

Microimplant-assisted Orthodontic Correction of Class I Bimaxillary Protrusion with Gummy Smile: A Case Report

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Abstract

Orthodontic management of Class I severe bidental protrusion with incompetent lip and gummy smile has always been a clinical challenge. Simple orthodontic biomechanics can bring compromised esthetic outcome and lacks three-dimensional control of the dentofacial deformity. Although a combination of orthodontics with orthognathic surgery may be the ideal approach, the complications, risks, and costs of surgery have stimulated interest in alternative treatment methods. In recent years, bone borne temporary anchorage devices such as endo-osseous implants, miniplates, mini-implants, microimplants, and screws have opened a new era in clinical orthodontics by revolutionizing the way anchorage is controlled. Microimplants can now be used as effective anchors by simultaneously intrusion and retraction of the upper anterior teeth to mimic a maxillary anterior subapical osteotomy. The aim of the case report is to show the efficiency of microimplant-assisted orthodontic correction of a severe and complicated malocclusion.

Key words: “Gull wing lip” deformity, Intrusion, Microimplant, Retraction

INTRODUCTION

Class I bimaxillary protrusion with incompetent lip is a common dentofacial deformity. If the differences between philtrum length and commissural length of the upper lip are more than 10 mm, it is called “Gull Wing Lip” deformity,^[1] as it resembles the wing of flying Sea gull. In the present case, conventional treatment plan is orthognathic surgery like maxillary anterior subapical osteotomy.

Microimplants are intraoral skeletal anchorage systems which provide absolute or perfect anchorage control, thus widening the envelope of orthodontic treatment.^[2] These have now become an indispensable tool in clinical orthodontics. Both the prosthodontic and the orthodontic implants are composed of titanium but the orthodontic

implants are to be used temporarily whereas the prosthodontic implants are to be used permanently. There is axial loading for the prosthodontic implants but the type of loading for the orthodontic implants is non-axial. The diameter of the implants used for prosthodontic purposes is larger than that used for the orthodontic purposes.^[3]

Microimplants are most often used because of their advantages such as tiny size, minimally invasive, easy placement and removal, ability to withstand immediate loading, placement at various anatomic locations, and low cost and do not require patient cooperation.^[4] Orthodontic mini-implants or microscrew implants are non-osseointegrated monocortical or bicortical titanium alloy screws, ranging from 6 to 12 mm in length, and 1.2–2 mm in diameter,^[5] fixed to bone temporarily to enhance orthodontic anchorage.

For orthodontic retraction, Hickham (1978) once stated “You have to get them up to get them back.” Hence, microimplant-assisted true intrusion and retraction were selected for orthodontic correction of Class I bidental protrusion with “Gull Wing lip” deformity.

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CASE REPORT

A 13-year-old female patient of Bengalee origin reported to the department of orthodontics with the chief complaint of protruding front teeth. Clinical examination and preliminary investigation revealed mesoprosopic facial form with convex profile and incompetent lip. Eight millimeters incisor display at rest and full incisor display with 3 mm gingival display on smile were found. The differences between philtrum length and commissural length were 14 mm, signify well-established “Gull Wing Lip” deformity [Figure 1].

It was a case of Class I bimaxillary protrusion with increased overjet, deep, and complete overbite. Lower arch was showing significant anterior crowding. The patient had significant anterior dentoalveolar proclination. Skeletally, the patient had Class II skeletal base and average growth pattern.

Orthodontic treatment started with extraction of all first premolars. Straight wire mechanotherapy started with 0.022

MBT system. After completion of leveling and aligning of upper arch, four microimplants were placed bilaterally, two between 2nd premolar and 1st molar, two between lateral incisor and canine [Figure 2].

Microimplants used were Aarhus type microimplant made of titanium alloy (S.K. Surgical), 1.5 mm in diameter and 6 mm in length. After following the disinfection protocol, microimplants were placed under local infiltration anesthesia. An infiltration of 0.5 ml of local anesthesia (Xylocaine 2%, 1:80,000 Lignox, Indoco Remedies Ltd.) was administered in each four region of labial and buccal vestibule of maxilla. Pre-drilling with pilot drill of 1 mm diameter is done before placement of the microimplant. Using hand guided microimplant handpiece, microimplants were inserted in the interdental bone in rotating motion, maintaining minimum insertion torque. Between the 2nd premolar and 1st molar microimplants were placed 5 mm above the interdental papilla, between lateral incisor and canine, it was placed 8 mm above the interdental papilla. Microimplants were placed in the attached gingival. Microimplants were placed in an oblique direction



Figure 1: (a-f) Comparison of pre- and post-treatment extraoral photograph



Figure 2: (a-c) Comparison of pre-treatment, mid-treatment, and post-treatment intraoral photograph

buccolingually 40° ^[6] to the long axis of the teeth and microimplants were inclined distally about 20° and placed 1 mm distally to the contact point^[7] to prevent injury to root and to cover maximum cortical bone for better stability.^[8]

Immediate loading of intrusion and retraction forces was done from small hooks attached to the archwire to microimplants. Intrusion force was 50 mg each side and retraction force was 150 mg each side. Archwire size was 19×25 ss. Archwire was customized with buccal crown torque to incisors to prevent lingual tipping. Archwire was given mild constriction in premolar region to prevent widening effect of retraction using microimplants.

Lower arch leveling was done by segmental mechanism and Burstone intrusion arch. Regular checkup was done in every 6 weeks. Completion of treatment occurred in 2 years. After finishing and detailing procedure, microimplants were removed under topical anesthesia. After significant incisor, intrusion has been achieved, gingival recontouring might be needed for increasing the clinical crown height particularly in gummy smile patients. However, in the present case, only periodic periodontal evaluation and oral prophylaxis were done.

