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Original Research Article

Gummy Smile and Dental Protrusion Ortho-surgical Approach: A Case Report

Rozzi Matteo (DDS, PhD)[1], Tiberti Giulia (DDS)[1], Silvia Fanelli (DDS, MS)[2*], Manuela Mucedero (DDS, PhD)[2], Paolantonio Chiara (MD)[3], Lorenzo Lancellotti (MD)[4]

[1]Independent Researcher
[2]Department of Systems Medicine, University of Rome "Tor Vergata", Viale Oxford 81, 00133, Rome, Italy
[3]Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, Via Caserta 6, Viale del Policlinico 155, 00161 Rome, Italy
[4]GVM Care & Research U.O. Chirurgia Maxillofacciale Maria Cecilia Hospital via Corriera 1, 48033, Cotignola (RA), Italy

***Corresponding Author**
Silvia Fanelli
Department of Systems Medicine, University of Rome "Tor Vergata", Viale Oxford 81, 00133, Rome, Italy

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Abstract: ***Background*:** A 26-year-old woman with Gummy Smile and Dental Protrusion was treated with extractive orthodontics combined with LeFort I Maxillary Impaction Osteotomy. ***Methods*:** The patient was treated with fixed orthodontic appliance and extractive therapy. After 18 months of pre-surgical orthodontic treatment, extraction gaps were closed, and a 1-jaw surgery was performed. Post-surgery orthodontic treatment led to improved facial aesthetics and occlusion. The total active treatment time was 23 months. ***Results*:** After surgery, the maxilla was acceptably impacted 5 mm at first incisor level and 5 mm at first molar level. The anti-clockwise rotation of the mandible allowed a4 mm pogonion advancement and a decrease of the mandibular plane angle of 11.3°. The post-treatment records show a great stability of the occlusion and a good aesthetics of the face two years after the end of the treatment. ***Conclusions*:** The combination of a LeFort I Osteotomy with orthodontic extraction therapy is a useful technique for a reliable superior repositioning of the maxilla and simultaneous control of dental proclination.

Keywords: Ortho-surgical, LeFort I, Gummy Smile, Dental Protrusion, Orthognathic Treatment.

INTRODUCTION

The term of "gummy smile" or "excessive gingival exposure" is used when there is overexposure of the maxillary gum during smile [1]. An excessive vertical growth, in which the lower third of the face is longer than the middle third, may be directly related to the origin of the gingival smile [2]. The diagnosis of patients with this facial pattern is based on cephalometric radiographs and facial pattern, visualized through the discrepancy of the maxillary bone [3-1]. Many patients turn to orthodontic and dental practices requesting to improve not only the aesthetics of the smile, but also the overall facial appearance. A gummy smile is an aspect that can generate concern among patients, as it constitutes a serious aesthetic disorder. Although mild to moderate gingival display during smiling (2-3 mm) may be considered an acceptable variation, excessive gingival display can severely alter an otherwise pleasant smile. The gummy smile has numerous etiologies (bone, muscular, dental and gingival) and each of them have a different treatment. For this reason, it is essential to develop a differential diagnosis based on the etiological factors present. In cases characterized by a predominantly muscular etiology, generally a short upper lip is present; alternatively, a lip hypermobility with facial height and gingival margin levels falling within normal standards [1-4]. Therapies in these cases include

injection with botulinum toxin or hyaluronic acid, surgical repositioning of the lips, or myectomy [5]. When the dento-gingival etiology includes small natural teeth, with a short clinical crown, gingival hyperplasia, or altered passive eruption, the therapeutic procedures involve gingivectomy, apical positioned flap, with or without bone resection [1-6].

Periodontal procedures addressing thick biotypes or frank hyperplasia have predictable results. The recontouring of the soft and hard elements of the periodontium has a proven record of improved aesthetics regarding tooth shape and gingival architecture, again resulting in great improvement within the aesthetic zone. Yet, the impact of excessive gingival display remains minimal [7, 8].

Mini-implants associated with the orthodontic appliance can be also indicated for the treatment of cases of dentoalveolar origin. Orthodontic intrusion mechanics with skeletal anchorage or temporary anchorage devices (TADs) [9-16], have demonstrated success. The limitations of TADS include: prolonged treatment time, patient compliance and comfort, loss of TAD stability at the bone interface resulting in TAD failure. More severe implications are root resorption, and long-term vertical instability of dental correction [17].

A gummy smile caused by vertical maxillary excess cannot be satisfactorily treated with adjunctive minimally invasive approaches such as botulinum toxin injection, crown lengthening procedure or orthopedic appliances - such as high-pull headgear$_{18}$ or vertical chin cup [19]. An ideal treatment option for vertical maxillary excess is the reduction of the maxillary vertical dimension by LeFort I osteotomy [20, 21].

