ORTHO-SURGICAL MANAGEMENT OF SKELETAL CLASS III MALOCCLUSION WITH SEVERE TOOTH SIZE ARCH LENGTH DISCREPANCY

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ABSTRACT

Skeletal Class III malocclusion may occur due to maxillary retrognathism, mandibular prognathism or a combination of both and is often associated with skeletal and dental dysplasia in all planes of space. Orthognathic surgery involving maxillary advancement, mandibular setback or a bijaw surgery is usually indicated in adult patients with no residual skeletal growth depending on the severity of skeletal dysplasia. A careful diagnosis, treatment planning and multidisciplinary approach are the cornerstones in successful management of such cases. The effects of ortho-surgical treatment on pharyngeal airway and possibility of subsequent breathing disorders like Obstructive Sleep Apnea should be assessed pre-surgically and due consideration should be given in treatment planning. This case report describes successful interdisciplinary management of a case of skeletal Class III malocclusion with Bijaw orthognathic surgery involving maxillary advancement and mandibular setback. The effect of treatment on pharyngeal airway was assessed using Acoustic Pharyngometry.

Key words: Ortho-surgical management of skeletal Class III, Bijaw orthognathic surgery, Acoustic Pharyngometry

INTRODUCTION

The desire to enhance facial aesthetics is one of the most common factors which bring a patient to an orthodontist. The compromised facial aesthetics may be a result of dental factors, skeletal disharmony or a combination. It is not always possible to restore facial aesthetics, function and harmony of hard and soft tissues by orthodontics alone and orthognathic surgery is a viable option in such cases [1]. Orthognathic surgery is usually indicated in adult patients with no residual skeletal growth or where the magnitude of skeletal dysplasia is too severe to be corrected by orthodontics alone or in combination with surgical camouflage [2]. Skeletal Class III malocclusion may result from a combination of maxillary retrognathism, mandibular prognathism or a combination along with an array of skeletal and dental dysplasia in all planes of space [3, 4]. Careful diagnosis, treatment planning and multidisciplinary approach are the cornerstones in successful management of such cases. Post-surgical relapse may occur due to forward pull of the pterygomasseteric sling in cases with large mandibular setback [5]. The effect of orthognathic surgery on pharyngeal airway narrowing and possibility of subsequent breathing disorders should be assessed pre-surgically and due consideration should be given in treatment planning [6]. A bijaw surgery is often indicated in cases with a large negative overjet after taking the above mentioned factors into consideration. This case report describes successful interdisciplinary management of a case of severe skeletal Class III with Bijaw orthognathic surgery involving maxillary advancement and mandibular setback.

DIAGNOSIS AND ETIOLOGY

A 20 years old male reported to the Department of Orthodontics and Dentofacial Orthopaedics with chief complains of a large lower jaw and crowded teeth. Patient was internally motivated with extreme desire to improve his facial aesthetics. No significant medical or dental history was elicited by the patient. Pretreatment photographs revealed a concave facial profile, acute nasolabial angle, non-consonant smile arc, incompetent

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Fig 1: Pre treatment facial and intraoral photographs

lips, everted lower lip and mandibular protrusion along with maxillary retrusion and reduced malar prominence. Incisal show at rest was 3mm. Maxillary midline was deviated towards right by 2mm in relation to the facial midline. Intraorally, he had Class III molar and canine relationship bilaterally along with crowding of 8mm in maxilla and 10 mm in mandible. Overjet and overbite were -2mm and 2mm respectively [Fig 1].

Pretreatment Orthopantomogram (OPG) [Fig 2] showed that patient was in a permanent dentition stage with no missing or supernumerary teeth. Third molars were present in both jaws and were impacted in maxilla.

