

Original Research**ENHANCEMENT OF SMILE ESTHETICS WITH TOTAL MAXILLARY ARCH
INTRUSION USING TEMPORARY SKELETAL ANCHORAGE DEVICE – A CASE
REPORT**

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Abstract:

Smile esthetics is a prime concern in contemporary orthodontic therapy. This case report is about a growing female patient with the inability to close the lips, vertical maxillary excess and hyperdivergent class II skeletal pattern. To enhance skeletal therapy benefits, differential intrusion of segments in the upper arch was required. Bilateral Bollard type miniplates were inserted on the infrazygomatic crest. The technique employed helped this patient avoid orthognathic surgery by allowing a complete upper arch intrusion, treating lip incompetence and causing counterclockwise movement of the mandible.

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Introduction:

The emphasis on smile esthetics is a primary focus in modern orthodontic therapy. More than 2mm of gingival display while smiling is deemed unaesthetic.^[1] Vertical maxillary excess is one of the main etiological factors for the development of gummy smile.^[2] Treatment for a patient who has VME with normal overbite should be the whole upper arch intrusion.

Numerous cases of miniscrew assisted total upper arch intrusion have been recorded. Some studies^[3-5] have shown significant disadvantages associated with miniscrew usage. Hence surgical miniplates were redesigned by incorporating intraoral attachments to serve as a skeletal anchorage system.^[6]

The following case report describes easy and successful mechanics for treating vertical maxillary excess in a growing patient by intrusion of entire maxillary arch using temporary skeletal anchorage device.

Pre-treatment evaluation:

A growing female patient aged 13 years sought orthodontic treatment with a primary concern of inability to close the lips. Extraorally, patient had a leptoprosopic facial form, convex profile and acute nasolabial angle with increased lower face height and incompetent lips. Amount of incisor display at rest was 7mm and during smile it was 100% with 3mm of gingival display. Dental midline coincided with her facial midline (Figure 1).



Figure 1 : Pre-treatment extra oral photographs

Intraorally, she exhibited Class I molar relationship bilaterally, End on and Class I Canine relationship on the right and left sides respectively, imbrication in upper and lower anterior region with shallow overbite. Overjet and Overbite were +5.0mm and +3.0mm respectively. (Figure 2).



Figure 2 : Pre-treatment intra oral photographs

Radiographic examination revealed no pathology. Cephalometric evaluation indicated that Vertical maxillary excess was present in the upper anterior and the posterior teeth (U1-PP, 27 mm; U6-PP, 24 mm) (Table 1), (Figures 3. a-b). On obtaining informed consent from the patient, treatment planning was initiated.

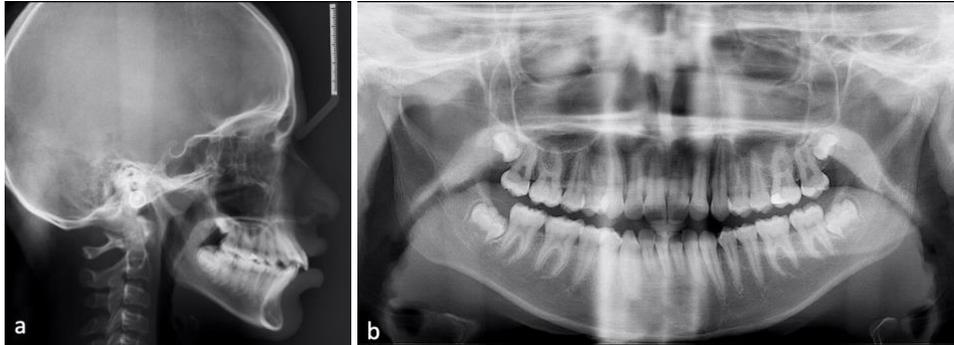


Figure 3.a-b : Pre-treatment lateral cephalogram and panoramic radiograph.

Treatment Objectives:

Following therapeutic goals have been established: 1) Enhancing facial esthetics and soft tissue profile. 2) Correction of vertical maxillary excess. 3) Aligning the maxillary and mandibular anterior teeth. 4) Maintenance of Class I molar relationship bilaterally and Class I canine relation on left. 5) Attainment of Class I canine relation on right side and optimal overjet and overbite.

Treatment Plan:

In order to correct vertical maxillary excess, two treatment plans were suggested for this patient.