When a severe gummy smile is characterized by overgrowth due to anterior vertical maxillary excess [22], conventional orthodontic treatment alone is not an option. Orthognathic surgery can provide significant skeletal improvement [23], in addition, orthognathic surgery, such as that provided by a LeFort I osteotomy, can yield a more aesthetically pleasing result, and it affords patients with severe gummy smiles a more acceptable outcome than orthodontic treatment alone.

MATHERIALS AND METHODS

Case Report

Diagnosis and Etiology

A Caucasian 26-year-old woman was referred to our office for an orthodontic evaluation. Her chief complaints were lip protrusion, dental proclination, and gummy smile (Fig. 1a-i). The patient was protected and informed consent was obtained.

The patient's medical history showed no general health problems. Clicking sounds were not detectable in the right and left temporomandibular joints. The patient denied any muscle or joint pain, or other symptoms typically associated with temporomandibular disease. Her lateral facial photos evidenced lip protrusion and a convex profile with a retruded chin; furthermore, the frontal facial photos highlighted labial incompetence and increased gingival exposure during smile.

The soft tissues cephalometric evaluation confirmed an excessive lips projection (Upper Lip to E-plane=-2.30 mm, Lower Lip to E-plane= 1.16 mm) and chin retrusion (Mentolabial angle=154°, Chin projection= 85.23°). The frontal aesthetic analysis showed an increase in the vertical height of the lower third of the face, no facial asymmetries were detected (Fig. 2a-b).

Intraoral analysis showed a complete dentition in the lower arch, instead, the upper arch showed the absence of the first permanent molar previously extracted. No posterior or anterior crossbites were detected. The occlusal scheme presented a bilateral canine Class I relationship with a mild anterior crowding in the lower arch. The maxillary and mandibular dental midlines were coincident. Dental midlines coincided with her facial midline. Overjet and overbite were 4.71 mm and 1.92 mm, respectively (Fig. 1 e-i).

In the panoramic radiograph evaluation, the condyles were found to have a normal shape and no asymmetry was highlighted in the mandibular ramal height. Mandibular lower right edges were symmetrical. She was missing her left and right upper first permanent molar. Also, her left upper third permanent molar was missing. At the radiographic analysis, the osteo-mucosal inclusion of her third permanent molar was evident. No active caries were detected; several conservative therapies were present on permanent molars (Fig. 3a).

The posteroanterior cephalometric analysis had not highlighted significant skeletal asymmetries or canting of the occlusal plane (Fig. 3b).

Cephalometric analysis indicated a skeletal Class II pattern with chin retrusion (ANB= 6.41°, APDI= 69.42°, B to N-perp (FH)= -16.82 mm, Pg to N-perp (FH)= -19.64 mm). Vertical skeletal analysis showed a hyperdivergent pattern with a clockwise rotation of the maxillary and mandibular bases (FMA= 38.62°, Bjork sum= 408.21°, ODI= 68.04°). Vertical maxillary excess was evident in both the anterior and posterior dentition (occlusal plane canting = 19.32°). Upper and lower incisors were

proclined (U1 to UOP= 48.33°, IMPA= 97.22°, L1 to NB= 11.77 mm) (Fig. 3c, Table I).

Treatment Objectives

Based on patient observation, the following items for inclusion in the treatment plan were identified:

1. Increase nasolabial angle, correct lower lip eversion, and reduce the upper and lower lip protrusion to improve the facial profile;
2. Obtain a passive labial seal;
3. Reduce dental proclination;
4. Improve smile aesthetics, including a reduction in the gingival display upon smiling;
5. Minimize as much as possible the anteroposterior skeletal discrepancy;
6. Achieve of proper overbite and overjet.

Treatment Plan

The following treatment plan was developed:

1. Performance of an orthodontic leveling and aligning of the maxillary and mandibular dental arches;
2. Extractions of the mandibular first premolars; closure of the first upper molar extraction gaps to provide spaces for retraction of the incisors, achieving an occlusal scheme with a bilateral canine first class and full third-class molar occlusion;
3. Le Fort 1 osteotomy and maxillary impaction with a counterclockwise rotation of the mandible;
4. Orthodontic finishing and retention.

Treatment Alternatives

Two treatment options were considered for the patient to reduce vertical maxillary excess: (1) surgical orthodontic treatment, which could relieve vertical maxillary excess with superior movement of the maxilla by Le Fort I osteotomy - in addition, favorable facial profile changes may be achieved by advancement and counterclockwise rotation of the mandible; and (2) nonsurgical orthodontic treatment with TADs for total dentition intrusion.

Orthodontic-surgical treatment of maxillary excess by maxillary repositioning was chosen, as it is based on skeletal stability and soft tissue modifications [24]. In addition, this approach enables the establishment of a balance between teeth and facial structures, providing aesthetic and functional benefits for the patients [3]. LeFort I osteotomies are strategies generally required to treat vertical maxillary excess in orthognathic surgery [25], in which a portion of the jawbone is removed, and the maxilla is then impacted to a predetermined position.

