Journal of Multidisciplinary Dental Research

ORIGINAL ARTICLE

An Integrated Concept for Orthodontic-Orthognathic Treatment – Management of Class III Dysgnathia with Laterognathia

N Watted[1,2,*], A Watted[3], N Tödmann[3], M Abuhussein[4]

[1] *Department of Orthodontics and pediatric Dentistry, Arab American University, Jenin, Palestine*
[2] *University Hospital of Würzburg, Julius-Maximilians-University of Würzburg, Germany*
[3] *Department of Cranio-Maxillo-Facial Surgery, University of Hannover, 30625 Hanover, Germany*
[4] *Department of Pediatric Dentistry, University of Athens, Greece*

ARTICLE INFO

Article history:
Received 10-07-2025
Accepted 04-08-2025
Published 19-11-2025

* *Corresponding author.*
N Watted
prof.watted@icloud.com;
Prof.watted@gmx.net

https://doi.org/10.38138/JMDR/v11i2.25.watted

ABSTRACT

Although adult patients undergoing combined orthodontic-orthognathic treatment represent a numerically small proportion of those receiving orthodontic therapy, such cases pose a particularly complex challenge to the interdisciplinary treatment team with regard to defining individualized treatment goals and planning. In patients with Class III dysgnathia and facial asymmetry, facial harmony is often primarily disrupted in the vertical, sagittal, and transverse dimensions. The skeletal lower face—and consequently the vertical soft tissue profile—is typically enlarged in relation to the midface. In these cases, a causal correction of facial imbalance can only be achieved through a combined orthodontic-orthognathic approach. This may involve surgical lengthening (in cases of ”short-face syndrome”) or reduction (in ”long-face syndrome”) of the interbasal angle between the maxilla and mandible. Treatment outcomes must not be evaluated solely on the basis of occlusal correction or functional restoration but must also meet the patient's aesthetic and cosmetic expectations. Therefore, therapeutic measures must be coordinated to ensure both functional improvement and a harmonious facial appearance. The present work aims to contribute to the understanding of Class III dysgnathia by highlighting the typical deviations in skeletal and particularly soft tissue configuration and contrasting these with the parameters of an aesthetically balanced facial structure.

Keywords: Laterognathia; Class III dysgnathia; Impaction; Autorotation; Aesthetic axis; Function; Aesthetics; Stability

1 INTRODUCTION

Orthodontic-orthognathic treatment is a combined approach to correct Class III malocclusion with laterognathia, addressing both dental and skeletal discrepancies.(1–5) This typically involves a combination of orthodontic treatment (braces or aligners) to align the teeth, followed by orthognathic surgery to reposition the jaws and correct facial asymmetry, ultimately improving both function and aesthetics. Characterized by a misaligned bite where the lower jaw (mandible) is positioned too far forward or the upper jaw (maxilla) is too far back, or both. A type of facial asymmetry where one side of the lower jaw is more prominent or shifted to one side, leading to a crooked or off-center jawline. Class III malocclusion with laterognathia presents a more complex challenge, requiring a coordinated approach to address both the sagittal (forward/backward) and transverse (side-to-side) discrepancies in jaw position.(1–5)

Patients seeking orthodontic treatment have a wide range of functional and esthetic needs and can be divided into three groups:

Group 1: Those with normal skeletal relationship and malocclusions that can be treated using routine orthodontic techniques.

Group 2: Those with mild to moderate skeletal discrepancies. The malocclusions of many of the patients in this group can be corrected by dental compensation and growth management.

Group 3: Those with moderate to severe skeletal discrepancy and noticeable facial imbalance. The negative effects of compromised orthodontic treatment for patients in the third group would be unacceptable, making combined surgery and orthodontics the treatment of choice.

Skeletal Class III malocclusion are complex skeletal relationships that have abnormalities and are difficult to correct. The incidence of this malocclusion in the Caucasoid race is around 5 percent. Etiology is generally influenced by genetic factors. Treatment made to improve function and aesthetics. This requires a combination of orthodontic treatment and orthognatic surgery.[3–5]

The oldest theory of beauty can be found in the work of the Greeks of the pre-Socratic period. Pythagoras found a strong connection between mathematics and beauty, noticed that the objects that had a perfect proportion were more appealing. Ancient Greek architecture is based on this definition of symmetry and proportion.[3–5]

Skeletal class III malocclusion is characterized by upper incisor proclination and retroclination of the lower incisors to compensate for the sagittal skeletal discrepancy.[3] The etiology of skeletal class III is multifactorial involving hereditary factors (race), environmental influences (normal position of the jaw or mouth breathing which stimulates mandibular growth) and pathologies (pituitary tumors such as acromegaly).[1–5]

Dysgnathia is the medical term for jaw misalignment, which is often accompanied by dental misalignment. It can not only affect appearance but also cause health issues such as snoring, sleep apnea, and impaired chewing function.[5].

The treatment typically involves the repositioning of the upper and/or lower jaw, following an orthodontic pre-treatment. A personalized treatment plan is created for each patient, taking both functional and aesthetic aspects into account.[6].

The surgery is performed under general anesthesia and lasts between three and six hours, depending on the complexity. An inpatient stay of about three days is required to monitor the healing process. .[7].

After dysgnathia surgery, you can expect a harmonious facial profile and an optimally functional jaw alignment. The treatment is tailored to your individual needs to achieve both functional and aesthetic improvements. .[1].

Whether a dysgnathia treatment is the right choice for you depends on your individual needs and preferences. Schedule a consultation at Sailer Clinic to clarify any open questions and develop a personalized treatment plan.[1–6]

Laterognathia ,this term describes a lateral bite in the lower jaw and is often associated with an unilateral crossbite in the posterior teeth and asymmetry in the whole of the lower face. Treatment of laterognathia is either possible with orthodontic tooth movement or a surgical relocation of the lower jaw.[1–6]

In orthodontics, three main categories of problems or dysgnathias can be distinguished, which may develop in all three spatial dimensions. These dysgnathias can occur either individually or in combination (Figure 1):

- **Functional dysgnathia:** The underlying cause of these dysgnathias is usually a functional disorder—such as impaired breathing, tongue dysfunction, or thumb sucking. Depending on the nature of the dysfunction, skeletal and dentoalveolar dysgnathias may develop over time, particularly during the period of tooth eruption. Examples include labial tipping of the maxillary incisors with protrusion of the premaxilla due to thumb sucking, transverse constriction of the maxilla or the development of a skeletal open bite resulting from chronic mouth breathing, or the formation of a dental open bite associated with tongue dysfunction.[1–6]
- **Skeletal Dysgnathias:** Skeletal dysgnathias typically result from disharmonious growth patterns, such as seen in Class II or Class III malocclusions, or from growth disturbances caused by trauma or syndromic conditions. Examples include impaired growth in patients with cleft lip and palate or temporomandibular joint fractures during the growth phase. These dysgnathias can manifest in the sagittal, vertical, and transverse dimensions, affecting either one or both jaws.[1–8]
- **Dentoalveolar Dysgnathias:** This type of dysgnathia is confined to the positioning of the teeth and the associated alveolar bone. It includes conditions such as tooth displacement and impaction. Malpositioned teeth can develop in all three spatial dimensions—vertically (infra- or supra-occlusion) as well as in terms of axial inclination.[1–9]

The impact of the three types of dysgnathias on facial appearance and the aesthetic axis varies. Skeletal dysgnathias (affecting the hard tissues) have the most pronounced effect, particularly due to the malposition of the maxilla, mandible, or both jaws. This misalignment leads to significant disturbances in facial harmony and causes deviations in the aesthetic axis (Figures 2 and 3).[1–6]

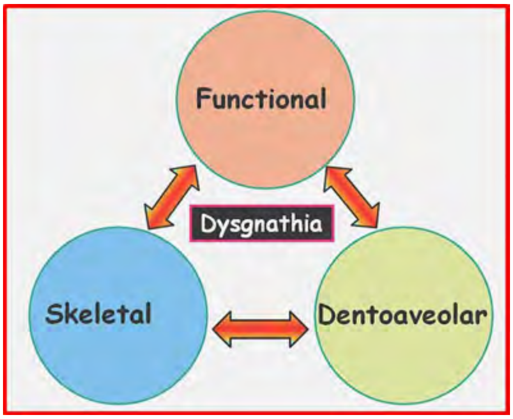


Fig. 1: Illustration of the different types of dysgnathia: functional, skeletal, and dentoalveolar

Figure 1 depicts the classification of malocclusions based on their etiological origin, distinguishing between dysgnathias caused by neuromuscular dysfunction, skeletal discrepancies, and dentoalveolar compensations.

