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Case Report

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Correction of Vertical Maxillary Excess with Le Fort I Osteotomy: A Case Report

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Abstract

Vertical maxillary excess (VME) is one of the significant developmental deformities which is present with excessive vertical growth of the maxilla, which often results in a long facial appearance, incompetence of lips and a gummy smile. Patients with VME apart from aesthetic concerns, there can be functional limitations such as occlusal and speech. Treatment options VME mainly involves orthodontic and surgical interventions. Le Fort I osteotomy being the best treatment approach as it allows for the superior repositioning of the maxilla. This case describes the effectiveness of Le Fort I osteotomy in correction of VME and improving the facial esthetics.

Keywords: genioplasty, gummy smile, Le Fort I osteotomy, vertical maxillary excess

Introduction

Vertical maxillary excess (VME) is one of the significant developmental deformities, characterised by excessive vertical growth of the maxilla, which often results in a long facial appearance, lip incompetence, and a gummy smile.[1] A gingival display exceeding 3-4 mm during smiling is classified as a gummy smile. Factors like altered passive eruption, hypermobile upper lip and dentoalveolar extrusion contribute to the appearance of a gummy smile.[2] The development of VME is multifactorial; its aetiology may involve genetic predispositions, developmental anomalies, and environmental factors that can be present simultaneously.[3] Patients with VME may experience functional limitations–such as occlusal issues and speech difficulties–in addition to aesthetic concerns. This condition is often associated with a steep mandibular plane angle and may present with a skeletal Class II relationship which further complicates the orthodontic management.[4] The existence of an anterior open bite determines the classification of vertical maxillary excess. In patients with VME and an anterior open bite, posterior tooth intrusion is a crucial part of treatment because upper molar intrusion causes the jaw to rotate counterclockwise, improving the convex profile. Since only molar intrusion can cause a posterior open bite, patients with VME and normal overbite should be treated by intrusion of the entire maxillary arch.[5] In order to attain ideal functional occlusion and balanced facial proportions, treatment of VME typically involves both orthodontic and surgical procedures. Le Fort I osteotomy is the best treatment approach as it allows for the superior repositioning of the maxilla.[1] This surgical procedure involves creating a horizontal osteotomy to separate the tooth bearing portion of the maxilla from the rest of the maxillary segment, enabling its repositioning to reduce vertical height and improving the facial esthetics.[6] Non-surgical treatment in growing patients using orthopaedic appliances such as high pull headgear and vertical chin cup can be used, while in grown individuals orthodontic mini-screws, can be used to intrude the anterior teeth and decrease gingival display when surgical intervention is not feasible or desired.[3]

This case report aims to emphasize the importance of accurate diagnosis in cases with VME that are characterized by Class II skeletal relationships, which can give the perception of protrusive dentition and thus lead clinicians to an extraction-based, orthodontic treatment approach to close spaces–ultimately leading to the perpetuation of the problem, with too much gingival display and aesthetic problems. VME is fundamentally a skeletal issue and should optimally be treated surgically, if a patient is non-growing. A full assessment of all etiologic factors contributing to gummy smile (which may include soft tissue factors such as upper lip length) is paramount to achieving optimal treatment results. This was established in this patient, as both VME and the short upper lip were treated. The clinical advantage of employing Le Fort I osteotomy in this instance is its unmatched capacity for increased repositioning of the maxilla, especially in instances of severe VME when both functional and aesthetic issues are significant. The operation corrects the fundamental skeletal discrepancy, providing predictable outcomes in diminishing gingival visibility, contributing to lip competence, and improving general facial harmony. This requires a thorough diagnostic protocol including cephalometric analysis, clinical photography and cervical vertebral maturation index (CVMI) assessment to differentiate between dental and skeletal etiologies. The emphasis on the reason for surgery in this young adult patient points to the key role of personalised, evidence-based treatment planning in attaining the best results.

Case presentation

A female patient, age 20, presented to us complaining of poor appearance. Although she had no pertinent past medical history when questioned, her dental history showed that she had previously had orthodontic treatment, which included having all four of her first premolars extracted. Upon extraoral assessment, the patient's lips were incompetent and her face form was grossly symmetrical and leptoprosopic (long and narrow face form). Examining the patient's profile revealed a convex facial profile. The soft tissue examination found an average nasolabial angle and a slightly protruding upper and lower lip. The patient had a short upper lip, extensive gingival show, and a symmetrical, non-consonant smile. When smiling, gingival show was 6 mm, and incisor visibility was 10 mm, with gingival show 2mm when at rest, which confirms gummy smile (Figure 1).

