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Case Report

Gummy smile correction with miniscrews in Class II vertical maxillary excess

Mohammed Fawas[1,*], Abdul Rahim[1], Junaid Ali[2]

[1]*Dept. of Orthodontics, Green health dental clinic Abu Humour, Qatar*
[2]*Dept. of Orthodontics, MES Dental College, Perintalmanna, Kerala, India*

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ABSTRACT

Clinical orthodontic treatment of gummy smile with VME has conventionally treated by Lefort 1 osteotomy and superior impaction of maxilla. Recent advents in TADs has broadened the scope and is replaced as less invasive procedure for such patients. This case reports describes the biomechanics and shows the excellent changes obtained with dual buccal mini screws supported orthodontic treatment.

1. Introduction

Treatment of orthodontic problems with vertical growth pattern is always challenging to orthodontist. Downward and backward rotation of mandible which produces a Class II skeletal base and increased lower anterior facial height usually presents with gummy smile and convex facial profile. Apart from VME other reasons for gummy smile are over eruption of anteriors, reduced lip length, hyperactivity of elevator muscles, inadequate anatomic crown exposure or combination of these factors.[1] Traditionally the best treatment outcomes are obtained for VME with Lefort I osteotomy and superior impaction which results in autorotation of mandible and reduction in the lower anterior facial height.[2]

With emergence of TADs, clinical orthodontic treatment has broadened their scopes in attaining the best outcomes like intrusion of molars which would have been difficult in earlier days. Kuroda et al[3] compared TADs with orthognathic surgery, results suggest that molar intrusion with TADs is simpler and effective than orthognathic surgery in the treatment of patients with increased lower facial height. Various reports are available in literature which shows treatment of hyperdivergent cases with TADs.[4–7]

Here we describe the treatment of class II hyperdivergent case with gummy smile using two buccal mini screws given bilaterally on maxillary arch to intrude whole maxillary dentition and retract the anteriors. Mini screw assisted gummy smile correction produced excellent outcome by correction of gummy smile, autorotation of mandible and reduction in LAFH.

2. Diagnosis and Etiology

An 18-year-old male patient presented to clinic complaining of protruded teeth and gummy smile. Extra oral examination reveals patient has symmetric face, convex facial profile, retrusive chin due to downward and backward rotation of mandible, increase LAFH with gummy smile suggestive of vertical maxillary excess, incompetent lip, increased inter-labial gap, and large buccal corridor width. Intra oral examination indicates class II divison 1 subdivision with class II molar on right and class I on left, with a midline shift of upper to left by 2mm. Overjet is 9mm and also have deep bite of 60%. Upper and lower arch is almost aligned without spacing. No symptoms of temperomandibular joint

* *Corresponding author.*
E-mail address: fawas3434@gmail.com (M. Fawas).

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disorders were seen.

Lateral cephalogram showed a class II skeletal base with reduced sagittal mandibular projection due to downward and backward rotation of mandible, increased vertical growth of maxilla, high mandibular plane angle, increased LAFH and proclined maxillary and mandibular anteriors.

On the basis of above findings, the case was diagnosed as class II divison 1 subdivision on right on a Class II skeletal base with sagittal mandibular deficiency due to downward and backward rotation of mandible due to increased vertical growth of maxilla, vertical growth pattern.

2.1. Treatment objectives

Treatment objective is intrusion of total maxillary arch and retraction of anteriors thus reduce lip protrusion and correction of gummy smile, also this aims at autorotation of mandible so that anterior projection of mandible is increased. This will tend to straighten the profile, reduce the LAFH, improve lip competency and interlabial gap, and to correct overjet and overbite.

2.2. Treatment alternatives

Since this post pubertal patient has moderate to severe skeletal problem in vertical and sagittal plane the first option would be orthodontics combined with orthognathic surgery. Lefort I osteotomy with superior impaction of maxilla and BSSO advancement of mandible will improve the gummy smile and facial profile.

Other option would be orthodontic treatment alone with help of miniscrews for total maxillary arch intrusion and retraction of maxillary anteriors after extraction of upper first premolars, retraction of lower anteriors after extraction of lower left first premolar (three premolar extraction), since class II subdivision and midline shift.[8]

Patient opted the second plan since he is reluctant to orthognathic surgery.

