Orthodontic-Surgical Management of a Skeletal Class II Patient with Reverse Smile Arc and Vertical Maxillary Excess

ABSTRACT

This is a case report of a 17-year-old female patient who presented with skeletal Class II malocclusion with excessive vertical growth of the maxilla and a reverse smile arc. Vertical maxillary excess, thin alveolar troughs, proclined upper and lower anterior teeth, excessive curve of Spee, crowding in the lower arch and excessive eruption of upper and lower incisors led to the decision of combination of orthodontic and surgical treatment. A combined orthodontic and surgical approach resulted in harmony in occlusion, function and esthetics in this patient.

Keywords: Vertical maxillary excess, Reverse smile arc, Thin alveolar troughs.

INTRODUCTION

Vertical maxillary excess, a clinically recognizable facial morphology is manifested primarily by increased length of lower facial third, excessive exposure of maxillary anterior teeth with the lips in repose, inordinate exposure of the maxillary teeth and gingiva upon smiling, large interlabial distance and a high mandibular plane angle. Occlusal analysis most often reveals a Class II malocclusion with or without open-bite deformity. This dentofacial deformity, with its wide spectrum of clinical manifestations has been recognized and described for years under different titles having varying degrees of ‘excessive vertical maxillary height,’ as their common denominator.1-3

The treatment of severe dentofacial deformities in adult patients is challenging to both the orthodontist and the oral surgeon. Treatment is difficult because of the skeletal and facial disharmony, cessation of jaw growth and a tendency toward relapse after treatment.4 The surgical-orthodontic correction of vertical maxillary excess via surgical superior repositioning of the maxilla is generally accepted as a treatment regimen on the basis of skeletal stability and esthetic soft-tissue changes.5,6 Surgery can sometimes be avoided by orthodontic camouflage but results are not generally satisfactory.7

This article describes orthodontic-surgical management of an adult patient with a skeletal Class II malocclusion caused by excessive vertical maxillary growth.

DIAGNOSIS

A 17-year-old female presented with the chief complaint of protruding upper front teeth (Fig. 1). Initial examination revealed long lower third of the face with excess visibility of gingiva at rest and during smiling; incompetent lips with an interlabial gap of 12 mm suggestive of vertical maxillary excess. She had a dolichocephalic, convex profile and posterior divergence, and a high lip line with 8 to 9 mm of gingival visibility during smiling and a reverse smile arc. Nasolabial angle was acute. Cross bite was present in relation to first premolars on left side. Molar and canine relationships were Class II on both sides, with an overjet of 14 mm and overbite of 4 mm. Curve of Spee was 5 mm due to over eruption of the lower anteriors.

Cephalometric analysis revealed Class II skeletal bases with an ANB angle of 7°, increased lower third facial height. Patient presented with a vertical growth pattern and mandible rotated downward and backward with a high mandibular plane angle of 37° (Fig. 2). The upper and lower incisors were proclined according to Steiner analysis. There was inferior rotation of the posterior maxilla as indicated by the angle of inclination of the palatal plane. Excessive eruption of upper and lower incisors was noted according to Burstone analysis. This excessive eruption of incisors is seen in patients with vertical maxillary excess in order to partially compensate for the jaw rotation. Excessive eruption of maxillary posterior teeth was also seen (Table 1).

Bolton tooth ratios were matching. Arch perimeter analysis revealed a tooth material excess of 3.8 mm in the lower arch and 5.9 mm in the upper arch respectively.
Fig. 1: Pretreatment extraoral and intraoral photographs

Fig. 2: Pretreatment radiographs

The vertical maxillary excess, thin alveolar troughs, excessive curve of Spee, proclined upper and lower anterior teeth, excessive eruption of upper and lower incisors warranted a surgical line of treatment.

Treatment Plan

Treatment objectives were to improve the positioning of the maxillary arch with a reduction in the gingival exposure on smiling and at rest, to facilitate autorotation of the mandible, to match skeletal bases, to obtain a Class I molar and canine relation, to level and align the arches, to achieve an ideal overjet and overbite, correct lip incompetency and achieve an esthetic profile. A surgical prediction was done and the treatment planned was, extraction of all four first premolars during surgery, mandibular subapical osteotomy to intrude the anterior segment by 5 mm, maxillary superior
repositioning of 5 mm by Le Fort I osteotomy along with anterior segmental osteotomy of the maxilla to setback the anterior alveolar segment by 6 mm.

