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Case Report

Surgery-First Approach in a Case of Mandibular Asymmetry

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Abstract

This case report describes the orthodontic and surgical treatment of an adult patient aged 25 years 10 months, who had a skeletal Class I and Angle Class III subdivision malocclusion, with mild mandibular crowding and facial asymmetry. The chief complaint was a deviated chin to the left. Treatment was performed using a surgery-first approach that included maxillo-mandibular advancement, followed by orthodontic fixed appliances. After 12 months, the treatment has addressed the chief complaint of facial asymmetry and resulted in an attractive smile, functional occlusion, passive lip seal, balanced facial profile, and esthetic improvement. After 2 years 5 months of follow-up, the patient showed a stable surgical-orthodontic outcome with increased airway space.

Keywords: Asymmetry, esthetics, malocclusion, surgery-first

Introduction

For many years, the conventional method of treatment in dentoskeletal Class III patients included orthodontic treatment before orthognathic surgery. Recent improvements in technology, however, lead to an additional safe option for treatment: the surgery-first approach.[1]

In the surgery-first approach, the skeletal bases and the facial esthetic concerns are fixed from the beginning of treatment. The approach is primarily indicated in cases that do not need extensive presurgical orthodontic alignment, leveling, and decompensation. It can be used to treat a variety of malocclusions that meet certain criteria, such as mildly crowded anterior teeth, a flat to the mildly accentuated curve of Spee, normal to slightly proclined or retroclined incisors, and minimal transverse discrepancies.[2]

Compared with the traditional approach, surgery-first protocols lead to a significantly reduced total treatment time.[3] This could be because (1) the dental decompensation in the surgery-first approach is resolved partly by surgery so that the complexity of the orthodontic treatment is reduced, and/or (2) the phenomenon of postoperatively accelerated orthodontic tooth movement shortens the treatment period.[2]

Recently, a precise treatment plan became possible with the help of three-dimensional (3D) imaging and simulation.[4] Virtual surgical planning, combined with a method of transferring the plan to surgery, permits maxillofacial surgeons to make an accurate diagnosis, provides a predictable means for 3D reconstruction, and facilitates the analysis of postoperative changes in both hard and soft tissues.[5] Ultimately, 3D surgical planning systems make it possible to handle complex cases, such as asymmetry problems.[6]

Given this recent progress in the field, the objective of this case report is to present the orthodontic treatment in an adult patient with a skeletal Class I, hyperdivergent pattern, mandibular asymmetry, and lip incompetence by using the surgery-first approach.

Diagnosis and Etiology

The patient, an adult, aged 25 years 10 months, presented for orthodontic treatment. The patient's chief complaints were difficulty with keeping lips passively closed due to lip incompetence, and facial asymmetry. Facially, the patient presented with the asymmetry of the lower third with mandibular deviation to the left side. In the intraoral exam,

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the patient presented with a Class III left subdivision and mild crowding in the mandible, as well as a mandibular midline shift to the left. The patient additionally presented with a crossbite on the left side; cusp tips abrasion to the occlusal faces of the first and second molars; maxillary lateral width, proportionally, smaller than central; slight gingival recession in the canines and lower right central incisor; crepitation in the temporomandibular joint; breathing mode predominantly buccal and cant of the occlusal plane [Figure 1].

The radiography showed maxillary incisor shortened roots and an absence of third molars. Cephalometrically, he presented a skeletal Class II (ANB = 5°), hyperdivergent pattern (FMA = 39°; SnGoGn = 54°), upright maxillary incisor (1NA = 18°), relatively well-positioned mandibular incisor (1NB = 23°), and a convex profile (Z-angle = 59°) [Figure 2 and Table 1].

Treatment Objectives

1. Improve the facial profile and correct the asymmetry
2. Stabilize occlusion
3. Rectify functional movements of temporomandibular joint
4. Increase periodontal stability
5. Shorten time for treatment.