Treatment Progress

Before orthodontic treatment, the mandibular first premolars were extracted and the post-extractive gaps of the first permanent molars were used for gap closure on each side. A preadjusted edgewise appliance (0.022x0.028 inches) with Roth prescription was used for presurgical orthodontic treatment; therapy was initiated by aligning maxillary and mandibular teeth using 0.016' preformed Ni-Ti arch wires. Maxillary and mandibular arch forms were coordinated with each other by sequentially increasing the rigidity of the arch wires. Gaps in the upper and lower arch were closed with sliding mechanics and power chain on stainless steel rectangular arch wires. Prior to surgery, both the maxillary and mandibular dentition were stabilized on 0.019" × 0.025" stainless steel wire with to allow efficient tip and torque expression, and to provide adequate rigidity. The maxillary anterior teeth were move forward by Ni-Ti coil springs positioned between lateral incisors and canines to increase the space in the maxillary arch, furthermore the mandibular anterior teeth were stabilized with a retainer and the brackets on them were temporarily removed. This allowed to avoid anterior interference during the counterclockwise rotation of the mandible following the maxillary impaction (Fig. 4 a-i).

At the end of pre-surgical phase, following extraction gaps closure, the patient had a class III molar relationship and a class I canine relationship, with an overjet of 4.75 mm and an overbite of 3.67 mm. As expected after an extraction treatment, the gingival exposure was increased [26]. (Upper Incisal Display= 5.47 mm) (Fig. 4a-d). At the end of the orthodontic treatment, the dental protrusion was corrected (IMPA=85.38°, L1^NB=25.38°, U1^FH=101.41°, U1^Na=10.94°).

After having completed the pre-surgical orthodontic preparation (arches stabilized with 0.019" x 0.025" stainless steel surgical arches with hooks), about 1 month before the scheduled surgery, the pre-surgical records were acquired (facial and oral photos, STL scan of the arches with 3D scanner, CT scan of maxillo-facial complex). These records were used to perform digital simulation of osteotomies, bone displacements and surgical splint fabrication.

Surgical programming consisted in: upper maxillary osteotomy according to Le Fort I, down fracture, removal of bony interferences and 5 mm upwards impaction of the maxilla with resection of the nasal septal cartilage and bone. For maxillary fixation, 2 titanium 1.5 mm plates were used on each side with corresponding titanium screws. Mandibular repositioning by counterclockwise rotation followed, with occlusal stabilization, splint,

and intermaxillary elastics. Finally, removal of the intermaxillary fixation and occlusal assessment.

To narrow the nasal alae, Prolene 5.0 sutures were placed; on the other hand, the surgical accesses were sutured with Vicryl 4.0.

RESULTS

Treatment Results

The post-treatment records analysis show that the treatment objectives were achieved. The facial profile has been improved, the lip protrusion has been corrected and the prominence of the chin has increased. Achievement of lip competence and an aesthetic smile were observed. Furthermore, the gingival exposure upon smiling can be judged ideal. The intraoral analysis evidenced good dental alignment and occlusion with midlines coincidence; normal overjet and overbite values were reached (Fig. 5a-i).

The post-treatment panoramic radiograph showed complete closure of the extraction spaces and acceptable root parallelism in both arches without significant root resorption. Post-treatment lateral cephalometric analysis showed ideal inclination of maxillary and mandibular incisors (IMPA=86.22°, L1^NB=25.66°, U1^FH=108.90, U1^Na=13.75°) and normalized values of skeletal divergence (FMA= 27.59°). No asymmetries were evident in the frontal plane (Fig. 6a-c, Table II). Superimposition between the pretreatment and post-retention images showed an upward movement of the upper arch with a slight anticlockwise rotation of the occlusal plane (Cant of Occlusal Plane= 6°) due to the maxillary impaction. The mandible evidenced a counterclockwise rotation movement that allowed the reduction of the skeletal divergence (ODI=71.06°, Bjork Sum=405.85°), the pogonion came forward by 4.0 mm. Furthermore, the incisal display at smiling was corrected (Upper Incisal Display= 2.87 mm) (Fig. 7).

Two years after the end of treatment the dental and skeletal results were maintained (Fig. 8a-i).

