Case Report

A Pair for the Impaired - Orthodontic and Surgical Combination Treatment of Skeletal Class III Malocclusion: A Two Year Follow up Report

Anjuman Preet Kaur Dua[1], Ajit Jaiswal[2], Laxman Kumar[3], Sumir Gandhi[4], Ekta Singh Suneja[5], Sunaina Jodhka[6]

[1]MDS Orthodontics, Professor and Head, Department of Orthodontics, Baba Jaswant Singh Dental College, Ludhiana, Phone: +919814996677, E mail: dranjuman@gmail.com
[2]MDS Orthodontics, Professor, Department of Orthodontics, Shahid Kartar Singh Sarabha Dental College, Ludhiana, Phone: 09876445320, E mail: ajitdentist@yahoo.co.in
[3]MDS Oral and Maxillofacial Surgery, Consultant,Kingston Public Hospital, Kingston,Jamaica, E mail:bineylax@gmail.com
[4]MDS Oral and Maxillofacial Surgery, Professor and Head, Department of Oral Surgery, Christian Dental College, Ludhiana, Phone: 09814433393, sumirgandhi@gmail.com
[5]MDS Conservative Dentistry and Endodontics, Professor, Department of Conservative Dentistry, Baba Jaswant Singh Dental College, Ludhiana, Phone: 9815182368, ektasingh.suneja@gmail.com
[6]MDS Pedodontics, Reader, Department of Pediatric Dentistry, Baba Jaswant Singh Dental College, Ludhiana Phone: 9815182368, drsunaina79@yahoo.com.sg

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ABSTRACT

This case report represents a 19-year-old male who complained of reverse occlusion with problems in mastication and unpleasant facial aesthetics. The lateral view showed a concave profile with a prominent chin and malar deficiency. The patient was diagnosed as having a skeletal and dental Class III malocclusion with a negative overjet of – 6 mm. The cephalometric readings showed a prognathic mandible and a small maxilla with an ANB angle of -13 degrees. The treatment plan included a phase of presurgical orthodontics with extraction of one lower incisor, alignment of both the arches individually and decompensation of incisors followed by a double jaw surgery. The sagittal split ramus osteotomy and Leforte I osteotomy were performed after sixteen months of presurgical orthodontics. Postoperative orthodontic treatment period was eight months. Total active treatment period was two years and at the end of which good interdigitation leading to better masticatory ability. The esthetics improved remarkably leading to a greater self confidence.

Keywords: Orthognathic surgery, Class III malocclusion, lower incisor extraction, bi jaw surgery

INTRODUCTION

Not all patients reporting to an orthodontist can be treated by means of conventional orthodontics. A synchrony of orthodontics and orthognathic sugery is required to achieve appreciable aesthetic results. The cases that fall under this realm of combination treatment are severe skeletal Class III, Class II and skeletal vertical discrepancies. It has been reported that nearly 4% of the population has a dentofacial deformity that requires surgical – orthodontic treatment to correct.[1] From the standpoint of demographics; this percentage may vary amongst population groups and ethnicities. Class III patients contribute to a large percentage of those looking for a surgical treatment. Proffit et al reported that 20 % of patients at a surgical – orthodontic clinic had mandibular excess, with 17 % having maxillary deficiencies and 10 % having both.[2] A subsequent article from the same centre reported that patients with Class III were more likely to seek clinical evaluation than Class II patients.[3]

As a general rule, Class III malocclusions are less likely to benefit from camouflage as retracting the lower incisors may make the chin look even more prominent.[1] Hence, in an adult, if the maxillo-

mandibular discrepancy is too large to compensate by camouflage or tooth movement alone; surgery seems to be the best approach to attain positive results.

Factors which are generally thought to influence the prognosis of a skeletal malocclusion and thereby the decision of undergoing a surgical treatment include the degree of A-P and vertical skeletal discrepancy, the inclination of the upper and lower incisors, the extent of overbite. Apart from these; the potential for remaining growth and the age of the patient are the key factors. Perception by the patient of their condition, quality of life and the functional disability caused by the malocclusion also play a decisive role.

