

Case Report

Anterior maxillary and mandibular subapical osteotomy for correction of bimaxillary protrusion

ABSTRACT

Bimaxillary protrusion (BP) is one of the most prevalent dentofacial deformities in the Asian population. Facial esthetics is the primary concern of these patients. Typical orthodontic treatment includes retraction of maxillary and mandibular incisors after extraction of the four first premolars, but this might not yield desired esthetic changes in the patient. Thus, orthognathic surgery such as anterior subapical osteotomies and extraction of premolars can be looked upon as an option to correct sagittal excess of the jaw bones and associated dental anomalies. This case report describes the treatment of a middle-aged woman with complaints of lip protrusion and unfavorable esthetics due to present malocclusion with the help of anterior maxillary and mandibular osteotomy procedure which provides a stable and viable treatment option for desired esthetic results.

Keywords: Anterior maxillary and mandibular subapical osteotomy, bimaxillary protrusion, orthognathic surgery

INTRODUCTION

Bimaxillary protrusion (BP) is one of the most prevalent dentofacial deformities in the Asian population.^[1] Facial esthetic problems related to BP include extreme protrusion of the anterior teeth and lip, lip incompetence, strain with hypermental action on closure, thick-looking lips with an everted vermilion border, convex profile, and toothy appearance in cases of chin deficiency.^[1] Since there is usually a considerable degree of association between basal prognathism and dentoalveolar proclination, bimaxillary proclination suggests the occurrence of bimaxillary prognathism and a bimaxillary dental proclination.^[2] The majority of patients who suffer from bimaxillary proclination seek treatment more for the enhancement of facial esthetics than for dental esthetics and function.^[3] The amount of tooth movement by orthodontic treatment is limited, the position of the anterior nasal spine (ANS) in adults cannot be corrected orthodontically, the social conditions (age, time, economic circumstances, etc.) sometimes preclude orthodontics in

such a scenario, and anterior segmental osteotomy (ASO) can be used as adjunctive procedure.^[4,5] When required, orthognathic surgery may include some combination of Le Fort I osteotomy, bilateral sagittal split ramus osteotomy, and upper and lower anterior subapical osteotomies (ASOs). This case report represents ASOs in the maxillary and mandibular arch as the adjunctive treatment protocol for correction of BP.

DIAGNOSIS

A 33-year-old Indian woman reported to the Department of Orthodontics and Dentofacial Orthopedics, with a chief complaint of protruding lips and unfavorable esthetics. She

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was unhappy with her looks. She did not have any systemic disease and exhibited good oral hygiene.

CLINICAL FINDINGS

The patient is a brachycephalic female with mesoprosopic face. She presented with convex facial profile, incompetent lips, gummy smile, and deficient chin with mentalis strain. She had a full complement of teeth devoid of any carious lesions. Her mandibular dental midline was shifted to the right side by 1 mm. Intraoral and dental cast examination revealed a Class I molar and canine relation on both the sides [Figures 1 and 2]. A panoramic radiograph showed that all third molars were present and were in occlusion [Figure 3]. The patient had a thin cortical plate clinically and cephalometrically in the maxillary and mandibular anterior region. The patient had skeletal Class I malocclusion with vertical growth pattern [Figure 3; Tables 1 and 2].

TREATMENT OBJECTIVES

The following presurgical objectives were established:

1. To level and align both arches
2. Achieve coincident midlines with the facial midline
3. To maintain Class I molar and canine relation on both sides
4. To reduce slight proclination in the available space.

Surgical objectives:

1. To reduce upper and lower incisor proclination
2. To reduce gummy smile
3. To achieve competent lips
4. To improve retruded chin position and overall facial profile
5. To maintain Class I canine and Class I molar relation on both the sides.

Postsurgical objectives:

1. Final tooth alignment and root parallelism
2. Maximal interdigitation
3. To maintain ideal overbite and overjet
4. To maintain Class I molar canine relation.