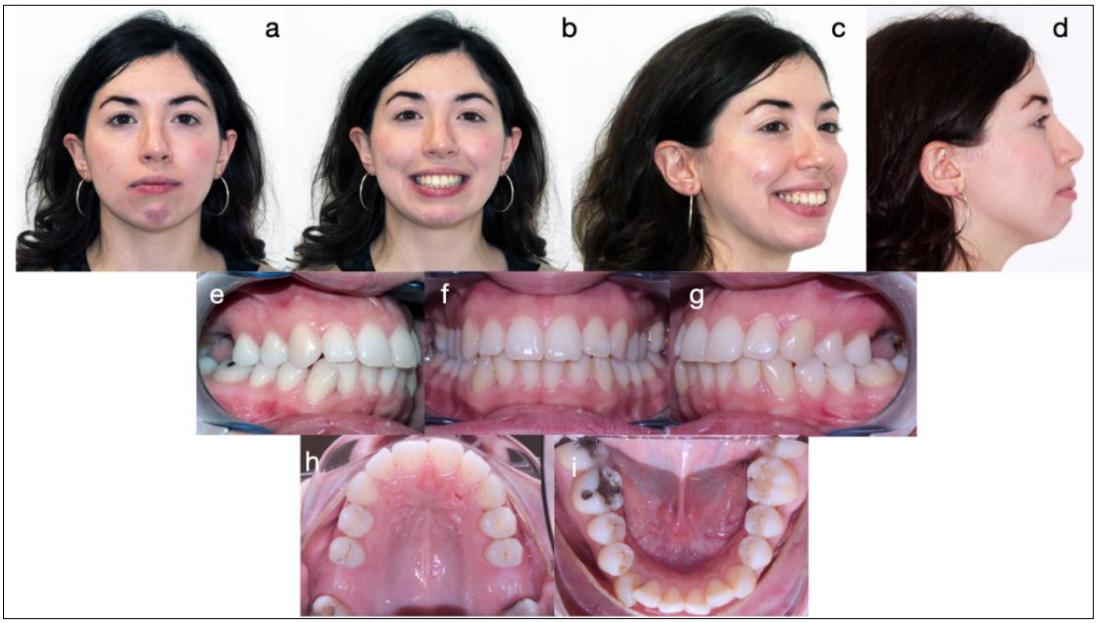

Fig. 1a-i: Pre-treatment extra and intra-oral photographs

Table I: Pre-treatment cephalometric values

Cephalometric measurements	Mean	S. D.	Result	Severity
SNA	81.08	3.7	78.22	
SNB	79.17	3.8	71.80	*
ANB	2.46	1.8	6.41	**
Bjork Sum	397.16	3.6	408.21	***
FMA	25	4.0	38.62	***
Gonial Angle	124.31	5.4	131.91	*
APDI	85.74	4.0	69.42	***
ODI	74.5	6.0	68.04	*
Combination Factor	157.9	6.5	137.46	***
A to N-Perp(FH)	0.4	2.3	-2.65	*
B to N-Perp(FH)	-3.5	2.0	-16.82	***

Cephalometric measurements	Mean	S. D.	Result	Severity
Pog to N-Perp(FH)	-1.8	4.5	-19.64	***
FH to AB	82	3.0	71.38	***
A-B to mandibular Plane	69.3	2.5	70	
Wits Appraisal	-0.3	1.7	-0.54	
Overjet	2	2.0	4.71	*
Overbite	2	2.0	1.92	
U1 to FH	113.8	6.4	110.67	
U1 to SN	105.28	6.6	101.08	
U1 to UOP	55	4.0	48.33	*
IMPA	90	3.5	97.22	**
L1 to LOP	66	5.0	61.51	
Interincisal angle	130	5.8	113.50	**
Cant of occlusal plane	9.3	3.8	19.32	**
U1 to NA(mm)	4	3.0	5.33	
U1 to NA(deg)	22	5.0	22.86	
L1 to NB(mm)	4	2.0	11.77	***
L1 to NB(deg)	25	5.0	37.23	**
Upper Incisal Display	2.5	1.5	6.06	**
Upper Lip to E-plane	-4.7	2.0	-2.30	*
Lower Lip to E-plane	-2	2.0	1.16	*
Nasolabial angle	95	5.0	106.08	**
Mentolabial angle	130.5	6.8	154.95	***
Chin projection	91.0	3.7	83.23	**
Extraction Index	153	7.8	135.30	**

S.D**.: Standard Deviation;*= One standard deviation;**= Two standard deviations;=Three standard deviations*

Table II: Post-treatment cephalometric values

Cephalometric measurements	Mean	S. D.	Result	Severity
SNA	81.08	3.7	76.88	*
SNB	79.17	3.8	73.58	*
ANB	2.46	1.8	3.30	
Bjork Sum	397.16	3.6	400.85	*
FMA	25	4.0	27.59	
Gonial Angle	124.31	5.4	133.11	*
APDI	85.74	4.0	78.20	*
ODI	74.5	6.0	71.06	
Combination Factor	157.9	6.5	150.73	*
A to N-Perp(FH)	0.4	2.3	4.65	*
B to N-Perp(FH)	-3.5	2.0	4.65	***
Pog to N-Perp(FH)	-1.8	4.5	2.46	
FH to AB	82	3.0	87.47	*
A-B to mandibular Plane	69.3	2.5	64.95	*
Wits Appraisal	-0.3	1.7	-2.35	*
Overjet	2	2.0	3.28	
Overbite	2	2.0	3.08	
U1 to FH	113.8	6.4	108.90	
U1 to SN	105.28	6.6	90.63	**
U1 to UOP	55	4.0	61.54	*
IMPA	90	3.5	86.22	*
L1 to LOP	66	5.0	68.09	
Interincisal angle	130	5.8	137.30	*
Cant of occlusal plane	9.3	3.8	6.00	*
U1 to NA(mm)	4	3.0	4.50	
U1 to NA(deg)	22	5.0	13.75	**
L1 to NB(mm)	4	2.0	6.05	
L1 to NB(deg)	25	5.0	25.66	