**Treatment Progress**

First molars were banded and 0.022" preadjusted brackets (MBT prescription, Victory series) were bonded to the remaining teeth in both arches except first premolars in all quadrants since they had to be extracted during surgery. A continuous maxillary archwire of 0.016" nickel titanium was inserted. The archwire size in the maxilla was gradually increased until 0.019" × 0.025" stainless steel surgical wires were placed. This resulted in decrease in the maxillary anterior teeth proclination and deepening of the bite. Initial alignment was started in the mandibular arch with .0175" coaxial wire. This was followed by 0.014" nickel titanium wire in the mandibular arch and incisors were excluded to prevent their proclination. Also, there was limitation of the space available because extractions were planned during the surgery. Leveling of the anterior segment was planned surgically by intruding the anterior segment because of the thin alveolar trough so as to avoid root resorption (Fig. 3).

After 6 months of presurgical orthodontics, surgery was performed. Two splints were fabricated with acrylic. Mandibular subapical osteotomy was carried out to intrude the anterior segment by 5 mm, this was followed by Le Fort I osteotomy to superiorly reposition the maxilla by 5 mm and anterior segmental osteotomy of the maxilla.
to setback the anterior alveolar segment by 6 mm. The maxilla was positioned superiorly so as to achieve 2 to 3 mm of maxillary incisor exposure with the upper lip at rest. Surgeries were performed without any complications and the correction was maintained by rigid fixation. This was followed by postsurgical orthodontics during which second molars were bonded. Lower arch was aligned and extraction space remaining in the lower arch was used to de-crowd the anterior segment and improve the molar relation. After completion of the postsurgical finishing and detailing, the appliance was deboned. Maxillary wraparound retainer and a braided lingual retainer were bonded to the mandibular anterior teeth. Total treatment duration was 2 years and 3 months.

RESULTS
Final records taken after treatment demonstrated facial symmetry with proportional facial thirds, a balanced maxillomandibular relationship, an esthetic smile line and good lip positioning. Treatment produced Class I molar and canine relation bilaterally, ideal overjet and bite (Figs 4 and 5).

Fig. 4: Post-treatment extraoral and intraoral photographs

Fig. 5: Post-treatment radiographs
Superimposition of the pretreatment and post-treatment cephalometric tracing indicated the amount of setback of the maxillary anterior segment and intrusion of the mandibular anterior segment. It also demonstrated the amount of superior repositioning of the maxilla along with the autorotation of the mandible (Figs 6A to C). Results remained stable 1 year post-treatment, as evident in the 1 year post-treatment records (Figs 7 and 8). Superimposition of post-treatment and 1 year post-treatment cephalometric tracings indicated negligible relapse (Figs 9A to C).
DISCUSSION

Two basic orthodontic decisions must be made prior to the institution of orthodontic-surgical treatment. First, one must decide whether extractions are necessary and if so, which teeth should be removed. Secondly, one must determine what specific orthodontic treatment needs to be carried out prior to the planned surgical intervention. The two primary reasons for extractions are crowding and excessive protrusion of the anterior teeth. In this case extraction of first premolars was done in the maxillary arch to correct the axial inclinations of the anterior teeth and in the mandibular arch to relieve crowding, to correct the axial inclinations of the lower anterior teeth and level curve of Spee. Space was also required for the osteotomy cuts in both the arches which were planned distal to the canines. Therefore, extraction of the first premolars was planned during surgery to prevent any space loss during presurgical orthodontic phase.

A question is always asked as to when it is best to level the excessive curve of Spee in the lower arch surgically as opposed to orthodontically. First the morphology of the curve itself must be considered. If the curve is biplanar (that is, molars and premolars are level and canines and incisors are level but elevated) then surgical leveling is possible. However, if the curve is a continuous one with the highest points being the second molars and the central incisors then surgical leveling cannot be done. Second, the treatment time involved must be considered. Where surgical leveling is possible and little if any presurgical orthodontics is necessary, it is obvious that from a time standpoint alone, the surgical leveling should be preferred. Third, the magnitude of the problem should be considered. In this case, patient had a biplanar curve and the depth of curve of Spee was large favoring our decision of surgical leveling of the anterior mandibular segment.
In long face patients, as a general rule it is preferable to level the lower arch before surgery. This guideline is in sharp contrast to the one for short face patients, whose leveling often is done postsurgically. Presurgical leveling is better when decreased facial height is the goal. Sub-apical osteotomy is a substitute for orthodontic leveling of the mandibular arch when significant intrusion of mandibular incisors is necessary in patients who manifest normal or excessive lower anterior facial height. In this case leveling of lower arch was done surgically, so that in the postsurgical orthodontics phase there was minimal risk of increasing facial height. Also, if there are steps in the maxillary arch distal to canines, the more severe the steps the more advantageous it is to segment the maxilla during surgery and level the arch by repositioning the dentoalveolar segment rather than moving the teeth orthodontically. In this case the anterior alveolar segment was setback surgically in order to minimize orthodontic retraction of teeth over such a large distance.

