower second and third molars, since

FIGURE 5
Upper and lower arches bonding. Insertion of 0.013 CuNiTi LSW Medium on upper arch. Insertion of 0.018*0.018 CuNiTi LSW Small between lower second premolars and second molars. Bonding of lingual buttons on lower canines. Insertion of build-ups on upper second molars. Insertion of closed elastomeric chain between lower canines and first molars

Figure 6

Insertion of 0.018*0.018 CuNiTi LSW Medium in the upper arch. Bonding of lower canines. Insertion of closed elastomeric chain between lower right canine and first premolar. Insertion of an open coil spring between lower lateral incisors

Figure 7

Insertion of 0.018*0.018 SS LSW Medium in the upper arch. Insertion of closed elastomeric chain between upper first molars. Insertion of 0.018*0.018 CuNiTi LSW Small in the lower arch. Ligation of lower central incisors. 3/16" 6 oz Class III elastics prescribed for night-time.

lingual clinical crown of the latter was short, with the insertion of 0.018*0.018 CuNiTi sectional wires (*figure 9*).

Six months later, after assessing an evident torque discrepancy on lower incisors, an auxiliary torque spring modelled and inserted on lower central incisors with an activation of 30° (*figure 10*). 3/16 6 oz intercuspation elastics were prescribed bilaterally full-time, after the insertion of 0.014 kobayashi on upper canines. A buccal 0.019*0.025 NiTi sectional wire was inserted on upper molars.

After four months the auxiliary torque spring was removed (*figure 11*). Lower reverse curve of Spee was added and refinement bends were performed. A closed elastomeric chain was inserted between lower left first molar and right second molar to stabilize spaces closure.

Four months later, a 0.0175*0.0175 TMA was inserted in the upper arch with the addition of refinement bends (*figure 12*). 0.014 kobayashi were inserted on upper right canine and first premolar, in order to prescribe 3/16'' 6 oz right intercuspation elastics. A closed elastomeric chain in upper arch between upper right first molar and left first premolar was inserted to stabilize space closure.

One months later buccal bonding of upper first molars was performed. A 0.019*0.025 NiTi was inserted on upper molars (*figure 13*). In 0.014 kobayashi were inserted on upper left and lower left first premolars for 3/16'' 6 oz left intercuspation elastics.

Figure 8

Insertion of 0.018*0.018 SS LSW Small in the lower arch with slight reverse curve of Spee, Insertion of closed elastomeric chains in upper and lower arches between second molars. 3/16" 6 oz Class III elastics prescribed full-time

FIGURE 9

Insertion of 0.0175*0.0175 TMA in the lower arch. Lower reverse curve of Spee addition and refinement bends. Insertion of a closed elastomeric chain between upper first premolars. Insertion of 0.014 kobayashi on 14, 24, 34. 3/16" 6 oz right Class III/intercuspation, left intercuspation elastics prescribed. Buccal bonding of upper and lower second and third molars. Insertion of buccal 0.018*0.018 CuNiTi

Figure 10

Auxiliary torque spring modelling and insertion on lower central incisors. The wire is ligated from right second premolar to left second premolar with a 30° activation on lower central incisors. Insertion of 0.014 kobayashi on 13, 23. 3/16" 6 oz intercuspation elastics prescribed full-time. Insertion of buccal 0.019*0.025 NiTi on upper molars

Figure 11

Lower torque spring remotion. Lower reverse curve of Spee addition and refinement bends. Insertion of a closed elastomeric chain between lower right second molar and left first molar

Figure 12

Insertion of 0.0175*0.0175 TMA on upper arch. Upper refinement bends. Insertion of 0.014 kobayashi on 13, 14 for 3/16" 6 oz right intercuspation elastics. Insertion of a closed elastomeric chain between upper right first molar and left first premolar

FIGURE 13

Buccal bonding of upper first molars. Insertion of a 0.019*0.025 NiTi on upper molars. Insertion of 24, 34 0.014 kobayashi for 3/16" 6 oz left intercuspation elastics

FIGURE 14

Upper and lower debonding

Results

After 36 months of treatment, upper and lower arch debonding was performed (*figure 14*). Upper and lower essix were delivered and final treatment radiographies were prescribed.

