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Interdisciplinary Management Of TMJ Ankylosis And Facial Asymmetry In Growing Patient With Orthodontics And Distraction Osteogenesis Of Mandible

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Abstract:
Temporomandibular joint ankylosis may cause severe micrognathia and also obstructive sleep apnea. This case report presents the management of a younggrowing patient with unilateral TMJ ankylosis, micrognathia and obstructive sleep apnea. Patient had severe mandible retrognathism and a significant convex profile. The treatment involved ankylosis release, correction of occlusal cant of maxillary arch, bilateral mandibular distraction osteogenesis. After surgical and orthodontic treatment, the micrognathia was rectified and the oropharyngeal airway was significantly improved.

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I. Introduction

Mandibular anomalies can be a major cause of concern because they may cause asymmetry in the face and abnormality in functions. TMJ ankylosis is extremely disabling disorder that cause difficulties in mastication, speech and, aesthetics. This affects the development of the maxillofacial skeleton when it occurs at a young age, resulting in retrognathic mandible, facial asymmetry, deviated jaw, midline change, occlusal cant, teeth crowding, and unerupted teeth. Retrognathic chin and jaw are main causes of decreased airway dimensions leading to sleep apnea.TMJ ankylosis is linked to multiple etiological factors like trauma, local andsystemic inflammatory conditions, neoplasm.

The treatment modalities include elimination of the TMJ ankylosis, restoring the joint's shape and function, regaining of mouth opening, upper airway obstruction relief and prevention of recurrence. While there has been a widespread acceptance of orthognathic surgery for maxillomandibular deformations, some drawbacks are associated with the acute advancement of the osteotomized bone segments. In addition, broad skeletal differences, involve wide- ranged bone movements that soft tissues around them cannot adjust to their new location, leading to rebound or diminished function and appearance. Distractionosteogenesis has emerged as a viable alternative to the above procedures.

II. Diagnosis & Treatment plan

A 14-year-old male presented with a chief complaint of disfigurement of face(fig.). He exhibited convex facial profile, Angle's Class II molar and canine relationship bilaterally, constricted mandibular arch, crowding in upper and lower anterior region, proclined and bodily forwardly placed upper and lower anterior teeth, increased overjet and overbite.

Cephalometric analysis revealed a Class II skeletal base relationship with a severely retrognathic mandible (SNB-66), vertical growth pattern with increased Frankfort-Mandibular plane angle (FMA-35). Ramus length (Ar-Go: 43mm) and corpus length (Go-Gn:52mm) reveal deficiency of both. There was a facial asymmetry with deviation of chin towards left side and decreased upper (10mm) andlower (5mm) airway spaces.

Upper (32,10 mm) and lower (33,12mm) incisors wereproclined and bodily forwardly placed with increased overjet (13mm).