TREATMENT ALTERNATIVES

1. First premolar extraction followed by intrusion retraction of anteriors for space closure to obtain Class I canine and Class I molar and advancement genioplasty
2. First premolar extractions followed by anterior subapical osteotomy in the maxillary and mandibular arch to reduce the gummy smile by impaction and clockwise rotation of maxillary segment to close extraction space and anticlockwise rotation of mandibular segment to obtain ideal incisor inclination and to obtain ideal overjet and overbite followed by augmentation genioplasty.



Figure 1: Pretreatment extra- and intraoral photographs

TREATMENT PROGRESS

Because the main concern was esthetics for the patient, the second treatment option was chosen which predicted



Figure 2: Pretreatment dental models

a better esthetic result. Extraction of all first premolars followed by ASOs in the maxillary and mandibular arch and horizontal advancement genioplasty was chosen. The rationale for choosing this approach is further elaborated in discussion. After obtaining patient consent for surgery, a full fixed (0.022 × 0.028) slot MBT prescription was used and both arches were bonded. After 6 months of leveling and alignment with 0.012” to 0.018” round NiTi wires followed by 0.017 × 25 NiTi, 0.019 × 25 NiTi, and then 0.019 × 25 SS wire, 2 days prior to anterior subapical osteotomy, a segmental 0.019 × 25 SS wire was adapted from canine to canine in the upper and lower arch and from the second premolar to the first molar in both the arches leaving all the first premolars [Figure 4]. Since earlier conventional treatment option of all four premolar extractions was chosen, the lower left first premolar had

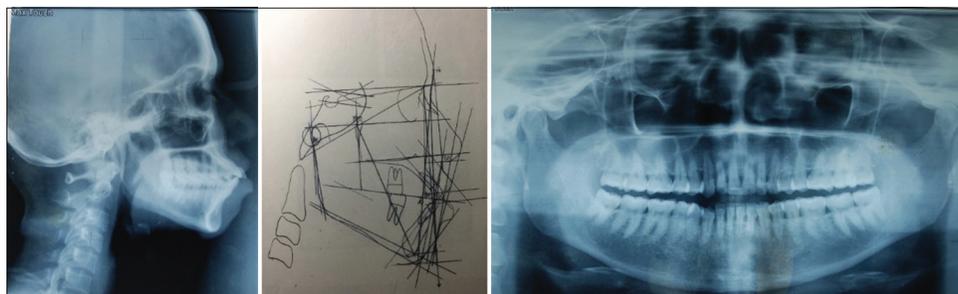


Figure 3: Pretreatment radiographs and cephalometric tracing

Table 1: Pretreatment and posttreatment cephalometric comparison

	Normal	Pretreatment	Posttreatment
Maxilla to cranial base (SNA)	82°	80°	80°
Mandible to cranial base (SNB)	80°	77°	78°
Maxillomandibular (ANB)	2°-4°	3°	2°
Wits appraisal	AO coincide with BO	AO is 1 mm ahead of BO	AO 3 mm ahead of BO
Angle of inclination (maxillary rotation)	85°	91°	88°
SN-MP	32°	34°	34°
FMA (MP-FH)	25°	34°	30°
U1-NA (mm)	4	13	6
U1-NA	22°	47°	30°
U1-SN	102°	128°	110°
L1-NB	25°	39°	25°
L1-NB (mm)	4	10	4
Interincisal angle	131°	91°	123°
L1-MP	90°	101°	90°
Soft tissue-lower lip to E-plane (mm)	2	5	1
Upper lip to E-plane (mm)	4	0	-2
S line upper lip (mm)	0	4	0
S line lower lip (mm)	0	8	2
Nasolabial angle	102°	77°	95°
Upper lip thickness (mm)	15+/-1	7	13
Soft-tissue chin thickness (mm)	10-12	6	10
Holdaway ratio (L1-NB: NB-Pog)	1:1	10:0	4:1

Sella: Nasion-Point A, SNB: Sella-Nasion-Point B, ANB: Point A-Nasion-Point B, SN: Sella-Nasion plane, MP: Mandibular Plane (Go.Me), FMA: Frankfurt Mandibular Angle, FH: Frankfort Horizontal Plane, NA: Nasion-Point A, NB: Nasion-Point B, AO: Perpendicular projection of Point A on occlusal plane, BO: Perpendicular projection of Point B on occlusal plane

already been extracted. However, later on further evaluation, patient consent was obtained for surgery, and the remaining premolars were extracted on the table.