Cephalometric measurements	Mean	S. D.	Result	Severity
Upper Incisal Display	2.5	1.5	2.84	
Upper Lip to E-plane	-4.7	2.0	0.03	*
Lower Lip to E-plane	-2	2.0	1.62	*
Nasolabial angle	95	5.0	103.09	*
Mentolabial angle	130.5	6.8	136.4	
Chin projection	91.0	3.7	88.6	
Extraction Index	153	7.8	146.31	

S.D.: Standard Deviation;*= One standard deviation;**= Two standard deviations;***=Three standard deviations.

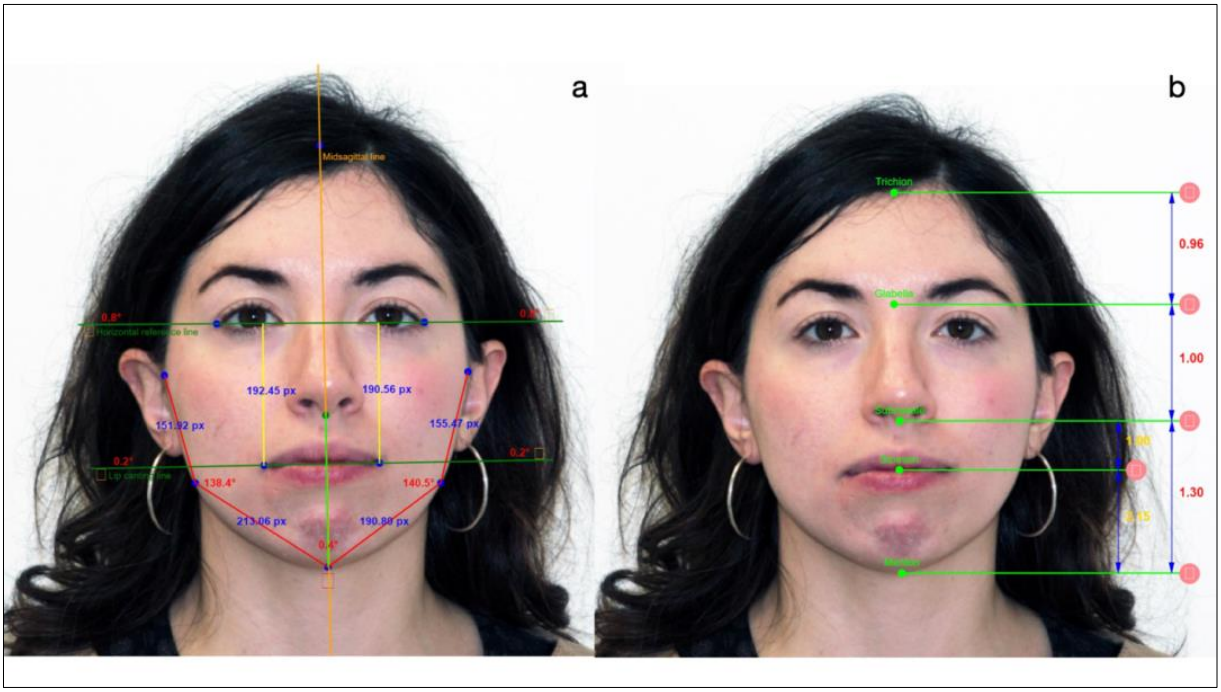

Fig. 2a-b: Frontal analysis of proportions and symmetry

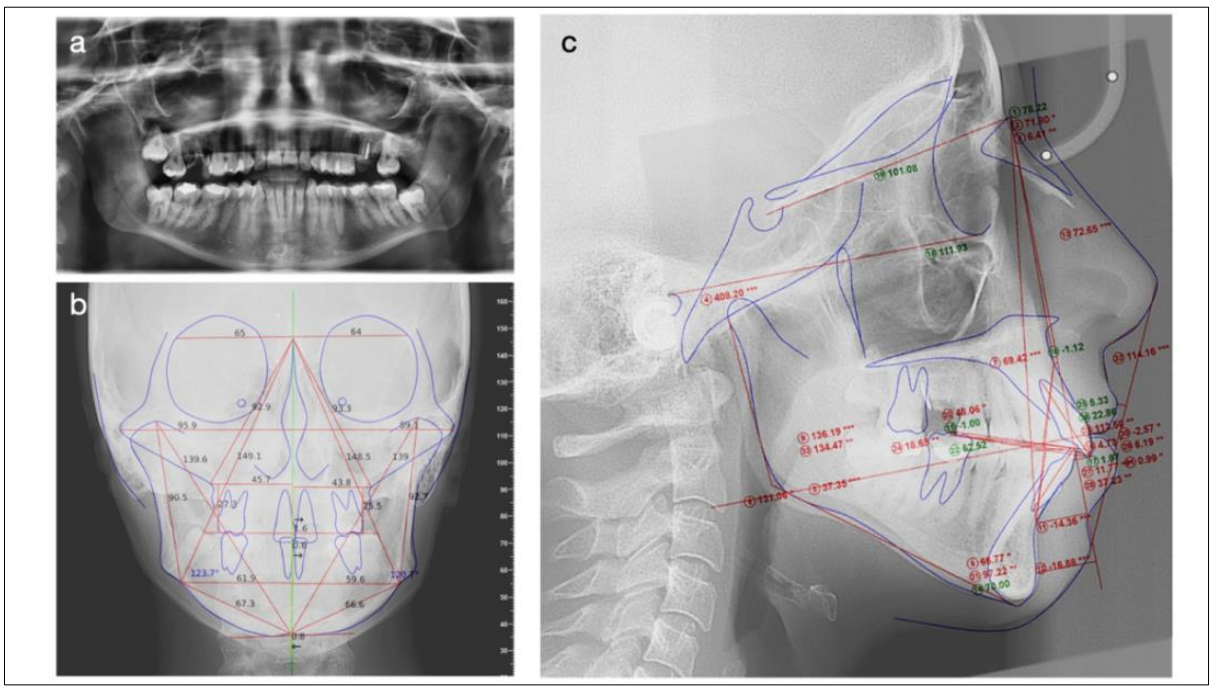

Fig. 3a-c: Pretreatment radiographs; a. Ortopantomography; b. Frontal cephalometric analysis; c, Lateral cephalometric analysis