Although most individuals who are evaluated for orthognathic surgery desire an improvement in function as well as esthetics, several studies have shown that 75% - 80% seek esthetic improvement. In a study by Nicodemo D et al, the quality of life of patients with Angle's class III malocclusion was evaluated and it was observed that orthognathic surgery had a positive impact on the quality of life of both male and female patients, improving physical and social aspects, and on that of female patients, improving emotional aspects. [4]

CASE REPORT

The patient was a very well built, tall 19 year old Punjabi boy who complained of immense discontent with his facial appearance. He perceived that is chin and the lower jaw were too prominent on his face. He also complained of some irregularities in the lower front teeth. His medical and dental histories were non-contributory; however the family history revealed a similar problem with a younger sister and a cousin.

DIAGNOSIS

The patient presented with a concave profile, with a slight deviation of the chin to the right and a deviated nasal bridge. The mandibular prognathism was evident by the significantly prominent lower jaw, lower lip and chin. Some mid face deficiency was also displayed by the sunken in appearance of the infraorbital area and the upper lip along with a thin vermilion border and reduced upper lip length. The intra oral examination revealed that despite the dental compensations which presented as severe crowding and retroclination of lower incisors (washboard effect), the patient had an anterior crossbite of nearly 6 mm. Posterior cross bite was observed in the right premolar region. The first molars and canines were in a Class III relation bilaterally. Upper arch was fairly well aligned and the lower arch had a crowding of nearly 6 mm in the anterior region. (Figure 1)

Cast analysis also revealed a discrepancy in the anterior Bolton ratio showing a lower anterior excess.

The panoramic radiograph revealed that all teeth were present except right upper third molar.

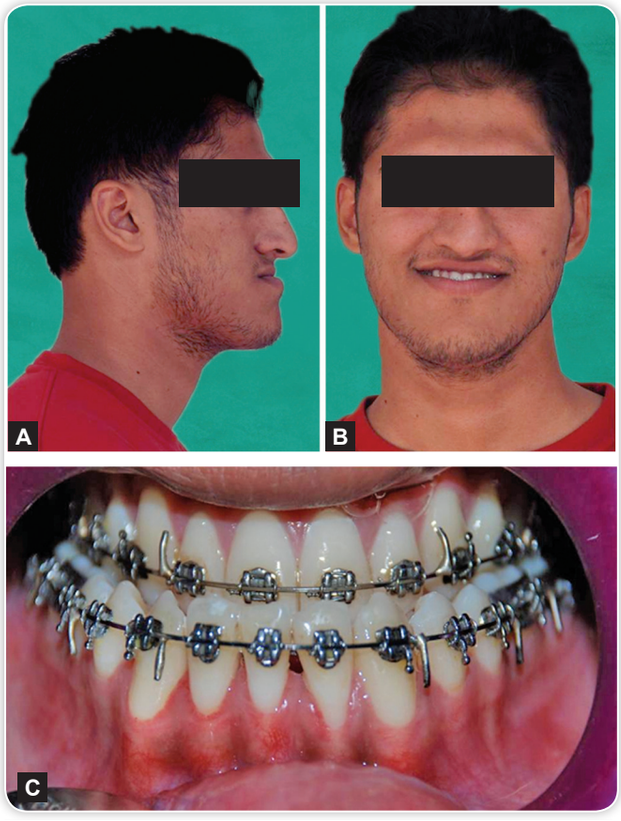
The cephalometric radiograph (Figure 2) and tracing revealed wits of – 20 mm, an ANB angle of -13^0 with SNA and SNB values of 76^0 and 89^0 degree respectively. The absolute maxillary and mandibular lengths were measured as 49.5 mm and 95 mm respectively indicating a large prognathic mandible and a small retrognathic maxilla. These findings were re-established by the measurements suggested by the Burstone analysis for orthognathic surgery.[5]

The FMA angle was 22^0; the jarabak ratio was 70 % suggesting a slight horizontal growth pattern.

The dental analysis depicted that upper incisors were somewhat proclined at angle of 36^0 and 9mm to the NA

Figures 1A to C Pre treatment Photographs

Figure 2 Pre treatment Cephalogram



Figures 3A to C Pre Surgical Photographs

line and severely retroclined lower incisors at an angle of 6^0 and 0 mm to the NB line and an IMPA value of 69^0.

