Case Report

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Treatment of maxillary hypoplasia with bone anchored maxillary protraction (BAMP) - A case report

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Abstract

Early diagnosis and treatment is known to be beneficial in Class III malocclusions secondary to maxillary hypoplasia. However, success of treatment largely depends on the patient's compliance and thus, appropriate choice of treatment, appliance and the age for interception plays an important role. Bone anchored maxillary protraction is one such approach presented in this case report for a 13 years old boy who reported with the chief complaint of lower front teeth visibility during speech and smiling. On examination his molars were in Angle's Class III relation, anterior crossbite and deep bite with unerupted maxillary canines. Orthodontic treatment was begun for deep bite correction and for creating space for the maxillary canines, followed by surgical intervention for placement of bone anchored miniplates. Protraction was done for 14 months and the total treatment time was 20 months. Improvement in the patient's profile, aesthetics and function was achieved with well aligned arches.

Keywords:

BAMP, Class III malocclusion, early treatment, maxillary hypoplasia, maxillary protraction

Introduction

The etiology of class III malocclusion is a broad spectrum of malocclusion consisting of mandibular prognathism, maxillary hypoplasia, or a combination of the above.[1] Different ethnic groups exhibit different prevalence rates of class III, Chinese showing a 15.69% prevalence rate and Malaysian showing 16.59%, while Indian populations show a relatively lower prevalence.[2]

More than 60% of class III malocclusion cases are due to skeletal discrepancies.[3] Obtaining skeletal changes in such cases requires growth modification, which implies intervention at the appropriate timing. One such approach is bone-anchored maxillary protraction (BAMP) in cases of mid-face deficiency. This case report presents an individual treated with this approach to get satisfactory outcomes, based on his age, clinical features, and malocclusion.

Diagnosis and Etiology

A 13-year-old boy reported to the orthodontic clinic with a chief complaint of lower front teeth visibility during speech and during smiling and inability to bite into food items [Figure 1]. He had a family history of similar malocclusion in his grandfather; further details or records were unavailable. Extra oral examination showed an absence of malar prominence, and maxillary deficiency with a concave profile, and intraoral examination showed Angle's Class III molar relation with anterior cross-bite and a complete deep bite. The left maxillary canine was impacted [Figure 2]. No functional shift of the mandible was present. Pretreatment cephalometric evaluation [Table 1] revealed a skeletal class III relationship (ANB = -11°) with

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Figure 1: Pretreatment records: extraoral and intraoral photographs

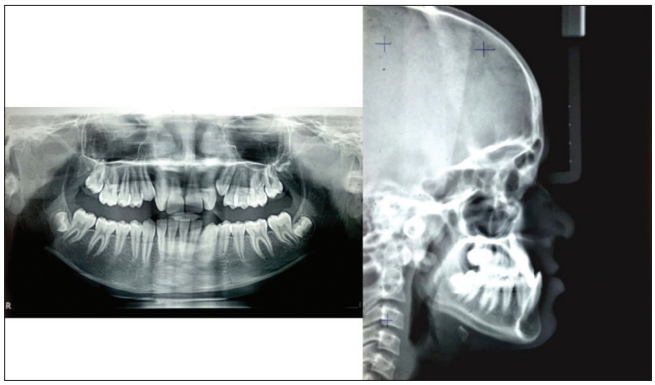

Figure 2: Pretreatment orthopantomogram and lateral cephalogram

hypoplasia of the maxilla sagittally (N perp. to Pt. A = -9.5 mm, effective maxillary length = 66 mm) and vertically.

Treatment Objectives

The primary objective was to achieve a good profile with the maximum possible skeletal correction, positive overjet, and deep-bite correction. The secondary objective was the achievement of well-aligned dental arches.

Treatment Alternatives

Other treatment options included growth modification with a protraction facemask in conjunction with rapid maxillary expansion[4] and Alt-RAMEC protocol.[5] An alternative to early treatment was to delay fixed-appliance therapy until the growth spurt had ended and use temporary anchorage devices as an aid to fixed appliances.