A solid canine and molar Class I was obtained on both sides, with crowding resolution, lower curve of Spee flattening, upper and lower curves of Wilson normalization and anterior crossbite correction.

From final treatment extraoral photographs, a correct smile arch could be noticed together with a significant improvement of upper incisors display. The profile was significantly improved (*figure 15*).

Cephalometric analysis evidenced the improvement of facial and dental relations (*figure 16*, *table I*). Upper incisor torque turned out to be normalized (from 114° to 110°) and lower incisors did not differ significantly (86° to 85°). Merrifield Z-angle [9] was slightly increased (from 76° to 84°) and confirmed the correct extraction decision. Superimposition of pre- and post-treatment cephalometric tracings carried out according to the methodology described in the image captions, as developed by Björk [21,22], show the correction was obtained by dento-alveolar movements (*figure 16*). Upper incisors were retroclined in consequence of space closure mechanics. Lower incisors were bodily retracted for anterior crossbite correction and slightly intruded. A good light contact was achieved. Upper and lower molars did not exhibit significant vertical movements. A significant mesialization for upper molars and a slight mesialization for lower molars were highlighted. A slight postero-

FIGURE 15
End of treatment frontal, lateral and submental extraoral photographs

rotation of the occlusal plane was evidenced. The final orthopantomography showed the root parallelism between the teeth with no signs of bone and/or root resorption (*figure 16*).
One month later, upper 12-22 and lower 33-43 fixed lingual retainer were directly bonded (*figure 17*).

One year later, the follow-up photographs show the occlusal and aesthetic result obtained with profile improvement (*figures 18 and 19*).