Treatment Alternatives

For the correction of facial asymmetry and mandibular retrognathism, orthognathic surgery is indicated as follows:

- Alternative 1: Consult the oral maxillofacial surgeon for orthognathic surgery. 1st stage: Alignment and leveling independent of the maxillary and mandibular arches. 2nd stage: In the mandible, maxilla with palatal expansion and/or mentoplasty. 3rd Stage: With orthodontic finishing, this is the conventional procedure indicated
- Alternative 2: Orthognathic surgery by using the surgery-first approach.

Treatment Progress

After the patient was informed about each alternative, the patient chose the surgery-first approach. In fact, the patient initially came for consultation, asking for surgery-first approach. The treatment was started by bonding all maxillary and mandibular teeth with a 0.018-in × 0.025-in SS archwire with interproximal spurs tied to the maxillary and mandibular arches. Orthognathic surgery was performed on the same day.

The patient was submitted to the surgical procedure under general anesthesia with nasal intubation. The total treatment plan and surgical guides were performed by virtual tools, and surgical guides were 3D printed.

For this case, orthognathic surgery was performed with mandibular surgery first. The mandible was advanced a total of 4.0 mm on the right side and 6.0 mm on the left side, associated with midline correction to correct the asymmetry. Basilar genioplasty with advancement of 5.0 mm and fixed

Figure 1: Pretreatment facial and intraoral photos

Table 1: Cephalometric measurements, pretreatment and posttreatment

Measurements	Initial	Final
SNA angle (°)	75	78
SNB angle (°)	70	76
ANB angle (°)	5	2
Ao-Bo (mm)	0	2
Facial angle (°)	83	89
Convexity (°)	8	3
FMA (°)	39	32
GoGn-SN) (°)	54	46
Y-Axis (°)	68	62
1-NA (mm)	5	7
1-NA (°)	18	30
1-NB (mm)	10	6
1-NB (°)	23	22
IMPA	80	80
Interincisal angle (°)	135	126
Z-angle (°)	59	78

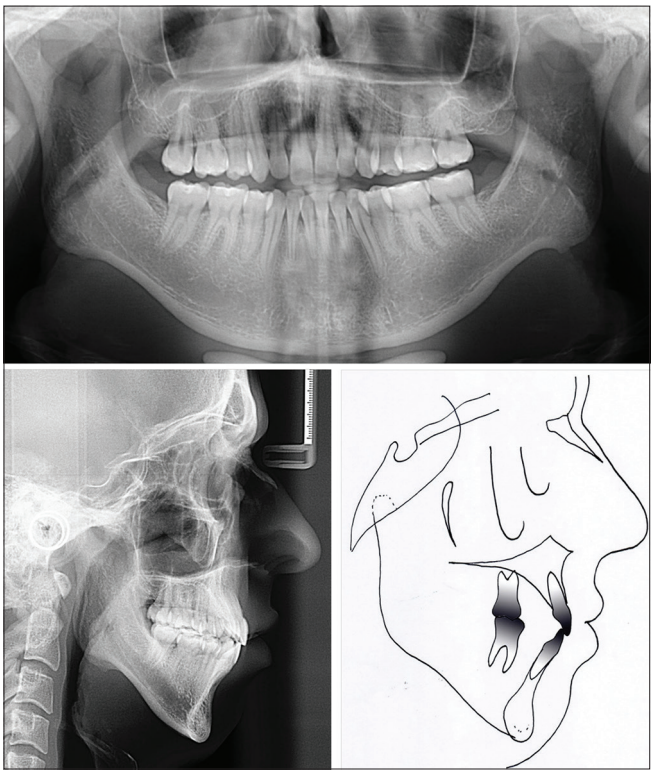

Figure 2: Pretreatment panoramic, cephalometric radiographs and tracing, and cephalometric measurements

with Paulus system fixation (Osteomed – TX, USA), was also performed to improve the anteroposterior projection of the face with counterclockwise rotation.

The surgical movements were maxillary advancement of 3.0 mm with downward movement of 3.75 mm of the left maxillary first molar and 2.25 mm of the right maxillary first molar by adjusting the present posterior occlusal cant of the maxilla. Le Fort I, osteotomy was performed at the maxilla, and stable fixation was obtained using two prebent plates system; 1.50 mm was associated with the two plates in an L-shape 2.00 mm system. The bilateral sagittal split osteotomy was performed in the mandible, and stable fixation was obtained using two BSSO straight plates. Bovine bone graft was used on the left side of the mandible to fill bone space.