Intraoral examination revealed that all teeth in both arches were present, except the maxillary third molars and the right and left first premolars in both the maxilla and mandible. Maxillary right central incisor was restored

with a temporary single-unit prosthesis. Bilateral end-on molar and canine relationships were observed. Mild crowding was noted in the lower anterior region, the upper anterior teeth exhibited under torqued, and the midline was shifted to the right. (Figure 1).

An orthopantomogram (OPG) revealed the presence of all teeth, except for the maxillary third molars and the first premolars in both the maxilla and mandible. Cephalometric analysis indicated Class I skeletal bases with a vertical growth pattern (FMPA = 30°) and CVMI of stage VI, suggesting that no further skeletal growth is expected. The maxilla exhibited a clockwise rotation, contributing to a gummy smile, in conjunction with a retruded chin (Figure 1). The initial impression of dental protrusion was revised after considering the skeletal and soft tissue components, leading to a diagnosis of skeletal rather than dental etiology. Clinical photographs and incisor display measurements further supported a diagnosis of VME and soft tissue, rather than dentoalveolar causes.

Diagnosis

The final diagnosis was skeletal Class I malocclusion with Angle's Class II Division 1 malocclusion (characterized by a situation where the upper jaw is out of alignment with the lower jaw, leading to a forward projection of the upper front teeth) with a left-side subdivision and vertical maxillary excess.

Treatment objective

The primary objective was to correct the gummy smile, address the short upper lip, and advance the retruded chin, aiming to achieve a Class I molar relationship on the left side and a Class I canine relationship bilaterally, while maintaining the existing Class I molar relationship on the right side and establishing normal overjet and overbite

Treatment plan

A modified Le Fort I osteotomy was planned for superior repositioning of the maxilla. Augmentation genioplasty was selected to correct the retruded chin. Lip repositioning surgery was also included to address the short upper lip.

Treatment progress

Following patient motivation and oral prophylaxis, orthodontic treatment commenced with bonding using 0.022”×0.028” MBT brackets in both arches. Presurgical leveling and alignment were achieved using 0.016 NiTi progressing to 0.019”×0.025” stainless steel wires. Decompensation involved proclination of upper incisors to increase overjet, facilitating mandibular autorotation post-surgery.

After completion of decompensation of teeth surgical planning was reviewed and facebow transfer for the patient was done and surgical splint was fabricated (Figure 2).

A combination of augmentation genioplasty and modified LeFort I osteotomy was performed. Additionally, lip repositioning surgery was performed. Modified Le Fort I osteotomy refers to surgical cuts and a down-fracture technique altered to suit particular anatomical concerns or specific operative needs, such as conservation of nasal structures, asymmetry correction, or minimizing damage to soft tissues, compared with the standard Le Fort I in which a horizontal osteotomy is made above the tooth roots to mobilize into one piece the maxilla. Modifications may consist of segmental cuts, differential positioning, or changes in vectors for movement. Following surgery,

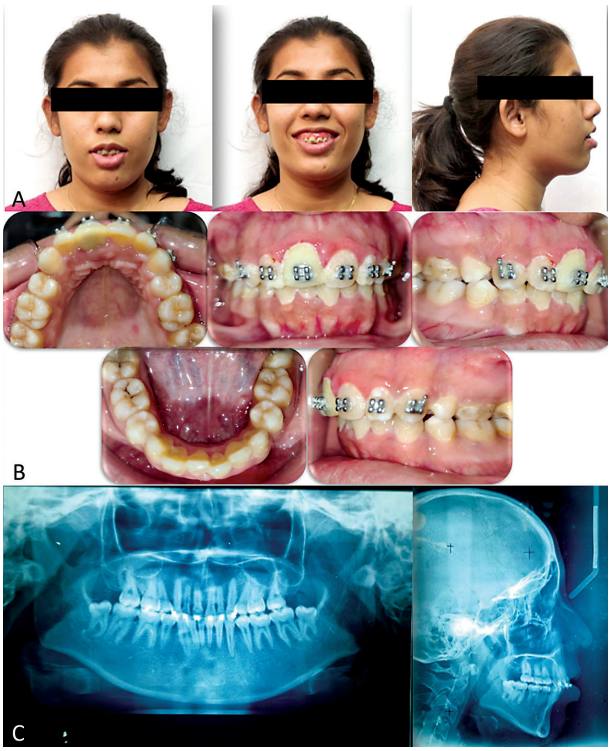

Figure 1: Pre-treatment photographs: (A), Extraoral photographs: (B),Intraoral photographs: (C), Radiographs.

there was a reduction in the gummy smile and an improvement in both functionality and appearance. The maxillary incisors were positioned in good harmony with the upper lip, and a normal lip seal was attained. When smiling, there was also reduced exposure of the teeth and gingiva. (Figure 3) (Table 1)

The patient remained in intermaxillary fixation (IMF) for six weeks. Orthodontic refinement using elastics was performed after the IMF phase to improve interdigitation. Final results showed well-aligned arches, normalized overjet and overbite, and coincident midlines. Full Class I occlusion could not be achieved due to the patient's satisfaction and decision to discontinue further treatment. Tooth 11 prosthesis was replaced with a composite build-up (Figure 4). One year post-operatively, extraoral results were stable with acceptable gingival display. Intraorally, occlusion was maintained with a minor relapse in overbite (2 mm). The patient expressed overall satisfaction (Figure 5).