Figure 1: Pre-Treatment Records

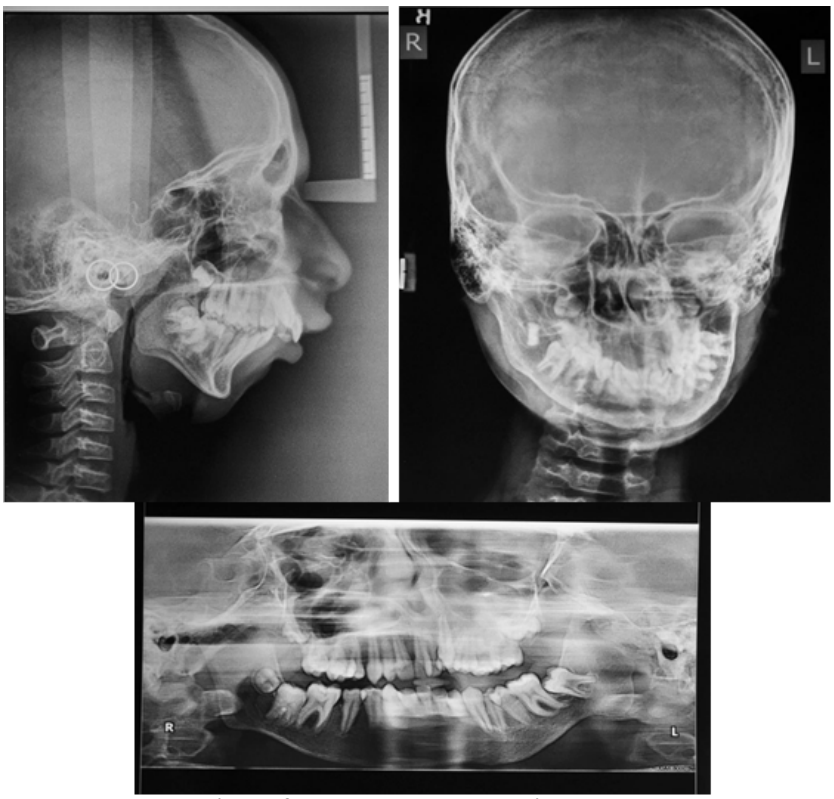

Figure 2: Pre-Treatment Radiographs

III. Treatment Progress

Patient had undergone gap arthroplasty on left side at the age of 9 years. In first comprehensive stage of treatment preadjusted edgewise appliances (0.022 × 0.025 inch) were placed in the maxillary and mandibular arches. Extractions of upper left first premolar and both lower 1st premolars were carried out to relieve the crowding in upper and lower arches. This was followed by levelling and alignment and remaining extraction space closure.

Second stage of treatment involved correction of occlusal cant by intrusion of upper right posterior segment. This was achieved by placement of Infrazygomatic bone screw (12*2mm) in maxillary right posterior region. This was followed by surgical phase for correction of facial asymmetry and retrognathic mandible. 3-D model of mandible was printed and guide stent for distractor screw placement was made for right and left sides. Extra-oral uniplanar Orthomax distractors (35mm range) were installed surgically. Distraction was started on 5th post-operative day. Total distraction of 24.5mm was achieved on right side and 26 mm on left side. Time duration of total distraction was 29 days. Skeletal and occlusal adjustments was done with elastics.

Figure 3: Pre-Distraction Records (After Occlusal Cant Correction)