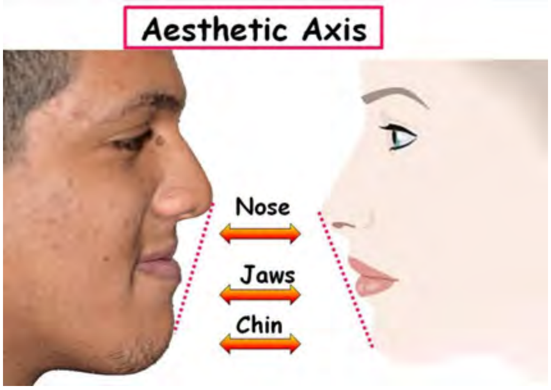


Fig. 2: Impact of skeletal Class III dysgnathia on the aesthetic axis

Figure 2 illustrates how skeletal discrepancies associated with Class III malocclusion—such as mandibular prognathism or maxillary (midfacial) hypoplasia—alter the alignment and balance of the facial aesthetic axis.

Fig. 3: Impact of skeletal Class II dysgnathia on the aesthetic axis

Figure 3 illustrates how skeletal Class II malocclusion, characterized by mandibular retrognathia, affects the alignment and harmony of the facial aesthetic axis, often resulting in an imbalanced profile.

It is generally well known that, in cases of dentoalveolar treatment, the therapeutic goals—defined as the individual functional and aesthetic optimum for the patient— can often be achieved with today's modern treatment methods and appropriate appliances [(1)].

While minor dysgnathias can be compensated for through purely dentoalveolar measures, in cases of pronounced skeletal discrepancies—such as Class II and Class III dysgnathias, skeletal open bite, or laterognathia—the question arises as to which treatment approaches can lead to successful outcomes. If the jaw relationship is correct and the dysgnathia is purely dentoalveolar, it can be corrected through dental treatment involving appropriate tooth movements. [(10)]

However, due to anatomical limitations, dental movements are only possible to a certain extent. Thus, correction or stable dental compensation of a skeletal dysgnathia—such as the elimination of an anterior crossbite in Class III cases, correction of a severely increased overjet in Class II, or closure of a skeletal open bite—is questionable in certain situations. In most cases, such approaches represent compromise treatments with regard to both aesthetics and function, and their long- term stability is also uncertain. [(11,12)]

To determine which treatment options are suitable for managing skeletal dysgnathias, it is essential to assess the patient's remaining growth potential [(13)]. One therapeutic approach considered causal in growing patients is functional orthopedic treatment—such as stimulating mandibular growth and inhibiting maxillary growth in Class II dysgnathia or promoting maxillary growth and restraining mandibular growth using a facemask in Class III dysgnathia. Both treatment methods aim to influence growth patterns. [(12,14–16)]

If growth is no longer therapeutically available, orthognathic surgery remains the only causal treatment option to correct the positional discrepancies between the jaws in all three spatial dimensions [(1–6)].

The relationship between the facial width and vertical height has a strong influence on facial harmony. Facial form and harmony should also be correlated with the patient's overall body build. When correcting facial form, the overall body build of the individual (corporofacial relationship) should be considered (i.e., short and stocky versus long and thin). The height-to-width proportion is 1.3:1 for females and 1.35:1 for males. The bigonial width should be approximately 30% less than the bizygomatic dimension . Short, square facial types are often associated with a Class II deep bite malocclusion, vertical maxillary deficiency, masseteric hyperplasia, and macrogenia whereas long, narrow facial types are often associated with vertical maxillary excess, a narrow nose, mandibular anteroposterior deficiency, microgenia, a high palatal vault, and an anterior open bite malocclusion. [(17–21)]

A prerequisite for successfully performing combined orthodontic-surgical therapy is that less invasive treatment approaches (such as the aforementioned growth modification) are no longer applicable, do not lead to the intended treatment objectives, or may even worsen the condition—for example, tooth extractions in patients with a flat facial profile, or distalization in cases with limited overjet.

This article discusses the causal treatment of a skeletal dysgnathia—specifically, a Class III case with laterognathia—through a combined orthodontic and orthognathic surgical approach. [(17–21)]

2 FACIAL AESTHETICS AND THE AESTHETIC AXIS

In the context of interdisciplinary dysgnathia surgery aimed at improving the facial profile, it is important to emphasize that functionally and orthodontically motivated interventions are always accompanied by improvements in facial aesthetics. This reflects the principle: **"Form goes with function" or, more precisely, the "correlation between form and function."**

Profile-enhancing interventions include repositioning procedures of the maxilla and mandible (orthognathic surgery) and, in a broader sense, repositioning procedures of the orbital and (frontal) cranial regions (craniofacial surgery). Due to its narrow operative indications and the higher surgical risk involved, craniofacial surgery has no place in aesthetic-oriented procedures and will not be further discussed here.

It must therefore be emphasized that the profile line connecting the nose, maxilla, mandible, and chin is of particular significance for overall facial aesthetics. We refer to this as the **"aesthetic axis"** (Figures 2 and 3)[17–23] .

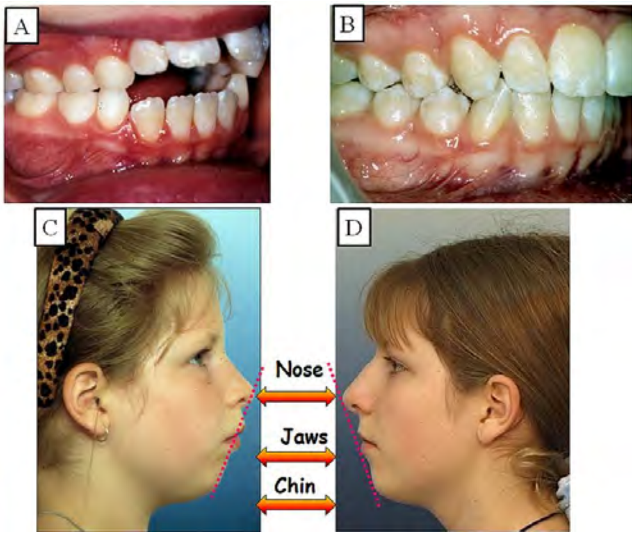


Fig. 4: a-d: Harmonization of the facial profile and aesthetic axis following treatment of a functional dysgnathia. The images demonstrate the improvement in facial balance and profile alignment achieved through the correction of a functional dysgnathia, emphasizing the role of neuromuscular adaptation in aesthetic rehabilitation

The beauty of the human face depends largely on the balance of the three prominent profile features—mouth, chin, and nose—collectively forming what we describe as the **facial aesthetic triad.** Within this framework, the prominence or convexity of the mouth plays a key role in conveying youthfulness and facial attractiveness.[9] Orthodontic treatments—whether skeletal, functional, or dentoalveolar—can influence this axis by improving or harmonizing it (Figure 4**a–d**, Figure 5**a–d**, Figure 6**a–d**, Figure 7**a–d**, Figure 8 **a–d**).