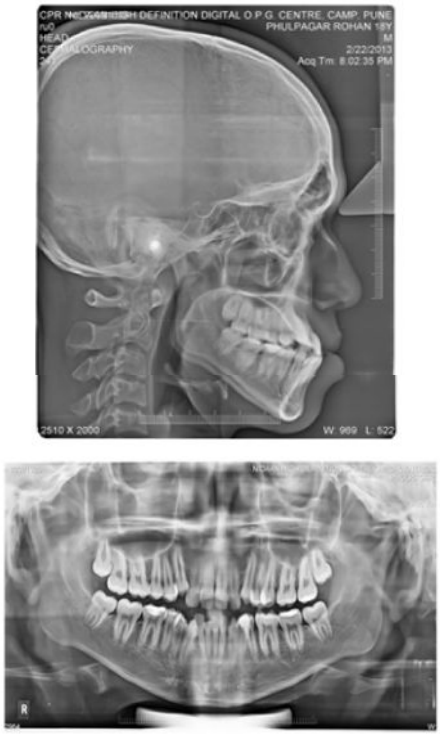

Fig 2: Pre treatment lateral cephalogram and panoramic radiographs

Lateral cephalometric assessment [Fig 2, Table 1] revealed a retrognathic maxilla and prognathic mandible (SNA = 82Ú, SNB = 87Ú and ANB = -5Ú, A-Na vertical = -3.5mm). Upper incisors were proclined [UI-NA = 47 Ú (11)] and lower incisors were mildly retroclined [LI-NB = 23Ú (5)]. Mandibular plane angle was increased (FMA = 30Ú). Maxillary antero-posterior hypoplasia and mandibular elongation was evident from Co-A and Co-Gn values (84mm and 121mm respectively). The lower lip was protrusive and upper lip was retrusive in relation to the esthetic E-line. The nasolabial angle was reduced to 85Ú.

Table 1: Lateral cephalometric measurements

Measurement	Pre treatment	Pre surgical	Post treatment
SNA	82°	82°	84°
SNB	87°	87°	82°
ANB	-5°	-5°	2°
UI-NA	47°(11)	29°(5)	29°(5)
LI-NB	23°(5)	25°(6)	24°(6)
GoGn –SN	34°	33°	35°
FMA	30°	30°	31°
IMPA	93°	88°	89°
Co-A	84mm	84mm	88mm
Co-Gn	121mm	121mm	117mm
LAFH	69mm	69mm	71mm
Pog-Na vertical	0mm	0mm	-2mm
A-Na vertical	-3.5mm	-3.5mm	0mm
ANS-PNS: GoPog	1:1.1.6	1:1.16	1:1.16
Nasolabial angle	85°	90°	88°

Assessment of airway on lateral cephalogram revealed upper airway dimensions were within normal limits [Superior Airway Space (SAS) – 12mm, Pharyngeal Airway Space (PAS) - 11mm, Minimum Airway Space (MAS) - 14mm]. Acoustic Pharyngometry (AP) evaluation was done to assess narrowing/obstruction of pharyngeal airway and

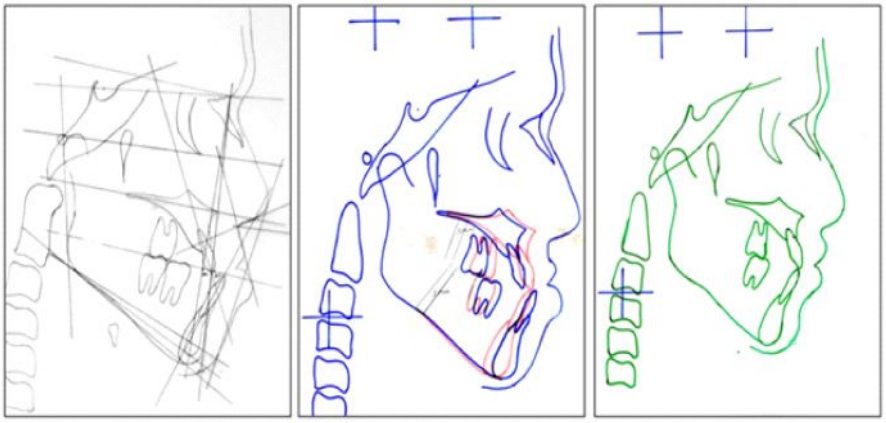

Fig 4: Pre treatment Prediction tracing indicating maxillary advancement of 5mm and mandibular setback of 5mm

also to establish a baseline data to compare with post-treatment results. The mean airway volume (40.58 cc), mean cross-sectional area (4.06cm^2) and minimum cross-sectional area (2.76cm^2) were within normal range. Any further reduction in these parameters was not desired as it could predispose the patient to development of Obstructive Sleep Apnea (OSA) in future [Fig 3].

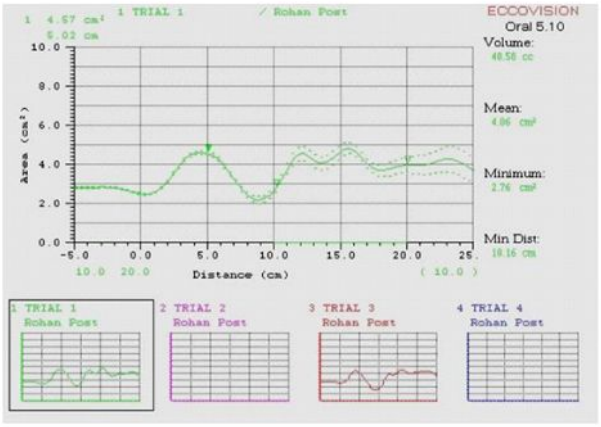

Fig 3: Pre treatment Acoustic Pharyngometry

Pretreatment Prediction tracing [Fig 4] was done which predicted an overjet of 7 mm post dentoalveolar decompensation and requirement of maxillary advancement of 5mm and mandibular setback of 5mm to establish optimal treatment results.