At the time of surgery after achieving adequate anesthesia, upper and lower anterior subapical osteotomies were performed with rigid fixation. Anterior subapical osteotomy was done in the maxillary arch by Wunderer^[6] procedure and in the mandibular arch by Kolle procedure along with horizontal advancement genioplasty.

The osteotomy cuts were placed parallel to canine and second premolar roots through extraction sites. The horizontal osteotomy cut was placed 5 mm above the canine roots in the maxillary arch, and some bone is removed for repositioning of the anterior segment to correct upper incisor angulation.

In the mandibular arch, vertical cuts were placed parallel to the canine and second premolar roots and horizontal cuts were made 5 mm inferior to the lower canine. Rigid fixation of osteotomized segments was done with miniplates and screws. Horizontal advancement of the chin was done by 4 mm along with ASOs. This helped in increasing the chin prominence and reduced mentalis strain [Figure 5]. A space distal to the

left upper canine was remaining after surgery and which was decided to close with orthodontic treatment [Figure 6].

Regional acceleratory phenomenon after orthognathic surgery increases to maximum level after 4 weeks, and then gradually decreases to preoperative level, and orthodontic tooth movement in this situation is accelerated.^[7] The round 0.0 18” NiTi wires were placed in the upper and lower arch for leveling and alignment after 4 weeks; after subapical osteotomy, some vertical defect is observed between canine and second premolar which got corrected with wires and the remaining space closure was done with elastomeric chains [Figure 7]. The patient wanted to discontinue, hence orthodontic appliance was debonded, and wraparound type of retention plates was given in the maxillary and mandibular arch after 24 months of treatment leaving space distal to the maxillary left canine.

TREATMENT RESULT

Maxillary and Mandibular prognathism were corrected with orthodontic treatment and anterior maxillary and mandibular subapical osteotomy. Along with this incisor proclination and gummy smile were reduced. Horizontal advancement genioplasty resulted in good chin prominence thus, resulting in acceptable facial esthetics. Intraorally, Class I molar on both the sides with Class I canine on the right side and end-on canine on the left side was achieved. Good dental intercuspation was seen [Figure 7]. Radiographs taken at the end of treatment showed good healing at the osteotomy cuts [Figure 8]. Cephalometric superimpositions show reduced dental inclinations as well as skeletal correction of the jaws [Figure 9].

DISCUSSION

The aim of this case report is to discuss anterior maxillary and mandibular subapical osteotomy as an adjunctive procedure to treat BP in patients.

The patient had typical characteristics of BP; her chief complaint was her protruding facial profile proclined teeth. She was overall unhappy with her esthetics. The other treatment option rather than subapical osteotomy to treat this case was extraction of all first premolars followed by intrusion and retraction of anterior teeth and advancement genioplasty. The intraoral examination revealed thin cortical bone in the maxillary and mandibular anterior region. As we know, in bidentoalveolar protrusion, retraction of anterior teeth poses a problem during retraction as a torque control of incisors becomes critical. A biological challenge arises in patients with narrow alveolar bone with a severe iatrogenic



Figure 4: Models before surgery

Table 2: Soft-tissue analysis

Parameter (facial form)	Pretreatment	Posttreatment
G-Sn-Pg'	-12°	-14°
G-Sn-(HP*), mm	-2	-2
G-Pg'(HP*), mm	-13	-4
G-Sn/Sn-Me', mm	1	1
Cm-Sn-Ls	62°	95°
Ls to (Sn-Pg'), mm	7	3
Li to (Sn-Pg'), mm	12	4
Si to (Li-Pg'), mm	2	2
Sn-Stms/Stmi-Me'		3.25
Stms/1, mm	5	3

