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Retreatment of a patient: Orthognathic surgery-first approach with customized lingual appliances combined with miniplate anchorage

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Orthognathic surgery is necessary when a patient's major complaints include skeletal discrepancies that cannot be corrected with orthodontic treatment alone. Currently, orthognathic surgery can be performed through conventional and surgery-first approaches. Some advantages are attributed to the surgery-first approach, such as shortened treatment time and immediate esthetic improvement. The aim of this case report is to present the retreatment of a patient presenting with a skeletal Class III malocclusion, with maxillary retrusion and mandibular protrusion, who was successfully treated with the surgery-first approach and customized lingual appliances, combined with miniplate anchorage in the postoperative orthodontic treatment. The total orthodontic treatment time was 8 months. (Am J Orthod Dentofacial Orthop 2019;156:675-84)

The surgery-first approach is an orthognathic surgery technique in which a presurgical orthodontic phase is not performed. The surgical procedure is carried out without ideal positioning of the teeth in the basal bones, and orthodontic treatment is initiated a short time after the surgery.[1-4]

Recently, several studies have been published on the surgery-first approach, highlighting some advantages attributed to this technique, such as shortened treatment time and immediate esthetic improvement.[5-8] In addition, technological evolution has increased the success rate of this approach,[9,10] and the use of skeletal anchorage systems in the postsurgical orthodontic phase has facilitated and accelerated subsequent orthodontic treatment.[11,12]

Development of esthetic appliances, especially lingual appliances, has increased the acceptability of orthodontic care for adults. However, lingual appliances are frequently considered less practical for the patient and the clinician, because of factors such as tongue discomfort and irritation, speech difficulties, and problems with the orthodontic mechanics and clinical outcomes.[13] The advent of customized lingual appliances has reduced many disadvantages and increased patient and orthodontist acceptances.[14,15]

The aim of this case report is to present the retreatment of a patient presenting with a skeletal Class III malocclusion, with clinical maxillary retrusion and mandibular protrusion, who was successfully treated with the surgery-first approach and customized lingual appliances, combined with miniplate anchorage in the postoperative orthodontic treatment stage. The total orthodontic treatment time was 8 months.

DIAGNOSIS AND ETIOLOGY

A man aged 36 years came to the orthodontic private clinic of Dr Graziane O. Pereira, in Belém, Brazil, asking for improvement in his facial esthetics. His medical history was not relevant, and the temporomandibular joint was normal. He had experienced previous compensatory

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Fig 1. Pretreatment facial and intraoral photographs.

orthodontic treatment but was not satisfied with the treatment outcome or stability.

The pretreatment clinical examination showed a concave soft tissue profile (Fig 1). The lower to upper anterior facial height ratio was increased. The nasolabial angle was obtuse. There was insufficient maxillary anterior teeth exposure upon smiling. The maxillary dental midline was coincident with the facial midline, and the mandibular dental midline was shifted to the left.

Intraorally, the patient had a full complement of teeth (Figs 1 and 2). There was a Class I molar relationship on the left and a Class III on the right side with an edge-to-edge incisor relationship and dental wear of the maxillary incisors (Fig 2). The maxillary arch was transversely constricted, resulting in molar crossbite on the right.

Cephalometrically, he had a skeletal Class III malocclusion resulting from the prognathic mandible, a slightly horizontal growth pattern, and presented accentuated labial tipping of the maxillary incisors and lingual tipping of the mandibular incisors (Fig 3; Table). The panoramic radiograph showed the absence of the left mandibular third molar. The alveolar bone crest level was within normal range, and he had healthy periodontal tissues.

TREATMENT OBJECTIVES

The treatment objectives were to improve the skeletal and soft tissue profile, align the maxillary and mandibular dental arches, improve the maxillary incisor inclination, correct the unilateral posterior crossbite, establish bilateral Class I canine and molar relationships, obtain ideal overjet and overbite, and achieve a good functional occlusion.