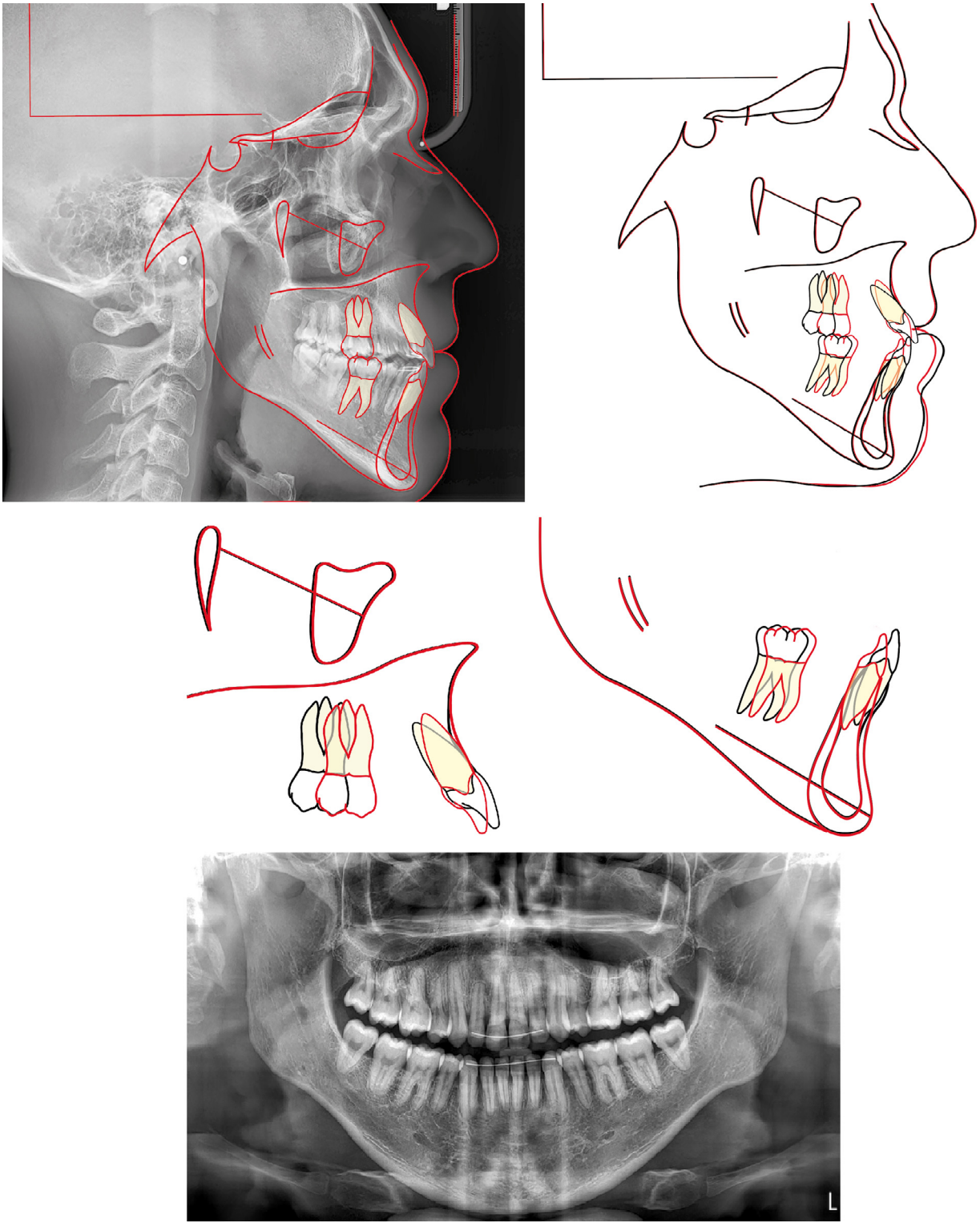

FIGURE 16

End of treatment radiographs. Lateral-lateral teleradiography cephalometric analysis. Overall superimpositions. Maxillary and mandibular regional superimpositions. Orthopantomography

TABLE I
Cephalometric morphological assessment.

	Pre-treatment	Post-treatment	Mean SD
Sagittal Skeletal Relations			
Maxillary Position S-N-A	84.2°	83.2°	82 ± 3.5°
Mandibular Position S-N-B	82.9°	82.3°	80° ± 3.5°
Sagittal Jaw Relation A-N-B	1.3°	0.9°	2° ± 2.5°
Vertical Skeletal Relations			
Maxillary Inclination S-N/ANS-PNS	−2.9°	−2.1°	8° ± 3.0°
Mandibular Inclination S-N/Go-Gn	42.2°	42.2°	33° ± 2.5°
Vertical Jaw Relation ANS-PNS/Go-Gn	45.1°	44.3°	25° ± 6.0°
Dento-Basal Relations			
Maxillary Incisor Inclination 1–PP	114.3°	109.5°	110° ± 6.0°
Mandibular Incisor Inclination 1–Go-Gn	86.0°	84.7°	94° ± 7.0°
Mandibular Incisor Compensation 1-A-Pg (mm)	7.5 mm	4.9 mm	2 ± 2.0
Dental Relations			
Overjet (mm)	0.3 mm	1.8 mm	3.5 ± 2.5
Overbite (mm)	0.9 mm	2.3 mm	2 ± 2.5
Interincisal Angle 1/1	114.6°	121.4°	132° ± 6.0°