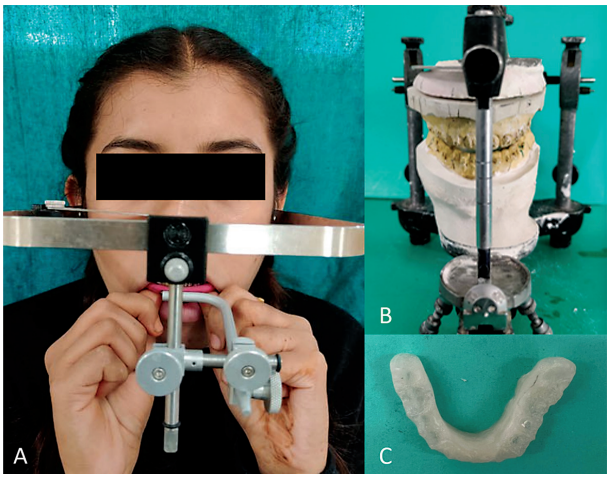

Figure 2: Splint Fabrication. (A),Facebow transfer: (B), Articulated casts: (C), Fabricated splint.

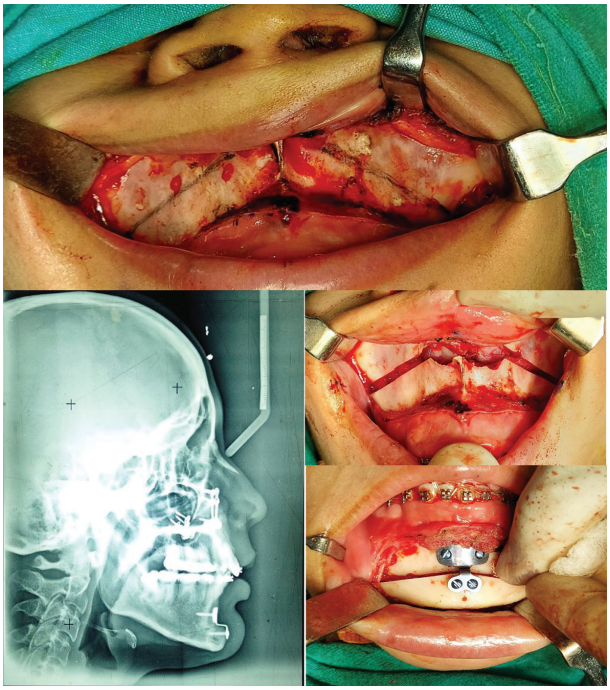

Figure 3: Osteotomy cuts placed with saw and Lefort I osteotomy done along with advancement genioplasty.

Figure 4: Post surgical photographs. (A), Extraoral photographs: (B), Intraoral photographs.

Figure 5: 1 year follow-up photographs. (A), Extraoral photographs: (B), Intraoral photographs.

Table 1: Cephalometric readings of pre-treatment and post treatment.

Skeletal Parameter	Norm	Pre	Current
SNA	82	82	81
SNB	80	77	79
ANB	2	5	2
N perp. To A	0+2	4	3
N perp to Pog	0-1	-9	-3
FMPA	25	30	28
Y axis	66	68	65
U1-NA	22	12	10
L1-NB	25	27	35
IMPA	90	95	98
Nasolabial angle	90-100	107	110

Discussion

VME is a notable skeletal deformity characterized by an overgrowth of the maxillary bone, which leads to a vertical elongation of the midface. This often creates the appearance of a shortened upper lip and can result in a gummy smile.[7] The condition has both aesthetic and functional implications, including potential oral health challenges. It's crucial to accurately diagnose VME to differentiate it from other reasons for excessive gingival display, such as altered passive eruption, dentoalveolar extrusion, and upper lip abnormalities. The management strategies can vary widely, ranging from orthodontic treatments to orthognathic surgery, depending on the root cause. Key features of VME include an increased lower anterior facial height, excessive exposure of the incisors, lip incompetence, a convex facial profile, and specific radiographic indicators like a steep mandibular plane, a high SN-MP angle, and an increased maxillary height. Diagnostic mistakes often occur when soft tissue causes are misidentified, cephalometric evaluations are incomplete, or when there's a reliance on 2D images and clinical photos without considering skeletal dimensions. VME may result from an increase in alveolar height, a downward-tilted palatal plane, or a combination of both, which can enhance gingival display when smiling.[8] In the case presented, both mechanisms played a role in the vertical dysplasia, highlighting the need for thorough cephalometric analysis, photographic documentation, and growth assessment (like the CVMI stage) to create an accurate, skeletal-focused treatment plan.[7]

