Mini screws – An absolute anchorage for en-mass retraction of bimaxillary dentoalveolar protrusion: A case report

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Abstract
This case report describes the treatment of a 22-year-old girl who had incompetent lips with severe bimaxillary dentoalveolar protrusion. The treatment of choice for such patients is usually extraction of four first premolars and retraction of the anterior teeth. To maintain the extraction space, maximum anchorage is required. Mini-implants were used to provide maximum anchorage for obtaining a good facial profile.

This case report describes the treatment of a 22-year-old girl who presented with incompetent lips with severe bimaxillary dentoalveolar protrusion. The treatment of choice for such patients is usually extraction of all four first premolars and complete utilization of extraction space for retraction of the anterior teeth. In order to complete utilize the extraction space to retract the anterior segment, absolute anchorage is required. Mini-implants were used to provide absolute anchorage to improve the patient's facial profile.

Keywords: Mini-implants; Dentoalveolar; Protrusion; En masse; Anchorage; Bimaxillary Protrusion

Introduction
Conventionally, orthodontists have used teeth, intraoral appliances, and extra-oral appliances, to control anchorage. Anchorage in orthodontics is defined as the nature and degree of resistance offered by an anatomic unit for the purpose of affecting tooth movement.1 However, because of Newton's third law, i.e., for every action there is an equal and opposite reaction, there are limitations in our ability to completely control all aspects of tooth movement.[2] The success of orthodontic treatment hinges on the anchorage protocol planned for a particular case.

Anchorage requirement can be classified according to anchorage loss permissible. Minimum anchorage where more than half of extraction space can be lost by anchor teeth moving mesially. Moderate anchorage in these cases anchor teeth can move forward into one fourth to one half of extraction space. Maximum anchorage in these cases, anchor teeth can move forward into less than one fourth of extraction space. The anchorage in these patients should be augmented to avoid unwanted movement of anchor teeth.[3]

A fourth type of anchorage was introduced as absolute which requires that the entire extraction space be used for retraction and no loss of anchorage occurs. Use of extra-oral anchorage devices such as headgears requires full patient cooperation, which is sometimes not possible and is unpredictable. Introduction of implants in orthodontics have solved this problem.[3] A micro implant can be defined as a device that is temporarily fixed to the bone for the purpose of enhancing orthodontic anchorage either by supporting the teeth of the reactive unit (indirect anchorage) or by obviating the need for the reactive unit altogether (Direct anchorage), which is subsequently removed after use.[4] Use of extraoral anchorage devices such as headgears requires full patient cooperation, which is sometimes not possible and is unpredictable. Introduction of implants in orthodontics have solved this problem.

In 1983 Gray James et al tested the ability of cylindrical endosseous implants to resist when loaded with constant orthodontic forces. This study was done on the femur of 12 rabbits and they saw no significant migration at the 3 force levels used in the study.[5] In 1990 W.E. Roberts et al used rigid endosseous implant to protract molar and close atrophic extraction sites. The implant remained firm over 3 years and a high remodelling rate was demonstrated.[6] Kanomi R in 1997 described implants made from mini bone screws and demonstrated intrusion of incisors with no change in stability of the mini implants.[7]

From then on mini implants have been routinely used for intrusion, retraction, rotational movements and all bodily movements. Upadhyay et al in 2008 conducted study to quantify the treatment effects of en-masse retraction of anterior teeth with mini-implants as anchor units in bialveolar dental protrusion patients undergoing extraction of all 4 first premolars in contrast to conventional anchorage methods. The study concluded that mini-implants provided absolute anchorage to allow greater skeletal, dental, and esthetic changes in patients requiring maximum anterior retraction, when compared with other conventional methods of space closure.[8] Sibaie et al in 2013 conducted study to evaluate skeletal, dental, and soft tissue changes following anterior teeth retraction comparing mini implant and conventional anchorage. The study concluded that when retracting anterior teeth in patients with moderate to severe protrusion, mini-implants anchorage gave superior results compared to conventional anchorage.[9]

Case Report

A 22 year old female patient reported in the Department of Orthodontics and Dentofacial Orthopaedics, Santosh Dental College and Hospital with the chief complaint of forwardly placed teeth and protruded lips. Facially, the patient exhibited a convex profile with incompetent lips. Intraorally, she had Class I canine and molar relationhips with minimal maxillary and mandibular crowding. With respect to the facial midline, the upper and lower dental midlines were deviated to the right, 1 mm and 2 mm, respectively. On examination it was found that the patient had a convex profile with bimaxillary protrusion along with Angle's Class I molar relation and potentially competent lips.