FIGURE 17
Upper and lower fixed lingual retainers bonding

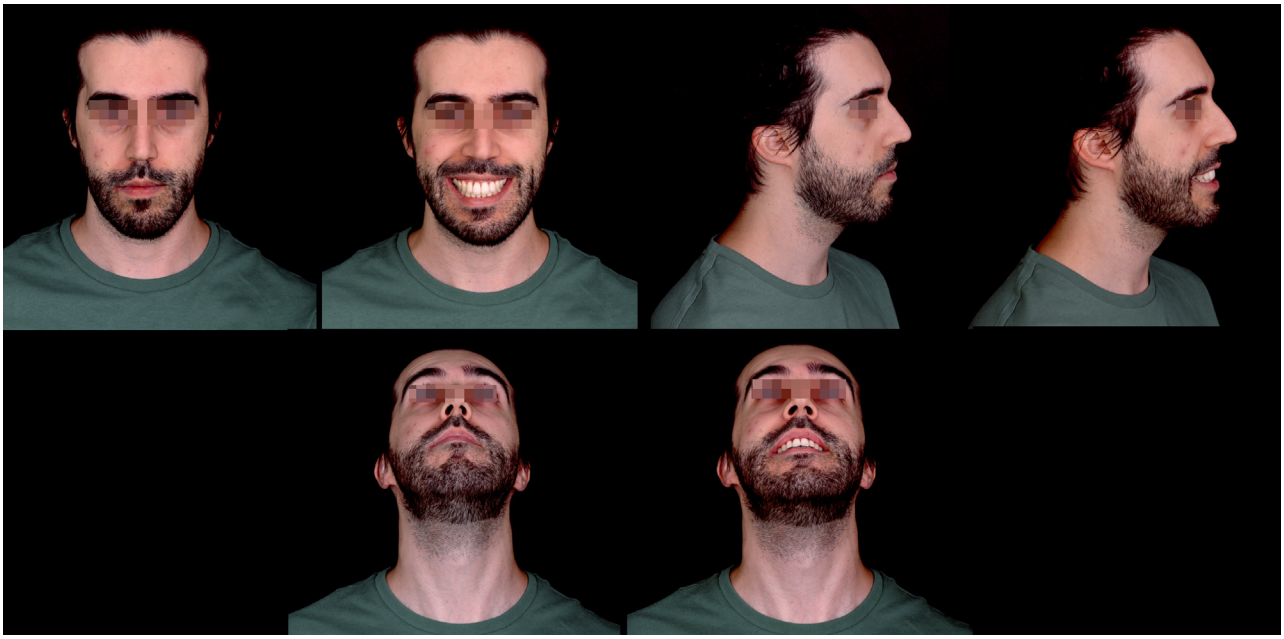

FIGURE 18
One-year follow-up (frontal, lateral and submental extraoral photographs)

FIGURE 19
One-year distance intraoral photographs

Discussion

In the present case-report a severe skeletal Class III malocclusion in a high-angle adult patient was corrected with a preadjusted lingual appliance by camouflage extraction treatment.

Even though the case would have benefited from orthognathic surgery for profile improvement, the patient refused this option, and the best camouflage treatment was researched with dento-alveolar Class III correction.

Stellzig-Eisenhower et al. [23] reported that the Wits appraisal was the most discriminative in determining whether the developing Class III malocclusion should be treated by camouflage treatment or surgery; the average Wits appraisal for patients who were successfully treated with camouflage treatment was −4.6 mm. In this case the initial Wits appraisal was −2.0 mm.

In severe Class III cases, extraction of four premolars should be done with caution because it may displace the upper lip backward and make the profile more concave [24]. In cases with retroclined lower anterior teeth, the camouflage increases the prominence of chin potentially, adversely affecting aesthetics [25]. In this case, the upper and lower lips were procumbent at treatment start, therefore a significant aesthetic improvement could be expected and was in the end obtained. The improvement in lip competency agrees with other studies that demonstrated that a decrease in facial concavity improved the posture of the lips [26,27].

Due to vertical skeletal excess, a little strain was however observed at the end of treatment. This could have been avoided if the patient had agreed to orthognathic surgery, which could also have improved the functional defect of mouth breathing. Dark circles under the eyes were still present at treatment end. Unfortunately, the patient refused any type of surgical procedure, including the vertical reduction genioplasty, that could have determined a divergence reduction by at least 7° [16–18]. The correction of skeletal Class III malocclusion associated with a hyperdivergent pattern is very difficult [28]. Patients with a hypodivergent facial pattern are easier to treat without surgery, because when the molars are extruded, the facial height increases and, simultaneously, the mandible moves backwards, improving the Class III relationship. Moreover, posttreatment relapse is common in open bite cases regardless of surgical and non-surgical treatment [29,30].