TREATMENT ALTERNATIVES

The following alternatives were presented to the patient: (1) Conventional surgery approach: previous orthodontic treatment to provide dental decompensation,

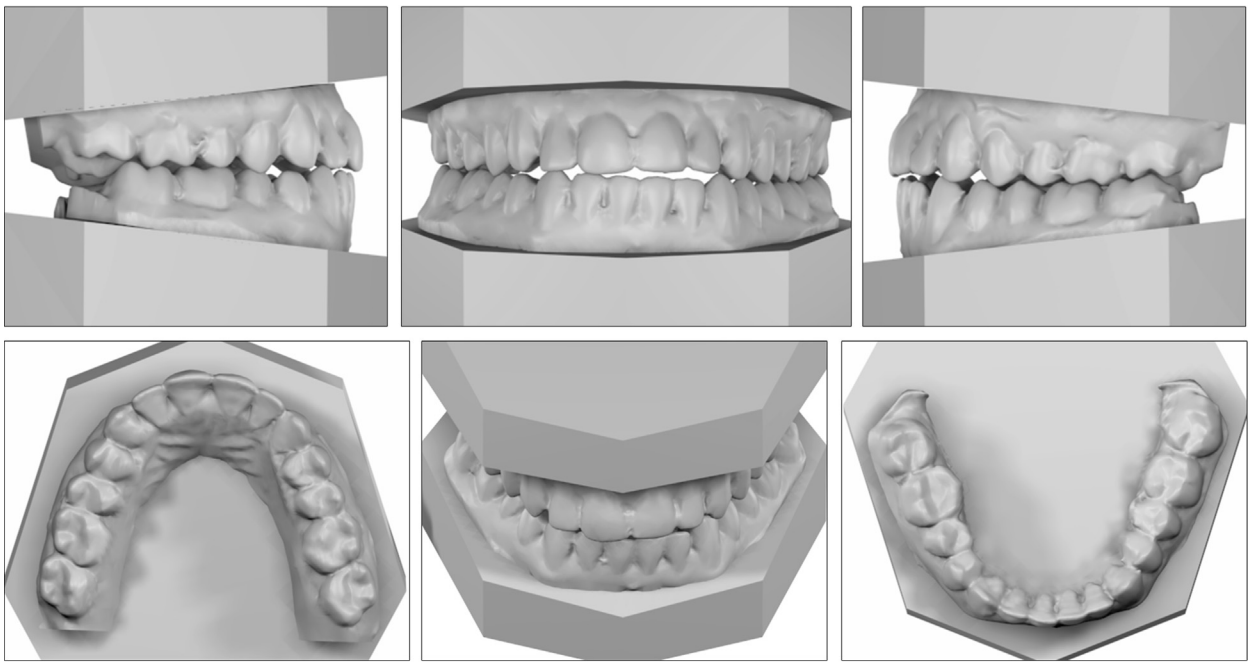

Fig 2. Pretreatment dental models.

followed by orthognathic surgery and postsurgical orthodontic treatment; (2) Surgery-first approach: performance of orthognathic surgery followed by postsurgical orthodontic treatment, with 4 miniplates to distalize the maxillary and mesialize the mandibular teeth.

The patient chose the second option because he wanted to quickly improve his facial esthetics and because of the expected short treatment time with this option. In addition, the patient wanted esthetic orthodontic treatment, and therefore, lingual orthodontic appliances would be used.

TREATMENT PROGRESS

Thirty days before surgery, customized lingual appliances (Hybrid System, Curitiba, Paraná, Brazil) were placed using indirect bonding with Arima individual impression trays (Dental Manufacturing SPA Ruthinium Group, Badia Polesine, Ro, Italy) (Fig 4). Arima trays are an individual tray made with light curable acrylic resin LC tray. CuNiTi archwires of 0.016 × 0.025 and 0.016-inch (Ormco Corporation, Orange, Calif), customized by a Memory Wire Bender (Kernit, Indaiatuba, São Paulo, Brazil), were placed in the maxillary and mandibular arches, respectively.

Both the surgical and orthodontic corrections were planned virtually. In the surgical plan, 7 days before surgery, a computed tomography scan (exposure time of 0.8 second; field view of 21 inches; voxel size of 1.25 mm) was taken for construction of a fusion/composite model of the skull, with the 3D Studio Max software (version 2015; Autodesk, San Rafael, Calif)[3] The orthodontic digital plan was defined based on the skeletal correction objectives.

To obtain the treatment goals, the virtual surgical plan consisted in a LeFort I osteotomy with 4-mm advancement of the maxilla, associated with clockwise rotation of the maxillomandibular complex (lowering the maxilla 2 mm at the incisors), and a mandibular bilateral sagittal split osteotomy to setback the mandible in 5 mm, rotating the mandible to the right, to correct the mandibular midline deviation (Figs 5 and 6). To compensate the mandibular retrusion, the chin was advanced 3 mm to improve the lower third facial profile. Soft tissue simulation was also performed based on the virtual surgical plan.