The total time of surgery was 5 h, and the patient remained hospitalized for 48 h. The presence of elastic guides in the immediate postoperative period is important to guide the occlusion soon after surgery. The use of elastic guides avoids the need for maxillo-mandibular fixation, and stable internal fixation allows the patient to return quickly to normal activities.

The immediate postoperative period is important due to muscle memory and the tendency for this musculature to relapse. Thus, the interocclusal control elastics were used to direct the musculoskeletal fibers [Figure 3]. Aspects of normality of the maxillo-mandibular fixation 45 days after orthognathic surgery [Figure 4]. Postoperative edema was controlled through immediate lymphatic drainage, and physical therapy was provided within 5–7 days for early muscle stimulation in the new position.

Three weeks after orthognathic surgery, the patient was released for the application of biomechanics. The archwires were changed to a 0.016-in × 0.016-in Copper Niti with Class III elastics on the right side and Class II on the left. Progress was made from 0.016-in × 0.022-in Thermal Niti to 0.019-in × 0.026 – in SS finishing archwires – always associated with intermaxillary elastics. Further, we utilized debonding and wraparound type removable appliance in the maxillary arch and premolar-to-premolar bonded retention in the mandibular arch.

Treatment Results

After 12 months, the objectives of the treatment were achieved, and the patient was satisfied with the functional occlusion and esthetic results. Notably, there was a pleasant facial esthetic change in the case. Balance and harmony of facial thirds is a critical goal of orthodontic-surgical treatment, in addition to returning chewing function, achieving adequate occlusal stability, improving the superior airway, eliminating periodontal disease, preserving temporomandibular joint movements, and achieving no Class II facial appearance [Figure 5].

The posttreatment panoramic radiograph showed acceptable root parallelism, and there were no significant signs of bone or root resorption. The lateral cephalometric measurements and superimposition showed skeletal changes in almost all measurements, with a counterclockwise rotation of the mandible ANB of 2° and the mandibular plane angle of 46°. The maxillary incisors upright were proclined (30°), and the mandibular incisor was maintained (22°) [Figure 6 and Table 1]. In this case, 3D simulation with facial asymmetry and asymmetrical surgical

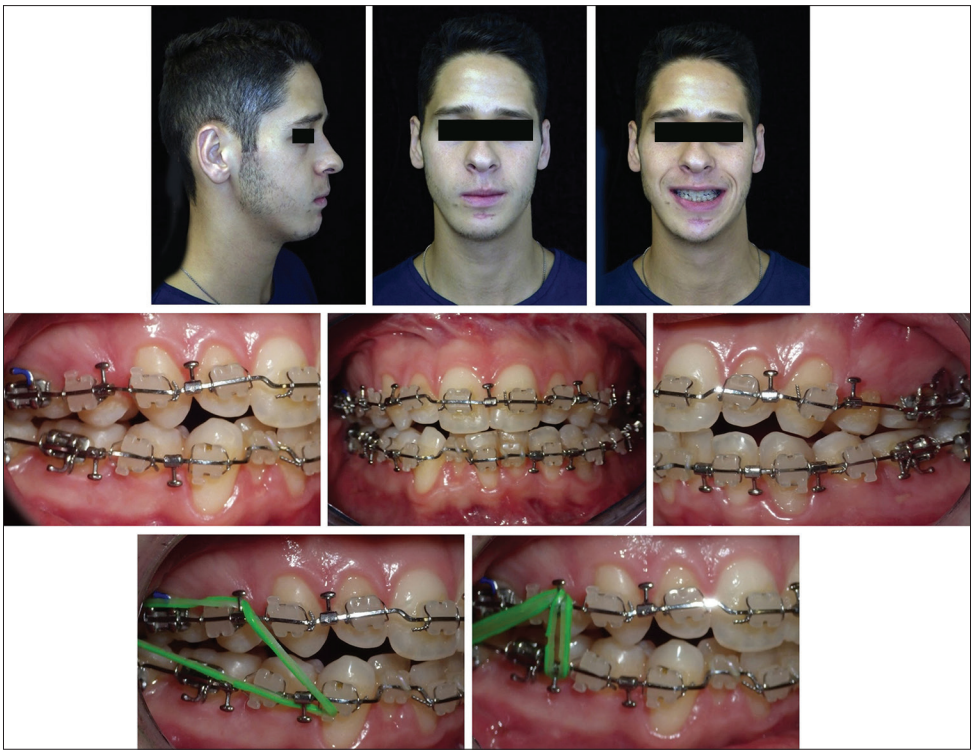

Figure 3: Progress facial and intraoral photos, 45 days after orthognathic surgery