In this case, vertical control was obtained by posterior build-ups. No molar extrusion occurred despite Class III intermaxillary elastics and sagittal correction achieved by anterior-posterior movements related to premolar extraction spaces. Counterclockwise rotation of the occlusal plane often results from Class III camouflage mechanics with extrusion of the lower incisors [31] and aesthetically unpleasant intrusion of the upper incisors. However, in this case, the combination of extraction mechanics with torque reduction and the set-up planning led to a slight favourable posterior rotation of the occlusal plane.

Maxillary incisors were slightly proclined at treatment start (114°). The extraction of the upper second premolars allowed their inclination to be normalised at the end of treatment, while extruding them to achieve a more aesthetic smile arc.

The mandibular incisors were slightly retroclined at baseline (with the exception of the left central incisor) in order to compensate for the skeletal Class III disharmony. However, given the vertical skeletal profile, their inclination was appropriate. Therefore, controlling the torque of the mandibular incisors during retraction was critical in order to keep them straight and prevent further retroclination. The biomechanics of the lingual technique in the lower arch favours the anchorage of the posterior teeth, to the detriment of the inclination of the anterior teeth. In lingual orthodontics, the anchorage value of the mandibular molars is particularly strong, making it difficult

to mesialise the mandibular molars in cases of premolar extractions [11]. The orthodontic force vectors exerted on the anterior teeth by the lingual orthodontic appliance are not directed exactly towards the centre of rotation of the teeth but are deviated towards the lingual surface in order to produce a radiculo-buccal torque of the anterior teeth. As a result, an upright force is imposed distally on the posterior teeth through the archwire and there is more resistance to anchorage loss in the posterior teeth [11].

Mandibular incisor retraction with good torque control could be one of the most important factors to make favourable change in the patient's profile as the root movement could lead to an alveolar bone remodelling and result in lower lip retraction. Class III hyperdivergent patients have in addition thinner alveolar ridges, especially in the mandibular anterior region [32], with buccal surface more frequently affected than lingual surface [33]. Several studies have demonstrated that patients with Class III malocclusion have a higher prevalence of lower incisor dehiscence compared to patients with other types of malocclusions. The thickness of the alveolar bone is less, the labial bone plate is non-existent, the labial gingiva is thinner, and the width of the keratinised gingiva is narrower. Mandibular incisors with skeletal Class III malocclusion, often compensating for skeletal Class III malocclusion, present a higher risk of gingival recession [7,34], particularly when associated with poor dental plaque control and aggressive tooth brushing [35]. Thinner gingiva is more susceptible to gingival recession, while thicker gingiva is less susceptible [8]. In this case, the periodontal tissue was thin, with a significant difference in inclination visible from the start of treatment between the central and lateral incisors.

The objective of camouflage treatment in this patient was to normalize the underlying skeletal discrepancies and centre the incisors in the medullary bone in order to prevent bone dehiscence [36]. For this reason, the set-up lower incisors had significantly increased ther lingual root torque as an overcorrection. Georgalis and Woods with buccal appliances reported a significant further retroclination of the lower anterior teeth which were already retroclined (mean lower incisor/MeGo: 84.3°) before Class III camouflage treatment with lower premolar extractions [37]. Elham et al. highlighted a mean lingual tipping of 8° in 30 patients treated with lower premolar extractions for Class III camouflage [38].

On the other hand, Thiem et al., with completely customized lingual appliances (CCLA), reported an improvement in the average inclination of the lower incisors from 86.8° at T1 to 88.6° despite lower premolar extractions [14]. Wiechmann et al. reported an excellent control of lower incisors inclination in cases of class III camouflage treated by lower premolars extraction [15]. According to these authors, it appears that CCLA can offer highly predictable torque control. In our experience, torque control with a preset lingual appliance, particularly in cases of severe malocclusion, is not always predictable and in some cases requires the use of torque springs on a single tooth or group of teeth in order to achieve the ideal final angulation. In this case, at the end of treatment, the torque of the lower incisors remained unchanged (from 86° to 85°) with an obvious correction of the torque of the central incisors determined by the action of the auxiliary spring. Despite the lower central incisors had the same overcorrection in the set-up as lateral incisors and the space closure mechanics was performed with almost full-size wires (0.018*0.018 SS on 0.018*0.025 slot dimension), they evidenced a significantly different inclination at the end of space closure. This often occurs in lingual orthodontics extraction cases, both in upper and lower arches, since lingual tipping of anterior teeth is more common than in labial orthodontics [4], and central incisors tend to highlight greater loss of torsion compared to the adjacent teeth, in addition to the difference in initial torque [39,40].

