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Minimally Invasive Technique for Anterior Maxillary Intrusion - A Series of 7 Cases with 1-year Follow-up

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Abstract

Objective: The conventional treatment for Anterior Maxillary Vertical Excess (AMVE) is surgical reduction and rigid fixation which has low patient acceptance. However, intrusion of some selected AMVE cases can be achieved with minimal intervention using micro plate anchorage, thus expediting and simplifying their management. The present paper demonstrates the efficacy of microplate anchorage in the intrusion of anterior maxilla. **Methods:** A total of 7 patients (2 males and 5 females) in the age group of 13–43 years were treated for anterior maxillary vertical excess. Anterior maxillary intrusion was carried out using two hole microplates anchored bilaterally at the naso maxillary buttress and closed coil spring attached to the arch wire. The activation was carried out at monthly interval. **Results:** The mean duration of surgical procedure was 18.4 minutes and the mean duration for intrusion was 4.86 months (3–7 months). The patients compliance were overall good and the average amount of intrusion achieved was 4.14 mm. All the patients were satisfied with post treatment smile. **Conclusion:** The result of this study elucidates that intrusion using micro plates is an easy, efficient, safe and cost effective option in the management of AVME. It is less invasive with acceptable clinical and radiographic outcome. Careful case selection is needed for achieving satisfactory result and smile.

Keyword: Anterior Maxillary Vertical Excess (AMVE), Maxillary Intrusion, Microplate Anchorage, Minimally Invasive Intrusion, Skeletal Anchorage

1. Introduction

AMVE is one of the etiologies for unaesthetic gummy smile.[1] AMVE is found in individuals with normal maxillary development but have gummy smile due to anterior dentoalveolar excess. The treatment outcome for AMVE may not always be successful with conventional orthodontic treatment alone. It usually requires surgical intervention such as Lefort I superior repositioning or anterior maxillary osteotomy to achieve satisfactory result.[1,2] But surgical therapy under general anesthesia is not always an acceptable treatment of choice for every patient. Moreover, surgical procedure is associated with various complications like hemorrhage, pain, paresthesia, soft tissue injury, fracture of dentoalveolar components and loss of tooth vitality. Recently, the mini implants

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have emerged as a stable skeletal anchorage for precised and controlled tooth movement.[3,4] These mini implants includes mini screws, mini plates and micro plates have been used successfully for space closure, anterior retraction, posterior intrusion, molar up righting, occlusal can't correction and even maxillary dental arch distalization.[4–6] The placement of mini implants can be done as a chair side procedure under local anesthesia. The development of mini implants has triggered various novel techniques for treating gummy smiles also. Kim *et al.*[7] intruded the maxillary anterior teeth to correct gummy smile using mini screw at the anterior nasal spine assisted by segmental arch wire.

Mini plates and micro plates were more stable when compared to mini screws. A systematic review by Schatzle *et al.*[8] indicated that the failure rate for orthodontic mini plates was 7.3% and that for mini screws was 14.1%. The surgical approach required for a mini and micro plate is more invasive than the simpler insertion and removal of mini screws; however, mini and micro plates allow greater versatility of force vector design. Micro plates which are smaller in dimension when compared to mini plates are in use for osteosynthesis since 40 years.[9] Micro plating system has excellent pull out strength similar to mini plates.[9] Thus, micro plate anchorage is still useful if extensive orthodontic treatment is required. The primary objective of the present study is to evaluate the clinical and radiographic outcome of anterior maxillary intrusion using micro plate anchorage at the Naso maxillary buttress bilaterally.

2. Methods

2.1 Cases and Technique

Patients from either gender reported for the correction of gummy smile were selected. The patient data were listed in Table 1. The procedure was explained to the patients and written informed consent was obtained.

2.2 Pre-operative Work Up

Complete history was taken and clinical evaluation was done. Routine blood investigations, photographs, (Figures 1, 2) panoramic radiograph (OPG) and lateral cephalogram (Figure 3) were taken. After thorough clinical and radiographic evaluation, individuals with associated skeletal deformity apart from isolated anterior maxillary (dentoalveolar component) vertical excess were excluded. The extent of dentoalveolar excess and the required amount of intrusion were calculated using POS Smile Stream diagnostic software. Initial orthodontic alignment was done using O14 heat activated NiTi wire. Labial torque brackets were fixed to the maxillary anterior teeth to prevent labial flaring during intrusion. Later on, the patients were prepared for the surgical procedure of micro plate placement.