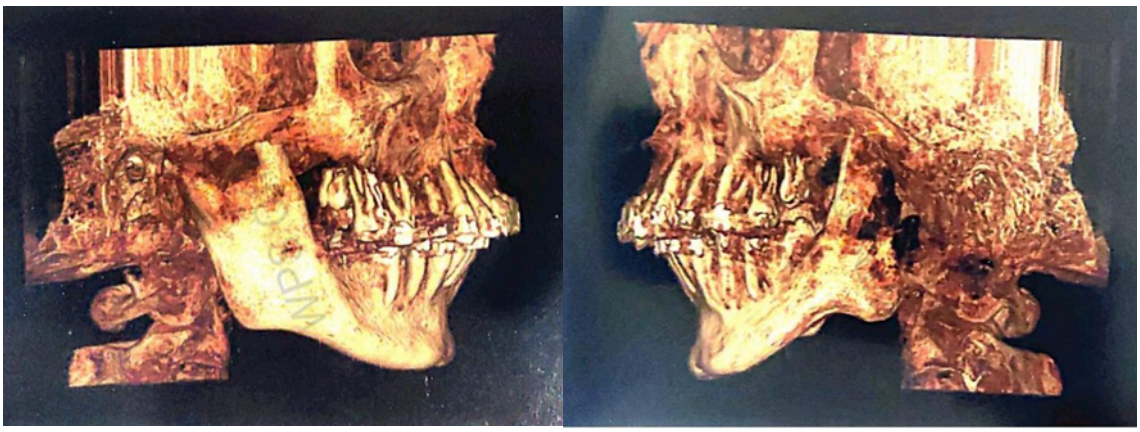

Figure 4: Pre-Distraction CBCT Images

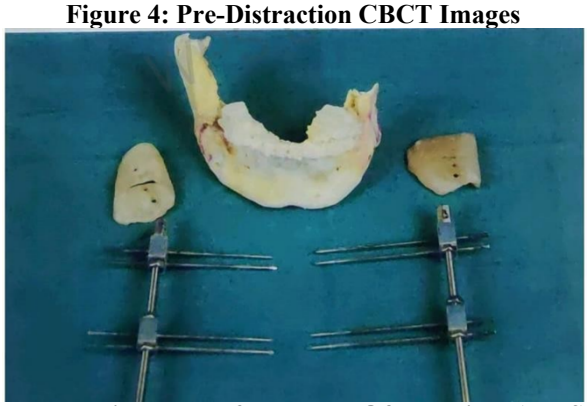

Figure 5: Orthomax Distractors, 3-D Model Of Mandible And Surgical Stent

Figure 6: Post-Distraction Records

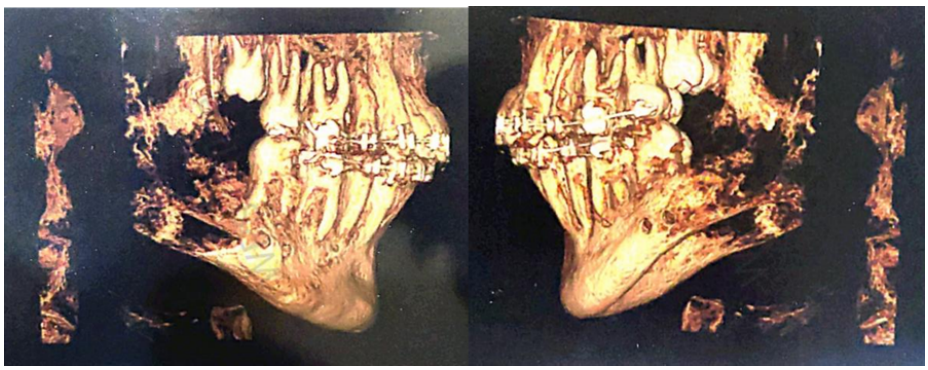

Figure 7: Post-Distraction CBCT Images

IV. Treatment Outcome

Total treatment time was 39 months. Incisor proclination and occlusal cant was corrected. Convex profile and maxillomandibular relationship were greatly improved with correction of facial asymmetry. Ramus length (Co-Go) was increasedon right side (7 mm increase). There was an increase in body length (Go-Me) on right (7mm) and left sides (9mm). upper and lower pharyngeal spaces were improved. Polysomnography (PSG) test reveals decreased AHI score to 2.66 post surgically which was 11.65 pre-surgically. Dental midline deviation was corrected from 4mm deviation to left side to no deviation.

Table No. 1: Comparative cephalometric findings

Parameters	Pre treatment	Pre-distraction	Post-distraction	Post-Debonding
SNA	75	75	75	75
SNB	64	64	70	70
SND	62	62	68	68
ANB	11	11	5	5

U1 TO NA(ANGULAR)	32	32	32	32
U1 TO NA (linear)	10 mm	9 mm	9 mm	9 mm
L1 TO NB (ANGULAR)	33	33	33	33
L1 TO NB (LINEAR)	12 mm	11 mm	8 mm	8 mm
Occlusal plane- SN	24	24	24	24
IMPA	106	106	97	97
<N-A-POG	22	22	11	11
GO-GN TO SN	36	36	40	40
JARABACK'S RATIO	62.7	62.7	59.50	59.50
FMA	36	36	40	40
BETA ANGLE	14	14	27	27
W ANGLE	41	41	49	49
YEN ANGLE	97	98	110	110
N PERP-A	-10	-10	-10	-10
N PERP-POG	-37	-37	-28	-28
EFF. MAXILLARY LENGTH	80	80	80	80
EFF. MANDIBULAR LENGTH	90	90	103	103
LAFH	70	70	72	72
NASOLABIAL ANGLE	104	104	104	105
PHARANGEALANALYSIS UL	10 mm 5 mm	10 mm 5 mm	18 mm 10 mm	18 mm 10 mm
SADDLE ANGLE	120	120	117	117
ARTICULAR ANGLE	146	146	157	157
GONIAL ANGLE	133	133	132	132
UPPER GONIAL ANGLE	53	53	50	50
LOWER GONIAL ANGLE	80	80	82	82
MANDIBULAR BASE	52 mm	52 mm	62 mm	62 mm
N-ANS	51 mm	51 mm	51 mm	51 mm
ANS-GN	59 mm	59 mm	62 mm	62 mm
PNS-N	51 mm	51 mm	52 mm	52 mm
Ar-Go(linear)	43 mm	43 mm	43 mm	43 mm
Go-Pg(linear)	52 mm	52 mm	62 mm	62 mm
U1-NF	30mm	30mm	30mm	30mm
L1-MP	43mm	43mm	43mm	43mm
U6-NF	21mm	21mm	21mm	21mm
L6-MP	35mm	35mm	35mm	35mm