Arnett's soft tissue analysis[6] revealed a significantly reduced upper lip length, less prominent upper lip and highly prominent lower lip and chin.

TREATMENT OBJECTIVES

- To achieve a normal orthognathic profile and soft tissue harmony
- Coordination of upper and lower arches
- To correct the Class III molar and canine relation
- To achieve normal overjet, overbite, incisal guidance and canine relation
- To relieve the lower incisor crowding

TREATMENT ALTERNATIVES

Considering the amount of discrepancy and the age of the patient, camouflage was ruled out as a treatment option.

With the aim of preparing the dentition for orthognathic surgery, two different plans were considered for presurgical preparation.

Extraction of upper first premolars to decompensate the upper incisors and lower second premolars to correct the molar relation and lower anterior crowding within a time period of nearly one and a half to two years.

Extraction of a single lower incisor to aid in relieving the lower incisor crowding and correction of the bolton discrepancy within a time period of nearly one year.

The skeletal Class III malocclusion with a pre surgical negative overjet of – 12 mm was contributed by both small retrognathic maxilla and a large prognathic mandible hence suggesting a bi jaw surgery.

THE TREATMENT PLAN

Both the extraction alternatives were explained to the patient but the patient opted for the extraction of lower incisor and a shorter presurgical period as he had to leave the country for further studies as soon as possible.

The final treatment plan was thus to extract 31 and prepare the case for a Le fort1 maxillary advancement and a mandibular setback by means of a bilateral sagittal split osteotomy.

TREATMENT PROGRESS

Presurgical Orthodontics

All first and second molars were banded and 5-5 bonding was done with a 0.018" slot roth appliance system. The mandibular third molars were extracted at the beginning of the treatment. Initial alignment and

levelling was carried out on round and rectangular NiTi wires. The patient was then shifted to 0.016" x 0.022" stainless steel wire followed by a 0.0175" x 0.025" TMA and then 0.0175" x 0.025" stainless steel wire. The upper and lower arches now seemed to be in a good alignment individually with a reverse overjet of – 12 mm (Figure 3). At this stage the models, OPG and cephalogram (Figure 4) were taken to analyse the case for the surgery. The cephalometric analysis showed that the lower incisors were now lying at nearly normal value of 87^0 to the mandibular plane and the upper incisors were at their pre-treatment value.

A total of 14 mm of movement was planned with maxillary advancement being 6mm and mandibular setback of 8mm. The facebow transfer and centric record was obtained and the articulation was done with the split cast technique on a semi adjustable articulator.

Figure 4 Pre Surgical Cephalogram

The split cast technique made the mock surgery quite simple. Two splints were prepared, the initial one for the maxillary advancement and the final splint after the mandibular setback. The splints were then checked in the mouth individually in each arch. A 0.017 x 0.025 stainless steel wire with soldered hooks was ligated in both upper and lower arches as the stabilizing wire.

SURGERY

The surgery was performed after 16 months of presurgical orthodontics.

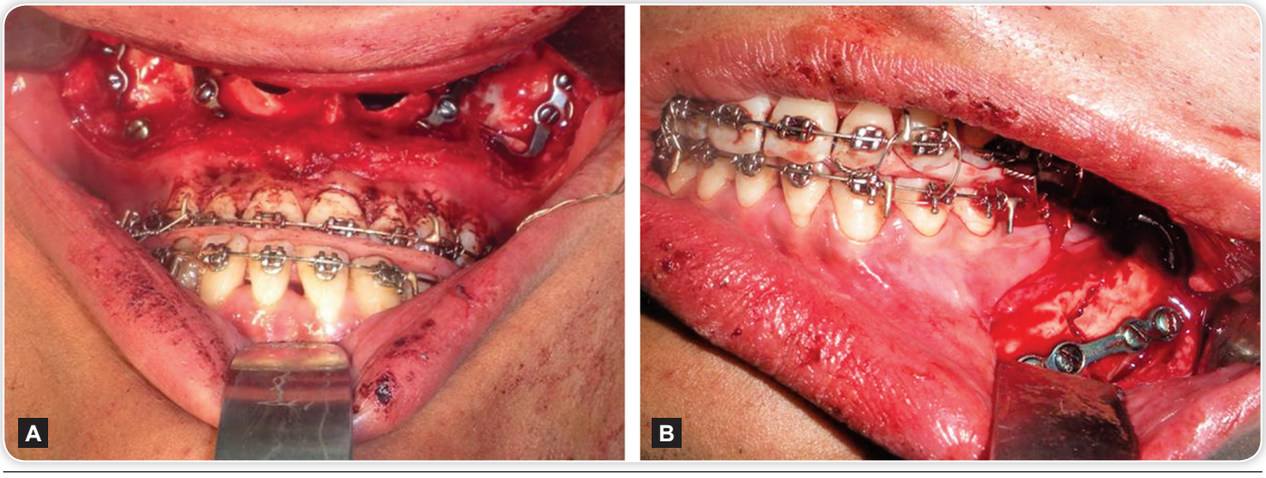
A 6 mm of Lefort 1 maxillary advancement was carried out and the maxilla stabilized by means of titanium miniplates using the intermediate splint as a guide (Figure 5). This was followed by mandibular setback (BSSO) of 8mm which was secured with the final splint and stabilised using titanium mini plates.