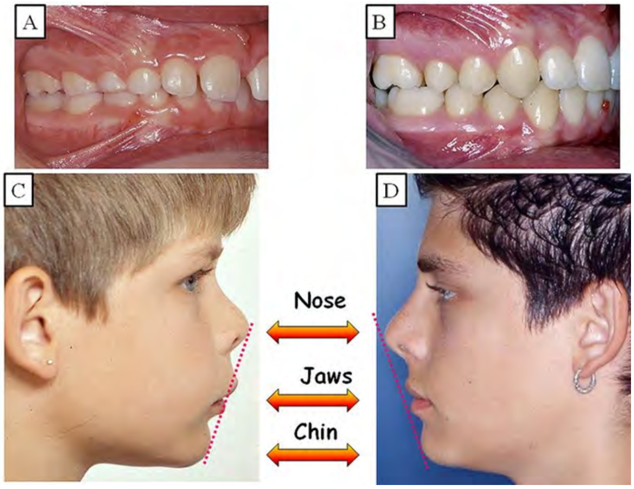


Fig. 5: a-d: Harmonization of the facial profile and aesthetic axis following treatment of a skeletal Class II dysgnathia with deep bite. The skeletal correction was achieved using functional orthodontic appliances to harness and guide growth. The images illustrate the resulting improvement in facial balance and the alignment of the aesthetic axis through growth-modifying therapy

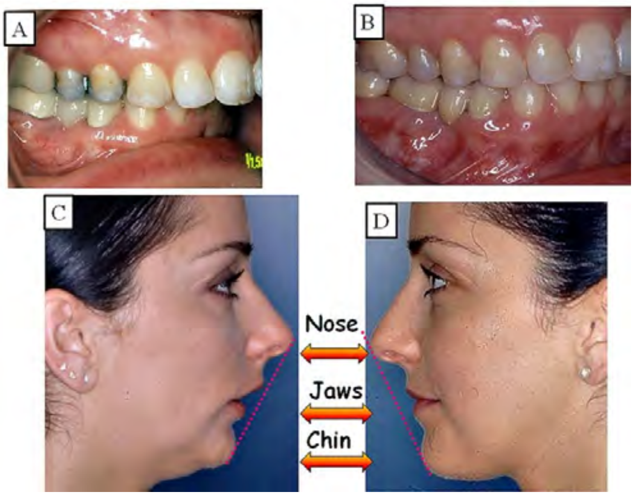


Fig. 6: a-d: Harmonization of the facial profile and aesthetic axis following treatment of a skeletal Class II dysgnathia. The skeletal correction was performed through mandibular orthognathic surgery (mandibular osteotomy). The images demonstrate the resulting improvement in profile symmetry and alignment of the aesthetic axis

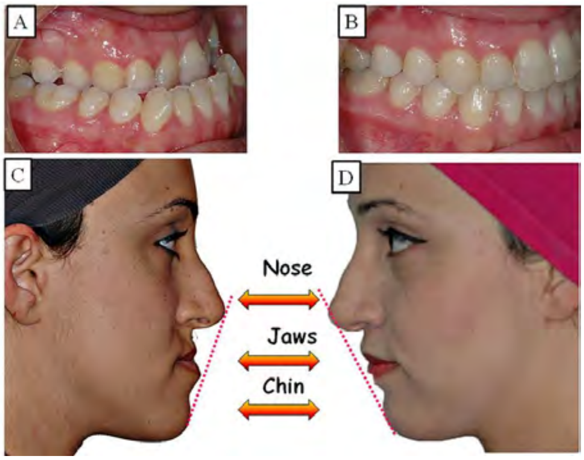


Fig. 7: a-d: Harmonization of the facial profile and aesthetic axis following treatment of a skeletal Class III dysgnathia. The skeletal correction was achieved through bimaxillary orthognathic surgery (maxillary and mandibular osteotomy). The images illustrate the enhanced facial symmetry and improved alignment of the aesthetic axis as a result of the surgical intervention

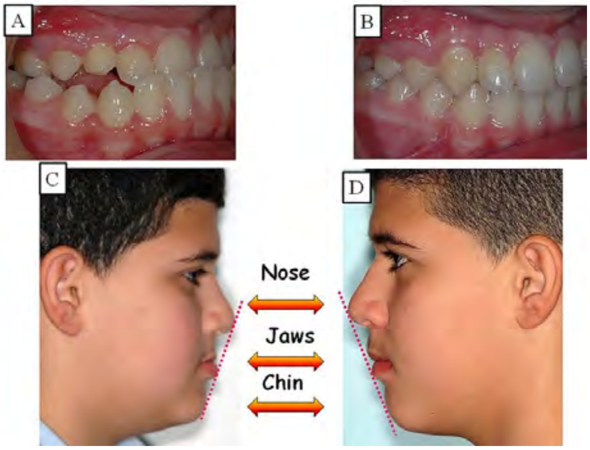


Fig. 8: a-d: Harmonization of the facial profile and aesthetic axis following treatment of a skeletal Class III dysgnathia. The skeletal correction was achieved using a facemask appliance to influence maxillary growth. The images demonstrate the improvement in facial balance and realignment of the aesthetic axis through growth-guided orthopedic intervention

3 INDICATIONS AND CONTRAINDICATIONS FOR COMBINED ORTHODONTIC - ORTHOGNATHIC TREATMENT

Orthognathic surgery often has profound effects on the external appearance of the face. In adults, where morphological structures are typically well established, the facial appearance constitutes an integral component of personal identity and thus plays a significant role in self-image.[7–10,24,25] Furthermore, individuals are socially perceived and recognized primarily through their face, which significantly influences the quality of social interactions. Consequently, such invasive procedures require careful indication and psychological evaluation.

The patient's perception of the treatment outcome—regarding both dental and general facial aesthetics, the subjective cost-benefit ratio (in terms of pain and effort), and the "social success" of the treatment—must therefore be regarded as evaluation criteria of paramount importance. For this reason, beyond functional outcomes (e.g., temporomandibular joint health, masticatory function), consideration of the psycho- aesthetic dimension—i.e., skeletal and soft tissue changes along with the patient's self-perception—constitutes an essential factor in the indication process.[2,26]

It is important to emphasize that in the context of interdisciplinary planning of dysgnathia surgery aimed at profile enhancement, functionally oriented orthodontic procedures always go hand in hand with improvements in facial aesthetics. This reflects the principle: "Form goes with function."[17–23]

Profile-enhancing procedures become necessary when a purely orthodontic correction is no longer feasible due to individual anatomical limitations. In such cases, a paradigm shift must occur in orthodontic treatment planning compared to orthodontics alone. This includes, first and foremost, preoperative decompensation of skeletal-related dental malpositions in order to align each dental arch independently, without regard to the opposing arch. The harmonization of both arches is then achieved surgically.[17–23,27]

Although combined orthodontic-orthognathic procedures are often elective in nature, they are subject to strict indication criteria—despite the high level of treatment standardization and low risk profile.[14–19]

It is the responsibility of the maxillofacial surgeon and the orthodontist to assess whether contraindications are present that would preclude surgical intervention.

The main contraindications include[13,21–24,27–32]:

- Cardiovascular diseases that render the procedure inadvisable
- Uncontrolled diabetes mellitus
- Lack of patient compliance, potentially associated with psychiatric history
- Infectious diseases, such as hepatitis B, hepatitis C, or HIV
- Hematological disorders, including coagulation factor deficiencies and diseases of the blood and lymphatic vessels (e.g., hemangiomas or lymphangiomas within the surgical field)

These factors must be carefully evaluated to ensure the safety and appropriateness of combined orthodontic-orthognathic treatment .