RESULTS

After completion of treatment, balanced facial profile with pleasing esthetics is achieved. Lip competency at rest is restored. On smile, full incisor display without any gum display is seen. Reduction in lip strain is achieved [Figures 1 and 2]. Cephalometric analysis showing significant improvement in E-line, S-line, and nasolabial angle [Figure 3]. Upper incisor to NA reduced to 4.5 mm/ 20° from initial value of 8.5 mm/ 31° . Four millimeters upper incisor intrusion in relation to nasal floor is measured. Two degree decrease in mandibular plane angle is seen, which may be due to slight intrusion of posterior segment of dentition (chart 1).

DISCUSSION

Intrusion of upper anterior teeth is helpful in correcting upper incisor display and to reduce “gummy smile.” It



Figure 3: (a and b) Comparison of pre- and post-treatment cephalogram

Parameters	Pretreatment	Posttreatment
Upp. incisor APog	16mm	5mm
Upp. incisor to NA	31degree/8.5mm	19degree/4.5mm
Upp. INCISOR to point A	16mm	5mm
Lower incisor to NB	45degree/11mm	28.5degree/4.5mm
Upp incisor to NF	8mm	4mm
Occlusal plane to SN	19 degree	19 degree
FMA	25 degree	23degree
Nasolabial angle	104.5degree	115degree
E-Line	U Lip +5mm/L Lip +9mm	U Lip +1mm/L Lip +2mm

Chart 1: Comparison of pre-treatment and post-treatment cephalometric data

occurs due to vertical maxillary excess, deep bite due to supraeruption of upper anterior teeth and short upper lip (“Gull Wing lip”). Since the lip morphology is directly related to the morphology of the vestibular sulci,^[9] the answer to the correction of gull wing lip morphology is to produce torque controlled true intrusion and retraction of upper incisors. Intrusion brings the incisors into a position where more spongy bone for tooth movement is available – this allows for greater range of retraction.

For every 1 mm of retraction, there is 0.5 mm reduction in the interlabial gap, when retraction is not associated with either intrusion or extrusion of incisors. When retraction is associated with intrusion of incisors, every 1 mm of retraction reduces the interlabial gap proportionately by 1 mm. When retraction is associated with extrusion of incisors, 1 mm of retraction does not reduce the interlabial gap.^[10]

Vertical lip height increases while dental height decreases with treatment. The increase in vertical lip height is significantly dependent on the reduction in overjet.^[11] During orthodontic intrusion of incisors in patients with intact periodontium, crown height reduction is less and gingiva also follows the intrusion. The gingival margin moves apically 79% and the mucogingival junction moves apically 62% of total intrusion,^[12] provided that there was adequate control of bacterial plaque. These results were also found to be considerably stable in long term.

Since it is biomechanically difficult to produce true intrusion and retraction with regular orthodontic mechanics, as all intrusion arches cause extrusion and distal tipping of molars. Flaring of incisor also occurs, which, in turn, restricts anterior intrusion due to close approximation of root to the palatal cortical bone. Rigid microimplant-supported anchorage with two in the anterior and two in the posteriors dentoalveolar segment is used to intrude and retract the incisors simultaneously, in the present case. Usually, a force originating from a single microimplant placed between the maxillary central incisor roots is adequate to intrude the anterior dentition. However, this may lead to a transverse cant of the occlusal plane. To minimize this, two microimplants are placed bilaterally between the roots of lateral incisor and canine. For retraction, two microimplants are placed bilaterally between upper 1st molar and 2nd premolar. It is the safest zone in the inter-radicular space of the posterior maxilla.^[13]

The incisor retraction with mini-implants primarily was achieved by controlled tipping and partly translation because the forces applied were closer to center of resistance of maxillary teeth.^[14] About 7 mm of bodily retraction was can be achieved.^[15] Palatal cortical bone and width of alveolar bone could be limiting factors in incisor retraction.^[16] Hence, forces used for retraction must be extremely physiologic (150–200 g/side).

Bodily tooth movement or root movement requires higher anchorage value than controlled/uncontrolled tipping. Retraction force from short hooks attached to archwire, the line of force runs below the center of resistance. It produces controlled tipping of anteriors when archwire fits passively to the anterior brackets. When the force is reduced to 100 g and additional labial crown torque is applied to the archwire in the anterior segment, a constant and light intrusive force from microimplant prevent extrusion or labial flaring of incisor. It causes “pure” root movement while maintaining the position of the incisor tip.^[5]

In microimplant-assisted intrusion and retraction, relapse of anterior teeth retraction ranges from 10 to 15% and

anterior intrusion is 25 to 30%,^[17] so slight overcorrection is required. However, microimplants have some disadvantages. Apical root resorption of maxillary incisors is 16.5–19.8% treated with miniscrews intrusion.^[18] It is significantly more than patients treated without miniscrews, which is 5.4%. This is due to longer retraction time required in patient treated with miniscrew. Lighter intrusion forces in the range of 60–120 g (10–20 g per tooth) are applied for proper intrusion of anterior teeth and to minimize root resorption.

CONCLUSION

- In severe bidental protrusion with gummy smile, better esthetic outcome can be achieved with microimplant-assisted orthodontic treatment
- In the present case, true intrusion and bodily retraction of upper anteriors are achieved
- An “Orthognathic-like Orthodontic” treatment outcome secures the patient with optimum smile esthetics.

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