2.3. Treatment progress

First molars were banded, TPA was placed in upper arch with a clearance of 3-4 mm from palatal surface. Extraction of 14,24 done, 34 extracted after two months. Both upper and lower arch is bonded with preadjusted edgewise (022*028 MBT) bracket system. After initial alignment, 19*25 ss were placed on both arches (Figure 1). Two miniscrews (Orlus, Yesanchor D1617, 1.6 * 8mm) were placed bilaterally on maxillary arch, one in between first molar and second premolar at height of 8mm from crest and another one highly placed above mucogingival junction just mesial to second premolar, miniscrews are inserted at a 45^0 angle to occlusal plane (Figure 2). Clinically acceptable high position for placement is needed since first premolar is extracted and bone quality will be good above the root apices and just mesial to second premolar, also this is favorable for intrusive biomechanics and also retraction of anteriors without hitting the roots of canines on miniscrews. Elastic forces of 200g is given from posterior miniscrews to canine or inverted crimpable hook placed distal to canine and same force is given from anterior miniscrews to lateral bracket or inverted crimpable hook placed distal to lateral.[9] The resultant of these two forces pass through center of resistance of maxillary dentition, which produce intrusion and retraction of maxillary arch (Figure 11). TPA facilitates the intrusion and prevents arch widening due to buccal force acting on wires. However, the case with large buccal corridor, labial tipping of posteriors will be beneficial. Here we extracted the first premolars, so retraction of anterior segment is enough and intrusion of both anterior and posterior segment is needed. So, space closure will be delayed despite retraction of anteriors if posterior segment also moves backward, to prevent that class I elastics force from molars to anterior segment may needed in later part of treatment. Retraction phase of treatment prolonged for 15 to 16 months since we used very light force and sometimes resting period to reduce root resorption and facilitate alveolar remodeling. Intrusion of the maxillary arch is evident because TPA impinged on palatal surface and it is removed at this time (Figure 4). After space closure settling elastics given for 1 week with 014 NiTi on upper arch and same rectangular SS wire on lower arch. Settling elastics are mandatory for intercuspation since intrusive force at canine premolar region is more and produce an open bite tendency at this region. Even though we expected gingival pocket formation and mild swelling because of much intrusion in maxillary anteriors, the probing depth was normal and there was no need of gingivoplasty possibly because of less intrusive force and long treatment duration which helped to remodel the soft and hard tissue around the teeth. OPG is taken post intrusion and retraction phase to check root parallelism and root resorption (Figure 5). At the end of treatment vaccum formed removable retainers given.

2.4. Treatment results

After treatment patients has got harmonious facial profile, gummy smile and lip protrusion is improved dramatically (Figure 6). Interlabial gap and incisor visibility at rest reduced. Good occlusal relationship achieved with class II molar on right, class I molar on left and class I canine and incisor relationship. A slight midline discrepancy of 1mm between maxillary and mandibular dentition occurred mainly because of three premolar extraction and asymmetric retraction of lower arch has been carried out. Lateral cephalometric comparison between pre and post treatment showed improvement in class II sagittal skeletal relationship suggested by reduction of ANB by 2.5^0, Wits value changed from 2.5 mm to 2mm (Table 1). Vertical progress is the culmination in our case supported by reduction of FMA from 30^0 to 28^0, closure of maxilla-mandibular plane by 1^0,

Anterior maxillary height(U1-PP) reduced from 31mm to 25mm however posterior maxillary height (U6-PP) reduced by 1mm only. Upper incisor to lip line (U1 – Lip line) is reduced by 4 mm (Figures 7 and 8).

Fig. 1: Initial extra oral and intraoral photographs taken after alignment of both arches showing gummy smile and other features of vertical pattern.

Fig. 2: Retraction and intrusion force applied after placement of dual buccal mini screws.

Fig. 3: Intrusion and retraction in progress, note the titration of direction and amount forces to produce more posterior intrusive force.

Fig. 4: TPA impinchment on palatal mucosa despite of initial clearance of 3 -4 mm clearly indicates the total arch intrusion.

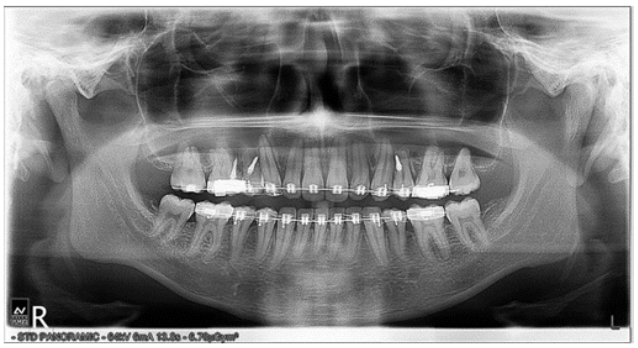

Fig. 5: OPG taken post intrusion and retraction phase to check root parallelism and rootresorption.