4 CLINICAL OBSERVATIONS AND STRUCTURED TREATMENT CONCEPTS

4.1 *Patient History and Diagnosis*

The patient presented for orthodontic treatment at the age of 21. She was primarily concerned with facial disharmony, especially the transverse asymmetry caused by a mandibular deviation to the right, consistent with laterognathia. The patient reported that the deviation had worsened over the past two years. Masticatory function was impaired. No underlying systemic disease was present.

Frontal photostatic images in centric relation revealed a marked deviation of the mandible to the right, as well as a transverse facial asymmetry between the intercanthal distance and nasal width on the one hand, and the width of the mouth on the other. The smiling image displayed a canted occlusal plane sloping to the left, attributable to asymmetric vertical alveolar growth. As a consequence of this asymmetric development, a unilateral gummy smile was observed on the left side. The lateral view showed a straight posterior facial profile. Vertical facial analysis indicated a mild elongation of the lower face (52% instead of the normative 50%)[23,27] (Figure 9**a–c**, Table 1). The extraoral findings were consistent with a skeletal Class III malocclusion accompanied by a mandibular deviation to the right.

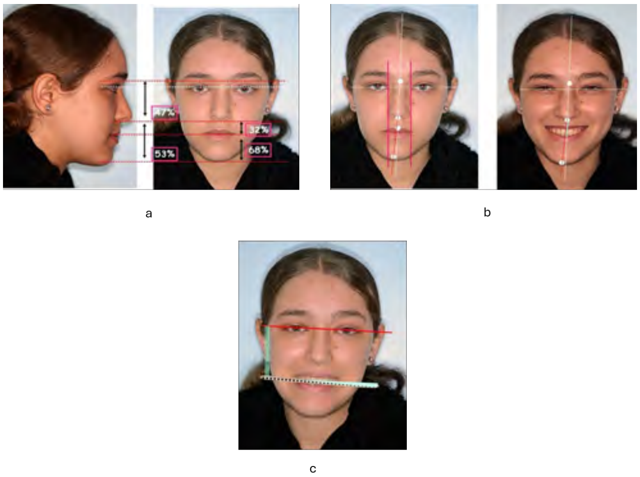


Fig. 9: a,b: The clinical photographs illustrate the characteristic features of skeletal Class III dysgnathia, including a mandibular deviation to the right of the facial midline and disharmonious proportions in the sagittal, vertical, and transverse dimensions. c: A canted occlusal plane resulting from asymmetric vertical

The intraoral images show a frontal crossbite with a mandibular midline shift to the right. As a result of this deviation, the occlusion is more mesial on the left than on the right. In the maxillary and mandibular dental arches, slight tooth misalignments were balanced (Figure 10 **a-e**).

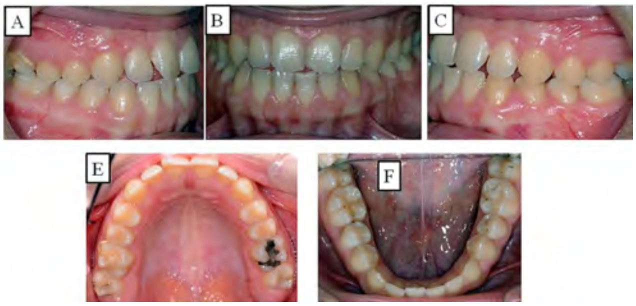


Fig. 10: a-e: Intraoral images in occlusion and occlusal view prior to treatment initiation; mesial occlusion and anterior crossbite are clearly visible

The lateral cephalometric radiograph clearly demonstrates the dysgnathia in both sagittal and vertical dimensions, affecting the soft tissue profile as well as the underlying skeletal structures. Considering the vertical facial proportions, the patient exhibits a mesiobasal jaw relationship. The difference between the ANB angle and the individualized ANB angle is −3.5 (ANB − Indv. ANB > +1 indicates a distobasal jaw relationship, whereas ANB − Indv. ANB < −1 is indicative of a mesiobasal jaw relationship) (Figure 11**a**, Table 1).

The skeletal midface hypoplasia is visually compensated by the pronounced soft tissue volume in the maxillary region above point A. The panoramic radiograph reveals no pathological findings. Teeth 38 and 48 were extracted as they were located within the planned surgical field (Figure 11**b**).

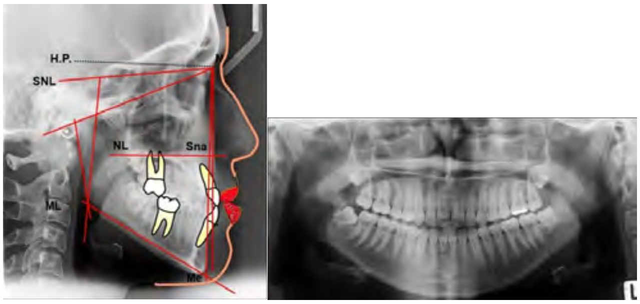


Fig. 11: a: Cephalometric tracing of the radiograph prior to orthodontic decompensation. b: Orthopantomogram

4.2 *Treatment Objectives and Treatment Planning*

The primary therapeutic goals were to correct the transverse mandibular deviation, restore symmetrical facial aesthetics, and reestablish functional occlusion. In addition, normalization of the sagittal and vertical skeletal relationships was targeted to achieve a stable, harmonious facial profile and optimal masticatory function.

Treatment planning was based on a comprehensive interdisciplinary approach, integrating orthodontic preparation with orthognathic surgical intervention. The planned procedures included preoperative decompensation of the dental arches, followed by a bimaxillary surgical correction to address the skeletal Class III relationship and the vertical maxillary asymmetry. The mandibular deviation was to be corrected through asymmetric mandibular repositioning, while maxillary impaction and rotation were considered to address the canted occlusal plane and the unilateral gummy smile. The overall aim was to achieve a balanced facial profile and long-term functional stability.

As an initial step prior to finalizing the treatment plan, a nuclear medicine examination (bone scintigraphy) was ordered to assess bone morphology and metabolic activity. A skeletal scintigraphy was conducted in the nuclear medicine department to evaluate potential condylar hyperplasia, as the patient had reported a history suggestive of progressive facial asymmetry possibly attributable to continued condylar growth.

For this purpose, a radiopharmaceutical (radionuclide) was intravenously administered. This compound preferentially accumulates in osseous tissue, with higher uptake corresponding to increased local metabolic activity. The emitted radiation from the radionuclide can subsequently be measured and visualized through imaging. In bone scintigraphy, technetium-99m (^{99m}Tc)-labeled phosphonates are commonly used for this purpose.

No increased bone activity in the region of the condyles was detected, thus excluding ongoing condylar growth. Consequently, orthodontic preparation for the planned orthognathic surgery was initiated.

The primary objectives of the combined orthodontic–orthognathic treatment are as follows:

1. Establishment of a neutral, stable, and functional occlusion with a physiologically appropriate condylar position.
2. Optimization of facial aesthetics through harmonization of the facial aesthetic axis.
3. Enhancement of dental aesthetics while preserving and protecting the periodontal structures.
4. Long-term stabilization of the treatment outcome through a well-established occlusion and appropriate retention appliances.
5. Fulfillment of the patient's expectations and satisfaction regarding both aesthetics and function.

An additional key treatment objective was the enhancement of facial aesthetics across multiple dimensions—not only in the sagittal plane of the lower face (mandibular region) but also addressing midfacial hypoplasia and transverse discrepancies. The anticipated improvements in the midfacial region were expected to affect the projection and contour of the upper lip and vermilion border, the nasal morphology, as well as the form and transverse width of the oral aperture [(10)].

These aesthetic outcomes were to be achieved through a combination of two targeted interventions.