Table no. 2: Comparative PA cephalogram and model findings

Parameters	**Pre-surgical**		**Post-surgical**	
Grummon's analysis				
	right	Left	Right	Left
Ramus length (Co-Go)	43mm	36mm	50mm	36mm
Body length (Go-Me)	45mm	46mm	52mm	55mm
Mid line deviation				
Menton		6 mm		4mm
Dental midline		4 mm		0mm
Readings from model				
Over jet	13mm		5mm	

Table no. 3: Comparative Polysomnographic Readings

SLEEP SUMMARY PRE-OP	
Bed Time	22:42:23
Rise Time	06:41 23
Total Report Time	07 hr 59 min
Total Sleep Time	07 hr 45 min
Sleep Efficiency	97.2%
Sleep Onset Latency	20 Min
REM Onset Latency	5 Min
WASO	204.5 Min
Bed Time	22:42:23

DESATURATION PRE-OP	
Desaturation Index (/h)	27.57
Total Number	220
Avg Saturation [%]	96
Avg Desaturation [secs]	50.75
Minimum Value	88

RESPIRATORY ANALYSIS PRE-OP		
No. of Events	NREM	REM
OSA	21	5
MSA	0	0
CSA	0	0
Hypopnea	72	11
AHI	11.65	02.01

SLEEP STAGE ANALYSIS PRE-OP		
	% of TST	Minutes
Awake Time	03	13
Stage 1 Sleep	01	3.5
Stage 2 Sleep	13	60
Stage 3/4 Sleep	30/28	144/135
Stage REM Sleep	26	123
Stage NREM Sleep	72	342.5

SLEEP SUMMARY POST-OP	
Bed Time	20:30:26
Rise Time	00:38:56
Total Report Time	04 hr 08 min
Total Sleep Time	00 hr 43 min
Sleep Efficiency	17.5%
Sleep Onset Latency	127.5 Min
REM Onset Latency	123.5 Min
WASO	174.0 Min
Bed Time	20:30:26

DESATURATION POST-OP	
Desaturation Index (/h)	10.9
Total Number	45
Avg Saturation [%]	94
Avg Desaturation [secs]	0
Minimum Value	90

RESPIRATORY ANALYSIS POST-OP		
No. of Events	NREM	REM
OSA	0	0
MSA	0	0
CSA	0	0
Hypopnea	11	0
AHI	02.66	00.00

SLEEP STAGE ANALYSIS POST-OP		
	% of TST	Minutes
Awake Time	23	57.5
Stage 1 Sleep	00	0
Stage 2 Sleep	01	3
Stage 3/4 Sleep	06/06	15.5/15.5
Stage REM Sleep	04	9.5
Stage NREM Sleep	13	34

