CASE REPORT

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Orthodontic Surgical Approach of Severe Skeletal Hyperdivergent Class II Malocclusion Treated by Le-Fort I Osteotomy, BSSO and Genioplasty

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ABSTRACT

Abstract: Class II skeletal base with vertical maxillary excess (VME) and skeletal mandibular deficiency presents a combination of several problems about function, psychology, and esthetics. The optimal treatment plan generally includes a harmonized orthodontic-surgical approach through superior repositioning (Vertical maxillary impaction) using Le-Fort I osteotomy, mandibular advancement, and genioplasty.

A 23-year-old woman with severe skeletal Class II malocclusion, convex profile, and gummy smile was referred to our department. Skeletally, she presented with vertical maxillary excess, mandibular deficiency along with a hyperdivergent growth pattern. Dentally, Class II molar, and canine relationships increased overjet and overbite with proclined upper (U1-SN: 118o) and lower incisors (L1-MP: 97o). Maxillary impaction was planned to correct the gummy smile, and mandibular advancement to improve the convex profile and correct the mandibular deficiency. In adjunct, genioplasty was also planned to correct the chin deficiency. The decompensation phase involved correction of the proclination and crowding of the upper incisors by extraction of the upper first premolars and decrowding, uprighting, and retracting the lower incisors by using the molar extraction space thus increasing the overjet. Bi-jaw surgery which included a Le-fort I osteotomy for vertical maxillary impaction (4mm), bilateral sagittal split osteotomy (BSSO) for mandibular advancement (5mm), and genioplasty was done to correct the skeletal and dental Class II.

This case report describes a multidisciplinary approach in the successful management of a patient with VME and mandibular advancement to achieve superior function, stability, facial esthetics, and an ideal occlusion.

Keywords: Orthognathic surgery; Skeletal Class II; Le-Fort I; BSSO; Genioplasty.

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INTRODUCTION

Severe skeletal Class II malocclusions have been generally focussed in combination with fixed orthodontic treatment and surgical interventionsto achieve the finest soft tissue and skeletal balance. Following an observant diagnosis of the severity and nature of the orthodontic problem, it is crucial to determine the constraints of the mode of orthodontic intervention, tooth movement, and its obligatory multidisciplinary approach that will be necessary to achieve it. The primary goal of this orthognathic surgical therapy is to reposition the maxilla and mandible sagittally and vertically as per the need ofthe patient's functional and an esthetic prerequisite which is regularly followed by a genioplasty procedurefor stability in the lower incisor region and to correct the chin deficiency.

West et al in 1975 [1,2]previously reported to treat vertical maxillaryexcess (VME) using the orthognathic approach andsimilarly Schendel et al. in 19763,4had employed only Le Fort-I procedures. The results of this procedure frequentlydeveloped into the autorotation ofmandible which allowed a mild forwardposition of the lower jaw. The present casereport describes a bi-jaw surgical intervention in consolidation with the fixed orthodontic therapywhich has been advocated to correct thedeficiencies in all three planes of space and also in the successful management of a patient with VME and mandibular advancementto achieve superior function, stability, facial esthetics, and an ideal occlusion.

DIAGNOSIS AND ETIOLOGY

A 23-year-old adult, female presented herself at the Department of Orthodontics, with a chief complaint of forwardly placed teeth in the upper front region of the jaw in the past5 years and

looking for a solution for her unesthetic facialappearance and protruding teeth.

General examination revealed (Annex 1, Figure 1), mesomorphic body type, mesocephalic head pattern, and hyperleptoprosopic facial patternassociated with a severe convex profile, posterior divergence, clinical FMPA suggests she was a vertical grower with hyperdivergent growth patternand anterior divergent of jaw bases. Upper and lower midline is shifted to left. Lips are potentially competent with an average resting lip line, the lower lip is protruded and lip step is slightly negative. The nasolabial sulcus is acute and mentolabial sulcus is deep.

Intraoral examination revealedan Angle's Class II molar relationship in reference to the molarson right and left side respectively. Whereas the canine relationship reflected a Class IIrelationship on both the right and left sides.Furthermore, severely proclined maxillary incisors, crowding concerning upper and lower anterior teeth with distolingually rotated 43,44, mesiobuccally rotated 14, mesiopalatally rotated 15, missing 36 and 46 and distally tipped 23. The overjet and overbite were 8 mm and 3 mm, respectively.