HP: Horizontal Plane

loss of periodontal support when the incisor apices hit the orthodontic walls of dense cortical plates during retraction. This will result in resorption of bone around the root apices which results in fenestrations, alveolar bone loss, or dehiscence. The other disadvantages, such as root resorption, severe lingual tipping of the anterior teeth, insufficient retraction because of anchorage loss, and increased upper incisor exposure, can occur.^[8,9]

The main concern of the patient was the esthetic appearance, and if we choose all the first premolar extraction approaches, the soft-tissue changes after all premolar extractions involve small entities and do not dramatically modify profile, and ANS position cannot be altered by all first premolar extractions.^[10]

We chose anterior subapical osteotomy in both arches followed by advancement genioplasty as the existing

molar relation was to be maintained. Furthermore, anticlockwise rotation of the maxilla indicated by the angle of inclination (J-angle: 91°) suggests that proclination of the upper anterior is due to the upward tipped maxilla. The vertical excess in the anterior region was attributed to the gummy smile even though the palatal plane was inclined upward. On the contrary, Le Fort I maxillary osteotomy would have disturbed the existing harmonious intercuspation and also Le Fort I maxillary osteotomy setback has a limited range and increased complications due to the risk of damaging the vascular structures posterior to the maxilla. Thus, correction of deformity by just moving the anterior maxilla was considered rather than Le Fort I maxillary osteotomy.

The subapical osteotomy was first used by Taylor *et al.* to treat alveolar protrusion.^[10] The anterior maxillary and mandibular subapical osteotomy procedure which was done by The Wunderer method which resulted in greater esthetic changes. The anterior subapical osteotomy has the advantages of the open surgical field, stable occlusal molar relation, almost no impact on the temporomandibular joint, and low rate of relapse. The treatment period by this method is short with a low incidence of complications; the occlusal relationship of the posterior teeth is not altered.^[11,12] The requirement of intraoral anchorage is much lower than that in orthodontic approach. The main differences in the facial profile between patients with BP and normal generation lie in the lip and chin. This approach overcomes the limitations of orthodontic treatment, which does not optimally improve the facial soft tissue of patients with severe protrusion when used alone to obtain the optimal effect.^[13,14] Certain minor drawbacks of AMO include loss of teeth vitality, persistent periodontal defects, communication with nasal cavity or antrum, and occlusal step formation, but these could be overcome by isolated AMO and surgical and postsurgical care.

The treatment with anterior subapical osteotomy in the maxillary and mandibular arch in this patient brought desired