The virtual plan was transferred to the CAD/CAM software (3D Studio Max software, version 2018; Autodesk) for digital construction of the surgical splints. The surgical splints, made of a hybrid epoxy-acrylate polymer, were physically generated using the rapid prototyping additive manufacturing process (3-dimensional open source fused filament fabrication, Aditiv, Rio de Janeiro, Brazil). The surgery was performed as planned. During the surgery, 4 miniplates were also installed, one on each side of the zygomatic pillar, between the maxillary first and second molar, and one on each side of the mandible, between the canine and the mandibular first premolar. The final splint was removed after surgery.

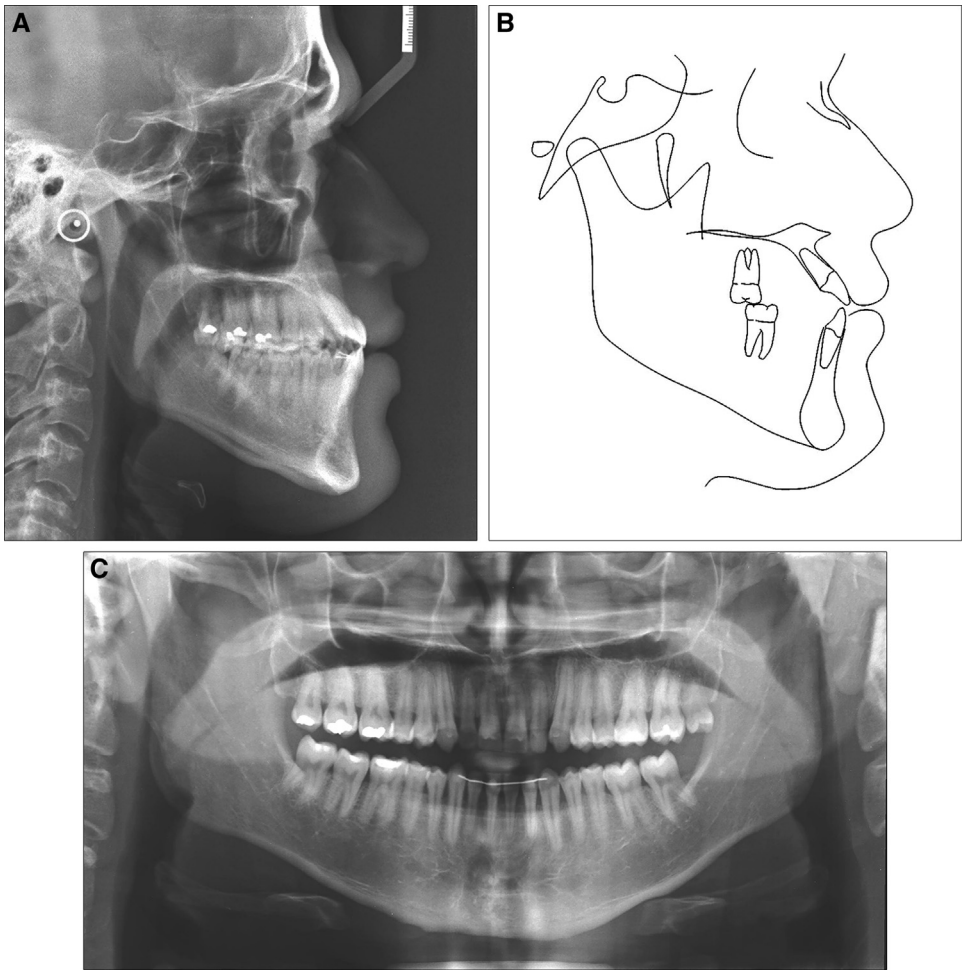

Fig 3. Pretreatment radiographs: **A,** cephalometric radiograph; **B,** cephalometric tracing; **C,** panoramic radiograph.

Table. Pre– and posttreatment cephalometric measurements

Variable	*Norm*	*Pretreatment*	*Posttreatment*
Skeletal			
SNA	82.0°	85.2°	88.0°
SNB	80.9°	90.3°	85.9°
ANB	1.6°	−5.1°	2.1°
Wits appraisal	−1.0 mm	−7.9 mm	−2.2 mm
LAFH (ANS-Me)	76.0 mm	72.0 mm	65 mm
FMA	25.0°	23.1°	22.3°
Dental			
U1–SN	102.8°	129.8°	121.4°
IMPA (L1–MP)	90.0°	81.0°	88.0°

Fifteen days after surgery, the patient was seen. A 0.017 × 0.025-inch CuNiTi archwire (Ormco Corporation) was bent with the Memory Wire Bender (Kernit), with accentuated curve of Spee and was placed in the maxillary arch with double ligature overtie (American Orthodontics, Sheboygan, Wis). Also, Memory elastic chains (American Orthodontics) were placed in the 6 anterior teeth to close the spaces. In the mandibular arch, a customized 0.016 × 0.022-inch CuNiTi archwire (Ormco Corporation), with the Memory Wire Bender (Kernit), was installed.