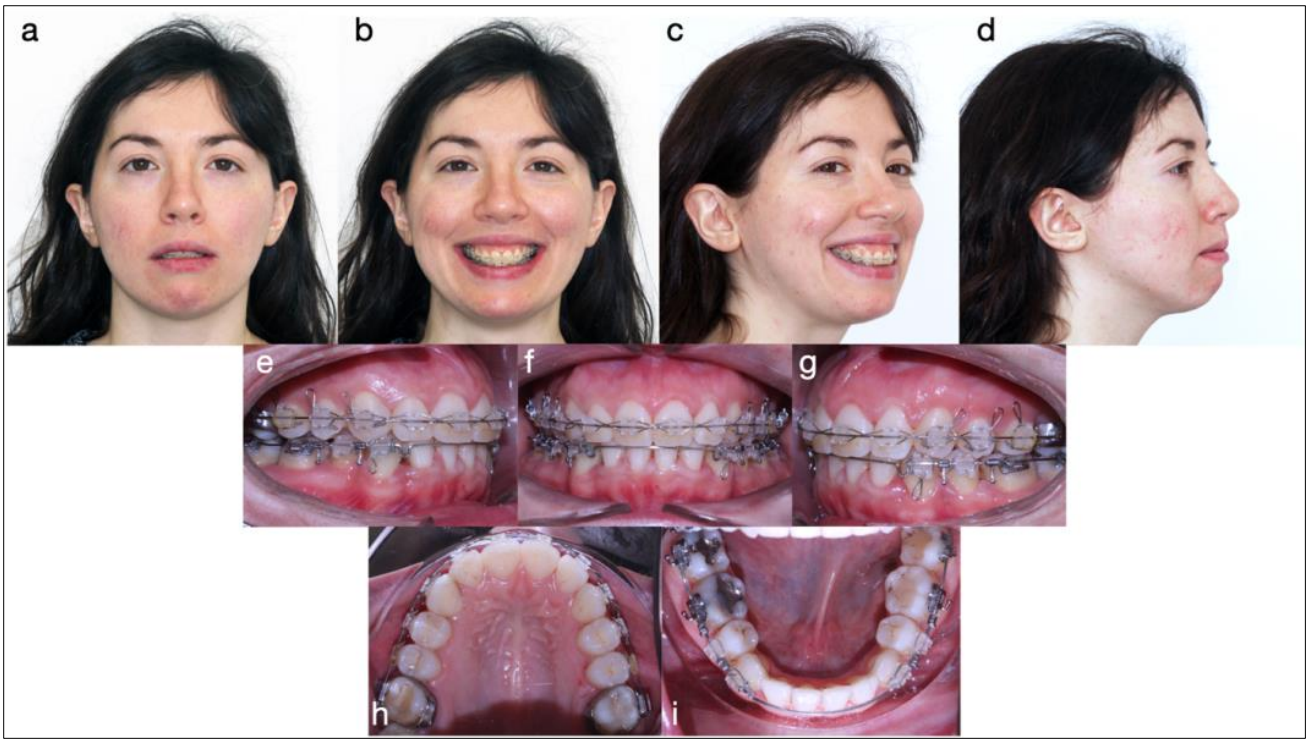

Fig. 4a-i: Presurgical extra and intra-oral photographs

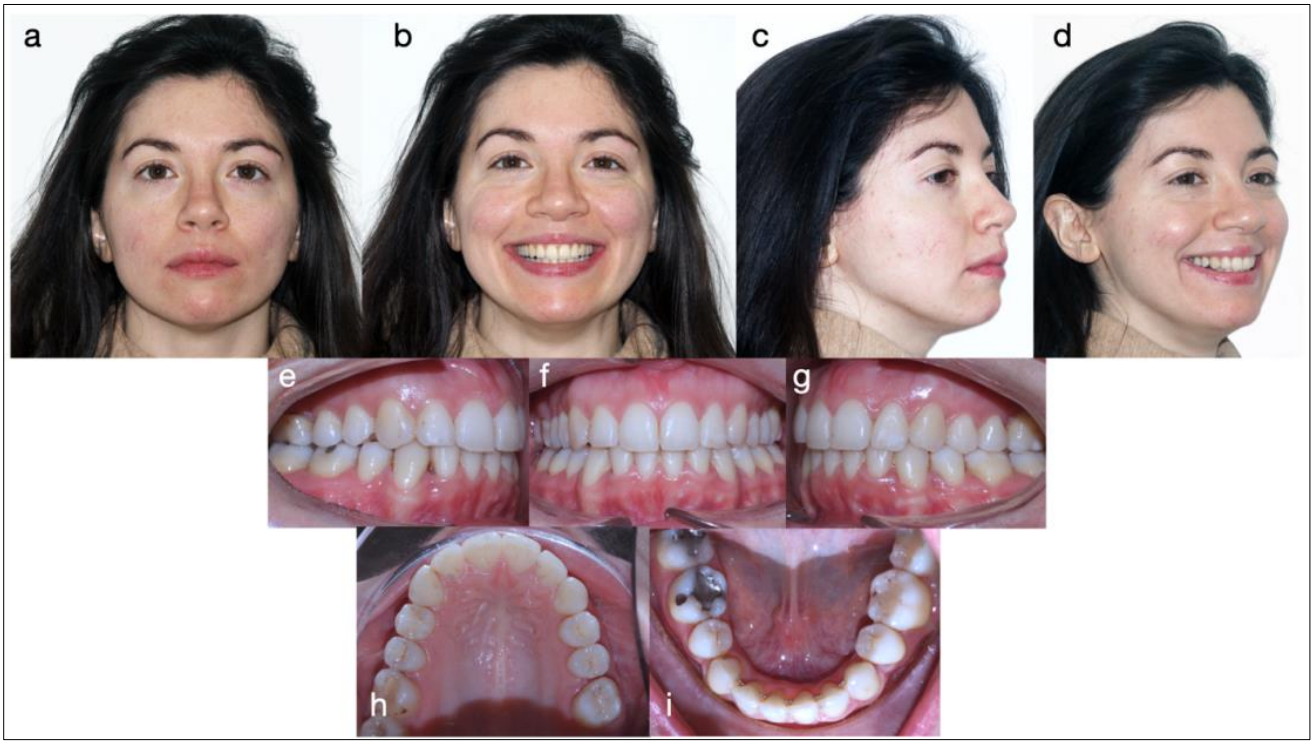