Treatment Plan

The case was treated according to the BAMP protocol[6] with slight variation from the conventional protocol due to the severity of deep bite and impacted canine. The BAMP protocol was considered ideal since a recent systematic review[7] has shown promising changes in facial profile without adverse effects on the dentition. Delay in treatment until growth cessation would have resulted in an increase in the skeletal discrepancy and crowding in the maxillary dentition due to lack of space for the canines.

Thus, the treatment was begun with deep-bite and cross-bite correction orthodontically, followed by bone-anchored plates and intermaxillary traction in the maxilla and in the mandible. Attention was given to the impacted canine in the second quadrant due to lack of space and the severity of the deep bite, requiring orthodontic mechanotherapy prior to the protraction phase in this case.

Treatment Progress

Maxillary arch was bonded with McLaughlin, Bennett, Trevisi (MBT) prescription 0.018″× 0.025″ slot brackets

Table 1: Composite cephalometric analysis to evaluate treatment changes achieved

Parameter	Mean	Pretreatment	Initiation of BAMP	1-yr post-BAMP	Post-treatment
		Skeletal			
		SN-FH=5° Correction- 2°	SN-FH=4° Correction- +3°	SN-FH=4° Correction- 3°	SN-FH=2° Correction- 5°
SNA angle (degrees)	820	72°	75°	76°	77°
SNB (degrees)	800	83°	82°	82°	82°
ANB (degrees)	20	-110	-70	-60	-5°
N perp. To A (mm)	0 ±2 mm	-9.5 mm	-7.5 mm	-6 mm	-6.5 mm
N perp. To pog (mm)	0 + -4 mm	+2.5 mm	+2 mm	+3.5 mm	+3 mm
GoGn to SN (mm)	32°	26°	29°	28°	29°
FMA	25°	27°	27°	25°	25°
Angle of inclination (degrees)	85°	87°	87°	89°	89°
Lower anterior face height	-	60 mm	62 mm	65 mm	67 mm
Eff. Maxillary length	95 mm	66 mm	71 mm	77 mm	76 mm
Eff. Mandibular length	120 mm	102 mm	106 mm	112 mm	116 mm
Y-axis angle (degrees)	66°	60°	63°	61°	64°
Facial axis angle (degrees)	0°	+6°	-2°	+1°	0°
Sum of post. Angles (degrees)	396°± 6°	389°	399°	386°	386°
		Dental			
U1 to NA (degrees)	22°	38°	47°	49°	46°
U1 to NA (mm)	4 mm	10 mm	10 mm	9 mm	11 mm
U1 to SN (degrees)	102°	109°	128°	132°	128°
L1 to NB (degrees)	25°	11°	15°	20°	22°
L1 to NB (mm)	4 mm	1 mm	1 mm	3 mm	4 mm
L1 to A Pog	1 to 2 mm	6 mm	5 mm	+3.5 mm	5 mm
L1 to mand. Plane angle (degrees)	90°	78°	83°	86°	91°
Interincisal angle (degrees)	130°	143°	119°	113°	111°
		Soft Tissue			
S line to U lip (mm)	0 mm	-2 mm	-1 mm	0 mm	0 mm
S line to L lip (mm)	0 mm	+3 mm	+1 mm	+2 mm	+2.5 mm
Nasolabial angle (degrees)	90°-110°	98°	100°	96°	94°

along with lower removable anterior bite plate [Figure 3]. Upon initial alignment, lower bite plate was replaced with a removable lower anterior inclined plane to aid in cross-bite correction along with traction.

Two orthodontic mini plates (Y shaped) were inserted into the infrazygomatic crests in the maxilla and two mini plates (inverted L shaped) between the canine and lateral incisor on the left side and between canine and first premolar on the right side of the mandible, owing to the root prominence of the mandibular right canine and thinned labial cortical plate in the canine region. The mini plates were fixed to the bone with three titanium screws (2 mm in diameter and 5 mm in length) after predrilling with a 1.6-mm diameter bur.