Two weeks later, elastic chains with 280 g of force were placed from the buttons bonded on the maxillary canine and first premolar to the miniplates (Fig 7). The mandibular miniplates were used to correct the midline deviation in the finishing stages. The patient was debonded 7 months after surgery, and a fixed retainer was bonded on the maxillary anterior teeth. After the end of treatment, the patient underwent complementary esthetic intervention to improve the color and shape of his teeth. After the complementary esthetic care, the fixed retainer was removed.

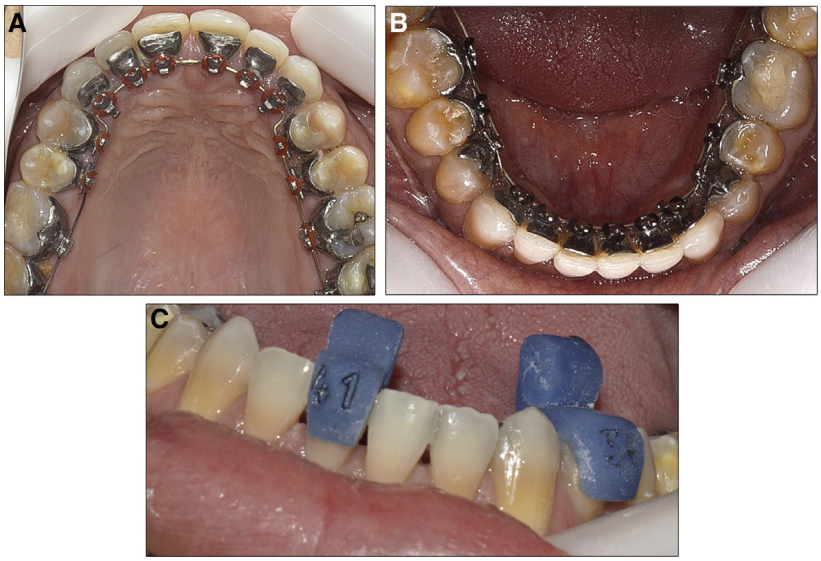

Fig 4. **A** and **B,** Customized lingual brackets; **C,** Arima individual impression trays.

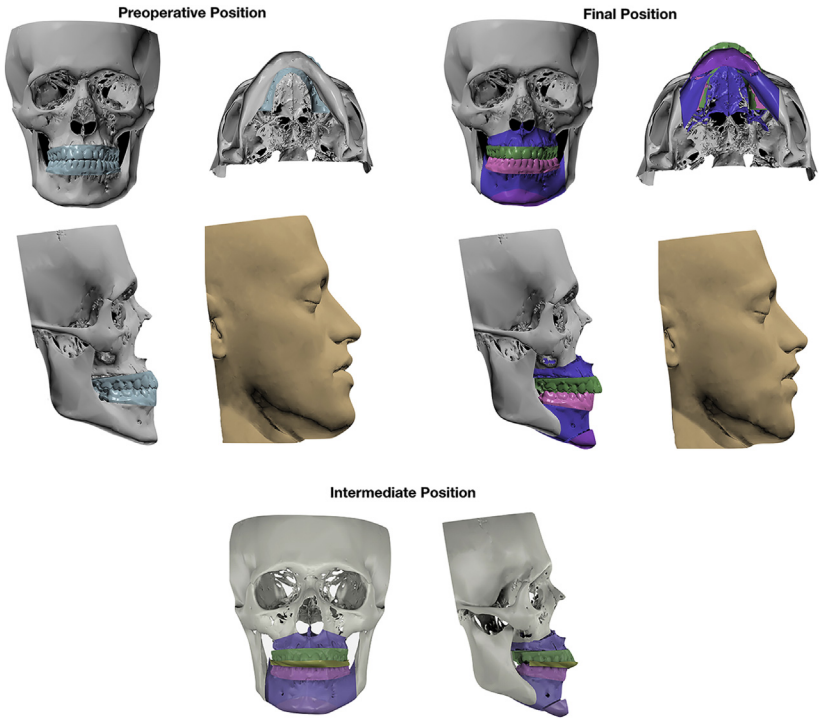

Fig 5. Virtual planning workflow.

