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Case Report

# Comprehensive orthodontic-surgical correction of a severe class iii with bimaxillary involvement

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## Abstract

Class III malocclusion expresses itself as a compound problem especially in adult patients. It is particularly challenging when the problem involves both the jaws. Here a case report is presented of a 19-year-old patient with skeletal class III discrepancy with mild asymmetry in lower third of face. The treatment constituted maxillary expansion with MARPE, followed with surgery involving Le Fort I osteotomy and maxillary advancement along with asymmetric bilateral sagittal split osteotomy and mandibular setback. After 36 months, all the appliances were removed and patient was satisfied with the result.

**Keyword-**Non-extraction, Bi-jaw surgery, MARPE, Class III malocclusion, Asymmetry

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## 1. Introduction

Class III malocclusion is considered to be one of the most complex orthodontic problems to treat. Skeletal class III cases may either be associated with maxillary retrusion, mandibular protrusion, or a combination of both.[1] These cases require careful treatment planning, an integrated approach and patient cooperation.

Adult patients with skeletal class III discrepancy often require surgical intervention for correction of one or both jaws. The magnitude and amount of surgical correction largely depend on the efficacy of the pre-surgical orthodontic decompensation, which should be meticulously planned in all three planes of space.[2]

This case report demonstrates comprehensive surgical-orthodontic treatment of a patient with skeletal discrepancies in all three planes: sagittal, transverse, and vertical.

## 2. Diagnosis and Etiology

A 19-year-old female presented with the chief complaint of a forwardly placed lower jaw. The patient had a brachycephalic head form, mesoprosopic face form, facial asymmetry with a marked deviation of chin towards the left side, frontal bossing and a concave profile with competent lips (**Figure 1**). There was 3 mm reverse overjet, 6 mm overbite, and crossbite in all teeth except upper right canine and premolars and upper left first premolar, upper midline shifted 1 mm towards the right side, lower midline shifted 1 mm towards the left side with mild crowding in upper and lower anteriors (**Figure 1**). The patient had multiple restorations in the lower posterior regions. The patient's siblings and relatives had similar facial and dental characteristics.

Radiographic evaluation revealed root-canal treatment of the lower right first and second molars, which were asymptomatic (**Figure 2**). All third molars were present in the radiograph. Lateral cephalometric analysis (Table 1) indicated a skeletal class III jaw relationship (ANB=-10°)

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with a retrognathic maxilla (SNA=80°; N ⊥ point A=-5 mm) and a prognathic mandible (SNB=90°) in relationship with cranium; with hypo-divergent growth pattern (FMA=22°). There were proclined maxillary incisors (U1-SN=120°) and retroclined mandibular incisors (IMPA=79°). The cephalometrics for orthognathic surgery (COGS) analysis confirmed maxillary retrognathism and mandibular prognathism (Table 1). The upper and lower airways were reduced (Table 1).

### *2.1. Treatment objectives*

Treatment objectives were to correct the skeletal bases, and facial asymmetry; achieve class I canine and molar relationships, a normal inclination of upper and lower incisors, normal overjet and overbite; coincide upper and lower midlines; and obtain an acceptable profile with a pleasant smile.

### *2.2. Treatment progress*

Prophylactic care was initiated before and during the treatment at regular intervals.

The patient was presented with a treatment plan involving pre-surgical orthodontics with MARPE (Miniscrew-Assisted Rapid Palatal Expander) and decompensation; followed by advancement of maxilla with Le Fort I osteotomy, along with asymmetric bilateral sagittal split ramus osteotomy set back of mandible. MARPE was chosen over a conventional tooth-supported expander because of the patient's age and potentially fused palatal suture.[3]

**Figure 1:** Pre-treatment extraoral and intraoral photographs

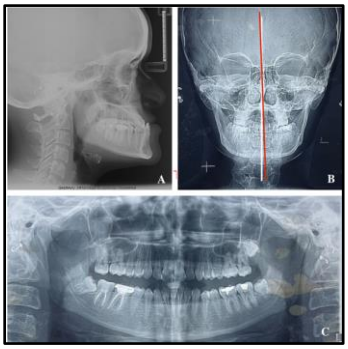

**Figure 2:** (A) Pre-treatment lateral cephalogram; (B) Pre-Treatment Pa Cephalogram Showing Mild Deviation Of Chin Towards Left Side (Red Color); (C) Pre-Treatment Orthopantomogram