- 1) Conventional orthodontic therapy combined with orthognathic surgery encompassing Le Fort I osteotomy and maxillary superior impaction.
- 2) Non extraction protocol by utilization of skeletal anchorage system for skeletal correction by intrusion of entire maxillary arch.

Since the patient was in growing stage, the latter option was preferred.

Treatment progress:

The procedure commenced by augmenting vertical anchorage with transpalatal arch 2mm distant from the palatal mucosa. The upper posterior teeth were initially bonded using MBT orthodontic brackets of slot dimension 0.022” x 0.028” (3M Unitek, CA) (Figure 4). Under local anaesthetic infiltration, the miniplates were implanted. A short mucoperiosteal incision was proposed, spanning over the attached gingiva in the premolar and molar region. A full-thickness flap was reflected using periosteal elevator.



Figure 4 : Initial upper arch strap up photographs.

Two miniplates (Bollard type; Tita-Link, Belgium) were inserted into the infrazygomatic crests bilaterally which were several millimetres apical to the molar brackets. For miniplate fixation, titanium screws with a diameter of 2mm and length of 5mm, were employed (Figure 5). Following the miniplate placement, the entire upper arch was bonded (Figure 6).



Figure 5 : Photographs depicting miniplate placement.



Figure 6 : Photographs depicting completed upper arch strap up.

Two week interval was allowed for soft tissue healing before the loading of skeletal anchorage system. Elastic chains were used to provide primary loading force of 100-120 gms from the miniplates to the maxillary anterior and posterior region (Figure 7). The lower arch was bonded (Figure 8). The arch wires were progressed sequentially from 0.016 NITI wire till 0.019 x 0.025 SS in the upper and lower arch. Distal driving forces from the bilateral miniplates measuring 200 gms and 350-400 gms were applied on the maxillary anterior and posterior segments respectively, delivering intrusive and distalizing force vector which passes near the centre of resistance of maxilla. The activation was done in 6 weeks interval. The amount of intrusive force used in this case was in accordance with Sugawara et al.^[7] and Erverdi et al.^[8] Figure 9 and Figure 10 reveals post intrusion extra oral and intra oral photographs respectively. Post intrusion lateral cephalogram showed 4mm of maxillary anterior intrusion and 2mm of maxillary posterior intrusion (Figure 11). Once intrusion was achieved, final settling was carried out using elastics.



Figure 7 : Photographs depicting initial force application.



Figure 8 : Lower arch strap up initiated 2 months post initial force application.



Figure 9 : Post intrusion extra oral photographs



Figure 10 : Post intrusion intra oral photographs



Figure 11: Post intrusion lateral cephalogram

Biomechanics of miniplates:

The use of miniplates placed at the zygomatic buttress for absolute anchorage allows three dimensional movement of the dentition (intrusion, extrusion, mesial or distal movement). When forces from the miniplate passes through the centre of resistance of maxillary dentition, moment is reduced and the rotational effect is decreased. This in turn results in controlled tipping and almost true intrusion of the maxillary dentition (Figure 12).

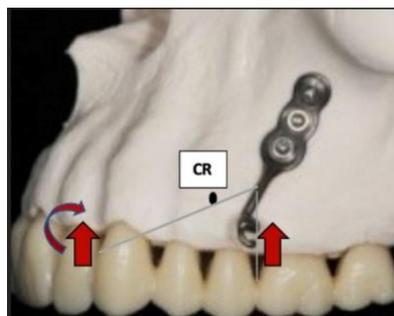


Figure 12 : Biomechanics of miniplate for intrusion

Treatment results:

The post treatment records demonstrated that the therapeutic goals were achieved in a satisfactory manner (Figures 13 & 14). The patient's profile has significantly improved. Aesthetic smile and lip competency were noticed.