Figure 8: Post-Debonded Records

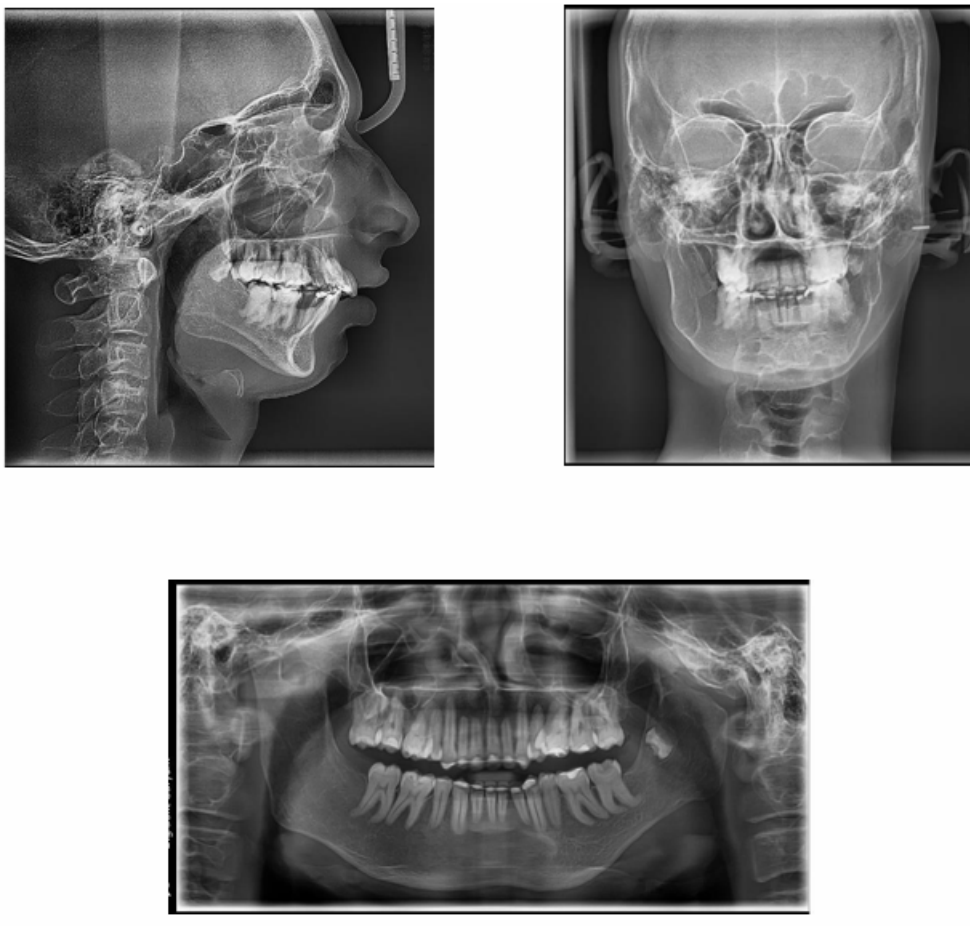

Figure 9: Post-Debonded Records

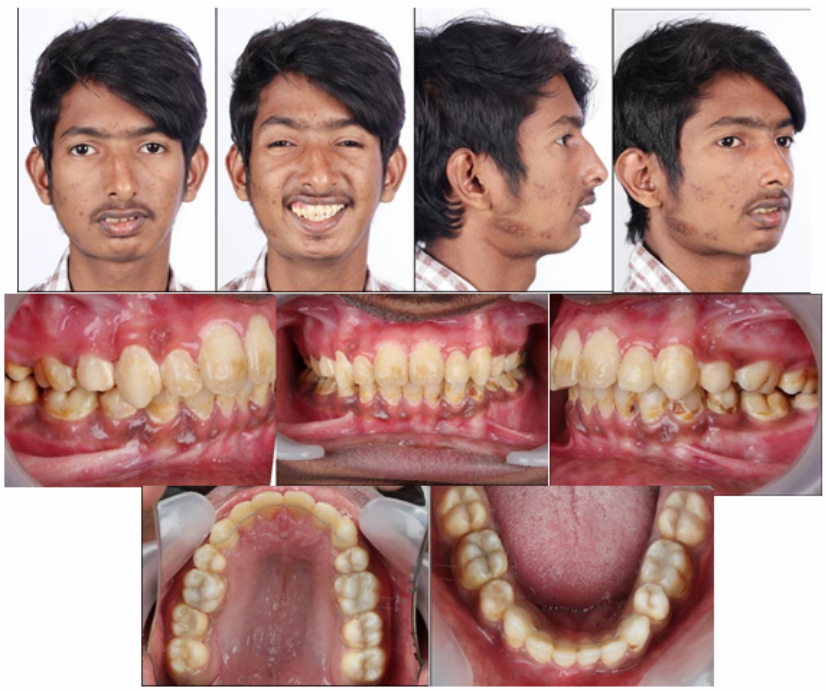

Figure 10: 1 Year Follow Up Records

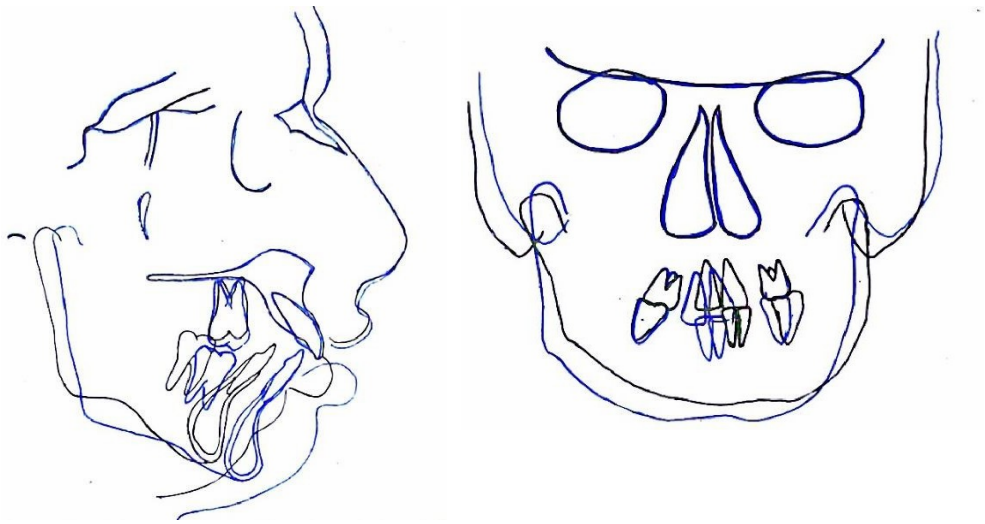