**Figure 3:** (A) Armamentarium for placement of marpe appliance; (B) Pre-expansion maxillary occlusal radiograph; (C) Jig for placement of mini-implants; (D) Intraoral placement of jig; (E) Marpe appliance

**Figure 4:** Post-expansion intraoral photographs and maxillary occlusal radiograph

**Figure 5:** Pre-surgical extraoral and intraoral photographs

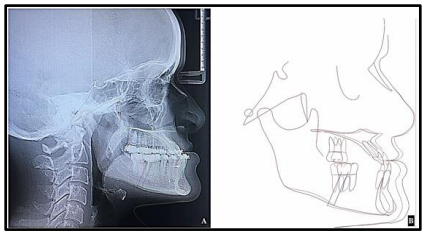

**Figure 6:** (A) Pre-surgical lateral cephalogram showing sto prediction; (B) Sto tracing showing 3 Mm of maxillary advancement and 4 mm mandibular setback (Red Color)

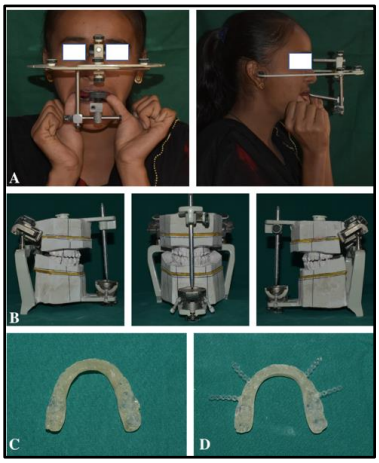

**Figure 7:** (A) Facebow record; (B) Mock surgery; (C) Intermediate splint; (D) Final splint

**Figure 8:** Post-surgical extraoral and intraoral photographs

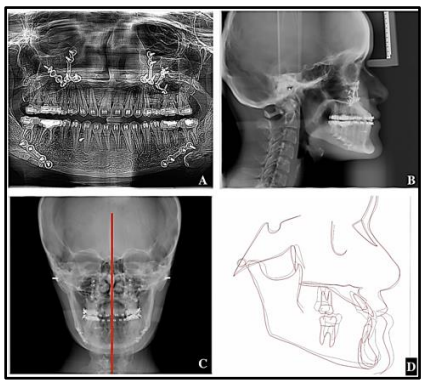

**Figure 9:** (A) Post-surgical orthopantomogram; (B) Post-surgical lateral cephalogram; (C) Post-surgical pa cephalogram showing coinciding midlines; (D) Pre-Surgical (Black Color) And Post-Surgical (Red Color) Superimposition