TREATMENT RESULTS

At the end of treatment, there were great improvements in the frontal and profile esthetics. Bilateral molar and canine Class I occlusion was obtained, with ideal overjet and overbite, well-aligned maxillary and mandibular dental arches, correct transverse relationships, maxillary and mandibular midlines coincident with the facial midline, and a harmonious smile arc (Figs 8 and 9).

The pre– and posttreatment superimposition illustrates the skeletal and dentoalveolar changes with treatment (Fig 10). The patient was very satisfied with the great facial improvement and short treatment time.

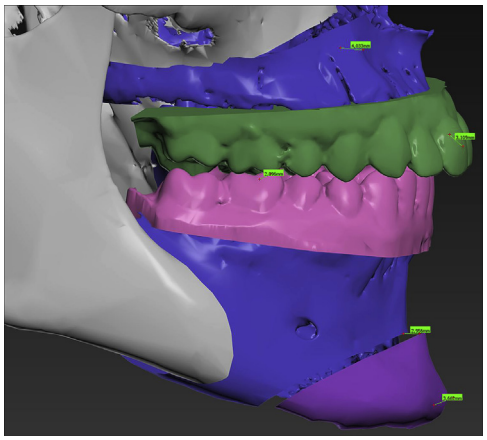

Fig 6. Virtual 3D surgical plan showing the dentoskeletal planned changes.

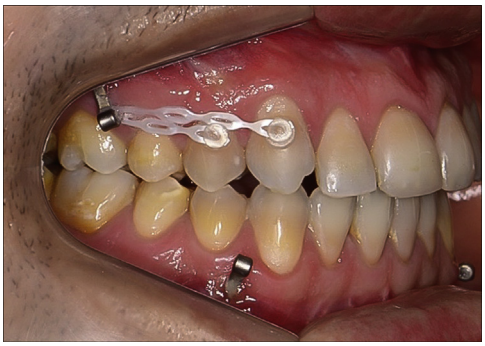

Fig 7. Elastic chains with 280 g of force were used from the buttons bonded on the maxillary canine and first premolar to the miniplates.