The lateral cephalogram and its tracing showed a Class I skeletal pattern with bimaxillary dentoalveolar protrusion. As evidenced by the maxillary incisor to NA angle and distance, the maxillary incisor inclination was 30° and was 8mm ahead of the NA line. With respect to the mandibular incisor, the axial inclination was 44° and 12 mm ahead of the NB line. Furthermore, IMPA was 112°. Upper and lower lips were protruded when compared to the E-line, 4 mm and 6 mm, respectively. The nasolabial angle was acute (83°) (Table 1). Overjet was 3 mm and the overbite was 2 mm. There were no signs and symptoms of temporomandibular disorders. All teeth have erupted to full length. No other abnormalities were seen and the patient reported no relevant medical history

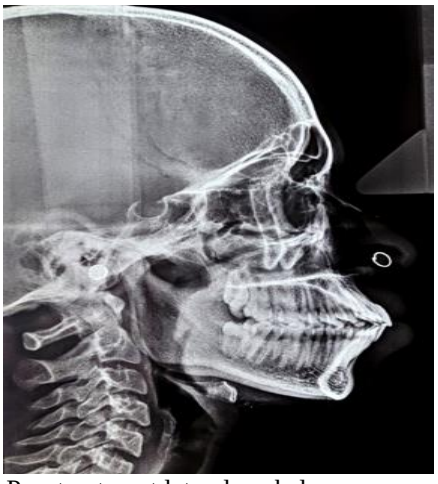

Figure 1: Pre- treatment lateral cephalogram

Figure 2: Pre-treatment O.P.G.

Treatment objectives

Treatment objectives included the following:

1. Align and level the teeth in both arches,
2. Maintain Class I canine and molar relationship
3. Achieve ideal overjet and overbite,
4. Obtain a balanced facial profile, and
5. Improve smile esthetics.

Treatment planning

The model analysis for total space analysis revealed a total space deficiency of 8 mm on each side. After cephalometric analysis (Table 1) and model analysis it was decided that this case was a high anchorage case. In order to improve the soft tissue profile of the patient the treatment objectives for the case were decided as to correct inclination of upper and lower anterior teeth while maintaining Class I molar relation on both side and to achieve ideal overjet and overbite. To achieve these objectives all first premolar extractions were performed in both maxillary and mandibular arch. Post extraction micro implants were placed in both maxillary and mandibular arch for retraction. The retraction was carried out with help of NiTi closed coil springs in both arches. The springs were reactivated every 2 to 3 months depending on need. The retraction was carried out on 0.019"x 0.025" stainless steel archwires.

Total treatment time for this case was 1 year and 7 months. At this time retraction of anterior segment of teeth was complete and the posterior teeth relation were maintained till the end.

Figure 3: Extra oral photographs showing changes pre and post treatment

Table 1: Cephalometric analysis – Pre-treatment

Cephalometric Analysis				
S. No.	**Parameter**	**Mean Value**	**Pre-treatment Value**	**Post-treatment Value**
1.	Facial Angle	87.8^0	91.29^0	85.97^0
2.	Y-Axis Angle	59.4^0	55.32^0	59.87^0
3.	Interincisal Angle	135.4^0	100.78^0	134.5^0
4.	Lower Incisor to Mandibular Plane	1.4^0	111.9^0	90.84^0
5.	SNA Angle	82.0^0	82.01^0	82.5^0
6.	SNB Angle	80.0^0	79.84^0	80.01^0
7.	ANB Angle	2.0^0	2.17^0	2.49^0
8.	Upper Incisor To SN Angle	104.0^0	115.19^0	103.55^0
9.	Upper Incisor To NA Angle	22.0^0	30.18^0	20.05^0
10.	Lower Incisor To NB Angle	25.0^0	43.87^0	23.97^0
11.	Occlusal Plane To SN Angle	14.0^0	15.76^0	14.25^0
12.	Upper Incisor To NA Distance	4.0mm	7.82mm	2.9mm
13.	Lower Incisor To NB Distance	4.0mm	12.18mm	4.46mm
14.	Upper Molar to NA Distance	27.0mm	26.71mm	26.51mm
15.	Lower Molar to NB Distance	23.0mm	28.95mm	25.18mm
16.	H Angle	0.0^0	21.42^0	18.34^0
17.	E Line upper lip	2mm posterior	2mm anterior	1mm posterior
18.	E Line lower lip	1mm posterior	5mm anterior	1 mm posterior
19.	S Line upper lip	On line	4mm anterior	On line
20.	S Line lower lip	On line	6mm anterior	On line