Fig. 6: post treatment extra oral and intra oral photographs

Fig. 7: Comparison of pre-treatment and post treatment cephalograms shows improvement in facial profile

Table 1: Cephalometric summary

Skeletal (sagittal)	Norm	Pretreatment	Posttreatment	Pre-post difference
SNA [^{0}]	82	91	90	-1
SNB [^{0}]	80	84	85.5	1.5
ANB [^{0}]	2	7	4.5	-2.5
Wits [mm]	0- -1	2.5	2	-0.5
Skeletal (Vertical)				
FMA [^{0}]	25	30	28	2
LAFH/TAFH [%]	55	58.2	57.4	0.8
Mx-Md plane angle [^{0}]		31	30	1
Dental				
U1-FH [^{0}]		126	113	13
IMPA [^{0}]				
Interincisal angle [^{0}]		115	128	13
U1-PP [mm]		31	25	-6
U6-PP [mm]		23	22	-1
L6-Md P [mm]		34	35	1
L1-Md p [mm]		45	45	0
U1-Lip line [mm]		7	3	-4
Soft tissue				
U Lip – E line [mm]		1.5	-1	2.5
L lip – E line [mm]		6	4	2

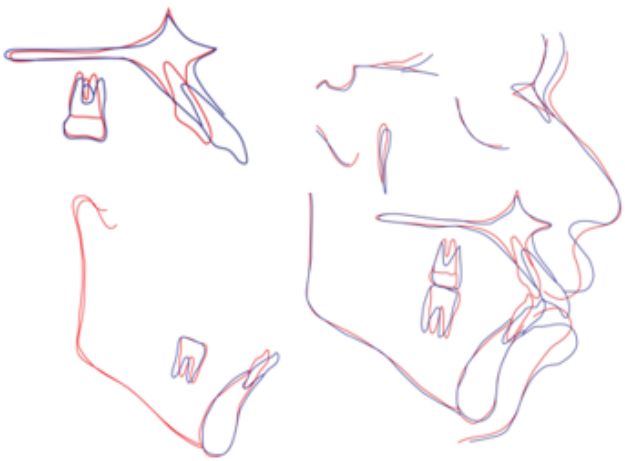

Fig. 8: Cephalometric superimposition.

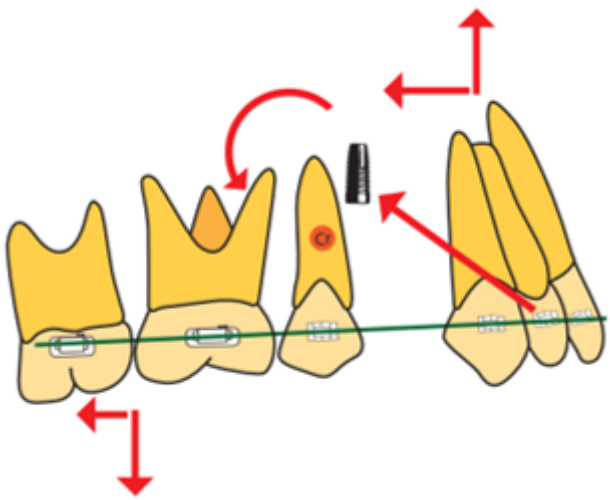

Fig. 9: Miniscrews placed anterior to CR of maxillary dentition produces intrusive & retraction force on anteriors & extrusive & retraction force on posteriors resulting in counter clockwise rotation of occlusal plane.

3. Discussion

Two main objectives were intrusion of whole maxillary arch (vertical plane) and retraction of anteriors to correct protusion of lips (sagittal plane). To obtain posterosuperior intrusion of maxillary arch force should pass through CR of maxilla which is considered to be in between roots of premolars towards apex.[1] Clinically with single miniscrew bilaterally it is difficult to produce the force passing though CR of maxillary dentition. Miniscrews placed anterior to CR of maxillary dentition with rigid archwire produces intrusive & retraction force on anteriors & extrusive & retraction force on posteriors resulting in counter clockwise rotation of occlusal plane (Figure 9). Miniscrews placed posterior to CR of maxillary dentition produces extrusive & retraction force on anteriors & intrusive & retraction force on posteriors resulting in clockwise rotation of occlusal plane (Figure 10). So, one force anterior (passing above) to CR and one force posterior (passing below) to CR help us to take the resultant force vector through CR (Figure 11). So, if we need whole arch intrusion without rotation of