TREATMENT OBJECTIVES

Based on the above findings, the patient was diagnosed as a case of skeletally and dentally Class III malocclusion along with dentoalveolar compensations and severe crowding in both maxilla and mandible. The treatment objectives were: 1. Improvement in facial profile; 2. Improvement in smile aesthetics; 3. Dentoalveolar decompensation; 4. Achievement of Class I molar and canine relationship bilaterally; 5. Optimization of overjet and overbite; 6. Correction of underlying skeletal discrepancy; 7. Finishing and detailing of occlusion; 8. Retention.

TREATMENT ALTERNATIVES AND PLANNING

Based on the clinical, radiological and prediction tracing findings, the following treatment alternatives were considered and discussed with the patient: (1) Single jaw surgery involving mandibular setback of 10mm with Bilateral Sagittal Split Osteotomy (BSSO); (2) Bijaw surgery involving maxillary advancement (5mm) by high level Lefort I osteotomy and mandibular setback (5mm) with BSSO. Both approaches would require fixed orthodontic mechanotherapy with 0.022 MBT pre-adjusted edgewise appliance (PEA) and therapeutic extraction of all first premolars and third molars. The advantage of option 1 was avoiding maxillary surgery. However, its disadvantage included high chances of relapse due to a large mandibular setback owing to excessive stretching of the pterygomandibular sling, marked decrease in upper airway with potential to develop OSA post treatment and no improvement in maxillary soft and hard tissue aesthetics. The disadvantage of option 2 included the need for surgery in both jaws. However, the advantages included improvement in facial aesthetics due to optimal movement of both jaws bones, minimal impact on airway and lesser chances of relapse owing to lesser degree of mandibular setback. Both options were discussed with the patient and the surgical team and option 2 was agreed upon unanimously.

TREATMENT PROGRESS

Pre-surgical orthodontics

After therapeutic extraction of all the first premolars and third molars, the case was bonded with 0.22 MBT PEA. Leveling and alignment of teeth was carried out to achieve dentoalveolar decompensation and 0.019X0.025 Stainless Steel wire was placed in both arches [Fig 5]. Facebow transfer [Fig 6] was done with a slide metric facebow and orientation of maxilla in relation to the cranial base was recorded and transferred to a semi adjustable articulator using a mounting Jig. Mandibular cast was articulated with the maxillary cast using an occlusal wax bite record. Mock surgery was performed on the articulated models and two stage surgical splints were fabricated (stage 1 splint for maxillary advancement and stage 2 splint for mandibular setback [Fig 7].