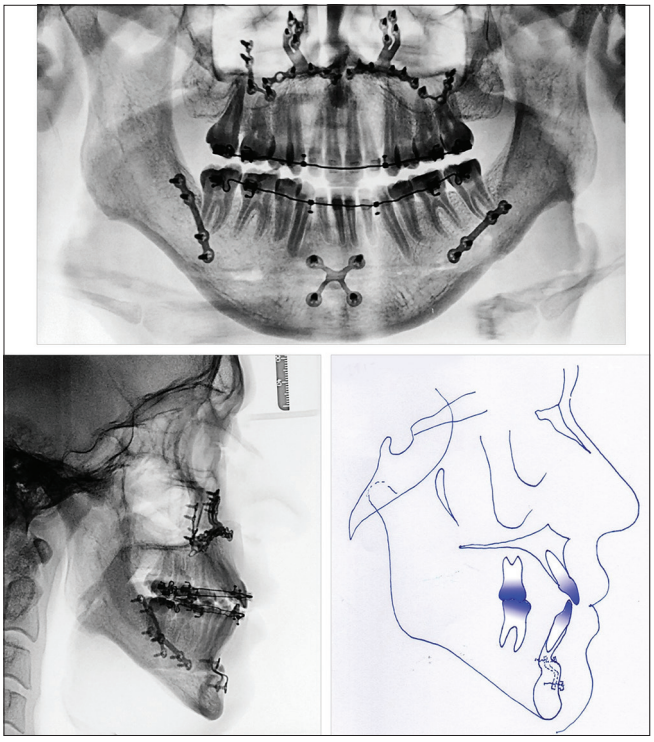

Figure 4: Progress panoramic, cephalometric radiographs, tracing photo, and maxillo-mandibular fixation view 45 days after orthognathic surgery

movements were important for the correct final position between osteotomized bone fragments. We can evaluate the mandibular deviation to the left side with a 3D tomographic image and correct it at the surgical moment. Furthermore, the chin forward movement was asymmetric and lateral deviation at 4 mm to the right side [Figure 7].

The new position of the condyle must be adjusted as passively as possible, by controlling the position of the temporomandibular joint (TMJ) at the transoperative moment. In this case, condylar manipulation and positioning after bilateral sagittal split osteotomy provided functional joint spaces for TMJ [Figures 8 and 9]. Primary occlusal stability and passivity in the positioning of the mandibular condyles are critical. In this case, we observed maintenance of the spaces in the anterior strands of the articular cavity. Furthermore, we observed a slight increase in the superior articular space of the temporomandibular joint, which is necessary for the correct functioning of the temporomandibular joints [Figures 8 and 9].

Despite not having a preoperative complaint of snoring or obstructive sleep apnea-hypopnea, the orthodontic-surgical combined treatment improved postoperative airway volume. The airway space changed from 145.1 mm^2 to 154.3 mm^2, which shows an approximate gain of 6.5%. In terms of air volume, we measured value of 34.5cc, compared to the previously measured volume of 29.6 cc. This change reflects a 16.5% gain in air volume [Figure 10]. From the clinical perspective, the patient reports improvement in the functional habit of breathing.

The 2 years and 5 months of follow-up examinations after the surgery-first approach, involved transverse, vertical, and sagittal dimensions that demonstrated the same or better skeletal and dental stability, as compared to that in classic orthodontics-surgery approach [Figures 11 and 12].