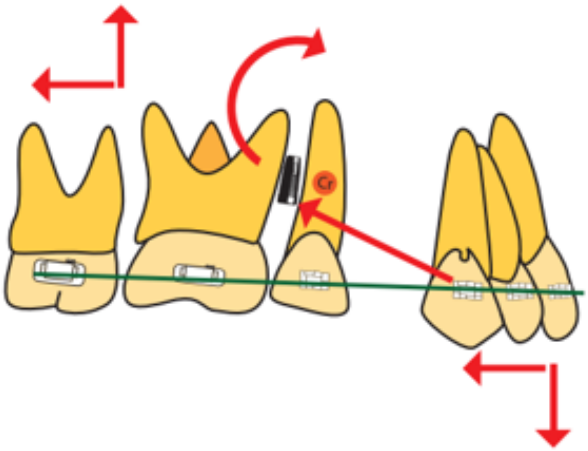

Fig. 10: Miniscrews placed posterior to CR of maxillary dentition produces extrusive & retraction force on anteriors & intrusive & retraction force on posteriors resulting in clockwise rotation of occlusal plane.

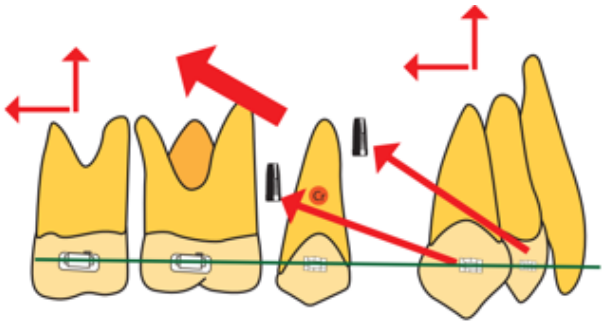

Fig. 11: Dual miniscrews placed anterior & posterior to CR of maxillary dentition, the resultant force from the two miniscrews pass through the CR resulting in total arch intrusion & retraction.

occlusal plane, the force should pass through CR.[10] If more anterior intrusion is needed (counterclockwise rotation of maxillary plane), anterior force has to be increased relative to posterior force. If more posterior intrusion is required (clockwise rotation of maxillary plane) posterior force has to be increased relative to anterior force. Careful titration of force delivered from anterior and posterior screw helps in proper control of tooth movements.

Use of TPA with clearance of 3-4mm from palatal surface facilitates the intrusive force on arch and it also prevents the labial expansion or buccal tipping of maxillary posteriors, because labially applied force from buccal miniscrews tend to do so.[2] In our case magnitude of anterior forces is initially increased for more intrusion anteriorly to correct the deep bite followed by careful adjustment in magnitudes of forces for whole arch intrusion. Total arch intrusion is expected to produce a counterclockwise rotation of mandible which reduces the LAFH and increase the mandibular projection anteriorly, which is the ideal objective in treating skeletal class II with vertical growth. This would tremendously increase the facial aesthetics.

Previous studies[11,12] reported that intrusion of maxillary molars leads to supra-eruption of mandibular molars which will reduce the effect of treatment hence consideration should be given to hold the lower molar during treatment. This is the limitation of this case and this might be the reason in our case cephalometric value L6 – Mand plane has been increased after the treatment.

Sagittally, dual buccal miniscrews produce retraction of whole dentition also along with intrusion, but here we have extracted the first premolars so we need only retraction of anteriors to close the space. Distalization of posteriors has to be prevented for two reasons, first for space closure and second, if posterior teeth distalisation root hits the miniscrew, relocation of posterior screw is required. Fortunately, distalisation of posterior segment is limited here since the wire will slide through posterior buccal tubes and brackets. However, some friction will produce some amount of distalisation of posteriors which can be prevented by class I elastics placed between molars and anterior segment in the later stage of space closure.

4. Conclusion

Considering the center of resistance and magnitude of force, Dual buccal miniscrews after extraction of first premolars is an excellent option to treat class II hyperdivergent cases with VME and this can produce maxillary arch intrusion thus correcting gummy smile, autorotation of mandible and reduction in LAFH which improves the facial profile.

So adult patients with gummy smile can be treated orthodontically rather than orthognathic.

However, intrusion of posterior region is limited compared to anterior maxilla which dictates that vertical class II with deep bite and increased anterior maxillary dentoalveolar height are the candidates for this mechanics.

5. Conflict of Interest

The authors declare no relevant conflicts of interest.

6. Source of Funding

None.

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Author biography

Mohammed Fawas, Orthodontist

Abdul Rahim, Orthodontist

Junaid Ali, Orthodontist

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