2.3 Surgical Procedure

Under aseptic condition, Local anesthesia with adrenaline (1:2,00,000) was infiltrated along the anterior maxillary



Figure 1. Pre-operative frontal view.



Figure 2. Pre-operative occlusion.

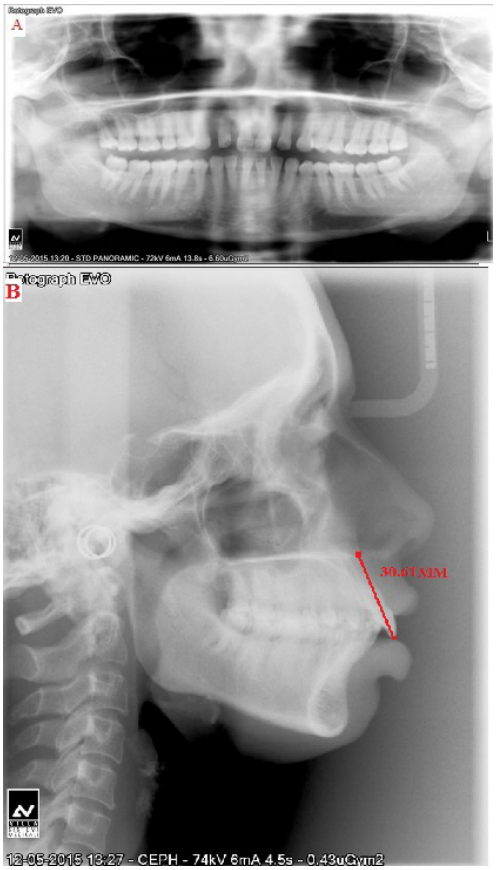


Figure 3. Pre-operative radiographs A) Panoramic radiograph B) Lateral cephalogram.

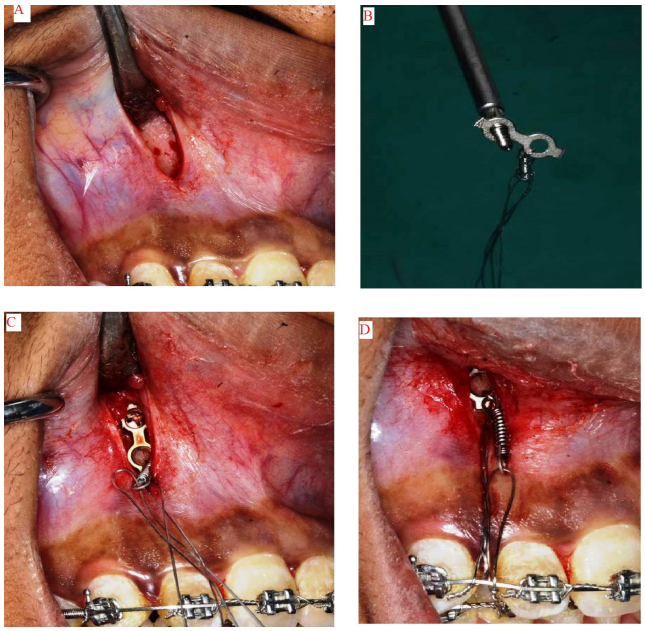


Figure 4. Surgical procedure- A) Incision B) Micro plate with screw C) Plate with coil fixed at nasomaxillary buttress D) Coil and suspension wire tied to the arch wire.



Figure 5. After placement of micro plates and coil.





Figure 6. Post insertion radiograph A) panoramic radiograph B) lateral cephalogram.



Figure 7. Post treatment frontal view.



