

Mini-plates as an alternative to Anterior Maxillary Osteotomy: A Case Series

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ABSTRACT

Background: Malocclusions with gummy smile and vertical maxillary excess mainly occurs by overgrowth of the maxillary anterior dentoalveolar heights, but it is difficult to intrude anterior segment with conventional orthodontic mechanics. Surgical treatment i.e. anterior maxillary osteotomy is the treatment of choice in such cases. However, if the patients are not willing to undergo surgical intervention, an alternative method must be considered to treat the gummy smile.

Aim: To describe the non-surgical treatment of skeletal malocclusion with vertical maxillary excess and gummy smile.

Method: In this case series, we treated malocclusions with severe gummy smile and vertical maxillary excess using mini-plates instead of mini-implant, so that:-

- 1) Simultaneous molar distalization, premolar retraction & anterior retraction with intrusion could be achieved with segmental mechanics.
- 2) Variable force vectors depending on amount of intrusion and retraction required in cases could be applied by varying line of action of force.
- 3) Mini-plates are more stable at higher forces.

Results: In all the cases the treatment resulted in marked improvement in the facial profile and correction of gummy smile. Ideal overjet and overbite was achieved. The cases were finished with Class I Molar and canine relation. Upper incisors were intruded & retracted remarkably avoiding orthognathic surgical intervention to correct gummy smile.

Conclusion: Mini-plate is a viable treatment option for correcting dentoalveolar malocclusion with vertical maxillary excess and severe gummy smile.

Key-words: Mini-plates, Anterior Maxillary Osteotomy, Gummy smile, Vertical Maxillary Excess

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INTRODUCTION

Anterior maxillary osteotomy¹ is the surgical procedure in which maxillary anterior segment is repositioned posteriorly as well as superiorly or inferiorly and indications for anterior maxillary osteotomy includes skeletal class II cases with long midfacial appearance and increased display of incisors and gummy smile. Risks associated with surgical line of treatment are necrosis of alveolar bone, non-vitality of teeth and increase in nasal alar width, which makes the patient's nasal profile worse. Mini-plates skeletal anchorage device have increased the envelope of orthodontic treatment, providing an alternative to orthognathic surgery particularly for malocclusion in the vertical dimensions. It also allows asymmetric tooth movement in three planes of space. Application of the mini-plate includes the expectable intrusion and distalization of molars². Therefore, mini-plates

as skeletal anchorage mode allow nonsurgical treatment option for skeletal malocclusions necessitating surgical correction³.

In this presentation of case series, describing the uses of mini-plates to convert surgical cases into non surgical clinically and documenting the biomechanical parameters necessary for the execution of a new clinical modality on a broad scale by describing the treatment of an adult female patients with severe gummy smile who were treated by orthodontic intrusion using mini plates.

CASE REPORT

Summary of Cases and Diagnosis

Three adult females (aged 17 to 21 years) clinically presented with (Figure-1,5&9)

- ✚ Excessive gingival display at rest and smile.
- ✚ Large interlabial gap (8.0 mm)

- ✚ Long face type
- ✚ Incompetence in lip closure

Pretreatment cephalometric evaluation of the 3 cases revealed extrusion of upper incisors which was indicated by increased vertical distance between upper incisors to nasal floor (Figure-2A, 6A&10A). Pretreatment OPG (Figure-2B, 6B&10B) reveals presence of all permanent teeth and no evident bone loss.

Treatment Alternatives

The degree of incisor show and gumminess of smile of these patients was judged too severe to be considered for conventional orthodontic mechanics and age of the patients were not favorable for headgear therapy. Therefore, a common, and perhaps the most predictable, treatment option would be surgical orthodontics. The patient refused orthognathic surgery. Instead, they choose mini-plate for camouflage treatment, as their treatment of choice.

All the cases were treated with similar intrusion mechanics using skeletal anchorage system to achieve maximal intrusion.

Treatment goals

Although it was impossible to radically correct the skeletal disharmony and the associated soft tissue profile without orthognathic surgery, it was possible to improve the dental and functional problems via three-dimensional movement of the upper incisors with the mini-plates. To solve the vertical problems, the treatment plan included intrusion of the upper incisors by 4 mm with simultaneous retraction to an ideal position. It was expected that gingival display, interlabial gap will be reduced. Upper molar position will be maintained vertically which will prevent clockwise rotation of the mandible and this would maintain the lower anterior facial height.

In the first case patient had increased nasolabial angle and distalization was treatment of choice after extraction of upper third molars. The upper molars would be distalized by 4 mm, space gained will be utilized to retract & intrude the anteriors and to achieve canines in class I relation. However, second and third case was treated with extraction of all first premolars.