Fig. 5a-i: Postsurgical extra and intra-oral photographs

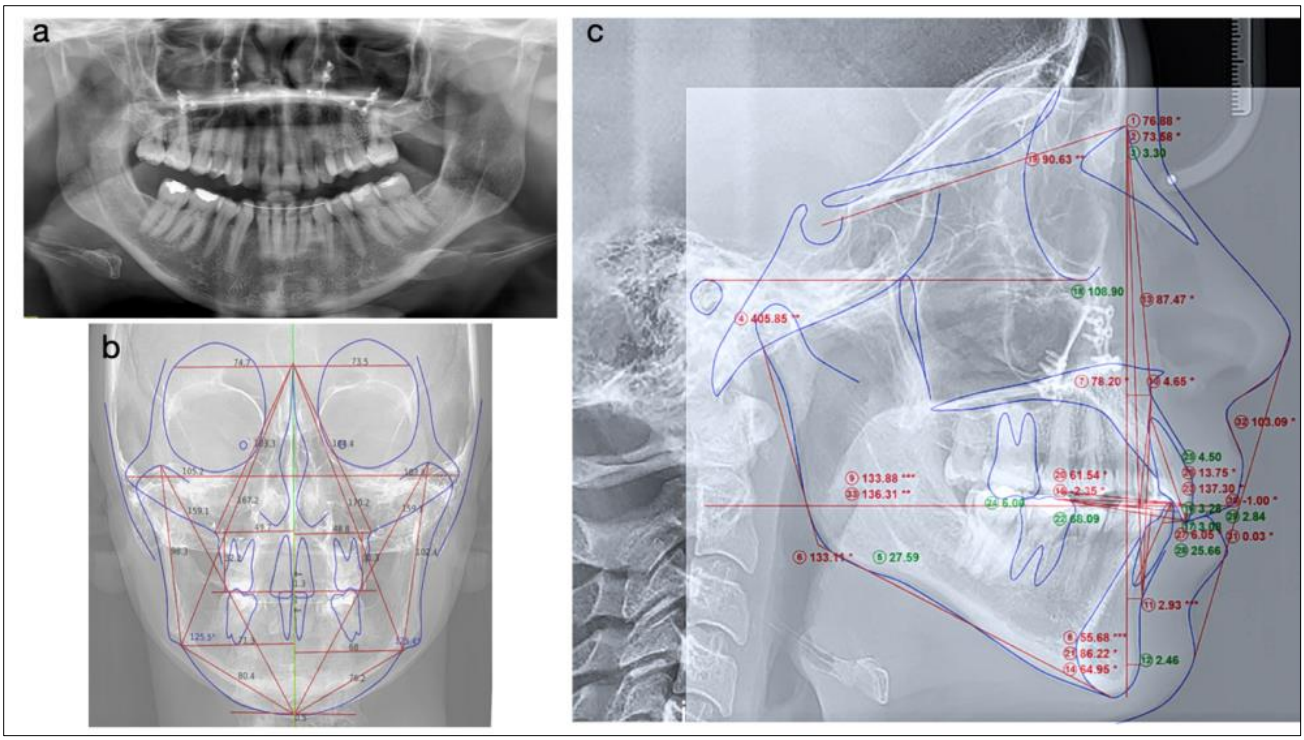

Fig. 6a-c: Post-treatment radiographs; a, Ortopantomography; b, Frontal cephalometric