- A maxillary impaction (cranial repositioning) combined with anterior advancement was performed. This approach aimed to correct vertical disharmony and to harmonize the midfacial region. [(11,29–31)]
- Following autorotation of the mandible, a posterior repositioning with a lateral shift to the left was carried out in order to correct sagittal and transverse discrepancies in both occlusion and the soft tissue profile. [(12,14,19)]

The improvement of facial aesthetics in the vertical dimension was to be achieved through a relative shortening of the lower face. Such vertical reduction, serving as a causal therapeutic approach with corresponding effects on facial aesthetics and lip function, could only be realized in this patient through a combined orthodontic– orthognathic treatment. The desired goals in terms of both aesthetics and function would not have been attainable through orthodontic measures alone. The severity of the dysgnathia exceeded the limits of a purely dentoalveolar compensation.

A bimaxillary osteotomy was therefore planned. To improve the vertical dimension, a maxillary impaction was indicated, with a greater degree of superior repositioning posteriorly than anteriorly. As a result of this impaction, the mandible—rotating around the condyles as a fixed center—was expected to autorotate in both the sagittal and vertical planes. This would lead to a forward and simultaneous upward displacement of the pogonion [(4–6,9–12,14–22)]. To achieve complete correction of the sagittal dysgnathia, an additional mandibular setback was planned (Figure 12).

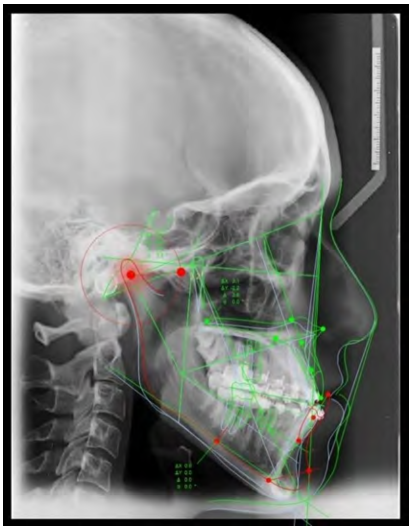


Fig. 12: Simulation of the surgical impaction of the maxilla and the resulting mandibular response, with the condyles serving as the "center of rotation," leading to autorotation in a cranial and simultaneous anterior direction

4.3 Therapeutic Approach

The correction of the aforementioned dysgnathia was carried out in four phases:

4.3.1. Phase I: Preoperative Measures and Orthodontic Preparation

1. **"Splint Therapy"**: To determine the physiological condylar position (centric relation) prior to final treatment planning, a flat occlusal splint or an Aqua-splint according to Sabbagh (Teledenta/Germany) was applied in the lower jaw for a period of 4–6 weeks. This allowed for the identification and quantification of a potential functional mandibular displacement. Manual functional analysis revealed no retrusion of the mandible following occlusal disengagement and muscular relaxation. If mandibular repositioning had been possible, a conventional orthodontic treatment strategy based on dentoalveolar compensation could have been considered.
2. **Presurgical Orthodontics:** The objective of the presurgical orthodontic phase is the alignment and coordination of the dental arches and the decompensation of the underlying skeletal dysgnathia. In other words, the dental positions in both jaws are adjusted to reflect the actual skeletal configuration and their spatial orientation within the craniofacial complex across all three dimensions. Therefore, a fundamental prerequisite for initiating orthodontic preparation is a clear understanding of the planned surgical procedure—specifically, which jaw is to be repositioned, in what direction, and by what technique.

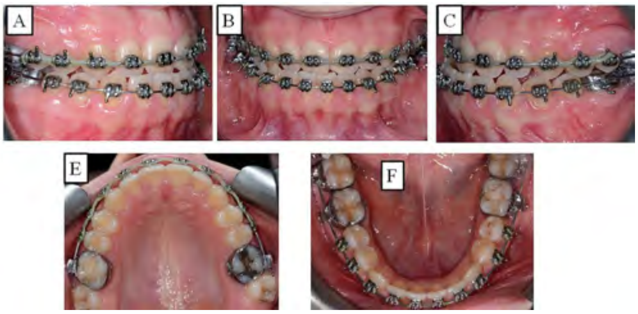


Fig. 13: a-f: Intraoral images following the coordination of dentoalveolar structures with the underlying skeletal dysgnathia

A critical aspect of the presurgical preparation was the torque control of the maxillary anterior teeth in anticipation of the planned surgical impaction of the posterior maxilla and its associated clockwise rotation. This maneuver results in a surgically induced steeper inclination of the maxillary anterior segment, which must be considered during orthodontic planning. Consequently, a labial inclination of the upper incisors could be tolerated preoperatively in light of the anticipated final jaw position.

A fixed multibracket appliance (0.022-inch slot brackets) was used for the orthodontic treatment. To establish a sufficiently pronounced negative overjet, adjusted to the skeletal dysgnathia, the mandibular incisors were protruded. This step is essential to facilitate the planned mandibular setback. The existing midline deviation was intentionally left uncorrected on the dentoalveolar level, as its correction was to be achieved through skeletal repositioning of the mandible during surgery.

As the final working archwire, 0.019 x 0.025 stainless steel wires were placed in both arches. The total duration of the presurgical orthodontic phase was 10 months (Figure 13**a–f**). It is crucial to ensure that the mandibular third molars are extracted at least 4 months prior to surgery, as their presence may interfere with the osteotomy site. Retaining the wisdom teeth in the surgical field complicates, or may even preclude, proper fixation of the osteotomy segments.

3. Splint Therapy: To determine the centric condylar position, the occlusion was disengaged for a period of 4–6 weeks prior to surgery. The objective was to register the temporomandibular joints in a physiological (centric) position, which would serve as the reference during the surgical procedure.

4.3.2. Phase II

Orthognathic Surgery for the Correction of Skeletal Dysgnathia Following precise planning and determination of the displacement vectors for both jaws, surgical splints were fabricated. Based on these splints, a Le Fort I osteotomy was performed in the maxilla with differential repositioning. The maxilla was impacted cranially by 2 mm on the right and 3 mm on the left, with minimal anterior–posterior variation, and advanced anteriorly by 2.5 mm, resulting in a slight posterior rotation of the entire maxillary complex[4–6,20–22].

The asymmetric maxillary impaction between the right and left sides was intended to level the occlusal plane and eliminate the gingival display (gummy smile) (Figure 12, Figure 14**a–g**). The autorotation of the mandible induced by maxillary repositioning led to an enhancement of the mesial occlusion (Figure 14**b**). The remaining correction of the Class III occlusion and the mandibular asymmetry was achieved through mandibular setback surgery[8,32] (Figure 14 **c**). The mandibular setback amounted to 2.5 mm on the right and 5 mm on the left, combined with a 3 mm transverse shift to the left, in order to restore facial symmetry.

4.3.3. Phase III: Postoperative Orthodontics

The earliest possible application of orthodontic forces is crucial for achieving effective tooth movement, as the desired orthodontic corrections are more easily implemented during this period. Therefore, the postoperative orthodontic treatment phase begins just a few days after surgery.

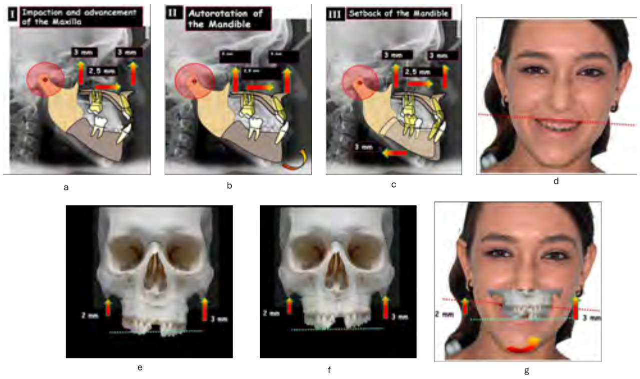


Fig. 14: Surgical Planning Steps. a: Surgical impaction with anterior advancement of the maxilla. b: Mandibular response in the form of autorotation in a cranial and simultaneous anterior direction, resulting in a new mandibular position in both the vertical and sagittal planes. c: Surgical setback of the mandible for final correction of the sagittal dysgnathia. d: The smiling image shows gingival asymmetry and a canted occlusal plane. e, f, g: Greater maxillary impaction on the left side to correct the occlusal plane and the gingival display (”gummy smile”)

During the stabilization phase of the mandibular segments, vertical interferences in occlusion were managed using ”up and down” elastics. To facilitate this, the rigid stainless steel arch wires were replaced postoperatively with more flexible 0.017 x 0.025-inch NiTi arch wires, into which bends were incorporated for the posterior teeth when necessary. Final occlusal adjustments were subsequently performed. This phase lasted approximately five months.