POST SURGICAL ORTHODONTICS

Postsurgicaly, the splint and the stabilizing wires were left for 6 weeks and heavy Class III elastics were initiated. After 6 weeks, the wires were changed to 0.016" stainless steel to settle the final occlusion. Lower incisor brackets were repositioned to improve the root angulations. Once the final settling was achieved, the case was debonded 8 months after the surgery.

TREATMENT RESULTS

The face showed a marked improvement with a change from a concave profile to a straight profile. Dentally, Class I molar relation was achieved bilaterally with a



Figures 5A and B Splint placement during the Surgery

Figures 6A to C Post treatment Photographs

good intercuspation posteriorly. A Class I canine was achieved bilaterally with an overjet and overbite of nearly 2mm (Figure 6). Post treatment OPG shows that the teeth are in good angulation.

Post treatment cephalogram (Figure 7) showed some significant changes which were quantified by means of a composite cephalometric analysis, Burstone analysis for Orthognathic surgery and Arnett's Soft Tissue Cephalometric Analysis (Table 1, 2, 3). The wits appraisal improved from – 20 mm to – 1.5mm, the ANB

Figure 7 Post treatment Cephalogram

Table 1 Composite cephalometric analysis

Skeletal	*Pretreatment*	*Presurgical*	*Postsurgical*	*Normal*
SNA	76	76	81.5	82^0
SNB	89	88.5	83	80^0
ANB	-13	-12.5	-1.5 deg	2^0
Wits	-20	-18	-1.5mm	0 mm
Max length	49.5 mm	49.5	55	54 mm
Mand length	95 mm	95.5	88	84 mm
FMA	23	22	21	24^0
SN-MP	30	29	28	32^0
Dental				
Upper Inc to PP	65	62	62	71^0
Upper Inc to NA	36^0,9mm	37^0, 8 mm	37^0, 8 mm	22^0, 4 mm
Lower Inc to MP	69^0	88^0	88^0	90^0
Lower Inc to NB	6^0, 0 mm	20^0, 4mm	20^0, 4mm	24^0, 6 mm
Soft tissue				
Upper lip prom.	0.5 mm	0 mm	2 mm	1-2 mm
Lower lip prom.	12 mm	13 mm	3 mm	- 1 mm
Chin prom.	20 mm	19 mm	2.5 mm	-1 to - 4 mm
Nasolab angle	92^0	91^0	91^0	98^0 - 106^0

Table 2 Cephalometric analysis for orthognathic surgery (cogs)[6]