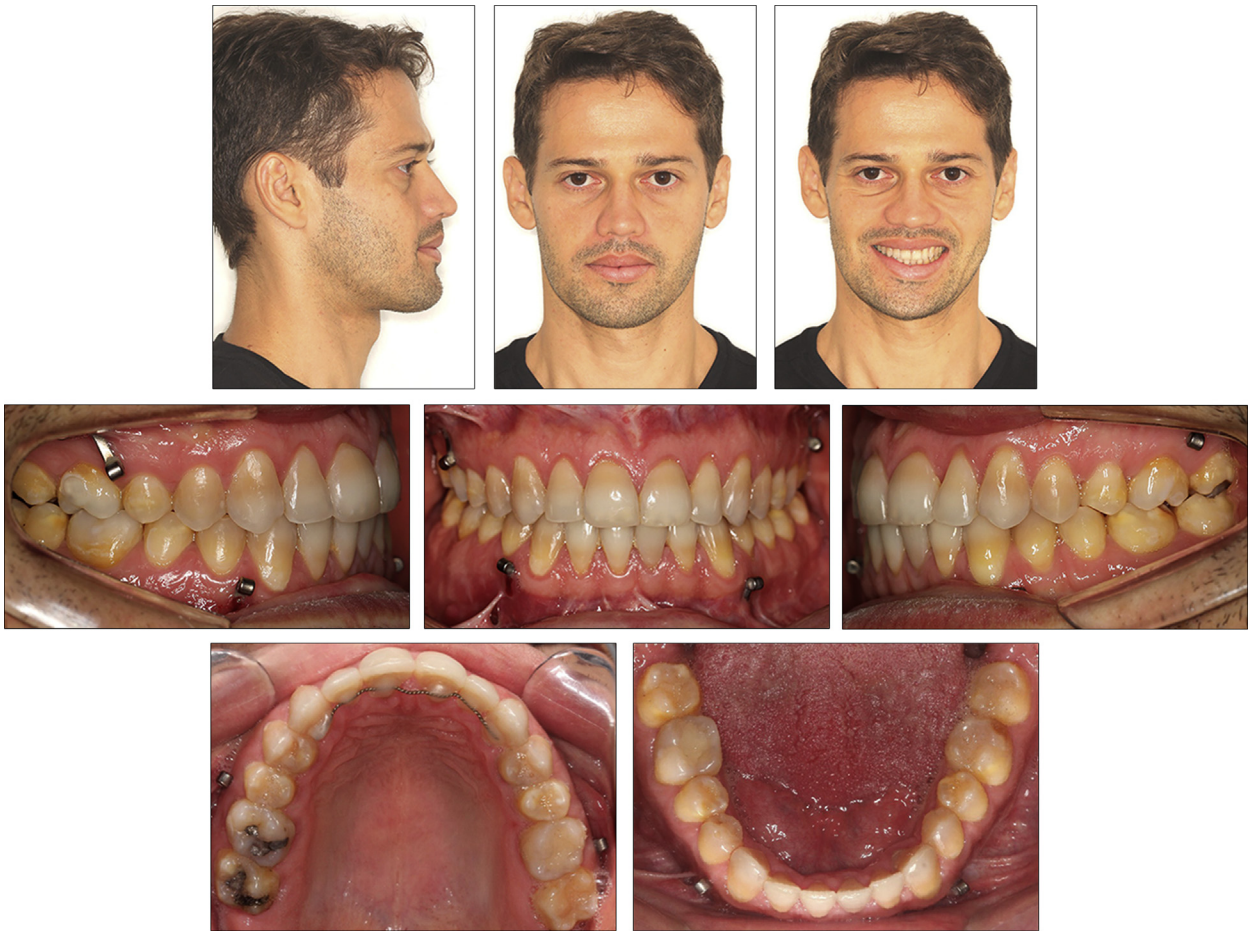

Fig 8. Posttreatment facial and intraoral photographs.

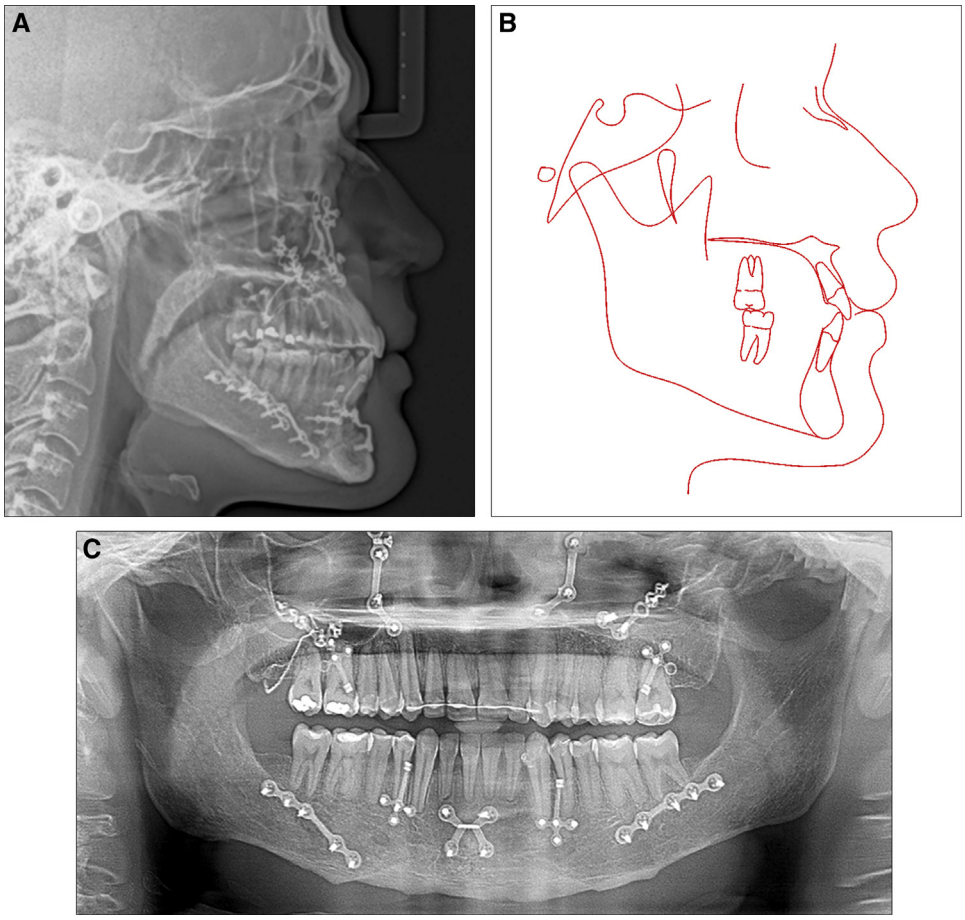

Fig 9. Posttreatment radiographs: **A,** cephalometric radiograph; **B,** cephalometric tracing; **C,** panoramic radiograph.