Figure 5: Posttreatment facial and intraoral photos, 12 months after surgery

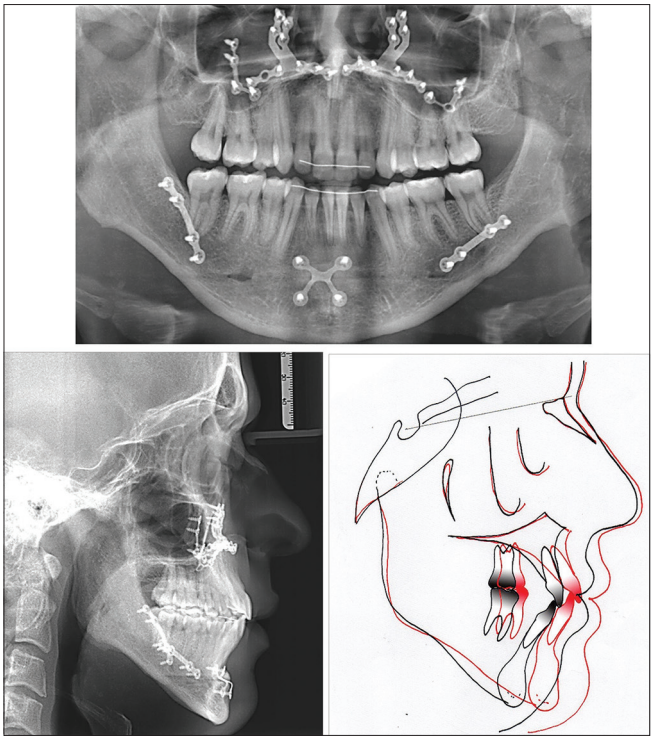

Figure 6: Posttreatment panoramic, cephalometric, and superimpositions. Back: Pretreatment, Red: Posttreatment (12 months of treatment)

Discussion

For adults who seek orthodontic retreatment of asymmetry, the preoperative orthodontic treatment period does not contribute to the improvement of facial appearance. For this type of patient, time and esthetic are usually the major concerns.[7]

One advantage of the surgery-first approach is the increase in patient self-esteem that results in greater acceptance of the proposed treatment and, therefore, a possible greater collaboration during the treatment. These benefits include facial esthetic improvement, better swallowing and speech function, and social acceptance; such improvements can be translated into an increase of about 50% in quality of life in early-benefit surgery compared to classic surgery.[3,8,9]

We describe the advantages of a surgery-first approach and highlight a striking reduction in total treatment duration in accordance with Jeong *et al*.,[10] with the treatment time approximately 6–12 months shorter using a surgery-first approach compared with using a conventional orthodontics first approach. From a patient-centered treatment approach, the psychosocial advantage of surgery-first was recently evaluated through a comparison of the surgery-first approach with the conventional approach, and the study highlighted that patients undergoing the surgery-first approach had better scores.[11]