**Figure 10:** Post-treatment extraoral and intraoral photographs

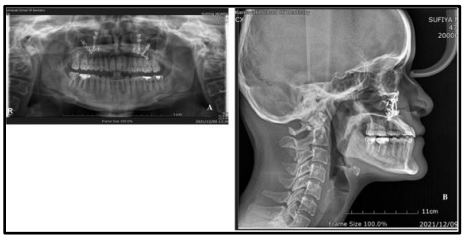

**Figure 11:** (A) post-treatment orthopantomogram; (b) post-treatment lateral cephalogram

**Figure 12:** Fixed canine-canine retainer

**Figure 13:** Post-retention (after a period of 6 months) extraoral and intraoral photographs with lateral cephalogram

**Table 1:** Lateral cephalometric analysis comparing pre-treatment, pre-surgical and post-treatment values

| **Lateral Cephalometric Analysis** | | | | |
|---|---|---|---|---|
| | **Normal** | **Pre-treatment** | **Pre-surgical** | **Post-treatment** |
| Hard Tissue Parameters | | | | |
| SNA | 82°±2° | 80° | 81° | 85° |
| SNB | 80°±2° | 90° | 90° | 88° |
| ANB | 0°±4° | -10° | -9° | -3° |
| Wits appraisal | 0 mm | -14 mm | -12 mm | -5 mm |
| N ⊥ point A | 0±1 mm | -5 mm | -5 mm | -1.5 mm |
| Effective maxillary length | Varies | 70 mm | 72 mm | 76 mm |
| Effective mandibular length | Varies | 103 mm | 105 mm | 106 mm |
| FMA | 17°-28° | 22° | 23° | 25° |
| SN-Palatal plane | 8°±3° | 11° | 11° | 11° |
| N-PNS | 50.6±2.2 mm | 41 | 41 | 43 |
| Upper facial height (N-ANS) | 50±2.4 mm | 44 mm | 44 mm | 45 mm |
| Lower facial height (ANS-Gn) | 61.3±3.3 mm | 47 mm | 49 mm | 51 mm |
| Dental Parameters | | | | |
| U1-SN | 102° | 120° | 112° | 113° |
| IMPA | 90°±3° | 79° | 84° | 84° |
| Soft Tissue Parameters | | | | |
| Facial angle | 90°±3° | 98° | 98° | 95° |
| Nasolabial angle | 102°±8° | 79° | 89° | 83° |
| Mentolabial sulcus | 4±2 mm | 3 mm | 4 mm | 1.5 mm |
| Maxillary incisor exposure (Stms/incisal edge) | 2±2 mm | 5 mm | 2 mm | 1 mm |
| Upper lip length | 21±1.9 mm | 13 mm | 14 mm | 16 mm |
| Lower lip length | 46.9±2.3 mm | 37 mm | 37 mm | 39 mm |
| Upper lip to E-line | -3 mm | -7 mm | -7 mm | -5 mm |
| Lower lip to E-line | -2 mm | -2 mm | 0 mm | -5 mm |
| Pharyngeal Airway | | | | |
| Upper airway | 17.4±3.4 mm | 14 mm | 14 mm | 18 mm |
| Lower airway | 11.3±3.3 mm | 10 mm | 11 mm | 13 mm |

**Table 2:** Poster anterior (pa) cephalometric analysis comparing pre-expansion and post-expansion values

| **Posteroanterior Cephalometric Analysis** | | |
|---|---|---|
| | **Pre-expansion** | **Post-expansion** |
| Nasal width | 30 mm | 30 mm |
| Maxillary width | 55 mm | 58 mm |
| Maxillary intermolar width | 50 mm | 54 mm |
| Mandibular width | 72 mm | 72 mm |
| Nasal:Maxillary ratio | 54.54% | 51.72% |
| Maxillary:Mandibular ratio | 76.38% | 80.55% |

Marpe was initiated by fabricating a customized appliance with a 9 mm Hyrax screw (Leone) as shown in **Figure 3**. A jig (**Figure 3**) was prepared with a 1 mm thermoplastic sheet, which was pressure moulded in a pressure moulding machine (Biostar). Four titanium mini-implants of 2.0 x 8.0 mm (S.K. surgical) were placed in the maxillary palatal region lateral to mid-palatal suture. The patient was advised to activate the appliance as instructed twice a day for 2 weeks. Each activation produces approximately 0.2 mm of lateral expansion. Post-expansion records are shown in figure 4. A retention period of 3 months was advised and upper & lower bonding was done with 0.022 MBT appliance subsequently. 0.016 NiTi archwires were placed followed by 0.019 x 0.025 HANT and 0.019 x 0.025 SS archwires.

As the patient presented with mild asymmetry in the lower third of the face and the skeletal midline shifted towards the left side (**Figure 2**), more amount of mandibular setback was needed on the right side than that on the left side. A 1.5 x 8 mm of mini-implant (**Figure 5**) was placed for protraction of the lower right molar and allowed the molars to finish into Angle's class I molar relationship after

asymmetric mandibular setback. All four third molars were extracted before the surgical phase.

As all the elective procedures were postponed during the time of the pandemic, the surgical phase proceeded after a halt of 1 year. Patient's pre-surgical intraoral & extraoral records were taken (**Figure 5**). A surgical treatment objective (**Figure 6**) and model surgery (**Figure 7**) were used to plan a Le Fort I osteotomy and bilateral sagittal split ramus osteotomy (BSSO). Facebow transfer was registered and two splints (intermediate and final) were fabricated by model surgery (**Figure 7**).