4.3.4. Phase IV: Retention

To ensure long-term stability of the treatment outcome, our interdisciplinary treatment protocol incorporates three retention strategies:

1. Fixed lingual retainer extending from canine to canine to preserve the alignment of the anterior teeth,
2. Pre- and postoperative physiotherapeutic support aimed at promoting myofunctional adaptation, and
3. The use of functional orthodontic appliances to stabilize the newly established jaw relationship—particularly in Class II dysgnathia cases characterized by muscular imbalance and a higher risk of relapse.

5 RESULTS AND DISCUSSION

Class III malocclusion, which was first described by Angle 3 [(1)], is considered a clinical challenge for orthodontists even today [(2)], as anterior open bite [(3–6)]. The treatment of Class III malocclusion with concomitant anterior open bite by orthodontics alone may not achieve satisfactory functional and aesthetic results if the underlying causes of the deformity are not addressed [(7,8)].

Thus, the orthodontic-surgical approach is indicated for such cases [(9)]. In the present case report, the patient presented with an increased vertical dimension, skeletal Class III malocclusion and skeletal anterior open bite, suggesting the need for orthodontic-surgical intervention to achieve satisfactory functional and aesthetic results.

Regarding the surgical technique, rotation of the occlusal plane in the clockwise direction can generate a more stable result for the correction of the anterior open bite compared to the upward repositioning of the maxilla as a whole together with mandibular rotation in the counterclockwise direction [(10,11)]. In the present clinical case, clockwise rotation on the palatal plane was performed, favouring the stability of the correction of the anterior open bite. Moreover, conventional presurgical orthodontic preparation was chosen in this case due to the need for leveling the curve of Spee and creating space for the positioning of teeth 35 and 45, which could generate important premature contacts if surgery has been performed first. Obviously, such a decision was made jointly between the orthodontist and oral-maxillofacial surgeon.

The intraoral images demonstrate the post-treatment outcome (Figure 15**a–e**). Bilateral neutral occlusal relationships were achieved, along with well-aligned and coordinated dental arches [(17–23)]. The extraoral photographs reveal a balanced vertical facial proportion, attained through surgical shortening of the lower face, and a harmonious sagittal profile. The gummy smile on the left side and the occlusal cant were successfully corrected by the asymmetrical maxillary impaction on the right and left sides. The oral profile appears balanced with passive lip closure (Figure 16 **a, b**). From a functional standpoint, mandibular mobility remained unrestricted [(13,17–23,27–31)].

The panoramic radiograph at the end of treatment shows no pathological findings (Figure 17). The lateral cephalometric radiograph demonstrates the changes in skeletal parameters (Figure 18, Table 1). Due to the surgical impaction and posterior rotation of the maxilla, the inclination of the maxillary base increased by 3°. This posterior rotation led to a steeper angulation of the maxillary anterior segment—referred to as “surgically induced retrusion.” For this reason, the orthodontic preparation included controlled protrusion and torque of the maxillary incisors.

The combined effects of maxillary impaction and mandibular autorotation resulted in a reduction of the anterior facial height, thereby improving the vertical facial proportions and achieving greater harmony (Figure 19**a, b**).

An evaluation of the vertical segmentation of the skeletal and soft tissue profiles shows improved proportional balance. Specifically, the relationship between the bony upper and lower facial thirds has become more harmonious.

Within the presented treatment protocol, a second application of an occlusal splint was implemented 3–4 weeks prior to final treatment planning and surgical scheduling in order to accurately determine the centric condylar position. Positioning the temporomandibular joints in an incorrect condylar position would have resulted in erroneous planning of the surgical displacement vectors in both jaws.

In agreement with the findings of Radney & Jacobs concerning the cranial displacement of the pronasale, as well as with the follow-up studies of Epker[5] and Rosen regarding the elevation of the nasal tip following maxillary impaction, both effects were observed in the presented patient. These results have been independently confirmed by other authors[16], particularly by De Assis et al. and Lee et al.

Fig. 15: a-f: Intraoral images at the end of treatment, showing Class I occlusion and well-aligned dental arches

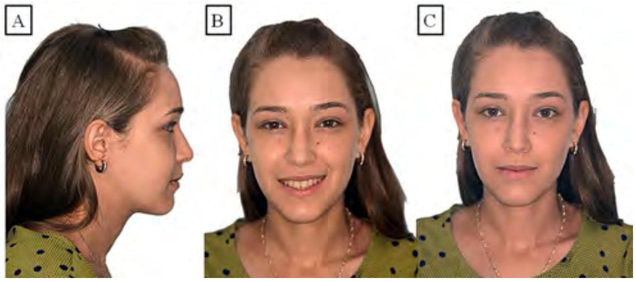


Fig. 16: a-c: Extraoral images following completion of treatment; aesthetically pleasing dentofacial appearance without asymmetry and without gingival display ("gummy smile")

Fig. 17: Panoramic radiograph at the end of treatment

Table 1: Cephalometric Analysis

Proportions of Soft Tissue Structures Before and After Treatment			
Parameter	**Norm Value**	**Before Treatment**	**After Treatment**
G‘-Sn / G‘-Me‘	50%	48%	50%
Sn-Me‘ / G‘-Me‘	50%	52%	50%
Sn-Stms	33%	28%	33%
Stms-Me	67%	72%	67%
Skeletal Analysis: Average Values and Proportions of Skeletal Structures Before and After Treatment			
Parameter	**Norm Value**	**Before Treatment**	**After Treatment**
SNA (°)	82°	83	85
SNB (°)	80°	81	81
ANB (°)	2°	2 (5,5 Indv.)	4 (5 Indv.)
WITS-Wert (mm)	± 1 mm	-3	0
Facial-K.	2 mm	1	2,5
ML-SNL (°)	32°	37	33
NL-SNL (°)	9°	6	7
ML-NL (°)	23°	31	26
Gonion-< (°)	130°	133	131
SN-Pg (°)	81°	81	81
PFH / AFH (%)	63%	58%	61%
N-Sna / N-Me (%)	45%	43%	44%
Sna-Me / N-Me (%)	55%	57%	56%
Dental Analysis			
Parameter	**Norm Value**	**Before Treatment**	**After Treatment**
1-NL (°)	70	68	67
1-NS (°)	77	76	75
1-NA (mm)	4	3,5	3,5
1-NA (°)	22	24	24
1-NB (°)	25	17	22
1-NB (mm)	4	3	5
1-ML (°)	90	94	90