In most cases, torque is properly controlled [41], while in other cases some teeth show evident differences [42,43].

This may happen because the anterior retraction can produce a reactive tipping force due to differences in the biomechanical force directions [44].

Despite the proven precision of Stb™ bracket slot in several in vitro research [45,46], the overcorrections inserted in the setup were not completely expressed. This clearly indicates that overcorrections inserted in the set-up and in the archwire are not completely predictable.

While a higher overcorrection could had been inserted on lower central than on lateral incisors in the set-up, this could have led to a problem in the positioning of the lower lingual straight-wire Kommon-base, determining a contact between lower central incisor bracket wing with the corresponding tooth, which would have made it difficult to insert the ligatures during treatment. Since the correction with a bend into the main wire was difficult, in consequence of the unfavourable moment ratio [47], with a short distance for the couple of force application [48], an auxiliary 0.016 spring was modelled and activated by ligating the wire as an auxiliary one in addition to the main 0.0175*0.0175 TMA.

The employment of an auxiliary spring with an auxiliary arch was necessary in order to obtain complete correction instead of applying torque to the main wire, due to the importance of torque correction and the distance between the brackets.

A correct control of upper and lower incisor torque was crucial in this case in order to avoid periodontal problems in the post-treatment. The lower incisors, which were slightly retroclined (86°) at the start of treatment, but with proper inclination considering the vertical skeletal pattern, needed to be bodily retract. At treatment end the lower incisors torque was maintained (from 86° to 85°), despite the premolar extractions. This was also helped by the fact that most of the extraction space was used for the canine relocation.

At the end of treatment, the facial balance was improved, with better maxillary and mandibular projection and ideal anterior

tooth inclination. An ideal root parallelism was obtained without the need for additional refinement tip bends.

Lower canines at treatment start were ectopically positioned with a very thin band of tissue and absence of keratinized gingiva. According to previous research, teeth moved by orthodontics to an area offering better bone support show improved periodontal condition [49].

The patient underwent periodontal follow-up after camouflage treatment. An increase in long-term side-effects, measured by gingival recession, has been reported in Class III patients who have undergone camouflage with significant dental compensation [50], in some cases in combination with the adverse effects of fixed lingual retainers [51].

Given that gingival recession seems inevitable in Class III patients, particularly in hyperdivergent patients with thin alveolar bone [52], it was considered crucial to achieve ideal inclination of all lower incisors. For this reason, the correction with set-up overcorrection and with lower auxiliary spring was considered essential.

After one year of follow-up, occlusal stability and periodontal health were ideal.

Conclusion

In this case the employment of a lingual preadjusted appliance allowed the sagittal, transverse and vertical correction of a Class III malocclusion in an adult patient by an extraction camouflage. The lingual appliance with all the auxiliaries on the inner side allowed one to have a completely invisible appliance, as requested by the patient.

Torque control, necessary to achieve the ideal occlusion and a good periodontal architecture, was obtained by overcorrections in the setup, space closure with light forces, stainless steel archwires, and compensation bends and curves. Despite the extractions the inclination on the lower lateral incisors was maintained, while the torque loss on the central incisors was corrected with an auxiliary SS spring in a 0.016 SS wire.

In consequence of the limited inter-bracket distance in lingual orthodontics, the employment of an auxiliary spring with an auxiliary arch is necessary in Class III extraction camouflage cases in order to obtain complete correction in place of torque insertion on the main wire.

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