Handelman, reported that patients with either narrow alveolar width or severe skeletal discrepancies are most likely to demonstrate limitation in orthodontic correction and may require surgery. Thin alveolar widths were found both labial and lingual to the mandibular incisors in groups of high mandibular plane angle and lingual to the maxillary incisors in Class II high angle groups. Orthodontic tooth movement in these patients results in iatrogenic loss of periodontal support. Considering the thin alveolar trough, it was decided to retract the maxillary anterior alveolar segment surgically rather than retracting the teeth over such a large distance.

Superior repositioning of the maxilla has proved to be a useful method for treating patients with vertical maxillary excess. The relationship of the upper lip line to the incisor is the keystone in planning treatment that will achieve an attractive smile. Superior repositioning of the maxilla leads to autorotation of the mandible with the condyle as the center of rotation. Wessberg et al reported that an ‘occlusal programming feedback mechanism’ operated within the central nervous system mediating the compensatory autorotation of the mandible following surgical superior repositioning of the maxilla. Thus, in each instance when planning for surgical superior repositioning of the maxilla one must decide on the basis of esthetics and cephalometric prediction criteria, the magnitude of autorotation and the contribution of this rotation towards the desired occlusal and esthetic results. In many instances a simultaneous mandibular surgery is not required to achieve the desired result. In this case, superior repositioning of the maxilla autorotated the mandible to achieve a good facial profile resulting in no need for any additional mandibular surgery like mandibular advancement or genioplasty.

In treating a patient surgically the stability of the surgical procedure is essential. With rigid fixation, the maxilla is quite stable during the first postsurgical year when moved up and there is almost no chance of clinically significant change. Superior repositioning of the maxilla falls into the highly stable category of surgery. Also, soft tissue changes noted 1 year following surgery is likely to remain stable for the next 5 years. This case also showed negligible relapse 1 year post-treatment.

CONCLUSION

For patients whose dental and skeletal problems are so severe that neither growth modification nor camouflage offers a solution, surgery to realign the jaws or reposition dentoalveolar segments is the only possible treatment. Since the surgery can produce a much simpler orthodontic problem, thus reducing treatment time and allowing a better overall result, it is recommended that it should be done as early in treatment as possible. Clinically, the overall improvement in facial appearance and the predictability and stability of the results have made this a more versatile and effective procedure when carried out with good planning, proper execution and attention to details. Surgery is not a substitute for orthodontics in these patients. Instead, it must be properly coordinated with orthodontics and other dental treatment to achieve good overall results, as in this case.

REFERENCES


Authorship Conflict – Change in Name of Authors

Article Title: Stress Distribution during Rapid Canine Retraction with a Distraction Device: A Finite Element Study
Authors: Nareen Chakravarthy Challagulla, Vignesh Kailasam, Arun B Chitharanjan
Issue: October-December 2013 Volume 47 Number 4 (Supplement II)

Upon a complaint received from Arun B Chitharanjan, Professor and Head, Department of Orthodontics and Dentofacial Orthopedics, Sri Ramachandra Dental College, Porur, Chennai regarding guest authorship in the above mentioned article, the editorial board put forward an inquiry and found that there is inclusion of names of those who were actually not involved in the study in the above mentioned manuscript. The work actually came out of Department of Orthodontics and Dentofacial Orthopedics, Sri Ramachandra Dental College as the postgraduate thesis of Nareen Chakravarthy Challagulla under the guidance of Vignesh Kailasam and the Head of the Department, Arun B Chitharanjan. The names of other authors, Shyam Kumar Bandaru, Revathi Peddu, Sai Prakash Aduasumilli (Sibar Institute of Dental Sciences, Guntur, Andhra Pradesh) and Balasubramanian Madhan (JIPMER, Puducherry), were intentionally included by the first and corresponding author, Nareen Chakravarthy Challagulla, without the consent from the original authors. The editorial board sees this matter as a serious violation of copyright, which the authors have signed and submitted to the journal at the time of manuscript submission. As a corrective measure from the journal editorial board, the authorship of the above mentioned article is revised to add original authors and delete the guest authors and henceforth will reflect as—Challagulla NC, Kailasam V, Chitharanjan AB. Stress Distribution during Rapid Canine Retraction with a Distraction Device: A Finite Element Study. J Ind Orthod Soc 2013;47 (4, Suppl II):312-18.

The matter of guest authorship from the member of Indian Orthodontic Society (Dr Nareen Chakravarthy Challagulla) has been informed to the head office for further action. The same has been informed to Dental council of India and the authors affiliated institution also.