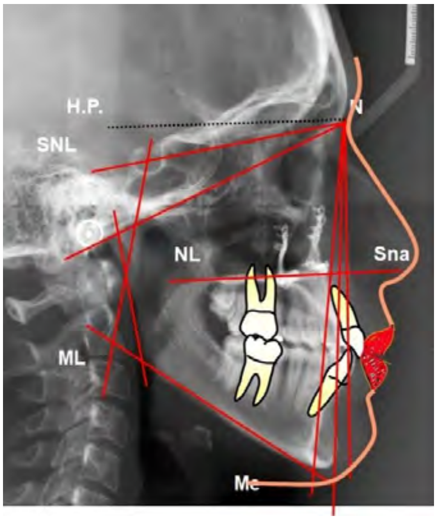
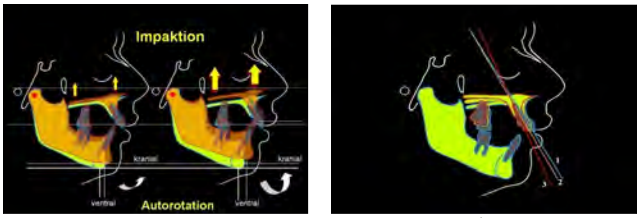


Fig. 18: Lateral cephalometric radiograph (FRS) at the end of treatment



a b

Fig. 19: a: Simulation of surgical maxillary impaction and the resulting mandibular response in the form of autorotation in a cranial and simultaneous anterior direction. Greater impaction leads to more pronounced autorotation, with corresponding changes in both the sagittal and vertical dimensions (right). b: Simulation of varying degrees of surgical maxillary impaction. The greater the impaction, the steeper the inclination of the anterior teeth

Cranial repositioning of the maxilla induces mandibular autorotation, whereby the mandible shifts ventrally in the sagittal plane and cranially in the vertical dimension. As a result of this impaction and subsequent mandibular autorotation, changes occur in both anterior (AFH) and posterior (PFH) facial height, leading to an increased PFH/AFH ratio [8,28]. A new skeletal jaw relationship is thereby established in both sagittal and vertical planes. The extent of this autorotation is proportional to the magnitude of the maxillary impaction (Figure 19**a**), with the rotational center of the impaction playing a critical role. Depending on the center of rotation, maxillary impaction also influences the axial inclination of the anterior teeth (Figure 19 **b**).

The significance and extent of these movements must be assessed and integrated into the cephalometric surgical planning to ensure accurate prediction and execution of the desired outcome [17–23].

The extent of maxillary impaction is determined not only based on functional considerations, but also from an aesthetic perspective. Several key aspects are evaluated in this context:

- The degree of gingival display ("gummy smile")
- The amount of visible dental hard tissue during smiling
- The overall facial morphology

These parameters play a critical role in defining the vertical position of the maxilla and contribute significantly to achieving both functional rehabilitation and facial harmony. [13,17–23,27–29]

It is of great importance to the analysis of soft tissues and the correct clinical examination of the patient, to determine the precise diagnosis and type of facial deformity. Also the cephalometric will be only used as a method of diagnostic support and not as standard surgical. Another important point is to achieve an optimal occlusion and finally mention that the harmony between clinic-facial aesthetics are specific to each patient and they depend on the surgical correction [18–23].

It is very important to make a correct assessment and an appropriate interdisciplinary diagnosis to be able to implement a correct treatment plan for the patient and try to cover all the objectives, besides obtaining correct integral health for the patient.

Retention is necessary after orthodontic treatment as there is a tendency for relapse. Although efforts are made to prevent relapse by wearing retainers, the patient's biological changes may cause relapse. Vacuum-formed retainers were used in these patients to maintain tooth alignment and arch width stability [24–26,31,32].

More clinical studies should be carried out to clarify the prevalence of bone dehiscence in patients after orthognathic surgery.

We believe the future digital medical student will require the following five core skill competencies:

1. **Multidisciplinary collaborator**: Specialized leadership skills required to resolve solutions between teams of different training backgrounds. For example, coordinating discussions between surgeons, data scientists, and software engineers.
2. **Data-driven decision-maker :** Proficient in digital health technologies; able to adopt, implement, and evaluate new technologies as they enter the system.
3. **Digital leader**: Fluency in use of all frequently used digital health platforms and digital technologies, allowing for more comprehensive patient care that is more personalized, preventative, and predictive care.
4. **Super-communicator :** Sophisticated professionalism and specialized communication skills adapted for digital health and AI-driven technologies.

5. **Community leader**: Awareness and advocacy for the sociopolitical, economical, and environmental factors that impact individual and population health.

A selection of key digital technologies that are impacting surgical training and education today include surgical robots, next generation minimally invasive surgery, and artificial intelligence [(21)]. Surgical robots and minimally invasive approaches via advanced laparoscopy are changing surgery globally by reducing morbidity and mortality of operations that were once performed with traditional open methods. As a result, surgery is becoming more dependent on technology, and accordingly, the surgeon's skill set is expanding to accommodate these new techniques. In accordance with this transition, the technical and nontechnical skills of surgeons must be adaptive. Surgeons will have to learn new technical skill approaches such as new robotic platforms and minimally invasive techniques that are incorporated into the surgeons' workflow, as well as more specialized nontechnical digital communication skills for online and virtual provision of care. [(8,15,21)]

6 CONCLUSION

This case analysis clearly demonstrates the effectiveness of a combined orthodontic– orthognathic treatment approach for managing complex Class III dysgnathia with laterognathia. Through individualized surgical planning, including maxillary impaction and mandibular segmental rotation both functional and aesthetic objectives were successfully achieved. In particular, the harmonization of the aesthetic axis and the restoration of vertical facial balance significantly contributed to the patient-centered quality of the outcome.

The importance of precise diagnostics, including skeletal scintigraphy and functional centric relation analysis, is emphasized as a critical component of interdisciplinary planning. The presented treatment concept highlights the necessity of a holistic approach that equally prioritizes aesthetics, function, and long-term stability.

7 DISCLOSURE

Funding: This article received no external funding.
Conflicts of interest: The authors declare no conflicts of interest.