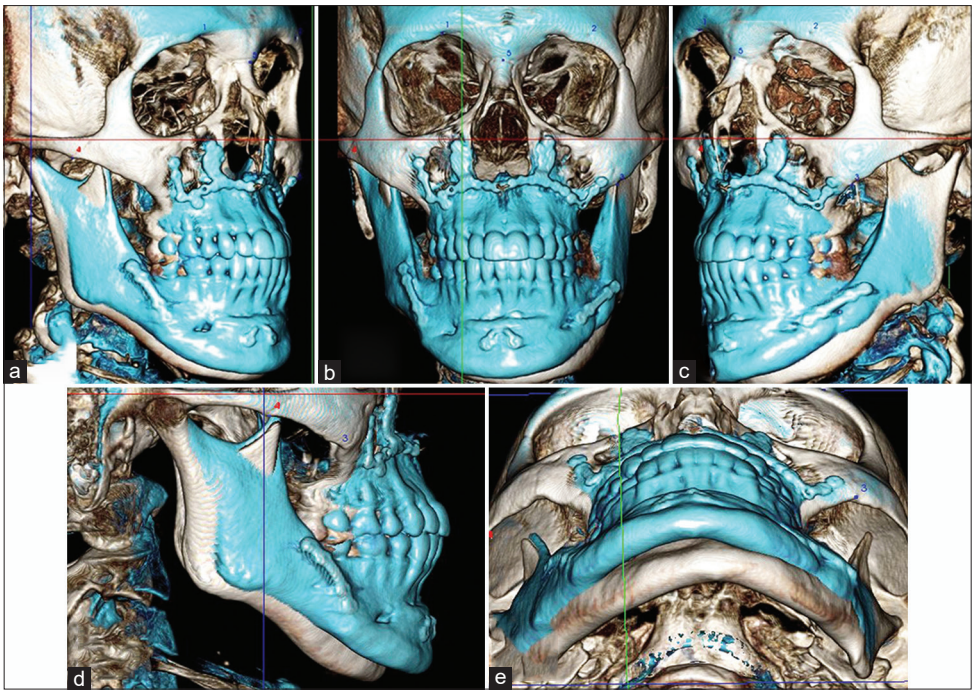

Figure 7: Three-dimensional superimpositions. (a and c) Lateral view; (b) frontal view; (d) maxillo-mandibular advancement superimposition; (e) inferosuperior view

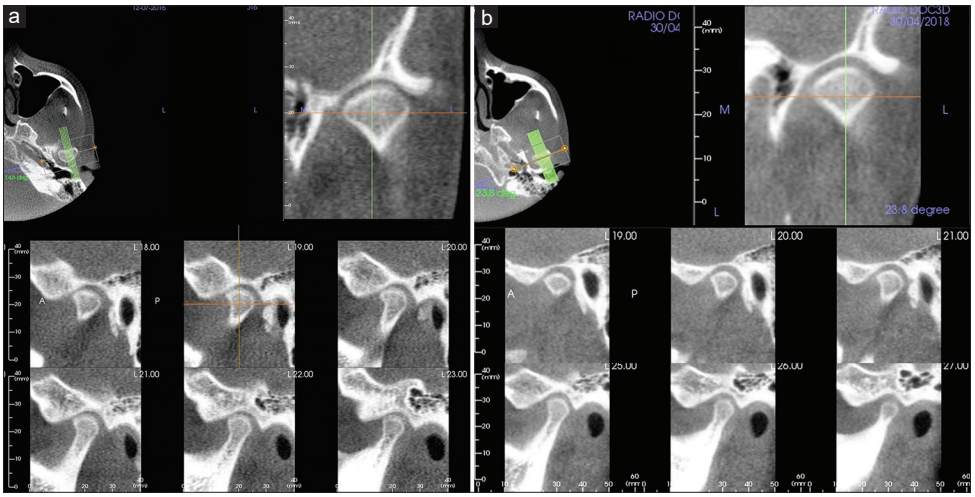

Figure 8: Temporomandibular joint, left side. (a) Preoperatory; (b) Postoperatory; maintenance of the anterior space and minimal increase of the superior articular space

There is commonly a need for a temporary anchorage device to permit a wider range of orthodontic movements and avoid bracket loading and dental extrusion, but in the present clinical case, only intermaxillary elastic was used.[3,12]

In the present clinical case, the 3D orthognathic surgery movements were done by the 3D simulation to achieve patient understanding and approval for surgery. The 3D virtual orthodontic setup predicted the final occlusion at the end of the treatment. The simulation included an intermediate and final splint fabrication to guide the surgeon. In this case, an intermediate splint was performed to guide the surgeon to the new 3D position of the double jaw. The orthognathic procedure was done through a mandibular first step. The bilateral sagittal split osteotomy was performed to adjust the mandible to a new position. This new position was defined by 3D virtual movements. The intermediate guide was created and used at the surgical moment, and the mandibular forward movement was asymmetrical, correcting the mandibular deviation to the right side.