Treatment progress

After the extraction of all first bicuspids, fixed pre-adjusted edgewise appliance MBT 0.022 slot was bonded. After leveling and alignment, four orthodontic mini-implants self-drilling type, conical shape with 1.5 mm diameter and 10 mm length in maxilla and 1.5 mm diameter and 8 mm length in mandible were implanted into the buccal alveolar bone between the maxillary and mandibular first molars and second bicuspids. A 0.019 × 0.022-inch S.S. arch-wire with anterior hooks was placed, Ni–Ti closed coil springs were applied from the maxillary and mandibular mini-implants and the six anterior teeth were retracted simultaneously (Figure 5 and 6). After en masse movement, the treatment was completed with ideal arch-wires and cusp seating elastics. Lingual bonded retainers on the maxillary and mandibular six anterior teeth and circumferential clear retainers were delivered for both arches. The total treatment time was 20 months. A Class I molar and canine relationship was maintained bilaterally. Ideal overjet (2 mm) and overbite (1 mm) was also achieved. The arches were well coordinated. The maxillary and mandibular dental midlines were coincident with one another as well as with the facial midline. Patients' bimaxillary dentoalveolar protrusive profile was significantly reduced. At the end of the treatment the patient was given Essex retainers. The patient was given instruction regarding the maintenance of retainer and was asked to wear the retainer for at least 18 hours in a day for 1 year and then only at night.

Treatment results

According to the final superimposition, the maxillary anterior teeth were bodily retracted (4 mm) with intrusion (1 mm). The mandibular anterior teeth were retracted (8 mm) with uprighting (IMPA 90°). There were no significant changes to the position of both maxillary and mandibular first molars. The ANB angle did not change significantly as shown in final stage lateral cephalogram (Figure 4).

All these changes contributed to improving the facial profile as there were significant profile changes (Figure 3) .The upper and lower lips had been retracted, 4 mm and 6 mm, respectively in relation to the E-line, and her nasolabial angle had increased (from 83° pre-treatment to

94° post-treatment). No other skeletal or soft tissue changes were noted (Table 1).

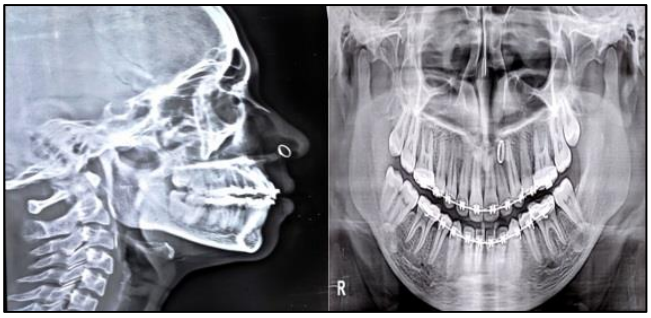

Figure 4: Finishing stage lateral cephalogram and OPG

Figure 5: Side view of the treatment progress

Figure 6: Occlusal view of the treatment progress

Discussion

Bimaxillary dentoalveolar protrusion, which is characterized by dentoalveolar flaring of both the maxillary and mandibular anterior teeth, with resultant protrusion of the lips and convexity of the face, is commonly seen in Indian population.[10] Facial esthetics is an important consideration in orthodontic treatment particularly when extractions are considered. It is accepted in orthodontics that extraction of permanent teeth reduces facial convexity.[11-13] On the basis of the patient's chief complaint and the diagnosis of the malocclusion, extracting the maxillary and mandibular first bicuspids is a valid and viable option to decrease lip procumbency.

The advances in the utilizing bone anchorage such as retromolar implant, onplants, palatal implants, mini-plates, mini-screws and mini-implants make it possible to overcome previous limitation of orthodontic tooth movement and perform en masse movement in the desired direction.[14-16] These armamentariums are becoming part of the orthodontic appliance system. As shown in the reported case, the use of mini-implants provided absolute anchorage for the desired tooth movement. Consideration has been made in placing the implant in a higher position to allow for an intrusive force vector during retraction of the incisors.

Till date, clinical efficacy and stability of temporary orthodontic skeletal anchorage devices have been widely described.[17-20] With the use of the mini-implants, maximum en masse retraction of the maxillary and mandibular anterior teeth was possible without patient compliance.[21] As can be seen in the current report, the use of mini-implants provided a better system for controlling anchorage and facilitating our mechanics. It avoided the use of conventional anchorage mechanics in the posterior segment and its side effect such as molar slippage or extrusion. This resulted in a favorable outcome.

Conclusions

1. Mini-implants can provide absolute anchorage for en masse retraction of the anterior teeth.
2. Mini-implants can simplify the treatment plan significantly in such extraction treatment of Class I bimaxillary dentoalveolar protrusion.

Source of Funding

None.

Conflict of Interest

None.

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