REFERENCES

1) Shaw I, Kumar C, Dodds C. Oxford textbook of Anaesthesia for Oral and maxillofacial surgery. Oxford, UK. Oxford University Press. 2010. Available from: https://books.google.co.in/books/about/Oxford_Textbook_of_Anaesthesia_for_Oral.html?id=OUyUwZezSxQC&source=kp_book_description&redir_esc=y.
2) Pawar A. Surgery First Approach in Orthognathic Surgery - An Evidenced Based Approach. *Journal of Surgical Techniques and Procedures*. 2020;4(3):1–3. Available from: https://www.remedypublications.com/open-access/surgery-first-approach-in-orthognathic-surgery-an-evidenced-based-6471.pdf.
3) Pansotra S, Mittal S, Aggarwal I, Merry, Parveen A. Treatment of Adult Class III Malocclusion with Orthodontic Camouflage: A 2 Case Report. *Journal of Research in Medical and Dental Science*. 2023;11(11):21–28. Available from: https://www.jrmds.in/articles/treatment-of-adult-class-iii-malocclusion-with-orthodontic-camouflage-a-2-case-report.pdf.
4) Fonseca RJ. Oral and Maxillofacial Surgery- Inkling Enhanced E-Book: 3-Volume Set. 3rd ed. Elsevier Health Sciences. 2017. Available from: https://shop.elsevier.com/books/oral-and-maxillofacial-surgery/fonseca/978-0-323-41499-9.
5) Epker BN. Maxillofacial contour esthetic deformities. *Atlas of the Oral and Maxillofacial Surgery Clinics*. 2004;12(1):75–89. Available from: https://dx.doi.org/10.1016/j.cxom.2003.10.005.
6) Proffit WR, Fields HW, Larson B, Sarver DM. Contemporary orthodontics-e-book. Elsevier Health Sciences. 2018. Available from: https://books.google.co.in/books/about/Contemporary_Orthodontics_E_Book.html?id=A45nDwAAQBAJ&source=kp_book_description&redir_esc=y.
7) Gusmão YG, Neri AMTR, Becheleni MT, de Oliveira PC, Silva TF. Biphasic Orthodontic Treatment for Severe Class III Malocclusion Using Orthopedics and Orthodontic Camouflage: A Case Report. *Archives of Current Research International*. 2024;24(10):225–233. Available from: https://dx.doi.org/10.9734/acri/2024/v24i10925.
8) Watted N, Watted A, Hussein MA. Muhamad Abu Hussein. Function, Aesthetics, and Strategy: Orthodontic-Orthognathic Concepts in The Treatment of Skeletal Deformities. *Journal of Stomatology & Dental Research*. 2025;3(2):1–22. Available from: https://doi.org/10.61440/JSDR.2025.v3.24.
9) Proffit WR, Turvey TA, Phillips C. Orthognathic surgery: a hierarchy of stability. *International journal of adult orthodontics and orthognathic surgery*. 1996;11(3):191–204. Available from: https://pubmed.ncbi.nlm.nih.gov/9456622/.
10) Muhamad AH, Watted N, Abdulgani A. Cleft lip and palate. A Comprehensive Review. *International Journal of Basic and Applied Medical Sciences*. 2014;4(1):338–355. Available from: https://www.researchgate.net/publication/319490528_Cleft_lip_and_palate_A_comprehensive_review.
11) Watted N, Hussein E, Abu-Mowais M, Abdulgani A, Proff P, Muhamad AH. Parathyroid Hormone: Is It Really the Cause for Increased Tooth Mobility after Orthognathic Surgery? *Open Journal of Stomatology*. 2014;04(08):424–433. Available from: https://dx.doi.org/10.4236/ojst.2014.48057.
12) Watted N, Witt E, Bill JS. A therapeutic concept for the combined orthodontic surgical correction of angle Class II deformities with short-face syndrome: Surgical lengthening of the lower face. *Clinical Orthodontics and Research*. 2000;3(2):78–93. Available from: https://dx.doi.org/10.1034/j.1600-0544.2000.030204.x.
13) Ghodasra R, Brizuela M. Orthodontics, Malocclusion. Treasure Island (FL). StatPearls Publishing. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK592395/.
14) Watted N, Abu-Hussein M, Watted A, Bill J, Proff P, et al. Modification of skeletal structures to harmonize soft tissue structures in the face. *Oral Surgery Journal* . 2015;12:41–48.
15) Watted N, Abu-Hussein M, Bill J, Proff P. Harmonisation of the Dento-Facial Complex A Result of Combination an Orthodontic and Orthognathic Surgical Therapy. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 2015*;2:128–139. Available from: https://doi.org/10.9790/0853-1427128139.
16) Watted N, Muhamad AH, Bill J, Proff P. A Therapeutic Concept by "Watted" for the Surgical Lengthening of the Lower Face by Short Face Syndrome. *Open Journal of Stomatology*. 2015;05(05):127–141. Available from: https://dx.doi.org/10.4236/ojst.2015.55018.
17) Watted N, Proff P, Reiser V, Shlomi B, Abu-Hussein M, Shamir D. CBCT; In Clinical Orthodontic Practice. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* . 2015;14(2):102–115. Available from: https://www.iosrjournals.org/iosr-jdms/papers/Vol14-issue2/Version-7/X01427102115.pdf.
18) Watted N, Awadi O, Bill J, Proff P, Abu-Hussein M. Change in the Vertical Relation in Class II Deformity with Skeletal Open Bite in the Orthognathic Surgery. *Open Journal of Dentistry and Oral Medicine*.

2015;3(1):13–20. Available from: https://dx.doi.org/10.13189/ojdom.2015.030103.

19) Watted N, Abu-Hussein M, Witt E, Proff P, Shlomi B, Festila D. A magnetic resonance imaging study of the temporomandibular joint and the disc-condyle relationship after functional-orthopaedic treatment. *Journal of Dental and Medical Sciences*. 2015;11:92–103. Available from: https://doi.org/10.9790/0853-1411192103.
20) Watted N, Abu-Hussein M, Watted A, Bill J, Proff P, Schlomi B. Combined orthodontic and maxillofacial surgical treatment: Effect of skeletal changes on soft tissue structures. *Journal of Oral Surgery*. 2016;1:35–42.
21) Watted A, Ghoul RI, Watted N, et al. Artificial Intelligence in Orthodontics: A Review. *Power System Technology Journal*. 2025;49(2):944–956. Available from: https://www.researchgate.net/publication/391538184_Artificial_Intelligence_in_Orthodontics_A_Review.
22) Habar EH, Ruslin M. Treatment of skeletal class III malocclusions with a combination of orthodontic treatment and orthognathic surgery. *Journal of Case Reports in Dental Medicine*. 2020;2(2):40–42. Available from: https://doi.org/10.20956/jcrdm.v2i2.116.
23) Goldwyn RM, Hullihen SP. Pioneer oral and plastic surgeon. *Plastic and Reconstructive Surgery*. 1973;52(3):250–257. Available from: https://dx.doi.org/10.1097/00006534-197309000-00005.
24) Chebel NA, Saadeh M, Haddad R. Unilateral sagittal split osteotomy: effect on mandibular symmetry in the treatment of class III with laterognathia. *Progress in Orthodontics*. 2020;21(1):19. Available from: https://dx.doi.org/10.1186/s40510-020-00319-3.
25) Watted N, Witt E. NMR study of TNJ changes following functional orthopaedic treatment using the "Würzburg approach". *European Orthodontic Society (EOS) 74th Congress*. 1998.
26) Watted N, Abu-Hussein M, Watted A, Bill J, Proff P, Schlomi B. Änderung der skelettalen Strukturen zur Harmonisierung der Weichteilstrukturen im Gesicht. *Oralchirurgie Journal*. 2015;12:41–48. Available from: https://www.researchgate.net/publication/283271782_Anderung_der_skelettalen_Strukturen_zur_Harmonisierung_der_Weichteilstrukturen_im_Gesicht.
27) Yosra T, Hafizou RAA, Fatima Z, Hicham B. Orthosurgical approach of a skeletal class III malocclusion with mandibular laterognathia: a case report. *Annals of Medicine & Surgery*. 2023;85(6):2965–2973. Available from: https://dx.doi.org/10.1097/ms9.0000000000000591.
28) Hollander Z, Fraser A, Paredes N, Bui J, Chen Y, Moon W. Nonsurgical maxillary orthopedic protraction treatment for an adult patient with hyperdivergent facial morphology, Class III malocclusion, and bilateral crossbite. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2022;162(2):264–278. Available from: https://dx.doi.org/10.1016/j.ajodo.2021.02.027.
29) Jing Y, Han X, Guo Y, Li J, Bai D. Nonsurgical correction of a Class III malocclusion in an adult by miniscrew-assisted mandibular dentition distalization. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2013;143(6):877–887. Available from: https://dx.doi.org/10.1016/j.ajodo.2012.05.021.
30) Ngan P, Hu AM, Fields HW. Treatment of Class III problems begins with differential diagnosis of anterior crossbites. *Pediatric Dentistry*. 1997;19(6):386–395. Available from: https://pubmed.ncbi.nlm.nih.gov/9348603/.
31) Trujillo AZC, López AF. Skeletal class III with laterognathia and lower facial third asymmetry. Surgical-orthodontic treatment. *Revista Mexicana de Ortodoncia*. 2017;5(2):e120–e126. Available from: https://dx.doi.org/10.1016/j.rmo.2017.06.018.
32) Pereira FL, de Marilac de Alencar Pinheiro L, Araújo PM, Chihara L, Nogueira RLM, Sant'Ana E. Surgical Treatment of Posttraumatic Laterognathia: A Case Report and a Literature Review, Focused on the Effects of a Condylar Fracture on the Face. *Craniomaxillofacial Trauma & Reconstruction*. 2018;11(3):211–218. Available from: https://dx.doi.org/10.1055/s-0037-1601861.