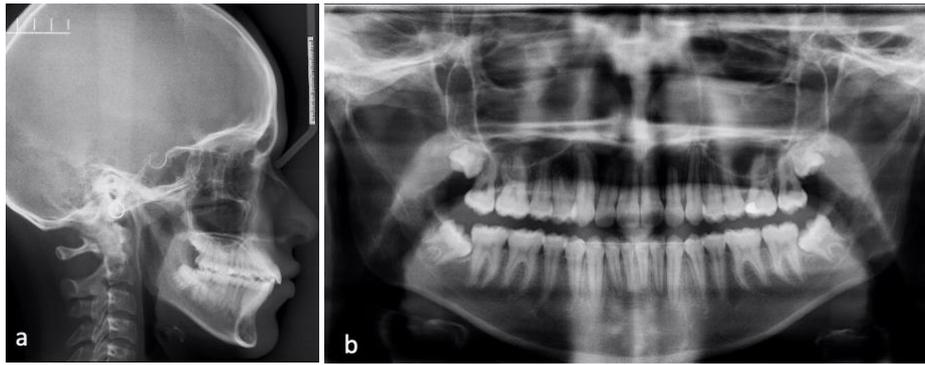


Figure 13 : Post treatment extra oral photographs



Figure 14 : Post treatment intra oral photographs

The post treatment radiographs show that both arches have satisfactory root parallelism with no substantial root resorption. The posttreatment lateral cephalogram reveal a 4mm and 2mm intrusion of the maxillary anterior and posterior teeth, respectively. Upper and lower anteriors shows proclination (Figures 15 a-b). The positive cephalometric comparison findings were shown in TABLE 1.



Figures 15.a-b : Post treatment lateral cephalogram and panoramic radiograph.

TABLE 1: CEPHALOMETRIC POSITIVE FINDINGS:

VALUE	PRE	POST
SNA	82°	84°
SNB	77°	81°
ANB	5°	3°
N PERPENDICULAR TO POINT A	2mm	3mm
N PERPENDICULAR TO POG	-5mm	1mm
FMA	30°	26°
GoGn - SN	34°	30°
Jarabaks ratio	60.5%	62.7%
1 to NF	27mm	23mm
6 to NF	24mm	22mm
1 to MP	38mm	41mm

6 to MP	34mm	31mm
1 to NA in mm & angle	7mm/ 26°	6mm/31°
1 to NB in mm & angle	10mm/36°	9mm/32°
E plane	4mm	1mm

After 22 months of active treatment, both the fixed appliance and the miniplates were removed since the desired amount of intrusion and occlusal settling had been attained. Following debonding, an upper wrap around retainer and lower fixed lingual retainer were given for retention (Figures 16). Overall treatment duration was about 2 years.



Figure 16 : Post retention intra oral photographs

Cephalometric superimposition in Figure 17 reveals that as a consequence of maxillary teeth intrusion, there was an autorotation of mandible (4°) and pogonion advanced by 4.0 mm . Since the treatment was initiated while the patient was still in her growth phase, there was an increase in the post treatment SNA and SNB values. Though the force had both distal and intrusive vector, only the intrusive component of force was evident and there was no distal molar movement. As the force from miniplates were buccal to the center of resistance, there was a considerable amount of arch expansion observed in the maxillary arch (Table 2).

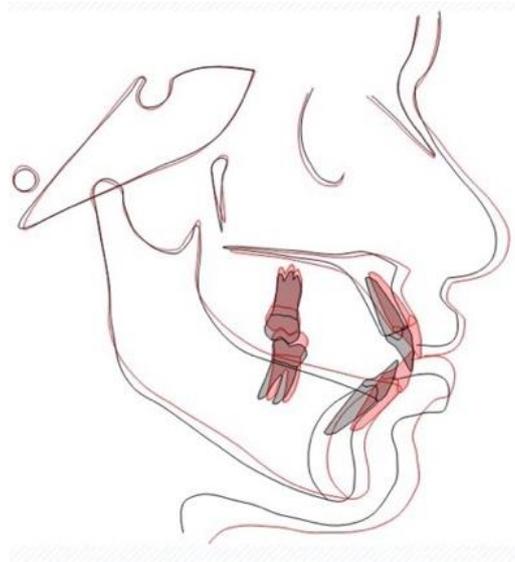


Figure 17 : Superimposition of pre and post lateral cephalometric radiographs.

TABLE 2: CHANGES IN TRANSVERSE DIMENSION:

	MAXILLARY ARCH		MANDIBULAR ARCH	
	PRE- TREATMENT	POST- TREATMENT	PRE- TREATMENT	POST- TREATMENT
INTERCANINE WIDTH	35.5mm	37.5mm	27mm	28mm
INTERPREMOLAR WIDTH	36.5mm	39mm	35mm	36mm
INTERMOLAR WIDTH	47mm	49mm	40mm	42mm

After 2 years of retention, the post treatment results continued to be stable (Figures 18 & 19). No relapse was noted and the patient was satisfied with her facial appearance. The cephalometric readings revealed good stability in incisor position and angle of mandible (Figure 20).