Treatment Objectives

The main treatment objective was to achieve a functionally stable occlusion with an esthetically pleasing smile and profile.

Treatment Progress

0.022" preadjusted edge-wise appliance was bonded on the buccal and anterior segments of upper arch. Leveling and

aligning of posterior and anterior teeth was started segmentally and in lower arch continuous mechanics were initiated using 014 NiTi archwire. Mini-plates were placed at the zygomatic buttress bilaterally. After placing rigid archwire (0.019"x0.025" stainless steel), distalization of the molars was initiated with sliding jig (In case 1) from auxiliary tube. Active tie backs (300 gm per segment) were placed from the anchor plates to crimpable hook on sliding jig. Following distalization of molars, premolars and anteriors were simultaneously retracted using mini-plates.



Figure-1(a-d): Pre-treatment Extraoral photograph Case-1

Figure-1(e-i) : Pre-treatment intraoral photograph Case-1



Figure-2(a-b): Pre-treatment OPG & Ceph Case-1



Figure-3(a-d): Post-treatment Extraoral photograph Case-1



Figure-3(e-i) : Post-treatment intraoral photograph Case-1

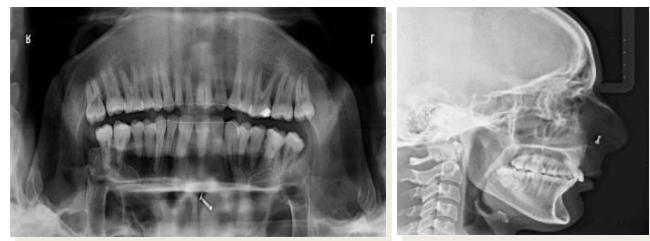


Figure-4(a-b) : Post-treatment OPG & Ceph Case-1

In all the Cases(1,2,3) crimpable hooks of 6.5 mm were positioned between lateral incisor and canine because center of resistance of anterior segment is distal to lateral incisor and is at the level of 6.5 mm. Active tie backs were given at an angle of 15 degrees from mini plate to crimpable hook. In lower arch conventional mechanics were followed. After the desired simultaneous intrusion and retraction of anteriors, class I canine and molar relationship was accomplished and continuous archwire was placed.



Figure-5(a-d) : Pre-treatment Extraoral photograph Case-2





Figure-5(e-i) : Pre-treatment intraoral photograph Case-2

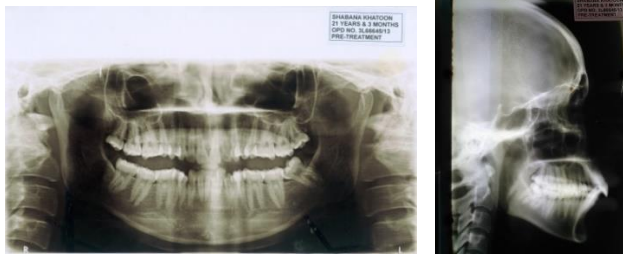


Figure-6(a-b) : Pre-treatment OPG & Ceph Case-2



Figure-7(a-d): Post-treatment extra-oral photograph Case-2



Figure-7(e-i) : Post-treatment intraraoral photograph Case-2



Figure-8(a-b) : Post-treatment OPG & Ceph Case-2

Results

In all the cases (Figure- 3, 7&11) soft tissue profiles were improved considerably, with significant reduction in gummy smile. Ideal overjet and overbite was achieved with Class I molar and canine relation. Upper incisors were intruded and retracted remarkably leading to phenomenal improvement of the relationship between the upper lip and incisors avoiding orthognathic surgical intervention to correct gummy smile. No change in molar and mandibular plane was observed.

Post treatment (Case -1 and 2) and post retraction (Case -3) cephalogram (Figure- 4A, 8A&12A) revealed in case 1: distalization of molars by 4.0 mm bilaterally. In all the cases, the gummy smile was corrected mainly by intrusion of anterior teeth. Panoramic radiograph (Figure- 4B, 8B&12B) showed no significant root resorption at the molars and anteriors.