Fig 5: Pre surgical facial and intraoral photographs

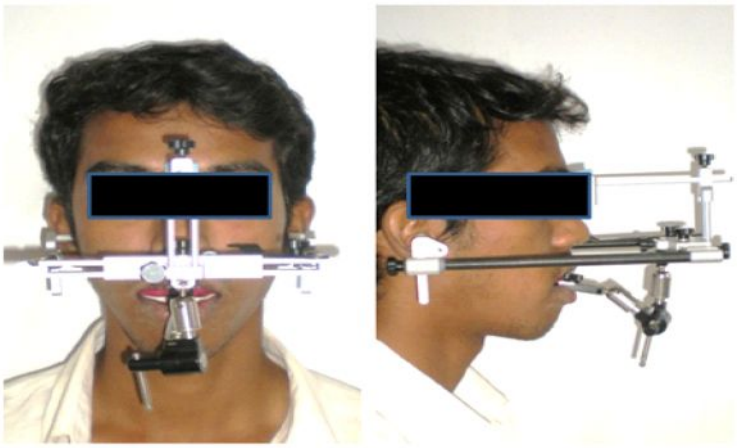

Fig 6: Face bow transfer

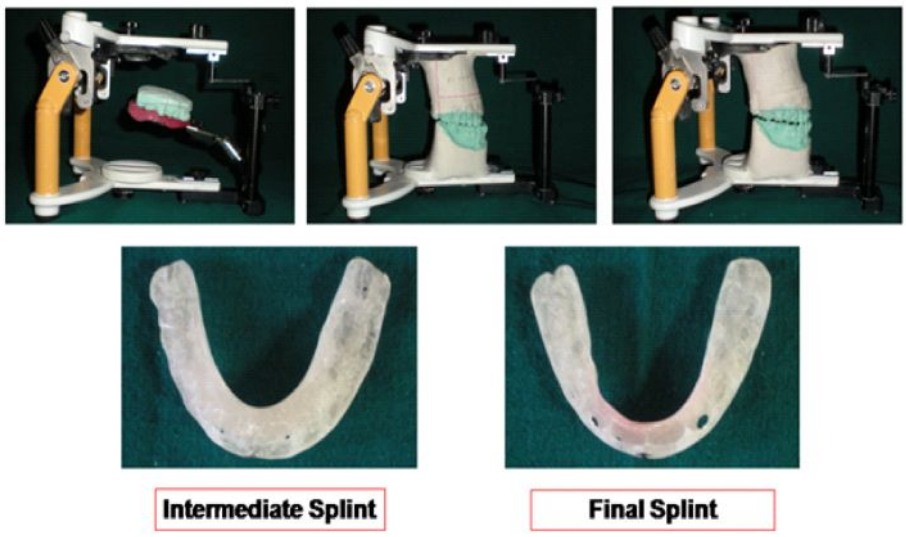

Fig 7: Transfer of facebow records to a semi adjustable articulator, mock surgery and splint fabrication

Fig 8: Le Fort I osteotomy and maxillary advancement by 5mm followed by bilateral Sagittal split osteotomy and mandibular setback 5mm. Cinching was done to prevent flaring of Alar base post maxillary advancement

Fig 9: Post treatment facial and intraoral photographs

SURGICAL PHASE

The patient was taken up for surgery under general anesthesia and a high level Le Fort I osteotomy was done in maxilla. A maxillary advancement of 5mm was carried out as guided by the stage 1 splint and rigid fixation was carried out using Titanium plates and screws. Cinching of the Alar base was done to prevent its flaring due to maxillary advancement. After the maxillary fixation, bilateral intraoral vestibular incisions were given and osteotomy was carried out distal to mandibular second molars bilaterally. The mandible was then repositioned in relation to maxilla as guided by the stage 2 splint and rigid fixation was carried out using Titanium plates and screws [Fig 8].

POST SURGICAL ORTHODONTICS

The patient was reviewed 2 days post-surgically and the stage 2 surgical splint was luted to the upper jaw using glass ionomer cement. Class III elastics were given for 2 weeks. After 2 weeks, the elastics were discontinued, the splint was removed and the patient was put on settling elastics. The settling elastics were removed after 1 week and the case was debonded. Fixed spiral retainer in the lower arch and a removable Hawley retainer in the upper arch were given for retention.

TREATMENT RESULTS

Post treatment photographs show a marked improvement in the facial profile, smile aesthetics and confidence of the patient. An ideal occlusion with an optimum overjet and overbite was achieved [Fig 9]. Post treatment Lateral Cephalogram [Fig 10, Table 1] shows correction of underlyin), LI-NA = 24Ú(6), IMPA = 89Ú], Pog-Na vertical (-2mm) and A-Na vertical values (0mm). Soft-tissue analysis revealed that both upper and lower lips were on the esthetic E line. The nasolabial angle was optimized (88Ú) and competency of the lips was achieved.