The final movement was the Le Fort I osteotomy at the maxilla. The final splint was used to guide the maxilla final position but was not maintained in the position after the surgery. The stable

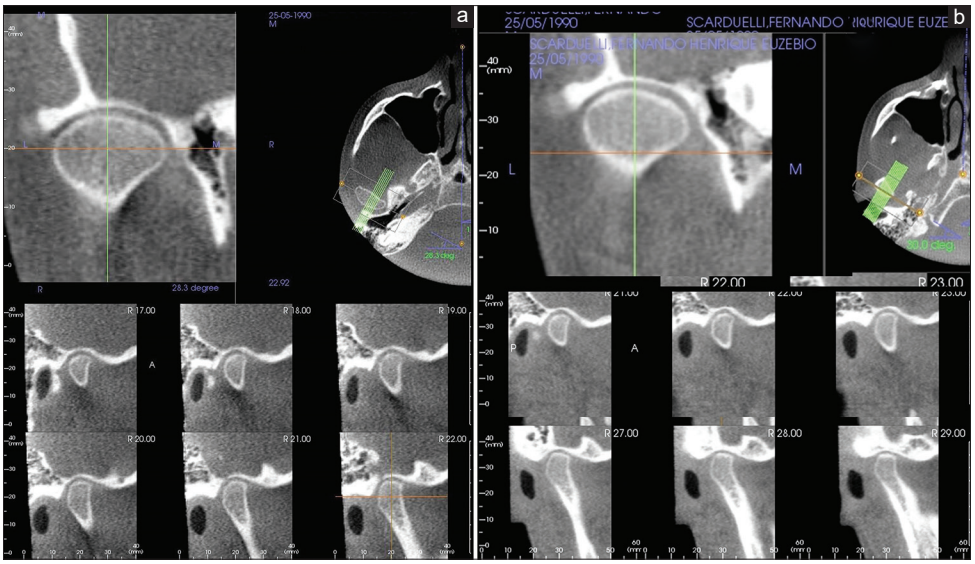

Figure 9: Temporomandibular joint, right side. (a) Preoperatory; (b) Postoperatory; Maintenance of the anterior space and minimal increase of the superior articular space

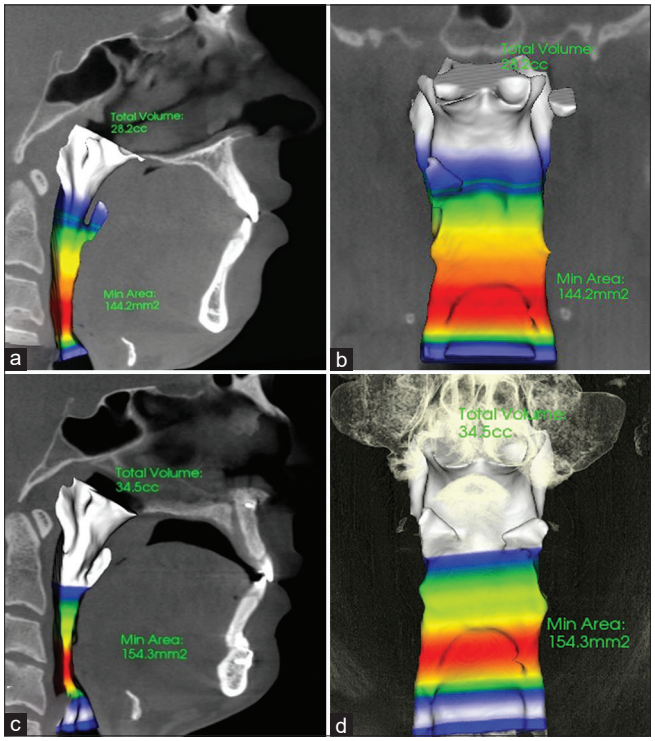

Figure 10: (a and b) Preoperatory front and lateral view of the airway; (c and d) Postoperatory. Increased volume and area of the airway space

fixation (plates and screws) without maxillary segmentation enabled good dental relation and short-term orthodontic movements postsurgery.

In cases of the asymmetric surgical resolution, the maintenance of postoperative inter-articular spaces is important for joint health. In the present clinical case, it was expected that, after asymmetric correction of the mandible, the joint space would change due to the condylar torque caused by osteotomy and consequent fixation of the bone segments. Thus, the use of bicortical screws was avoided to reduce the condylar torque, and the mandibular osteotomy was instead stabilized with plates and monocortical screws. Given that condylar positioning control is not visual, the maintenance of joint spaces is essential in the long-term preservation of temporomandibular joints. After 2 years of evolution, the patient remains asymptomatic and with preserved functional mandibular movements.