Figure 8. Post treatment occlusion.

labial vestibule. Incision of about 1cm length was given in the maxillary labial vestibule along the naso maxillary (pyriform) buttress region bilaterally. The flap was elevated and a two-hole titanium micro plate was fixed bilaterally at the nasomaxillary buttress with one 1.5x6 mm titanium screw on the distal end of the plate. A 6mm Stainless steel closed coil spring was tied to the proximal screw hole and attached to the arch wire. (Figure 4) An O12 stainless steel ligature wire was used as a suspension wire from the plate to the arch wire. The Coil was activated immediately by 150 grams on each side with the intrusion rate of 1mm/month. The distance from plate to arch wire was measured in millimeter and documented as a base line value. The plate was completely submerged in the soft tissue and the surgical site was closed primarily with 3-0 vicryl. Thus, only the coil and suspension wire were visible through the soft tissue (Figure 5). Antibiotics and analgesics were prescribed for 5 days. The patients were advised to maintain proper oral hygiene and to use 0.12% chlorohexidine mouth rinse twice a day.

The patients were recalled after a week to review soft tissue healing and sutures were removed. Lateral cephalogram and panoramic radiographs were taken



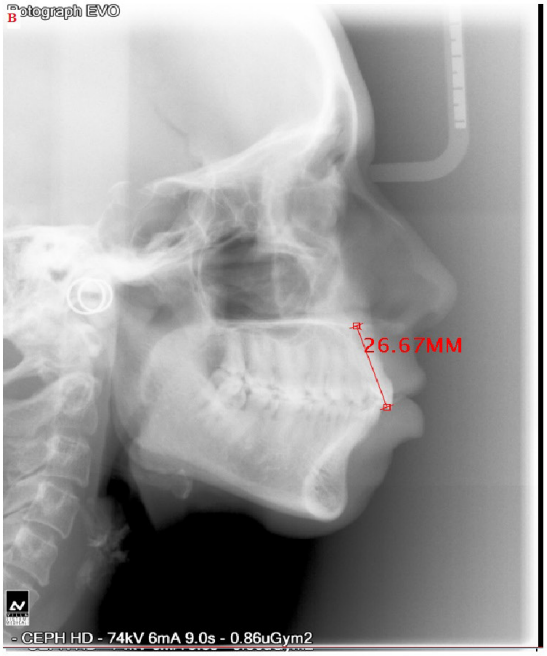


Figure 9. Post treatment radiograph A) Panoramic radiograph B) Lateral cephalogram.

(Figure 6). The patients were recalled every month to check the amount of intrusion and reactivation of the coil. The activation of the coil was stopped when there was clinically 0-2 mm of gingival exposure at wide smile which was considered as youthful and esthetically acceptable.[1,2,10] The coil was removed and the suspension wire was left in place as a retention until bone remodeling.

Later, retraction of maxillary anterior teeth was done using 19x25 SS wire and 12mm closed coil spring. In cases, where there was a need for space, extractions of maxillary and mandibular first premolars were done. In case of bi-maxillary protrusion, the mandibular retraction was followed simultaneously. During finishing stage, a functionally stable occlusion with proper anterior

Table 1. Clinical evaluation

S.no	Patient	Age/ Gender	Type of malocclusion	Duration for surgical procedure - mins	Duration for completion of intrusion (months)	Amount of intrusion (clinical) mm
1	A	22/F	Class I Bimaxillary protrusion with VME	25	3	3
2	B	16/M	Class I ,AVME	14	3	4
3	C	14/F	Class I AVME with anterior spacing	15	4	4
4	D	13/F	Class II div 1 with gummy smile	23	6	4
5	E	43/F	Class II div 1 AVME with spacing	14	6	5
6	F	18/F	Class I with AVME	20	5	4
7	G	16/M	Class I with Bi maxillary protrusion	18	7	5

Table 2. Radiographic evaluation

S.no	Patient	Pre intrusion alveolar height (mm)	Post intrusion alveolar height (mm)	Total intrusion achieved (mm)
1	A	27.3	24.1	3.2
2	B	33.1	29.1	4
3	C	29.4	25.2	4.3
4	D	25.6	21.3	4.3
5	E	30.6	26.7	4.1
6	F	29.8	26.4	3.4
7	G	26.5	22.3	4.2

guidance was achieved. The micro plates were removed after the completion of treatment by a second surgical procedure under local anesthesia. Smile stream software from progressive orthodontic seminars was used for all orthodontic treatment planning.