Three weeks after surgery, interarch elastic wear between the upper and lower mini plates was begun on each side, applying a force of 100 g (1/4", 3.5oz) per side [Figure 4]. The force was increased to 150 gm (1/4", 6oz) per side later for 6 weeks and further to 250 gm (2 ¼", 4oz) for 8 weeks. The patient was asked to replace the elastics once a day and to wear them 24 hours per day. Lower

Figure 3: Initial phase of treatment for maxillary arch alignment and lower removable bite plate

arch bonding was not done assessing the cost risk benefit ratio, and further that the correction of the deep Curve of Spee would require proclination of the lower incisors, which would tax the upper incisor proclination. Lateral cephalograms were recorded before treatment, before the initiation of BAMP, 1 year after BAMP, and in finishing stage of the treatment [Table 1].

Treatment Outcome

A positive overjet was obtained in the initial stage of the treatment, after which intermaxillary traction was begun and continued for 9 months. The protraction phase was in conjunction with fixed orthodontic treatment. After satisfactory correction of the profile, along with the alignment of the arches, the patient was debonded and given Essix retainers to maintain the achieved dental correction [Figure 5].

The mini plates were retained and night-time elastic wear was continued for 1 year after debonding until the individual's growth nearly ceased. It is also interesting to note that the BAMP protocol did not restrain growth of the mandible but instead it altered the direction of mandibular growth [Figure 6], by closing the gonial angle and distalizing the posterior ramus and condyles (frankfort mandibular plane angle reduced from 27° to 26°). Effective maxillary length was also seen to increase by 10 mm [Figure 7] and the ANB angle improved from -11° to -5°. On evaluation of treatment changes with the aid of the Growth Treatment Response Vector analysis, a value of 0.98 was obtained suggesting that the need for orthognathic surgery was avoided.[8] Although the maxillary incisors were proclined [Figures 8 and 9], the individual's profile, cheek prominence, and lip posture also improved [Figures 10 and 11].

Discussion

A normal occlusion and improved facial aesthetics of skeletal class III malocclusion can be achieved with growth modification, orthodontic camouflage, or orthognathic surgery.[9] Orthognathic surgery was ruled out owing to the patient's favorable age for growth modification. Face mask treatment was indicated prior to the maturation and ossification of the circum-maxillary sutures, and due to the required compliance for the success of the treatment,[10] was ruled out as well.

The BAMP technique has the merit of reduced patient compliance, minimum surgical intervention, and

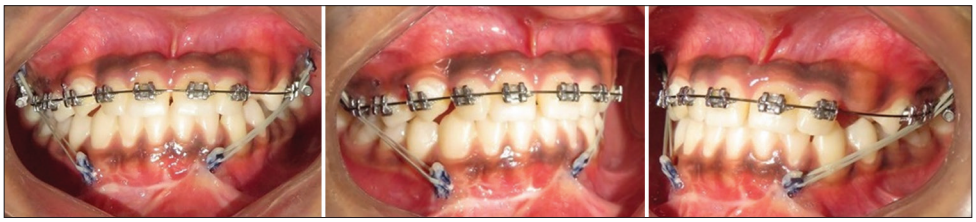

Figure 4: Initiation of bone anchored maxillary protraction (BAMP)