The cephalometric analysis highlighted a severe Class II skeletal base with vertical maxillary excess and a retrognathic mandible / skeletal mandibular deficiency (SNA-80o, SNB-77o, ANB-3o) with an increased mandibular plane angle (FMA-34o) and matching soft tissues. The fault lies in the maxilla (increased size by 1mm) and dorsal placement by 6mm, and mandible (decreased size by 7.5mm). Sagittal relation is worsened by vertical. The vertical parameters (N to ANS-48 mm, N to PNS-43 mm) indicated the anterior downward pitch in the maxilla resulting in the vertical anterior maxillary excess. The maxillary incisors were severely proclined (U1 to NA- 41o, 14 mm, U1 to SN-114o) and mandibular incisors were proclined (L1 to NB- 31o, 10 mm, IMPA-95o).(Table 1) The panoramic radiographs showed no missing teeth or any root resorption and horizontally impacted third molars. Intraoral Periapical Radiographs (IOPA) revealed dilaceration with respect to 12,13,22,23,41,42, and 32. No signs and symptoms of temporomandibular joint disorder were elicited through the questionnaire or clinical examination.

Based on these findings, the diagnosis was dentoalveolar Angle's Class II molar relationshiponthe Class II skeletal base owing to an orthognathic maxillawith VME and a skeletal retrognathic mandible.

The objectives of treatment involved were as follows:

- To correct the Skeletal Class II pattern with hyperdivergence.
- To correct the proclination of upper incisors.
- To correct the crowding with respect to upper and lower anteriors.
- To correct the rotation with respect to 14, 15, 43, 44.
- To correct the distally tipped with respect to 23.
- To replace with respect to 36, 46.
- To achieve stable soft tissue profile with soft tissue harmony and functional occlusion with a normal overbite and overjet.

TREATMENT PLAN AND ALTERNATIVES

The following treatment plan was discussed with thepatient considering the treatment objectives and correlatingwith the patient's requirements.The initial treatment plan for the patient fulfilling thetreatment objectives was an orthodontic-surgical combinedapproach. Initially, the orthodontic treatment planthat was intendedinvolved the leveling and aligning of the upper and lower arches. In the upper arch, space obtained by extraction of 14 and 24 was utilized for leveling. In the lower arch, space previously present due to extraction of 36 and 46was utilized for leveling. Decompensation was done pre-surgically (increased overjet followed by the closing of all the spaces by retraction, after which the surgery was carried out. The quantum of surgical movements was determined after decompensation. After the initial orthodontic phase, the surgical line of treatment was planned where surgical vertical maxillary impaction and mandibular advancement with genioplasty ie; bi-jaw surgery combining Le- Fort I osteotomy to bring about the maxillary impaction and rotational bilateral sagittal split osteotomy (BSSO) for mandibularadvancement combined with sliding genioplasty for further profile enhancement. was advised to correct both skeletal and dental Class II. However, the prognosis was compromisedconsideringthe severity of the skeletal discrepancy. The patient chosethe ideal treatment option and accepted to go ahead with the decided treatment plan.

Stepwise Treatment progress:

Treatment was carried out in three phases:

• Presurgical phase - Alignment/Uprighting and Decompensation

• Surgical phase

• Postsurgical phase – Finishing and settling.

Presurgical phase

This phase involved 2 stages: Alignment/Uprighting and Decompensation. In Stage 1 Alignment/Uprighting stage, the orthodontic treatment was initiated with extractions of upper first premolars in the maxillary arch and space was initially present in the mandibular arch due to the previous extraction of 36 and 46 which facilitated decompensation; following this, the fixed appliance treatment was commenced using0.022 × 0.028 MBT prescription. Initial aligning and leveling involved the 0.014", 0.016", 0.018" NiTi, in both upper and lower arch After initial levelingand alignment, the extraction space was closed using friction mechanics on a 0.019 × 0.025 SS,which resulted in improvement of inclination of the upperanterior and relieved the crowding in the lower arch. Later the second molars were bonded where 0.017" x 0.025" NiTi was placed. The duration taken for this stage was approximately 5 months. The Stage 2 Decompensation stage, involved the correction of the proclination and crowding of the upper incisors by extraction of the upper first premolars and decrowding, uprighting, and retracting the lower incisors by using the molar extraction space thus increasing the jet. This stage involved placement of 0.019 × 0.025 SS in both upper and lower arch with Class III elastics. The duration taken for this stage was approximately 10 months. (Annex 1, Figure 2 and 3).