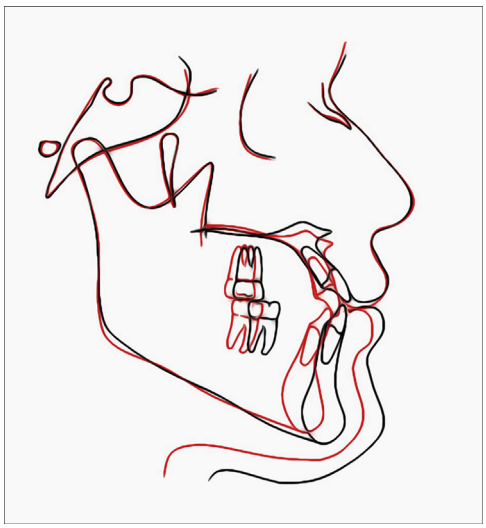

Fig 10. Cephalometric superimpositions: *black line*, pretreatment; *red line*, posttreatment.

The 1-year posttreatment photographs show excellent stability of the treatment results (Fig 11).

DISCUSSION

Treatment of adult patients with skeletal Class III malocclusion may need orthognathic surgery, especially when there is impact on facial esthetics.[16-18] In this case the patient's main requirement was improvement of facial esthetics, and therefore, orthognathic surgery was necessary to achieve the objectives.

Besides the esthetic problem, the patient also complained of dental wear of the maxillary incisors, caused by the end on bite resulting from relapse of previous orthodontic treatment, and the insufficient maxillary anterior teeth exposure during smiling that produced an unattractive smile.[19] The patient had undergone previous compensatory orthodontic treatment but was not satisfied with the treatment outcome and its instability.

