



Biomechanics for Correction of Vertical Skeletal Class II and Dental Class II Subdivion Malocclusion Using Infrazygomatic Screws

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Abstract

The class II division 1 subdivision malocclusion is one of the common dental asymmetry noticed by orthodontist. This case report display the correction of vertical class II division 1 subdivision malocclusion using orthodontic camouflage. The efficient biomechanics using absolute anchorage will thrive us for managing this kind of malocclusion. The absolute anchorage used here was infrazygomatic screw to bring about more skeletal change than dental change. The post treatment result signify the efficacy and biomechanical advantage of infrazygomatic screw.

Keywords: class II division 1 subdivision malocclusion, infrazygomatic screw, vertical malocclusion

Introduction

The Class II subdivision malocclusion estimated to represent 50% of the entire class II malocclusion and one of the most common dental asymmetric noticed in orthodontic patients¹. The class II subdivision malocclusion patients have class I molar relation on one side and class II molar relation on the other side which may be associated with midline shift or the sagittal facial plane change². The correction of this asymmetric malocclusion is always been a challenge to orthodontist.

The overall prevalence of dental asymmetry class II subdivision is relatively high. The etiologic factor being abnormal tooth eruption, premature loss of deciduous or permanent teeth, crowding, maxillary posterior dental asymmetry , maxillary anterior and

posterior dental asymmetry, mandibular skeletal asymmetry³. In a study it was evident that there is strong association between molar asymmetry with facial asymmetry, noncoincident midlines and Race⁴. In orthodontic patients the mandibular deviation away from the midline is noticed 62% , lack of midline coincidence is seen 46%, maxillary midline deviation from facial midline is seen in 33%, asymmetric molars in AP plane is seen in 22%, maxillary occlusal asymmetry of 20% and mandibular occlusal asymmetry of 18% are seen⁴.

When asymmetry is identified in patients, it's better to differentiate whether the asymmetry is due to skeletal or dental problem. The initial diagnosis should be commenced from clinical examination and should be performed directly on patients as extraoral and intraoral examination. Followed by the radiographic evaluation, these include both 2-dimensional radiograph i.e. submentovertex (SMV), posteroanterior (PA) cephalograms, and pantomographs) and 3-dimensional i.e. CBCT to find the skeletal asymmetry. The cbct is most preferred method for the asymmetry diagnosis than 2D radiographic evaluation, as the measurement value of cbct is almost equal to the direct craniofacial measurement⁵.

The correction of asymmetric dental class II subdivision along with severe skeletal class II pattern make the treatment mechanics more difficult.

There are various methods by which biomechanics can be efficiently planned, one of them is by employing skeletal anchorage system to efficiently camouflage skeletal class II associated with correction of dental class II subdivision.

The main objective of this case report is to present a clinical case of class II subdivision with vertical

skeletal class II in a non-growing adult treated successfully using infrazygomatic bone screws.

Diagnosis and Treatment Plan

A 27 year old male patient presented with the chief complaint of forwardly placed upper front tooth and gumminess during smile.

Clinical examination revealed a convex facial profile , posterior divergence along with high clinical FMA and average nasolabial angle. Lip competency was evident during rest. Smile analysis revealed straight smile arc along with 90% of upper incisal show. The maxillary dental midline was coincident with the facial midline and the mandibular midline coincident with maxillary midline. The intraoral photograph and cast analysis revealed ovoid maxillary and mandibular arch with end on molar relation on right side and full cusp class I molar relation on left side. The canine relation was End on right and left side. The overjet 4mm and overbite of 30% was seen. Mild crowding was seen in lower arch(fig1).

Fig 1: Pretreatment records



No history and any signs of TMD were seen. No functional shift or any discrepancies between centric relation and centric occlusion were noted.

The panoramic radiograph showed all teeth were erupted with adequate inter dental bone. Cephalometric analysis revealed Class II skeletal base with prognathic maxilla and orthognathic mandible with a vertical

growth pattern(table I). The maxillary anteriors were mildly proclined and mandibular incisors were proclined. The prognathic maxilla attributed to forwardly placed incisor than the proclination as such. Soft tissue analysis showed protruded upper and lower lips.

Treatment Objective

To correct the skeletal vertical class II skeletal base, upper incisor angulation and gummy smile, lower incisor proclination, mild crowding in lower anterior , asymmetric molar relation and soft tissue profile.

Treatment Plan

The ideal treatment plan being orthognathic surgery combined with presurgical and post orthodontics.

The presurgical phase would comprise of upper second premolar extractions and lower first premolar extraction followed by maxillary impaction and set back causing autorotation of mandible and post- surgical orthodontic setting. The patient denied the surgical option hence a camouflage treatment option was suggested which utilized bone screws for dento-alveolar correction.