Le Fort I osteotomy, a surgical technique intended to realign the maxilla and address vertical excess, is frequently used to treat patients who show more than 4 mm of gingival display as a result of vertical maxillary excess, according to Graber and Salama. Conventional methods, however, have drawbacks, particularly when significant superior maxillary displacement is needed. In Le Fort I osteotomy, the lateral maxillary cuts usually end inferiorly at the piriform opening, which may limit the amount of bone that may be removed and the degree of vertical correction that can be achieved.[9]

A modified Le Fort I osteotomy approach, as outlined by Mommaerts *et al*.,[10] was used in this instance to get around these restrictions. This adjustment, referred to as the "subspinal" approach, was made to avoid the unintended soft tissue alterations that anterior maxillary displacement may cause. For our patient, who needed extensive superior relocation and correction of maxillary cant, the typical method may result in an increase in the breadth of the interalar rim. In order to prevent detaching perirhinal muscle insertions and to reduce postoperative increases in interalar width, a V-shaped incision is made beneath the piriform opening. This method enables more efficient bone resection from the inferior surface as opposed to the superior aspect by positioning the inferior osteotomy incision precisely at the base of the piriform aperture, including the anterior nasal spine.[11]

This approach offers several advantages. First, it increases the amount of bone available for resection, which is critical for achieving the desired vertical repositioning of the maxilla. Second, by preserving soft tissue attachments and minimizing changes in the interalar width, the modification reduces the risk of adverse aesthetic outcomes. Third, it reduces the likelihood of damage to the infraorbital nerve, thereby decreasing the risk of postoperative sensory disturbances. The modified technique thus represents a valuable option for managing severe cases of vertical maxillary excess, offering improved outcomes in terms of both bone resection and preservation of surrounding tissues. Further research and clinical validation will help to confirm the long-term benefits and efficacy of this approach.[12]

In the present case, the Le Fort I osteotomy consisted of the vertical maxillary excess counteracted by upwardly positioning the maxilla. Vertical maxillary impaction was directed primarily in the anterior region, with the aim of minimizing gingival exposure and enhancing lip function. This impaction permitted autorotation of the mandible in

a counterclockwise manner, with the result of enhanced chin projection and facial aesthetic enhancement.

These movements are in line with typical Le Fort I osteotomy for VME correction, with maxillary impaction–more specifically, anterior impaction–resulting in mandibular autorotation and improved lower facial aesthetics. In this particular instance, however, the degree of maxillary impaction was fairly substantial, and the application of a modified subspinal osteotomy technique allowed for greater vertical correction with less undesirable widening of the nasal base. The modification, along with simultaneous genioplasty, allowed for more significant improvement of chin position and facial harmony than could otherwise be accomplished with standard techniques alone, and this modification enhanced surgical precision and aesthetic outcomes.

In this instance, lip repositioning was used to address the soft tissue component of the gummy smile that can persist following skeletal correction by Le Fort I osteotomy. While the osteotomy corrected the vertical maxillary excess by elevating the maxilla, the patient also had a short upper lip and hyperactive elevator muscles. Lip repositioning is used to reduce the display of the gingiva by minimizing the length of the upward movement of the upper lip during smiling. The technique used in surgery involved excising a mucosal strip in the upper vestibule, then suturing the lip mucosa nearer to the gingiva, hence shortening the vestibule and preventing excessive elevation of the lip.

This treatment is indicated when soft tissue-related issues, i.e., hypermobility or short upper lip length, lead to excessive gingival exposure. It offers a less invasive way of enhancing the aesthetic smile appearance, especially when combined with orthognathic surgical correction. It has advantages of improved aesthetic outcome and patient acceptability; however, disadvantages can be transient discomfort, limited lip mobility, and relapse. In this specific instance, the integrative treatment addressed both the skeletal and the soft tissue aspects, thus establishing a more harmonious and stable result.

Conclusions

The case here represents that proper skeletal diagnosis is essential in patients with protrusive dentition and gummy smiles. While extraction-based orthodontics would appear appropriate in Class II profiles, failure to deem VME as a possibility can lead to poor aesthetic and functional results. Modified Le Fort I osteotomy and genioplasty, in association with lip repositioning, treated in this case all the features, skeletal and soft tissue alike. This follow-up shall thus stress the importance of evidence-based approach to treatment planning, especially for the non-growing patient with truly great complexity brought about by her dentofacial discrepancies.

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