2.4 Outcome Evaluation

The outcome variables measured were 1. Duration of surgical procedure measured in minutes from the time of incision to closure 2. Total duration for intrusion - measured in months from the time of activation till completion of intrusion 3. Amount of intrusion achieved clinically, measured in millimeter from micro plate to the arch wire and 4. Radiographically the difference in the linear distance measured in millimeter from anterior nasal spine to maxillary central incisal tip in the pre and post intrusion lateral ceplalogram (Figures 3, 9) 5. Patient satisfaction about profile and smile. All the data were collected and documented.

3. Results

A total of 7 patients were treated for anterior maxillary vertical excess. Two male and five females with the mean age of 21.4 years (13–43years). Three patients had class I malocclusion with AMVE, two has Class I malocclusion with AMVE and bialveolar protrusion and two with Class 2 division 1 malocclusion (Table 1). The mean duration of surgical procedure was 18.4 minutes. The mean clinical intrusion was 4.14 mm and the mean radiographic intrusion was 3.9 mm (Table 2). The mean duration for intrusion was 4.9 months (3–7 months) (Table 1). None of the cases showed root resorption or bone loss in post treatment radiograph. Neither infection nor

plate loosening was found in our cases throughout the treatment period. The post treatment facial and intraoral photographs (Figures 7–9) show remarkable improvement in lip posture due to intrusion and retraction of maxillary anterior teeth and patients were much satisfied with their post treatment smile. All the patients were followed for a period of 12 months and showed no sign of relapse either clinically or radiographically.

4. Discussion

The uncertainty in the management of gummy smile is wide spread in the literature. The treatment should largely be customized on the etiology. According to Schendel *et al.*[11] gummy smile may be due to 1. Soft tissue etiology like short upper lip, 2. Dentoalveolar type - Anterior Maxillary Vertical Excess (AMVE), and 3. Skeletal type with its five variations like total maxillary vertical excess, clockwise and counter clockwise rotation of palatal plane, posterior vertical maxillary excess and maxillary excess with premaxillary elevation. The skeletal type is usually found in patients with long-face syndrome and associated with mandibular deformity.[11] If detected at early age, it can be managed with orthopaedic appliances and growth modifications.

In Adults, orthognathic surgery is generally required to treat this kind of skeletal deformities.[2,11] Surgical procedure to correct minor deformities like AMVE has a significant effect on the soft tissue components like widening of the alar base and change in upper lip posture. Despite safety and reliability, modern General Anaesthesia (GA) disrupts the patient physiology and cause metabolic stress. The incidence of postoperative nausea, vomiting, drowsiness and the need for hospital stay are high in GA.

Some AMVE are camouflaged by orthodontic treatment and mucogingival surgery;[1] however the outcome is suboptimal with its own risk and complications like anchorage loss, root resorption, loss of tooth vitality, tooth mobility, insufficient intrusion and relapse. A successful orthodontic treatment needs a good anchorage either skeletal or dental. Dental anchorage is easy to achieve but there may be loss of anchorage control, tipping of molars and the amount of intrusion is not effective.[12,13] Recently skeletal anchorage came in to the focus of attention due to more stable results. Skeletal anchorage using mini plates, micro plates and mini screws have better anchorage than headgears and lessen the use of orthopedic appliances now a days.[14–17,18] Mini and micro plates provide more stable anchorage when compared to mini screws and allow great versatility of vector force design and mainly indicated for Intrusion and distalization.[18,19] Micro plates were extensively used for maxillary protraction procedures, cleft segment expansion and stabilization, and tooth movement into narrow alveolar cleft sites where the availability of bone is less.[20]

In this study, the authors made an effort to find an improved treatment option for AMVE which offers optimum outcome than conventional orthodontics and less risk when compared to surgery. The author's intention was not to obviate orthognathic surgery, but the procedure presented in the current study, reduces the treatment of AMVE in any age group to a minor procedure with less operating time and acceptable outcome.