The orthodontic therapy advocated was by asymmetric extraction of 14, 24, 34 and 45 followed by retraction using bone screw in the upper arch (infrazygomatic screws) and lower arch using conventional friction mechanics. Extraction of 18, 28, was advised to provide distalizing effect of maxillary arch with minimal resistance. The main advent of this method using bone screw in upper arch was help to reduce vertical skeletal class II by intrusion and distalization of maxillary teeth along with the alveolar bone which would result in autorotation of mandible and significant reduction in upper proclination and good soft tissue profile.

Treatment Progress

The treatment was carried out using Pre adjusted edgewise appliance , MBT prescription, slot 0.022 inch (ORMCO). Initial levelling and aligning was carried out by sequence of arch wire starting with 0.014niti wire , 0.016niti wire, 16X22 NiTi wire , 17X25 NiTi wire , followed by 19X25 NiTi wire.

Once the arch was levelled and aligned , retraction was carried out using 19X25 S.S wire, using IZC screws in the upper arch. Conventional posted arch retraction was carried out in lower arch applying group B anchorage.

Biomechanic of Upper Arch Retraction With Infrazygomatic Screw

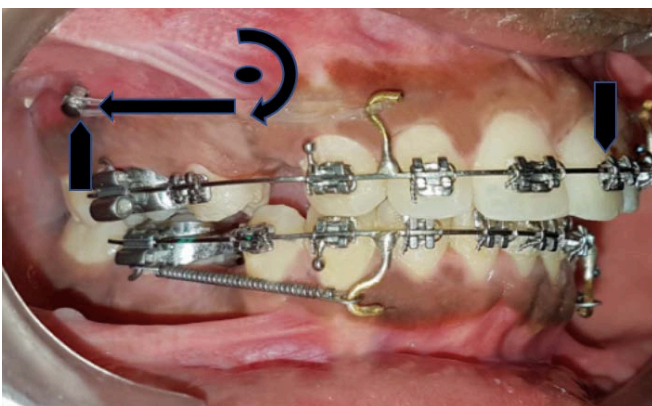
The bone screws (Favanchor, India) of length 12mm and diameter 2mm placed bilaterally in the infrazygomatic area for anterior retraction and for entire maxillary arch distalization. The bone screw has got a merit over usage of mini implants. The infrazygomatic crest present above the maxillary first molars in adults⁶. According to Liou's⁶ the infrazygomatic bone screws were placed in infrazygomatic crest between upper 1st and 2nd molar where bone is thicker and chance of root injury is minimal⁶. The Bone screw were placed at an angle of 70⁰ to the maxillary occlusal plane and 15mm above the occlusal plane which is according to the guideline given by Liou's⁶. The self-drilling screw initially placed at an angle of 90⁰ to the maxillary occlusal plane for the initial notch⁷. Later the driver directed toward at an angle of 70⁰ to the occlusal plane⁷. The anterior retraction and along with slight distalization of maxillary arch was carried out using 19x25 rectangular arch wire to which customized hook were placed. A 9mm closed coil spring was placed in lower arch. The retraction and distalizing force of 340g force was used as mentioned in the literature(fig2).

Fig 2: Space Closure



The line of force pass below the Centre of resistance of the entire maxillary dentition(fig 3), thus resulting in retraction of upper incisor with a clockwise moment causing intrusion of posterior and extrusion of anterior with mild distalization of upper arch due to the continuous arch wire mechanics.

Fig 3: Space Closure Biomechanics



The retraction was carried out for 8 months, till the entire space closure of upper and lower arch were completed. The mechanics helps in effective space closure and management of prognathic maxilla by effective remodeling of the anterior maxillary alveolus.

Treatment Outcome

Revealed the final outcome which was achieved after 17months of orthodontic treatment. Frontal analysis revealed significant improvement in the patient’s smile. Profile analysis disclosed reduction in maxillary prominence, reduction in protrusion of upper lip. The

dental midline were coincident with the facial midline. There was a significant change in the sagittal relationship with reduction of upper and lower proclination. The class I molar relation and canine relation were achieved bilaterally(fig4). There was significant control in the occlusal plane. Cephalometric analysis revealed a significant reduction of the upper and lower proclination with reduction in the ANB angle i.e. the severity of class II (ANB- 3 deg)(table 1). The maxillary incisor were upright at the end of treatment with no root resorption. The overall treatment with bone screw resulted in more esthetic pleasant profile with significant camouflage of skeletal class II. The retention protocol of upper Begg’s wrap around retainer and lower lingual retainer were placed.