Surgical phase

The intermediate and final splints were fabricated using the simulated mock surgery protocol. The bi-jaw surgery involving High Le-Fort I osteotomy (maxillary impaction) of 4 mm was first carried out, the patient's occlusion was stabilized using intermediate splints, followed by rotational bilateral sagittal split osteotomy (BSSO) for the mandibular advancement of 5 mm which was plated using the final splints. Following removal of the stabilizing splint, the acquired occlusionwas checked with the predetermined occlusion. Finally, the profile enhancement was carried on by advancing the chin through genioplasty. Later

Parameters	Pre-treatment	Presurgical	Postsurgical
SNA (°)	80	78	77
SNB (°)	76	72	75
ANB (°)	3	6	2
Y-Axis (°)	72	71	68
Witts appraisal (mm)	5	6	1
GoGn-SN (°)	42	41	34
GoMe-FH (°)	39	38	29
Posterior Cranial Base(mm)	32	31	30
Go-Pog (mm)	65	66	71
U1-NA (°)	41	25	26
L1-NB (°)	31	25	26
Interincisal angle (°)	105	122	124
Nasolabial angle (°)	100	101	102
Lower Lip to E plane (mm)	4	1	-2
Basal Plane Angle (°)	38	37	29

Table 1: Comparison of cephalometric values

Class II elastics were placed to hold the corrections in place. The duration taken for this phase was approximately 1 month.

Postsurgical phase

Postsurgical orthodontics was continued after surgery toclose minor spaces distal to canines in both upper andlower arches. The main objective of this phase involved the Finishing and Settling stage where 0.016" SS wire was placed in both upper and lower arch with bracket repositioning and settling elastics. The goals of this phase involved the rehabilitation and restoration of the neuromuscular functionand to achieve superior function, stability, facial esthetics, and an ideal occlusion. Occlusal function andsettling were significantly improved through the use ofintermaxillary or settling elastics. The postsurgical phaselasted for 2 months. (Annex 1, Figure 3)

Figure 1: Pre-treatment records of a 23-year-old female patient with Angle's Class II molar relationship with vertical maxillary excess, mandibular deficiency along with a hyperdivergent growth pattern.

RETENTION PLAN

It involved the delivery of upper and lower lingual fixed retainer and Beggs' wrap-around retainer.

RESULTS

The appraisal of the treatment outcomes showeda well-aligned dentition where extraorally, she demonstrateda pleasant smile and well-balanced facial profileand competent lips. Cephalometricevaluation and superimposition confirmed an exemplary change in the profileand the case was finished in the Class II skeletalbase (SNA-77^0, SNB-75^0, and ANB-2^0).

The vertical maxillary impaction has attributed to a decrease in anteriorand posterior vertical maxillary heights thereby reducing the total VME which had existed in pre-treatment, this, inturn, reduced gummy smile which was seen during the pre-treatment phase and had been slightly exaggerated following presurgical orthodonticdecompensation. Proclination inthe maxillary and mandibular incisors were reduced (U1 to NA-26^0, L1to NB-26^0) on post-treatment.The intraoral photographsand study model revealed a well-settled occlusion withClass II molar and Class I canine relationship on both the sides.Ideal and appropriate overjet and the overbite was achieved posttreatment. (Annex 1, Figure 4)Post- debonding, the retention procedure comprised of upper and lower fixed lingual retainers and Begg'sremovable wraparound retainers in both upper and lower arch. The overall treatment durationlasted for 18 months, following which the patient was satisfied with the treatment results and improved facial esthetics, profile, and appearance.

CRITICAL APPRAISAL

There was a marked improvement in the facial profile. Paraesthesia persisted post-surgically. Black triangles needed correction and lastly, the molar settling was needed.

DISCUSSION

Treating VME orthodontically without an anterior openbite is a challenging problem andconsiderably difficult totreat than when treated collectively with an anterior open bite. Counter-clockwise rotation of the mandible is caused by molar intrusion which results in the correction of an anterior openbite automatically.Fish et al in 1979 suggested that, a more significant amount ofanterior teeth intrusion with a normal overbite to be considered for the treatment of VME than posterior teeth[5]. And an autorotation of mandible and upward and forward movement of pogonion is caused due to the superior reposition of the maxilla. Sperry et al[6]state that 5 mm of maxillary impactionbrought about 1.5 mm of forward and upward movementof pogonion. Due to the amount of underlying skeletaldiscrepancy influenced by the retrognathic mandible andan average lower facial height, it might further reduce the facial height and hence, mandibularadvancement was considered essential for optimalcorrection of the facial profile. To correct the chin deviation and the profileenhancement, horizontal sliding genioplasty was undertaken[7].

Considering the stability of the mandibular advancementtaking into the muscular remodeling of attachmentmuscle structures into the mandible, as suggested by Simmons etal. in 1992, the advancement of 7 mm was opted. Due to the reduction in the amount ofmaxillary anterior proclination after the presurgical orthodontic phase, it increased the amountof gingival exposure during the smile which worsened the patient facial profile. However, the motivating factor for the patient was that the facial

profile was significantly corrected, and esthetics was enhancedimmediately postsurgery[7,8]. The final treatment outcome washighly successful as the enhancement of facial estheticscombined with well-stable occlusion was established due to the combined orthodontic – surgical approach. Thelong-term follow-up of the patient resulted in exceptional stability.