It is indicated to place the micro plates at the buttress region in maxilla which has dense cortical bone for anchorage and provide high primary stability,[18] which in turn allows immediate loading and activation without any latency period. Zygomatic maxillary buttress is the most commonly used site for skeletal anchorage; however, it is not ideal for isolated anterior vertical maxillary intrusion as the forces are directed mainly in the anteroposterior direction than vertical which is essential for AMVE. In our study we used nasomaxillary buttress as a site for anchorage where the force can be directed more vertically. Thus more amount of expected intrusion can be achieved than retraction. The placement of plate should be bilaterally symmetrical so that the intrusion will be uniform or else it may cause asymmetrical movement.

The titanium plates are biocompatible and devoid of tissue reaction. Usually the skeletal anchorage devices are exposed to oral environment leads to difficulty in maintaining oral hygiene and cause inflammation and infection around the mini screws heading to screw loosening and loss of anchorage. In our study, the plates were completely submerged in the soft tissue and only the wires were exposed to facilitate proper oral hygiene maintenance.

The mean duration of intrusion was only five months and the intrusion time was decreased in young patients when compared to aged patients. This could be because the resilient natures of bone in younger individuals yield more to the given force than elder ones. The rate of intrusion was declining with time, based on our clinical observation. In our study maximum amount of intrusion achieved was 5 mm and the average was 4.14 mm in 3-7

months duration of treatment. In some other studies the amount of intrusion by skeletal anchorage varies from 1.92mm[12] to 5mm[18] which were comparable with our cases.

Controlled gradual movement by micro plate anchorage has little or no effect on lip posture and alar base. Lip length is one of the determinant factors for successful intrusion. Short upper lip may give a false appearance of inadequate intrusion; therefore careful case selection is mandatory to get expected result. The micro plate anchorage is considered unsuccessful or failed when there was significant loosening of plate or mobility that could not withstand orthodontic loading.[19] No short term or long term complications like infection, root resorption, plate loosening and loss of tooth vitality were noted in our study. It is purely intrusion of maxillary anterior teeth with micro plate anchorage at the nasomaxillary buttress region.

Baek *et al.*[21] reported relapse rate of 30% in molar intrusion cases in 3 years' period, with 80% of relapse in first year. But in our cases, there is no noticeable relapse either clinically and radiographically in 1 year follow up, which could be attributed to the slow and gradual intrusion and passive retention using the suspension wire, which was left in situ till the completion of orthodontic treatment. The authors have not compared this minimally invasive technique to other conventional techniques, and hence authors could not declare the superiority of this technique to other.

5. Conclusion

Intrusion of dentoalveolar complex to correct AMVE can be successfully achieved with micro plate anchorage at the nasomaxillary buttress. There will be little or no changes in the soft tissue components like alar base, lip posture when compared to surgical procedure. Intrusion using micro plates is an easy, efficient, safe and cost effective option in the management of AVME. It is less invasive with acceptable clinical and radiographic outcome, while avoiding surgery under GA with its risk and complication. Although we acknowledge the limited number of patients in this series, we consider that this technique is simple and a promising one to solve the difficult problem of gummy smile. However, careful patient selection is needed for achieving satisfactory result and smile. More empiric experience and a study with a larger sample size are needed.