Figure 11: Overall Superimpositions

(Black= Pre-Distraction) (Blue= Post- Distraction)

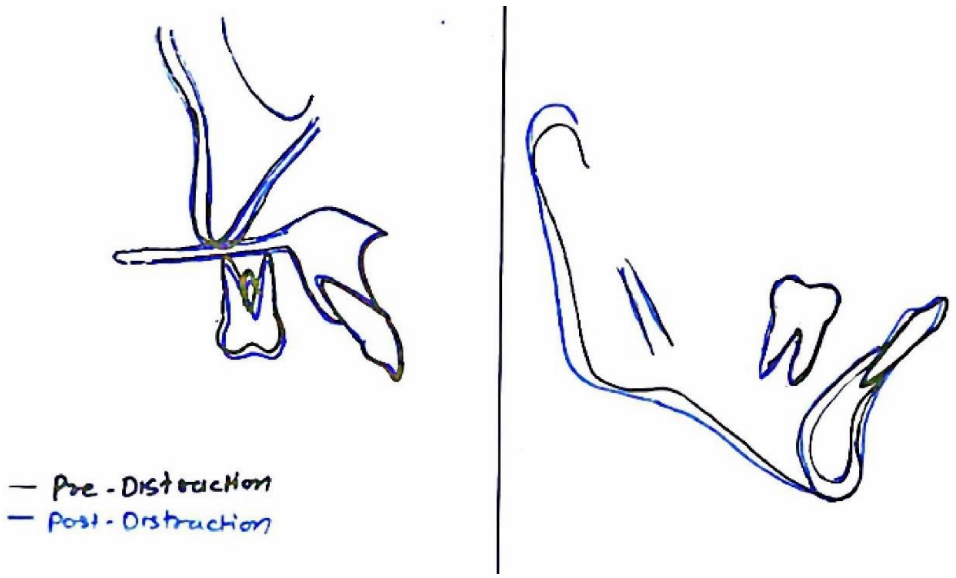

Figure 12: Regional Superimpositions (Black= Pre-Distraction) (Blue= Post-Distraction)