Table 1- cephalometric correlation

Variables	Norms	Pre treatment	Post treatment
Sagittal skeletal relationship			
SNA (degree)	82	86	84
SNB(degree)	80	80	80
ANB (degree)	2	6	4
Dental base relationship			
U1 to NA(mm)	4	7	4
U1 to NA(°)	22	29	23
L1 to B(mm)	4	10	7
L1 to B(°)	25	35	30
IMPA	90	94	92
Inter-incisal angle (°)	131	110	120
Vertical skeletal and dental relationship			
FMA	25	28	27
Body length(Go-Me) (mm)	71+-5mm	70	70
ANS-PNS(mm)	48.1-56.1	55	55
Lower Anterior Facial Height (Ans-Gn/HP) (mm)	57.6+-65.0	70	69
1toNF(mm)	25.8-29.2	34	30
1toMP(mm)	39.0-42.6	46	45
6toNF(mm)	21.7-24.3	24	22
6toMP(mm)	30.2-34.0	37	36
Soft tissue			
Nasolabial angle(°)	90-110	115	110

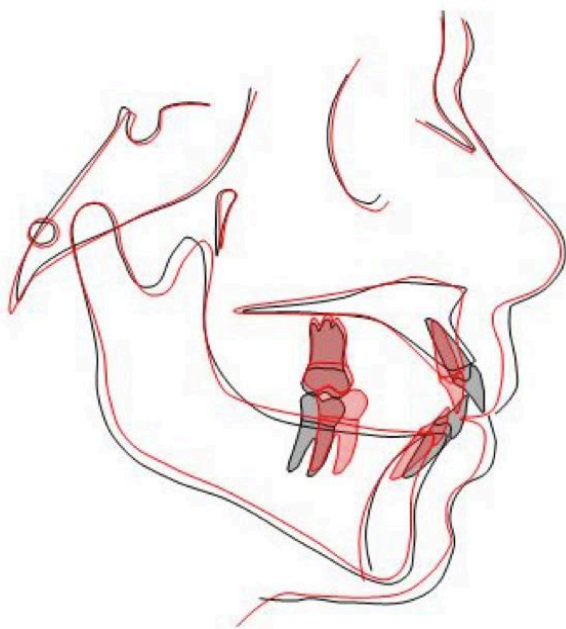
Fig 4: Post Treatment Records



Superimposition of pre and post treatment on the cranial base (Sella - Nasion) indicate the changes due to extraction and retraction with bone screw in maxillary arch (fig 5). The superimposition reveal effective anchorage maintenance in the upper arch with complete retraction of upper incisor and mild distalization of the upper arch. The lower Group B anchorage on right lower quadrant with a mild 1° auto rotation of mandible was noticed.

Fig 5: Pre And Post Superimposition

Black - Pre , Red- Post



Discussion

The correction of asymmetric malocclusion like class II subdivision always require careful biomechanical

planning. The successful treatment plan and the final outcome for a malocclusion, it always depended on careful and accurate diagnosis of a malocclusion.

The class II subdivision could be effectively managed by various methods. They could be corrected either by asymmetric extraction, unilateral or bilateral distalization of upper segment. The extraoral distalizer like headgear can be used, but usually require lot of patient compliance. The various other methods which require less patient compliance can be used such as magnetic appliance, jones jig, pendulum or pendex appliance, Niti springs, Distal jet appliance etc. The undesirable effect such as molar tipping and proclination of upper incisor will be seen. The other most efficient way is to use mini implants or bone screw for distalization with very less undesirable effect. If asymmetrical malocclusion occur due to facial asymmetry then it would require a surgical intervention.

The mini implant placed in the interradicular region for distalization, may interfere with distalization process by approximation with the premolar roots. This may require repositioning of the mini implant for distalization. Bone anchors or mini implant placed in infrazygomatic crest area has an advantage as it does not interfere with distalization. The biomechanical advantage and the bone thickness is usually high than inter radicular bone. Good cortical bone thickness in the infrazygomatic crest area help to withstand high force level for retraction and distalization⁹.

The literature evidence has recommended usage of infrazygomatic screw for entire maxillary arch distalization and retraction of anterior segment⁹. The titanium bone screws were used for retraction and entire maxillary arch distalization. The literature proves that the titanium bone screws have less failure rate

compared to the stainless steel bone screw¹⁰. No studies have quantified the amount of distalization possible with infrazygomatic screw and with the normal mini implants in the infrazygomatic crest area. The different type of dental movement is possible by altering the height of the hook in the anterior area or height modification in the extra alveolar mini-implant insertion⁹.

The retraction force of 300g/side were. The overall success rate range around 93.7%¹⁰. The chance of bone screw penetrating into the maxillary sinus is very minimal and author has recommend use of 12x2mm bone screw. Thus the most simple , efficient method of distalization and retraction can be carried out using bone screw in the infrazygomatic area.

Conclusion

Correction of asymmetric dental malocclusion with skeletal problem is always been a challenge to orthodontist. The various way by which the vertical class II and asymmetric malocclusion can be corrected. The efficient biomechanical planning plays a crucial role ,when correction is by camouflage method. The invent of skeletal anchorage system helps us to efficiently manage the borderline case. Bone anchor are more simpler method on comparison with mini plates. We conclude that biomechanics of retraction and distalization combined with skeletal anchorage system can be used to correct vertical class II and mild anteroposterior discrepancy.

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