Asymmetric maxillomandibular advancement also provided considerable improvement in airway space. Although the patient does not complain of apnea or hypopnea, via an examination of the computed tomography image, we found an increase in the area and volume of the upper airway.

Other factors that should be considered in surgery-first cases include the temporary decrease in muscle activity after surgery, bite force, and occlusal pressure for a few weeks after surgery. In addition, the regional acceleratory phenomenon and favorable soft-tissue tone after skeleton movements optimized the orthodontic movements.[3,9] The procedure might promote higher bone metabolism 3 or 4 months after the surgery.[7]

Nevertheless, contraindications for the surgery-first approach include severe dental crowding that necessitates extractions, severe transverse discrepancy requiring previous surgically-assisted rapid palatal expansion, arch discrepancy, missing teeth, history of facial trauma, local infection, periodontal disease, and syndromic or cleft-related dentofacial deformities patients.[3,9] The current case did not present such characteristics.

The current clinical case took only 12 months to complete and accomplished good occlusion with esthetics and adequate function in addition to the improvement in facial symmetry,

Figure 11: 2 year-5 months follow-up facial and intraoral photos

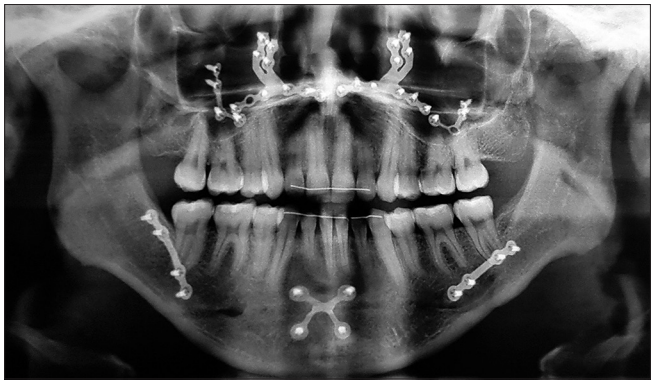

Figure 12: 2 year-5 months follow-up panoramic radiograph

which was the patient's chief complaint. The patient was satisfied with the results achieved. This short time to completion may be due to increased tooth movement due to the trauma produced by surgery, which stimulates bone repair.[8] The long-term stability with the surgery-first approach is comparable to classic surgery.[13] Similarly, as reflected in the relevant literature, the long-term outcomes reflected in transverse, vertical, and sagittal dimensions showed the same or better skeletal and dental stability, as compared to that in classic orthodontics-surgery approach.[14,15]

In the present clinical case, the patient sought treatment using the surgery-first approach, but the selection of malocclusion was critical. High clinical expertise, accurate prediction of postoperative tooth movement, and precise assessment of skeletal discrepancy are mandatory. Moreover, the impacted mandibular third molars could add difficulty to surgery, and hence, communication between the surgeon and orthodontist is indispensable.[3] In this particular case, it was possible to observe all features.

Finally, the challenging step of predicting the final occlusion based on the current position of the teeth requires precise and accurate diagnosis and planning. Orthodontists should be aware of the orthognathic principles and the limits of orthodontic movement; they must be experienced and skilled with the skeletal anchorage system technique, which can be essential to achieving predictable 3D molar movement. With the use of the surgery-first approach, it is imperative that the surgeon and orthodontist are prepared to work together.

The combination of the surgery-first approach and skeletal anchorage proved to be an excellent approach to treating a patient with a skeletal Class III malocclusion. A surgery-first approach was effective and efficient for the treatment of facial asymmetry, and it led to an increase in airway space, passive lip seal, and a more esthetic and balanced facial profile. Moreover, it resulted in stable temporomandibular joints, no pain, and no periodontal diseases. The short time to results and the dentofacial long-term stability should be considered serious advantages to this treatment method.

Conclusions

After 12 months, the treatment addressed the patient's chief complaint of facial asymmetry and achieved an attractive smile, functional occlusion, passive lip seal, balanced facial profile, and esthetic improvement. The 2 years and 5 months of follow-up showed a stable surgical-orthodontic outcome with increased airway space.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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