Figure-9(a-d): Pre-treatment Extraoral photograph Case-3



Figure-9(e-i) : Pre-treatment intraoral photograph Case-3



Figure-10(a-b) : Pre-treatment OPG & Ceph Case-3



Figure-11(e-i) : Post-Retraction intraoral photograph Case-3

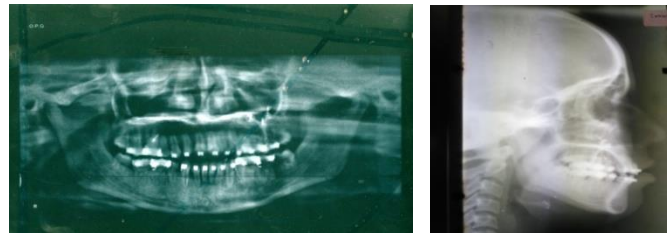


Figure-12(a-b) : Post- Retraction OPG & Ceph case-3



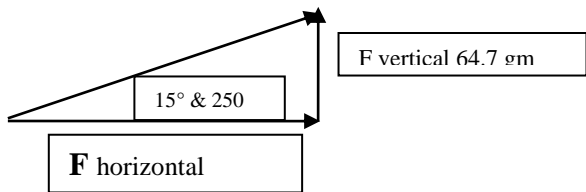
Figure-11(a-d) : Post-Retraction extra-oral photograph Case-3

Discussion

Excessive gingival display is an unattractive smile characteristic with multiple etiologies. Vertical maxillary excess, supra-eruption of the maxillary incisors, and shortness or hypermobility of the upper lip are some of the most common factors involved. In our cases the gummy smile was due to supra-eruption of the maxillary incisors and Proffit and Fields reported that if elongated incisors creating an unesthetic gummy smile, intrusion of incisors to obtain proper gingival exposure is treatment of choice. In our cases, evaluation led us to the conclusion that the gummy smile would be improved by maxillary incisor intrusion. Intrusion archwire systems such as a utility arch or an intrusion base arch are frequently used for incisor intrusion. This system creates a force to elongate the molars. In growing patients with hypodivergent facial pattern, extrusion of molar can be compensated by ramus lengthening. However, in nongrowing patients or those with a poor facial pattern, molar extrusion should be avoided. As a result, the lack of posterior anchorage compromises the ability to intrude incisors. Furthermore, molar elongation may invite a downward and backward rotation of the mandible.

Recent literature has tended to focus on mini-screws, perhaps because of their small size and apparent ease of placement. However, mini-screws have been associated with a fairly high failure rate, including fracture during placement, loosening under loading, and impingement on roots either during placement or tooth movement. Mini-screws might also need to be repositioned during treatment to allow all intended tooth movements to be accomplished. To address some of these issues, surgical mini-plates with intraoral attachments have been modified to serve as temporary skeletal anchorage devices. Mini-plates, which are placed at a safe distance from the roots, offer the advantages of reduced risk of root impingement, allow the free movement of roots past the temporary skeletal anchorage devices, and are associated with a lower failure rate than mini-screws. Claims have been made that mini-plate anchorage simplifies previously complex treatments and permits correction of malocclusions previously thought beyond the scope of orthodontic therapy alone. Although appearing to be safer and more stable, and extending treatment possibilities that's why mini-plates were preferred in these cases.

Our cases required more of vertical correction. The maxillary incisors needed intrusion of 3-5 mm. To determine the vertical component of force, the sine function was used ($F \sin \theta$) and to determine the horizontal component of force, the cosine function was used ($F \cos \theta$).

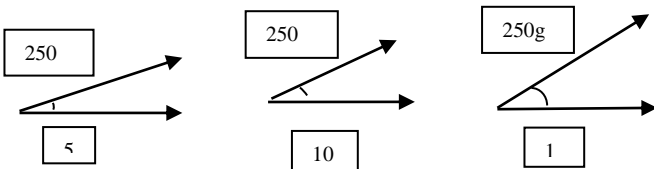


$$\sin 15^\circ = \frac{F_{\text{Vertical}}}{250\text{gms}}$$

$$\cos 15^\circ = \frac{F_{\text{Horizontal}}}{250\text{gms}}$$

$$F_{\text{vertical}} = \sin 15^\circ \times 250 \text{ gms} = 64.7 \text{ gm}$$

$$F_{\text{horizontal}} = \cos 15^\circ \times 250 \text{ gms} = 230 \text{ gm}$$



Force components can be varied by changing the force vector. When force of similar magnitude were applied at different angulations. As the angle that the force vector makes with the horizontal increases, the resultant horizontal component

($F_{\text{horizontal}}$) decreases while the vertical component (F_{vertical}) increases.

The same principle was used while retraction and intrusion of anteriors, force was applied at an angle of 15 degree with force of 250 grams which generated the vertical force of 64.7 grams and horizontal force of 230grams. Mini-plates have three points of force attachment depending on the intrusion and retraction requirement we can alter the point of force application depending on intrusion and retraction requirement

Conclusion

- Mini plates were located away from the dentition, and therefore, do not interfere with tooth movement. They obviate the need for significant patient compliance, particularly with regard to extra oral appliances, which allows more predictable treatment results.
- Mini-plate also allows an overall decrease in the number of extraction and orthognathic surgery cases.
- Mini plate can be a viable treatment alternative for anterior maxillary osteotomy.

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