Figure 18 : 2 year Follow up extra oral photographs.



Figure 19. : Follow up intra oral photographs.



Figure 20 : Follow up lateral cephalogram

Discussions:

Vertical maxillary excess, increased gingival display, anatomically short upper lip or combination of all these characteristics can cause gummy smile.^[9] However the gummy smile in this patient appeared to be the consequence of vertical maxillary excess as confirmed by cephalometric findings and also relatively short upper lip since the patient is still in growing phase.

Skeletal anchorage permits the management of certain dentofacial deformities. Numerous authors^[10,11] have reported that miniplates offer absolute anchorage for the intrusion of over erupted teeth. According to De Clerck^[10], the miniplate anchorage has an overall favourable outcome of 97% with regards to stability. The miniplates were well accepted by the majority of patients and had little side effects. Though the placement of miniplates require surgical elevation of mucoperiosteal flap, these procedures were associated with minimum pain and inconvenience. Cornelis et al^[6] stated that miniplates are widely regarded by both patients and clinicians as an effective supplement for tortuous orthodontic procedures.

Umemori et al^[11] reported 4 to 5mm of intrusion of mandibular posterior segment with miniplates during active treatment period of 18-26 months. In this study, approximately 4mm and 2mm of maxillary anterior and posterior teeth intrusions were achieved. This is similar to the results obtained by Sherwood et al.^[12]. However Ervedi et al.^[13] has achieved 3.6mm of maxillary molar intrusion.

In the current study, GoGn SN angle was decreased by 4°, FMA by 4°, indicating that the intrusion of maxillary posterior teeth caused the autorotation of mandible. As a result, there is an increase in SNB angle by 2° and decrease in ANB angle by 2°.

Before finalizing the treatment mechanics, the clinician must perform detailed facial analysis. At the time of orthodontic diagnosis and treatment planning, the soft tissue changes that occur with age should be taken into account. Ram S Nanda^[14] in his study discovered that lip length in women increased by 2.65 millimeters between the ages of 7 and 18 years.

However, Mamandras^[15] stated that the greatest incremental growth rise for both lips occurs between the ages of 12 and 14 years, while no notable changes found beyond 16 years of age. Hashim et al.^[16] revealed that lips develop in length and thickness with age and male subjects experience more growth than females. Solow et al.^[17] reported that a rise in lower face height corresponded to an increase in both upper and lower lip height by 1mm and 0.2mm respectively. Forsberg et al.^[18] studied the developmental changes in adult face between the ages of 24 and 34 years and concluded that the distance between soft tissue nasalis and stomion increased most noticeably in the vertical direction. In males, this distance increased by 1.37mm and in females by 1.22mm. Martinelli et al.^[19] found that there is an increase in the upper and lower lip lengths by 2.6mm and 3.46mm respectively during facial development in individuals with skeletal class II pattern. In the current case, the upper incisor proclination is not completely addressed owing to the increase in lip length as the patient ages. Lahoti et al.^[20] has stated that the stability following posterior intrusion has been a major problem. Isometric clenching exercises may maintain the vertical influence on the posterior teeth after intrusion.

Critical appraisal:

The patient was treated using non extraction protocol as the E plane showed retrusive upper lip though she had an acute nasolabial angle. Post treatment evaluation showed the upper and lower lips were well within the aesthetic limit due to the forward and upward chin growth. The current treatment plan was opted considering the growth

changes with regard to the soft tissues. The proclination of upper incisors were not addressed owing to the soft tissue considerations. The smile improved dramatically with no incisal display after debonding. Two year follow up showed 2 mm of gingival display but cephalometric readings revealed good stability in incisor position and angle of mandible.

Conclusion:

Correction of gummy smile can be achieved using Miniplates by total maxillary arch intrusion, which offers stable skeletal anchorage. The total arch intrusion, gummy smile correction and counterclockwise rotation of the mandible were all aided by the intrusion force provided to the miniplates and palatal arch.

Declaration of Patient consent:

Appropriate patient consent has been obtained.

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Nil

Conflicts of interest:

There are no conflicts of interest.

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