	Pretreatment	*Presurgical*	*Postsurgical*	*Normal*
Cranial Base				
Ar – PTM	30 mm	30 mm	30 mm	37.1 ± 2.8 mm
PTM – N	55 mm	55 mm	55 mm	52.8 ± 4.1 mm
Horizontal (skeletal)				
N – A – Pg angle	-30 deg	-30 deg	-10 deg	3.9 ± 6.4 deg
N – A (HP)	-6 mm	- 5.5 mm	- 1 mm	0 ± 3.7 mm
N – Pg (HP)	19.5 mm	20 mm	10 mm	- 4.3 ± 8.5 mm
N – B (HP)	13 mm	12.5 mm	2 mm	- 5.3 ± 6.7 mm
Vertical (skeletal)				
N – ANS (_HP)	56 mm	54 mm	56 mm	54.7 ± 3.2 mm
N – PNS (_HP)	59.5 mm	59 mm	60 mm	53.9 ± 1.7 mm
ANS – Gn (_HP)	76 mm	75 mm	75 mm	68.6 ± 3.8 mm
MP – HP angle	20 deg	20 deg	20 deg	23.0 ± 5.9 deg
Vertical (dental)				
Upper inc – NF	30 mm	29.5 mm	30.5 mm	30.5 ± 2.1 mm
Lower inc – MP	46.5mm	47 mm	46 mm	45.0 ± 2.1 mm
Upp Molar –NF	24 mm	25 mm	25 mm	26.2 ± 2.0 mm
Low Molar – MP	37 mm	37 mm	38 mm	35.8 ± 2.6 mm
Maxilla , Mandible				
PNS – ANS	55 mm	55.5 mm	60.5 mm	57.7 ± 2.5 mm
Ar – Go	58.5mm	59 mm	59 mm	52.0 ± 4.2 mm
Go – Pg	94 mm	94 mm	86.5 mm	83.7 ± 4.6 mm
B – Pg	13 mm	14 mm	14 mm	8.9 ± 1.7 mm
Ar – Go – Gn angle	122 deg	122 deg	119 deg	119.1 ± 6.5 deg
Dental				
OP upp – HP angle	4 deg	3 deg	3 deg	6.2 ± 5.1 deg
A-B (OP)	-20 mm	-19 mm	- 2 mm	-1.1 ± 2.0 mm
Upper inc – NF angle	116 deg	119.5 deg	120 deg	111.0 ± 4.7 deg
lower inc – MP angle	69 deg	88 deg	88 deg	95.9 ± 5.2 deg

angle changed from -13^0 to -1.5^0 with SNA and SNB values of 81.5^0 and 83^0 degree respectively. The absolute maxillary and mandibular lengths changed to 55 mm and 88 mm respectively. Superimposition (Figure 8) also showed a noteworthy improvement in the profile. As planned, there was no significant change in the face height during the course of treatment. The patient also observed a significant improvement in his speech and functional ability postsurgically.

Retention follow up of the patient shows good health and stable results both in terms of esthetics and the occlusal changes. Figure 9 shows the photographs taken two years post surgically.

DISCUSSION

Orthognathic surgical procedures lead to changes in appearance and function of dentofacial structures,

Table 3 Arnett soft tissue cephalometric analysis [7]

Dentoalv factors	*Pretreatment*	*Presurgical*	*Postsurgical*	*Normal*
Mx Occ Plane to TVL	93	92	92.5	95.0 ± 1.4
Mx 1 to Mx Occ Plane	54	55	53	57.8 ± 3.0
Md 1 to Md Occ Plane	89	67	73	64.0 ± 4.0
Overjet	-9	-12	2.5	3.2 ± 0.6
Overbite	5	4	2	3.2 ± 0.7
Soft Tissue Structure				
Upper lip thickness	13	14	13	14.8 ± 1.4
Lower lip thickness	17.5	19	14	15.1 ± 1.2
Pog – Pog'	10	9	11	13.5 ± 2.3
Me – Me'	6.5	6	6	8.8 ± 1.3
Nasolabial angle	91.5	90	95	106.4 ± 7.7
Upper lip angle	-1	-1	10	8.3 ± 5.4
Facial Length				
Nasion' – Menton'	140	140	140	137.7 ± 6.5
Upper lip length	16	16	19.5	24.4 ± 2.5
Interlabial gap	0	0	1	2.4 ± 1.1
Lower lip length	59	58	57	54.3 ± 2.4
Lower 1/3 of face	76	76	77	81.1 ± 4.7
Overbite	5	4	2	3.2 ± 0.7
Mx 1 exposure	6	6.5	3	3.9 ± 1.2
Maxillary Height	23	23	22.5	28.4 ± 3.2
Mandibular Height	57	57	57	56.0 ± 3.0
Projection to TVL				
Glabella	-7	-8	-7	-8.0 ± 2.5
Nasal Projection	17	16	19	17.4 ± 1.7
Subnasale	-1	-1	0	0
Upper lip anterior	0.5	0	3	3.3 ± 1.7
Mx 1	-14	-13	-10	-12.1 ± 1.8
Md 1	-6	-2	-13	-15.4 ± 1.9
Lower lip anterior	11	11	4	1.0 ± 2.2
B' point	8	9	-3	-7.1 ± 1.6
Pog'	14	15	4	-3.5 ± 1.8
A' point	-3.5	-4	-2.5	-3 ± 1.0