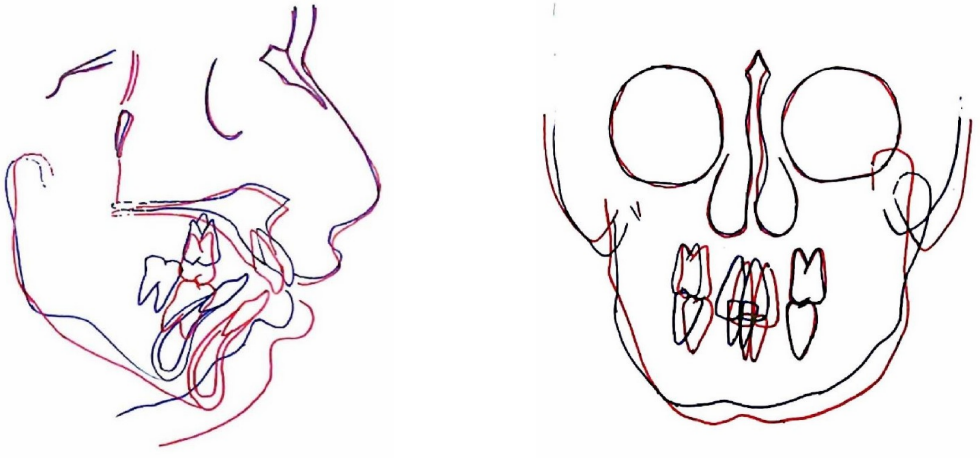

Figure 13: Overall Superimpositions (Black= Pre-Treatment) (Red = Post-Treatment)

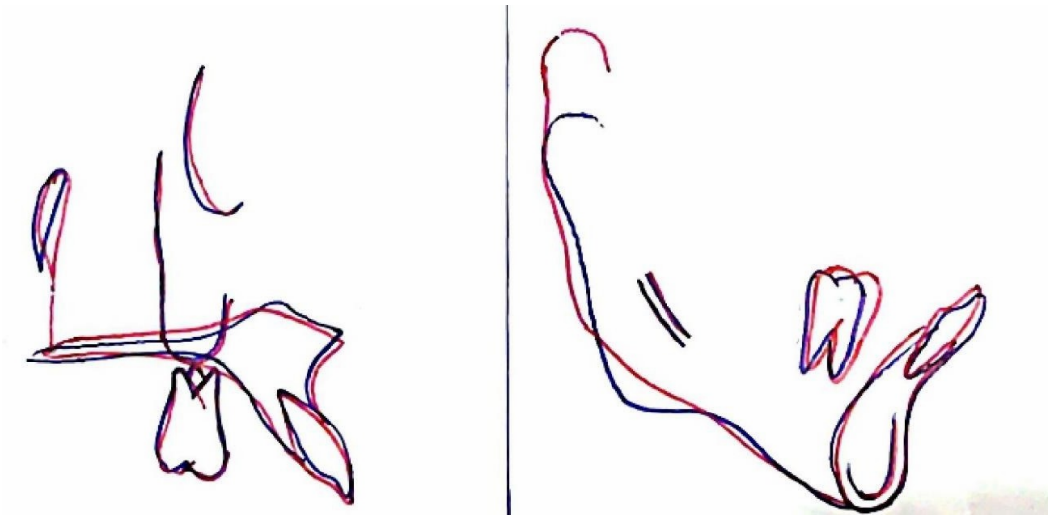

Figure 14: Regional Superimpositions (Black= Pre-Treatment) (Red = Post-Treatment)

V. Discussion

Traditional orthognathic surgery is rarely performed in pediatric patients due to the presence of developing tooth germs or ongoing growth of facial skeletons. Mandibular Distraction Osteogenesis would be the only option left in this group of patients to lengthen the mandible in order to open the airway and correction of deficiency.

Benefits of Distraction Osteogenesis are maintenanceof vascularity and neurosensory integrity, greater stability, single jaw surgery insteadof two-jaw surgery and pre-surgical orthodontics is optional in many cases. Potentialadvantage to distraction is its effect on the inferior alveolar nerve. A recent study suggested that if acute nerve injury is avoided by surgery, there would be minimal effects on inferior alveolar nerve function of up to 10 mm of mandible distraction.

The extent of the mandibular correction that can be achieved is greater in caseof distraction osteogenesis as compared to traditional orthognathic surgery. There isa reduced risk of permanent nerve damage following intraoral and extraoral distraction also.

In addition, soft tissue changes during gradual lengthening may have apositive effect on the stability of the procedure therefore it is preferred option for greater advancement. A second surgery is always required for all patients undergoing the distraction to remove the distractor devices which is a disadvantage.

Chances of relapse are greater in high-angle patients treated with intraoral mandibular distraction whereas for low-angle cases procedure is stable. The long- term relapse is associated with the extent of mandibular surgical advancement.

In the case presented here, a satisfactory union with proper calcification of the edges was achieved. Orthodontic finishing was started after 2 months of surgical phase. No temporomandibular dysfunction was observed after surgery.

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