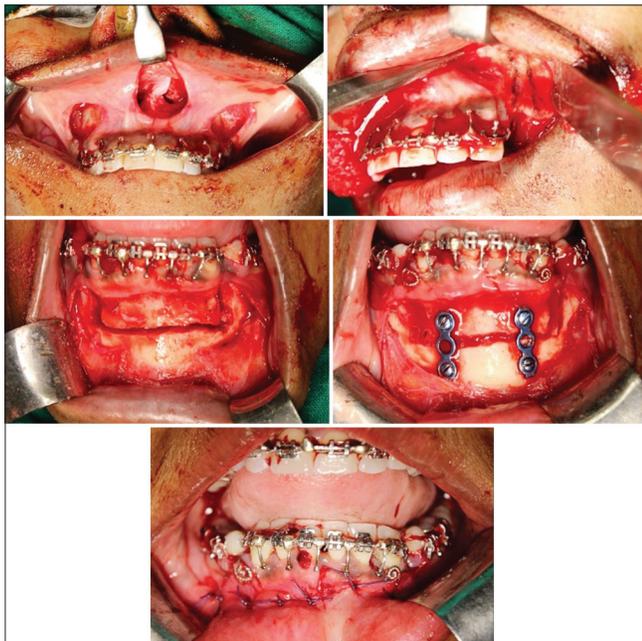


Figure 5: During surgery photographs



Figure 6: Postsurgery photographs after 4 weeks



Figure 7: Posttreatment photographs

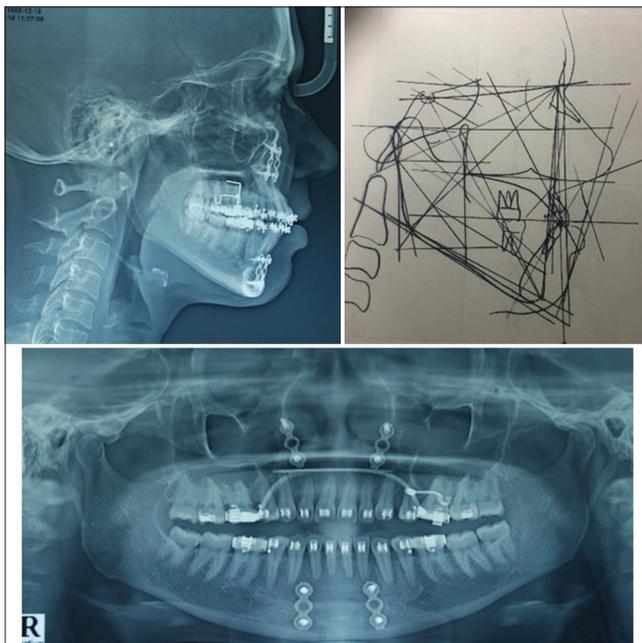


Figure 8: Posttreatment radiograph and tracing

soft tissue, and occlusal changes. The patient at last wanted to discontinue the treatment and hence the appliance was removed leaving some space in the upper arch distal to the canine on the left side. Clockwise rotation of maxillary segment helped in axial inclination correction of incisors and helped in establishment of interincisal angle. Impaction of

segment helped in reduction of gummy smile. Advancement genioplasty helped in establishment of straight profile and reduction of mentalis strain. The lip incompetence was corrected, and the lip relationship was improved.^[15]

Anterior maxillary and mandibular subapical osteotomy procedures show stable results with rigid fixation.^[16] With advancements in computer-aided manufacturing/computer-aided design procedures, anterior subapical osteotomy can be further enhanced and then increasingly used for the correction of malocclusions such as BP to achieve dramatic clinical outcomes, in terms of both occlusal relationship and esthetic facial appearance. Meticulous planning and execution of the osteotomies in accordance with the surgical plan are essential for optimal esthetic and functional outcomes.

CONCLUSION

Anterior maxillary and mandibular subapical osteotomy is a simply manipulated orthognathic surgery, and despite the associated risk, it is a relatively safer procedure. Successful treatment of patients with BP depends on careful listening to the patient's concerns and establishing a personalized treatment plan with the orthodontist and oral surgeon. Improvement in facial esthetics is usually the most important

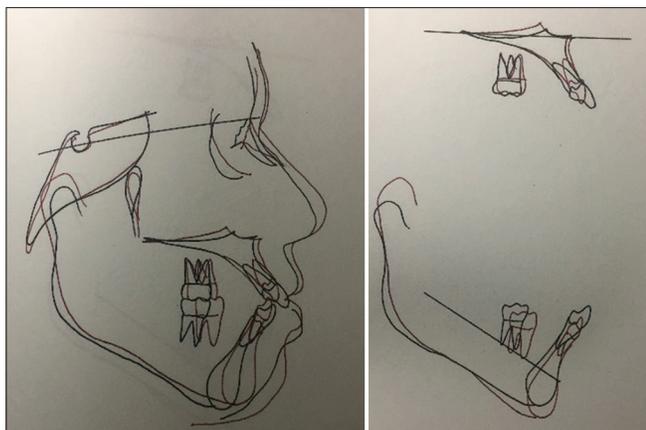


Figure 9: Cephalometric superimposition

concern of these patients with BP. Subapical osteotomy provides a viable treatment option in such cases.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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