respiration, swallowing, speech and mastication. The alterations are brought about in a single moment during the operation.

Several studies have examined the factors that influence the choice between conventional orthodontic treatment and surgical treatment. Kerr et al reported that surgery should be performed for patients with an ANB angle of less than -4°, a maxillary/mandibular (M/M) ratio of 0.84, an inclination of the lower incisors to the mandibular of 83°, and a Holdaway angle of 3.5°.[7] Wits appraisal, length of the anterior cranial base, M/M ratio, and lower gonial angle have also been recommended as important variables to determine the treatment option in a recent study.[8] Keeping in mind all these measurements, the amount of reverse overjet, other cephalometric parameters, the limits of the

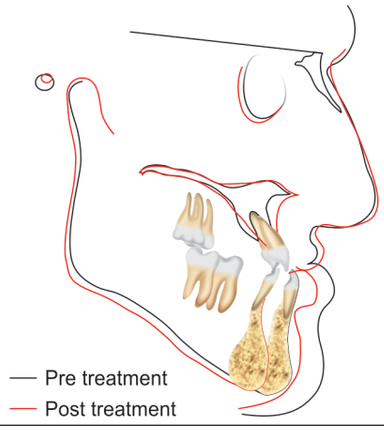


Figure 8 Superimposition

Figures 9A to C Two years post treatment photographs

envelope of discrepancy[9] and the soft tissue limitations; the case definitely seemed to be beyond the limits of camouflage and the surgical option seemed to be the best choice for this patient.

A lower incisor was extracted as a part of presurgical plan as the amount of crowding in the lower anterior segment was significant and also to eliminate the existing anterior Bolton discrepancy which indicated an anterior mandibular excess.

A cephalometric study by Johnston et al concluded that bimaxillary surgery was the most frequently used procedure and was associated with an increased likelihood of an ideal correction of the anteroposterior skeletal discrepancy.[10] There has been a rise in the use of bi jaw surgeries because it is documented to produce more stable results than single jaw surgery.[1, 11] Thus; with a 14 mm of room for the surgeon to operate; a bi jaw surgery seemed to be the most logical option.

Comparison among the pre treatment and the post treatment records put forward some significant findings. There has definitely been a significant amount of improvement in this patient which is evident both clinically and cephalometrically. The maxillary length increased by 5.5 mm, the mandibular length decreased by 7mm. the pre-treatment SNA of 76^0 was improved to 81.5^0 and SNB decreased from 89^0 to 83^0.

The comparison between the pre-treatment and post- treatment COGS values shows a significant improvement in the maxillary and mandibular values. The A point moved from a -6mm to -1 mm and the B point shifted from a 13 mm to a post-treatment value of 2 mm in relation to the reference plane. Arnett's soft tissue measurements also show a significant improvement in the upper and the lower lip position as well as chin position.

This improvement in esthetics of a severe Class III patient is possible only when orthodontics and surgery are paired together. The esthetic enhancement translates into an improvement in the self confidence and outlook of the patient.[12]

Esthetic improvement was the driving force behind seeking treatment as observed by Zhou et al when they carried out a study to find the impact of skeletal Class III malocclusion on patients' emotional status.[13] The large number of Class III patients undergoing orthognathic surgery suffered psychologic and functional problems related to their looks prior to treatment.

We also observed a marked boost in the patient's self-worth and attitude. He came out as a much more confident person who was now ready to face his peers and the world with a positive outlook.

Address for Correspondence
Anjuman Preet Kaur Dua
78-C, BRS Nagar, Near DAV Public School
Ludhiana, Punjab
Pin Code: 141012

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