Figure 2: At the end of presurgical orthodontic phase.

Figure 3: Presurgical VTO dolphin prediction.

Long face syndrome is an evident skeletal dysplasia which exhibits VME with increased anterior facial height and gummy smile. When the mandibular plane angle is steep due to the downward and backward rotation of mandible with associated mandibular deficiency, the facial esthetics becomes compromised and appears worse.The ideal treatment approach generally includes maxillary setback to correct maxillary prognathism with superior repositioning of the maxilla and counter-clockwise rotation of mandible which helps in positioning of mandibular advancement and further retrogenia is corrected by genioplasty, resulting in a significant decrease in facial height and considerable balance in the facial profile. In this treatment approach, the skeletal stability and esthetic changes are very promising[9,10].An apparent facial profile deficient is generally addressed through genioplasty which is a reliable adjunctive procedure in restoring facial harmony which includes lip competency, an increase in symphysial bone thickness, and chin fullness with better bone remodeling above the repositioned chin segment. And it has been indicated that facial architecture is generally considered beautiful only if the chin is tangential to 0 meridian[11]. Recent studies have reported that Le-fort I osteotomies cause thinning, flattening and shortening of the upper lip, the upturning of the nasal tip with alar base widening, and decreased vermilion show[12-14].

Handelman et al[15]reported that patients exhibiting severe skeletal discrepancies or narrow alveolar arches are generally difficult to correct and they establish limitations in orthodontic treatment and often require surgical intervention. The patient had thin alveolar arches both labially and lingually to the mandibular incisors with a high mandibular plane angle and also lingual to the maxillary incisors in high angle Class II cases. And patient had exhibited severe skeletal discrepancy along with a narrow maxillary arch. A narrow alveolus is seen in patients with high mandibular plane angle and the orthodontic correction was found to be difficult in this case especially in the mandibular anterior region and chances of iatrogenic damage were expected to be high.

Figure 3: Post-surgical records.

Wessberg et al[16]mentioned that the compensatory autorotation of the mandible after surgical superior repositioning of the maxilla mediated within CNS is operated due to the occlusal programming feedback mechanism. The orthodontist must decide for superior maxillary repositioning based on cephalometric prediction criteria, facial esthetics, the amount of autorotation required, and the effect of this rotation towards the desired ideal esthetic and occlusal results and is performed frequently. It is a useful method for treating patients with vertical maxillary excess (VME). The most important factor in planning treatment is the relationship of the upper lip line to the incisor which will achieve an attractive smile. Superior repositioning of the maxilla will generally lead to the autorotation of the mandible with the condyle as the center of rotation. In such cases, superior repositioning of the maxilla autorotatedthe mandible leads to an improved facial profile, without performing mandibular advancement (BSSO) or genioplasty. The retention and stability of the surgical procedure are essential when the patient is treated surgically.The maxilla is very stable during the

first year after superior repositioning with rigid fixation (IMF) to prevent any significant relapse clinically[17].

Figure 4: Post-treatment records.

In severe cases, orthodontic camouflage treatment implies fitting teeth on improper skeletal bases can lead to possible periodontal problems, such as a gingival recession in the lower anterior region, worsening of facial esthetics, root resorption, and occlusal instability[18-21]. In patients with severe A-P skeletal discrepancies, airway problems, transverse maxillary skeletal constriction, and improper facial esthetics, the surgical approach combined with orthodontic treatment is an effective treatment alternative to gain ideal results regarding facial esthetics, function, ideal occlusion and stability[19-28]. During the pre-surgical orthodontic treatment, the opposite of camouflage treatment is performed dentally where, decompensation by moving teeth to a proper functional position relative to the skeletal bases[18,19]. During this phase of treatment, generally, the goal is to eliminate the dental interferences for the ideal correction of existing skeletal discrepancies[29].

CONCLUSION

Combined surgical and orthodontic approaches for severe skeletal discrepancies which are complicated by soft tissue adaptations and the combined bi-jaw approach with adjunctive profile enhancement procedures resulted in betterharmony between the underlying soft tissues and skeletal framework. Furthermore, this multidisciplinary approach favoured in the successful management of a patient with VME, mandibular advancement (BSSO), and genioplasty to achieve superior function, stability, facial esthetics, an ideal occlusion and also provided good postoperative stability.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patient consent. The patienthas given his/her consent for his/her images and other clinical information to be reported in the journal. And the patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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