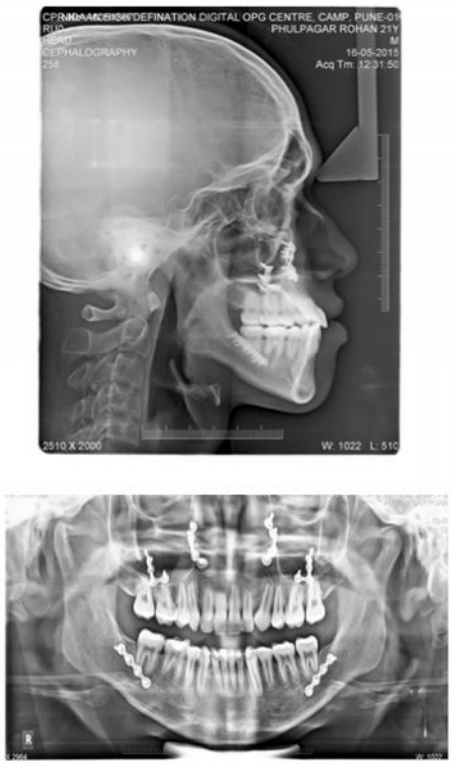

Fig 10: Post treatment lateral cephalogram and panoramic radiographs

Post treatment assessment of airway on lateral cephalogram revealed minimal reduction in upper airway dimensions [Superior Airway Space (SAS) – 11mm, Pharyngeal Airway Space (PAS) – 10mm, Minimum Airway Space (MAS) - 12mm]. Post treatment AP [Fig 11] taken 6 months post surgery commensurate with cephalometric findings and showed minimal reduction in mean pharyngeal volume and mean pharyngeal area to 92% of pretreatment indicating minimal effect of bijaw surgery on pharyngeal airway dimensions. The patient is under follow up and the results 2 years post treatment are extremely stable.

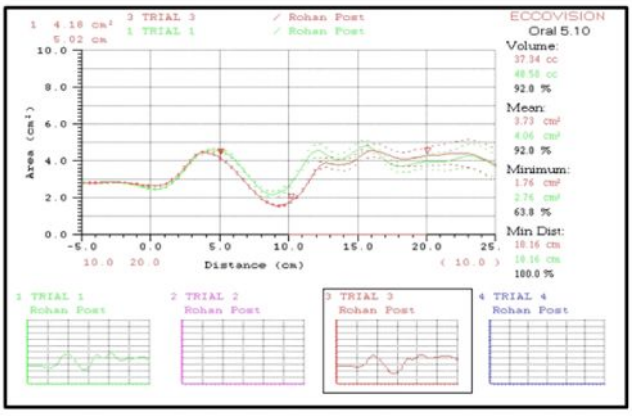

Fig 11: Post treatment Acoustic Pharyngometry

DISCUSSION

Class III malocclusion has been defined as one of the most difficult malocclusion to diagnose and treat. It may result from maxillary retrognathism, mandibular prognathism or a combination and is often associated with dysplasia in transverse and vertical dimensions also [3, 7]. Varying degree of dentoalveolar decompensation often seen with this condition makes an accurate diagnosis and treatment planning difficult. Hence, a holistic multidisciplinary approach is required in accurate diagnosis and treatment planning of such cases [8]. Standard surgical treatment modalities for management of skeletal Class III malocclusion includes maxillary advancement, mandibular setback or a combination along with other surgical options like Surgically Assisted Rapid Maxillary Expansion (SARME) wherever required. Surgery is usually deferred till attainment of skeletal maturity (13 years in females and 20 years in males) as the residual mandibular growth may lead to relapse [9]. A bijaw surgery is usually indicated when the antero-posterior skeletal discrepancy (negative overjet) is more than 3-4mm as excessive mandibular setback may result in stretching of the pterygomandibular sling and subsequent relapse [10]. Various studies have shown that Bijaw surgeries may be performed wherever feasible (rather than only mandibular setback) in skeletal Class III cases to prevent narrowing of upper airway which might predispose the patient to OSA [10-12]. Our patient was a 20 years old male with a combination of maxillary retrognathism and mandibular prognathism and pre-surgical overjet was 7mm. Hence, bijaw surgery was planned taking into consideration the above mentioned factors and the fact that correction of mid face deficiency and overlying soft tissues is possible only with a bijaw surgery. Bijaw surgery provides better skeletal and muscular stability in such cases without detrimental effect on airway [11-13].

AP is a noninvasive modality for assessment of pharyngeal airway dimensions and compliance in individuals with or without OSA and also to establish the candidacy of patients for treatment like an oral appliance therapy for OSA or orthognathic surgery [14, 15]. AP provides an objective assessment of nasal and pharyngeal airway by acoustic Rhinometry and Pharyngometry respectively. Its accuracy and repeatability have been comparable to Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) and can detect airway obstruction in severely constricted nasal and oral airways also [16]. In the present case, pre-treatment lateral cephalogram and AP evaluation indicated that pharyngeal airway dimensions were within normal limits and any further decrease in airway post treatment was undesirable due to risk of OSA. This also indicated Bijaw rather that only mandibular setback as the preferred treatment modality for the patient.

CONCLUSION

The present case report shows successful management of a case of skeletal Class III malocclusion with a large negative overjet and severe dentoalveolar decompensation with

combined orthodontics and bijaw orthognathic surgery. A multidisciplinary team approach in required in holistic diagnosis and management of such cases. Effect of the surgical procedure on pharyngeal airway dimensions should always be kept in mind and airway assessment should be an integral part of diagnosis and treatment planning in such cases.

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