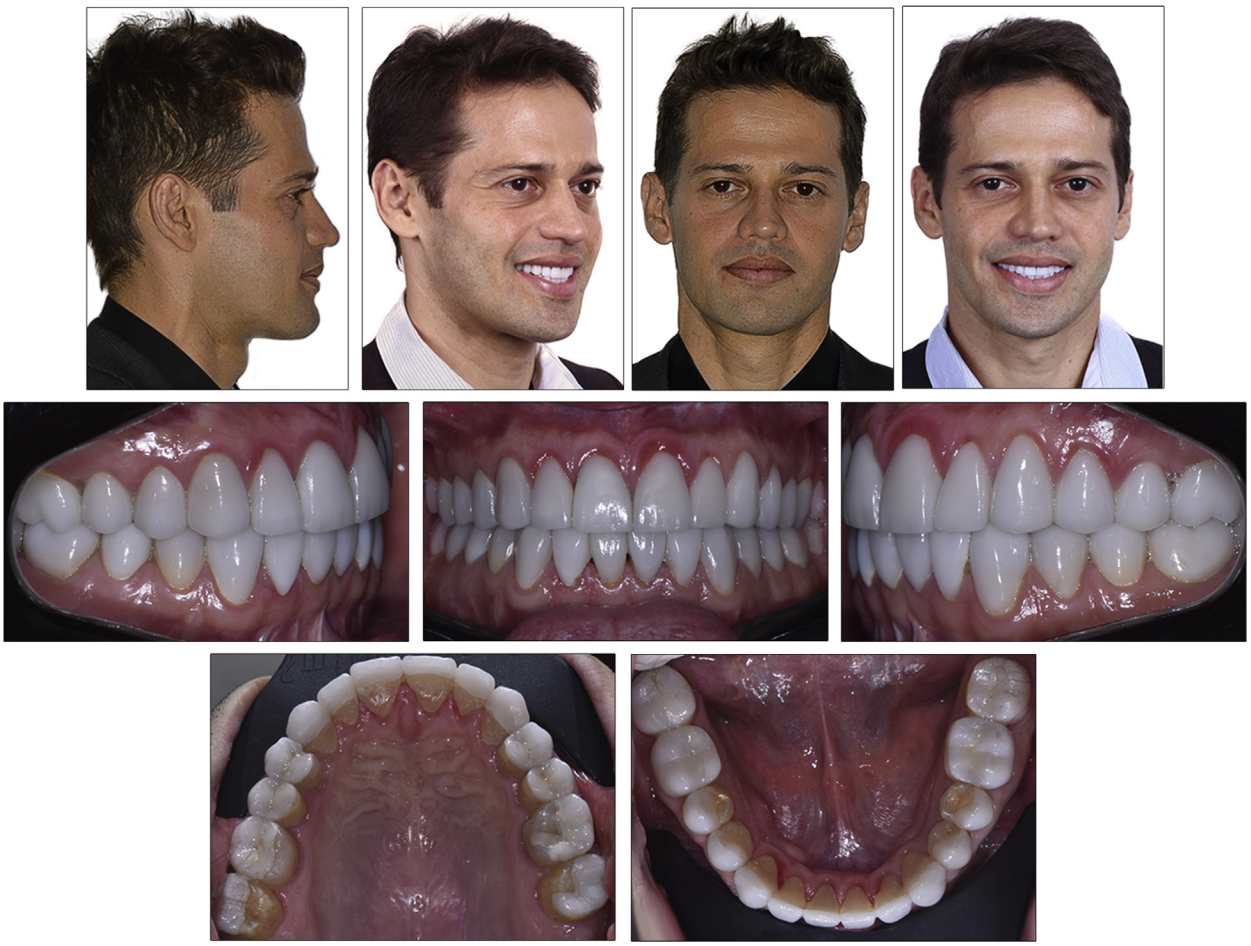

Fig 11. One-year posttreatment follow-up showing excellent stability of the interdisciplinary treatment.

An interactive communication between patients and orthodontists is very important to achieve the goals and satisfaction of the patient with orthodontic treatment. Patients seeking orthodontic retreatment have good perceptions of dental esthetics, strong motivations, and objective treatment needs.[20]

In 1959, Skaggs[21] suggested that in cases with dentofacial deformities, the surgery should precede orthodontic treatment if a satisfactory interarch relationship could be surgically reached. From that date, the concept of surgery-first approach appeared; however, until today, this approach has not been frequently used. There is currently no consensus regarding complications, limitations, and stability of the results of this treatment sequence.[5]

The literature shows that early improvement of the facial profile and reduction of total treatment duration produce high levels of patient and orthodontist satisfaction when the surgery-first approach is used.[5,22-25] In our case, these advantages were also observed.

Possible explanations for the short treatment duration may be associated with greater patient compliance and with a more efficient orthodontic decompensation consequent to correction of the skeletal base discrepancy before beginning orthodontic treatment.[22,24-26] Another possible explanation is a complex physiological phenomenon involving accelerated bone turnover and decreased regional mineral density resulting from the surgically–induced regional acceleratory phenomenon.[1,27-29]

A systematic review was conducted in 2016 to answer the questions regarding the surgery-first approach. The studies of this systematic review reported that Class III malocclusion was the most prevalent underlying malocclusion, which underwent bimaxillary surgery with Le-Fort I osteotomy (segmented or not) and bilateral sagittal split osteotomy in most cases.[5] Despite other malocclusions that can be treated with the surgery-first approach, Class III malocclusion has characteristics that favor this approach because no previous dental movements are necessary in most cases. In Class II

division 2 malocclusions, orthognathic surgery cannot be performed before decompensation of the maxillary incisors.

A disadvantage of the surgery-first approach is the limited number of cases that can be treated with this procedure.[30,31] The characteristics that contra-indicate the procedure are severe crowding, excessively proclined or retroclined maxillary central and mandibular incisors, and large transverse discrepancies. However, performance of virtual planning and modified surgery-first approach (with minimal orthodontic treatment previous to the orthognathic surgery) can reduce this limitation.

In 2011, Ko et al[32] compared the cephalometric changes of skeletal Class III correction with and without presurgical orthodontic treatment and observed that the treatment outcomes were similar. The case report presented could be treated with conventional orthognathic surgery, however, the patient wanted fast treatment with immediate improvement of the facial profile. Regarding postoperative complications, a systematic review did not find enough data supporting that postoperative complications in the surgery-first approach are greater than those in conventional orthognathic surgery.[33]

The lowest scores for maxillary anterior tooth exposure during smiling are assigned to smallest incisor displays.[34] In our patient, clockwise rotation of the maxillomandibular complex (lowering the maxilla 2 mm at the incisors) was performed to correct his unattractive smile.

The use of miniplates for distal movement of the maxillary teeth[11] and the use of miniscrews to facilitate postoperative orthodontic treatment are reported in the literature.[1,22,24] After surgery, our patient presented a dental Class II malocclusion, so the miniplates installed during surgery were used to correct the dental relationship in the postoperative orthodontic treatment.

Good stability of the surgery-first approach has been reported in the literature, however, with a maximum follow-up of 3 years.[23,24,26,30,35] In this patient, 1 year after treatment, the occlusal and esthetic results have remained stable (Fig 11). This stability is probably consequent to the association of the above described procedures.

CONCLUSIONS

- Due to a combination of the orthognathic surgery-first approach, customized lingual appliance, and miniplate anchorage, correction of the skeletal Class III malocclusion was successfully achieved.
- The patient was very satisfied in obtaining improvement in facial esthetics in a short treatment time.

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