An asymmetric BSSO setback was done with 4 mm on the right side and 2 mm on the left side; along with 3 mm advancement of the maxilla with high Le Fort I osteotomy. Rigid fixation was done in both the maxilla and mandible; with intermaxillary fixation with light intraoral elastics in a class 3 pattern for a period of 1 month. The patient was closely monitored post-surgically for a period of 2 months. After a period of 3 1/2 months, the mandibular surgical plates were removed as the patient was infected due to lack of oral care at home, however, the surgeons found healing satisfactorily.

Post-surgical orthodontics was initiated involving the continuation of 0.019 x 0.025 stainless steel archwires to finish and detail the occlusion. Light intra-oral elastics (2.5 oz) were advised bilaterally from the upper first molars to lower canines in the class 3 pattern. Post-surgical records are shown in **Figure 8** and **Figure 9**.

After a period of 36 months, all appliances were removed (**Figure 10** and **Figure 11**) and a fixed canine-canine retainer was bonded as shown in (**Figure 12**).

Post-retention records after a period of 6 months showed stable results. (**Figure 13**)

*2.3. Treatment results*

Post-treatment records confirmed good occlusal and esthetic results. The patient and her family were pleased with the esthetic results achieved (**Figure 10**, and **Figure 11**).

Lateral cephalometric analysis revealed significant changes in skeletal, dental and soft tissue parameters (**Table 1**). PA cephalometric analysis showed changes in maxillary width and maxillary intermolar width after expansion (**Table 1**). The panoramic radiograph revealed parallel root positioning and no root resorption (**Figure 11**).

## 3. Discussion

Skeletal Class III dentofacial conditions with complex craniomaxillary deformities and dental compensation mechanisms in three dimensions are inevitably complex and usually require combined surgical-orthodontic treatment to achieve the best results in terms of occlusal function, facial esthetics, and long-term stability.

The patient was presented with a mild asymmetrical skeletal Class III, a complex three-dimensional craniomaxillary deformity, involving excessive mandibular growth and deficient maxillary growth in the sagittal dimension, bilateral inconsistency of maxillary and mandibular height in the vertical dimension, and inconsistency of the maxillary and mandibular widths in the transverse dimension.

After MARPE, the maxillary skeletal width (J-J') increased by 3 mm, while the maxillary intermolar width (A6-A6) increased by 4 mm (**Table 2**). The ratio of nasal/maxillary widths (40-42%) and maxillary/mandibular widths (80%) improved (**Table 2**).

The N-PNS distance was increased by 2 mm, suggesting PNS point downwards than ANS owing to increased SN-palatal plane angle (11°). Considering the patient's facial proportions, after surgery, the palatal plane inclination was not changed which would favour the patient's midface depression.

After surgery, the maxilla not only did advance but there were changes in vertical dimensions also. The upper facial height (N-ANS) increased by 1 mm while the SN-palatal plane angle remained the same which implies that along with maxillary advancement, there was a slight downward movement of the maxilla. The lower facial height increased by 4 mm, while the mandibular plane angle (FMA) increased by 3° which contributed to the improvement of the profile of the patient. For soft tissue changes, Marsan et al.[4] noticed in a study that after orthognathic surgery for maxillary advancement, upper lip length increases, which can be seen in the present case (**Table 1**). After the surgical setback of the mandible, retraction and extension of the upper lip is seen.5

In recent years, several authors have expressed concern about the negative effects of a significant mandibular setback on the posterior airway space.[6] This may result from the hyoid bone following the direction of the surgical movement as the mandible is displaced downward and backwards.[7] Advancement of the maxilla on other hand helps increase the airway.[8] Overall, the total airway volume of the patient did increase after surgery.

## 4. Conclusion

Bi-jaw surgical treatment with excellent facial profile and stable result by rigid fixation was achieved in a 19-year-old patient along with an orthopaedic expansion of the maxilla with the help of a MARPE appliance. This approach allowed the correction of posterior crossbite and gained space for correction of mild crowding and incisor inclination preventing extraction of teeth.

## 5. Source of Funding

None.

## 6. Conflict of Interest

None.

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