6. References

1. Polo M. Botulinum toxin type A in the treatment of excessive gingival display. Am J Orthod Dentofacial Orthop. 2005; 127:214–18. https://doi.org/10.1016/j.ajodo.2004.09.013. PMid:15750541
2. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. Periodontol. 2000; 11:18–28. https://doi.org/10.1111/j.1600-0757.1996.tb00179.x. PMid:9567953
3. Ali D, Mohammed H, Koo SH, et al. Three-dimensional evaluation of tooth movement in Class II malocclusions treated without extraction by orthodontic mini-implant anchorage. Korean J Orthod. 2016; 46:280–9. https://doi.org/10.4041/kjod.2016.46.5.280. PMid:27668191. PMCid:PMC5033767
4. Seres L, Kocsis A. Closure of severe skeletal anterior open bite with zygomatic anchorage. J Craniofac Surg. 2009; 20:478–82. https://doi.org/10.1097/SCS.0b013e31819bd161. PMid:19276813
5. Lin JC, Liou EJ, Yeh CL. Intrusion of overerupted maxillary molars with miniscrew anchorage. J Clin Orthod. 2006; 40:378–83.
6. Cornelis MA, De Clerck HJ. Maxillary molar distalization with miniplates assessed on digital models: A prospective clinical trial. Am JOrthod Dentofacial Orthop. 2007; 132:373–7. https://doi.org/10.1016/j.ajodo.2007.04.031. PMid:17826606
7. Kim SJ, Kim JW, Choi TH et al. Combined use of miniscrews and continuous arch for intrusive root movement of incisors in Class II division 2 with gummy smile. Angle Orthod. 2014; 84:910–8. https://doi.org/10.2319/080713-587.1. PMid:24512532
8. Schatzle M, Mannchen R, Zwahlen M et al. Survival and failure rates of orthodontic temporary anchorage devices: Asystematic review. Clin Oral Implants Res. 2009; 20:1351–9. https://doi.org/10.1111/j.1600-0501.2009.01754.x. PMid:19793320
9. Hegtvedt AK, Michaels GC, beals DW. Comparison of the resistance of miniplates and microplates to various in vitro forces. J Oral Maxillofac Surg. 1994; 52:251–7. https://doi.org/10.1016/0278-2391(94)90294-1
10. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. Am J Orthod Dentofacial Orthop. 1992; 101:519–24. https://doi.org/10.1016/0889-5406(92)70126-U
11. Schendel SA, Carlotti AE. Variations of total vertical maxillary excess. J Oral Maxillofac Surg. 1985; 43:590–6. https://doi.org/10.1016/0278-2391(85)90126-0
12. Ozsoy OM, Ozcirpici AA, Veziroglu F. Miniscrews for upper incisor intrusion. E J orthodontics. 2009; 31:412–16. https://doi.org/10.1093/ejo/cjn122. PMid:19289539

13. Costa A, Raffainl M, Melsen B. Miniscrews as orthodontic anchorage: a preliminary report. Int J Adult Orthodon Orthognath Surg. 1998; 13:201–9.
14. Kanomi R. Mini-implant for orthodontic anchorage. J Clin Orthod. 1997; 31:763–7.
15. Reynders R, Ronchi L, Bipat S. Mini-implants in orthodontics: a systematic review of the literature. Am J Orthod Dentofacial Orthop. 2009; 135:564–19. https://doi.org/10.1016/j.ajodo.2008.09.026. PMid:19409331
16. Scheffler RN, Profit RW, Phillips C. Outcome and stability in patient with anterior open bite and long anterior face syndrome treated with temporary anchorage device and maxillary intrusion splint. Am J Orthod Dentofacial. 2014; 146;594–602. https://doi.org/10.1016/j.ajodo.2014.07.020. PMid:25439210. PMCid:PMC4427344
17. Yao CJ, Chang H, Chang JZ, et al. Revisiting the stability of mini-implants used for orthodontic anchorage. Journal of the Formosan Medical Association. 2015; 114: 1122–8. https://doi.org/10.1016/j.jfma.2014.08.001. PMid:25260551
18. Vachiramon A, Urata M, Kyung HM. Clinical applications of orthodontic microimplant anchorage in craniofacial patients. The Cleft and Craniofacial Journal. 2009; 46:206–19. https://doi.org/10.1597/06-219.1. PMid:19254050
19. Londa G. The anchorage quality of titanium microplates with short microscrews for orthodontic anchorage applications. J Orofac Orthop. 2005; 66:67–77. https://doi.org/10.1007/s00056-005-0428-1. PMid:15711901
20. Deguchi T, Murakami T, Kuroda S, et al. Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear. Am J Orthod Dentofacial Orthop. 2008; 133:654–60. https://doi.org/10.1016/j.ajodo.2006.04.047. PMid:18456138
21. Baek MS, Choi YJ, Yu HS, et al. Long-term stability of anterior open-bite treatment by intrusion of maxillary posterior teeth. Am J Orthod Dentofacial Orthop. 2010; 138:396–9. https://doi.org/10.1016/j.ajodo.2010.04.023. PMid:20889043