Figure 5: Post-treatment records: extraoral and intraoral photographs

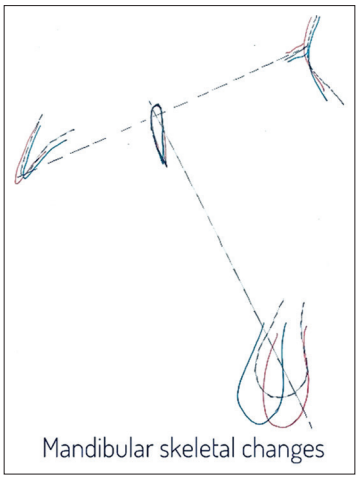

Figure 6: Rickett's superimposition: Mandibular skeletal changes

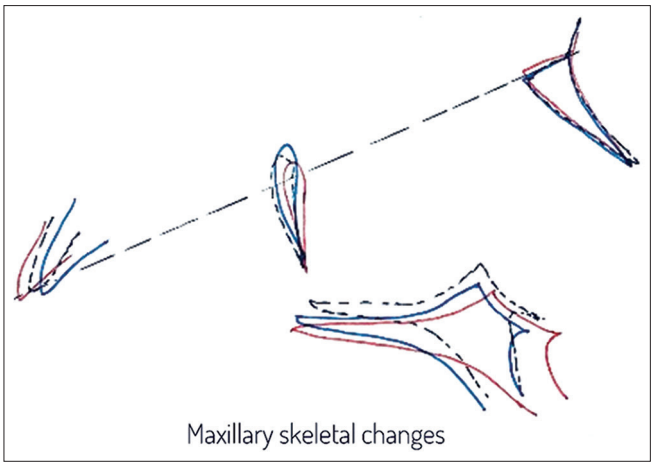

Figure 7: Rickett's superimposition: Maxillary skeletal changes

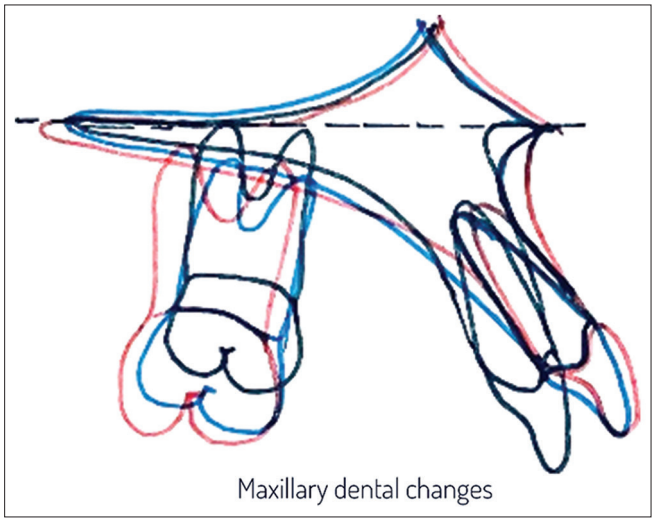

Figure 8: Rickett's superimposition: Maxillary dental changes

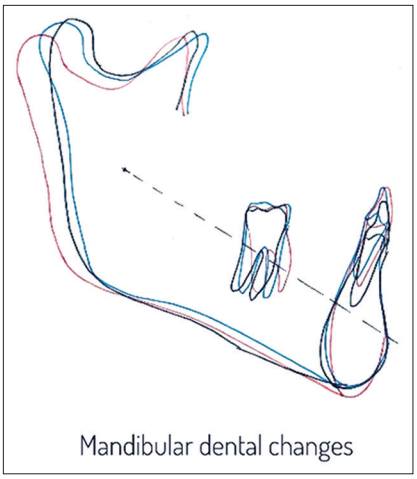

Figure 9: Rickett's superimposition: Mandibular dental changes

Figure 10: Lateral cephalogram in the finishing stages of treatment showing compensatory proclination of the maxillary incisors

Figure 11: Superimposition showing treatment changes

favourability for the age group of 11-14 years.[4] The maxillary expansion was not indicated in this case since there was no transverse deficiency.

In most of the earlier studies, dental compensations using face mask therapy constituted half of the total corrections and these dental effects continued to increase depending on the patient's age.[11] The undesirable effects of facemask treatment, such as anchorage problems in mixed

dentition, unesthetic appearance, discomfort, patient compliance, increased vertical dimensions, excessive maxillary incisor protrusion, and mandibular incisor retrusion were eliminated with this method. Studies reported that patients treated with the mini-implants and elastics exhibited skeletal improvements with little effect on mandibular position.[12] BAMP protocol resulted in distraction of many of the circum-maxillary sutures. A constant force from the elastics when applied before sutural maturation can effectively produce distraction of these sutures resulting in the forward displacement of the entire midface. Studies have shown that continuous force application is more effective at expanding the sutures when compared to intermittent forces.[13]

Conclusion

Treatment results showed a satisfactory and class I incisor, molar and canine relationship, along with a good facial balance and straight profile. Although compensatory proclination of maxillary incisors was seen, results were stable and patient's chief complaint was addressed. Thus, BAMP is a viable nonsurgical option in the current trend of least invasive treatment strategies.

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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Nil.

Conflicts of interest

There are no conflicts of interest.

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