analysis; c, Lateral cephalometric analysis

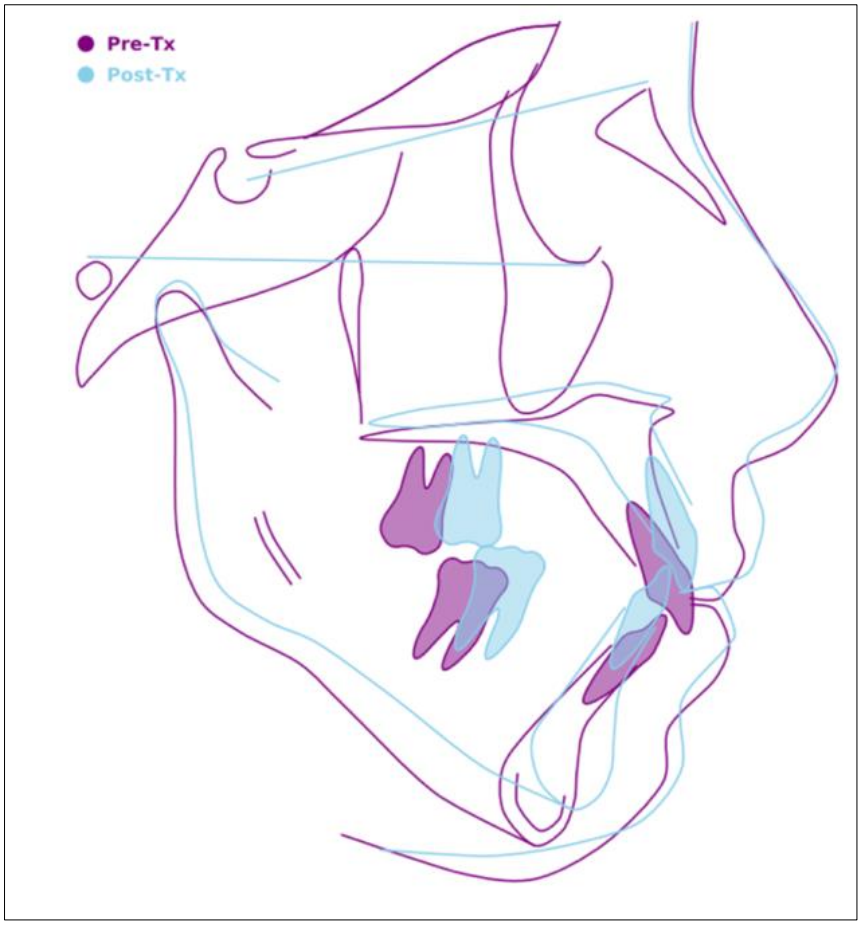

Fig. 7: Pre-treatment and Post-treatment cephalometric superimposition

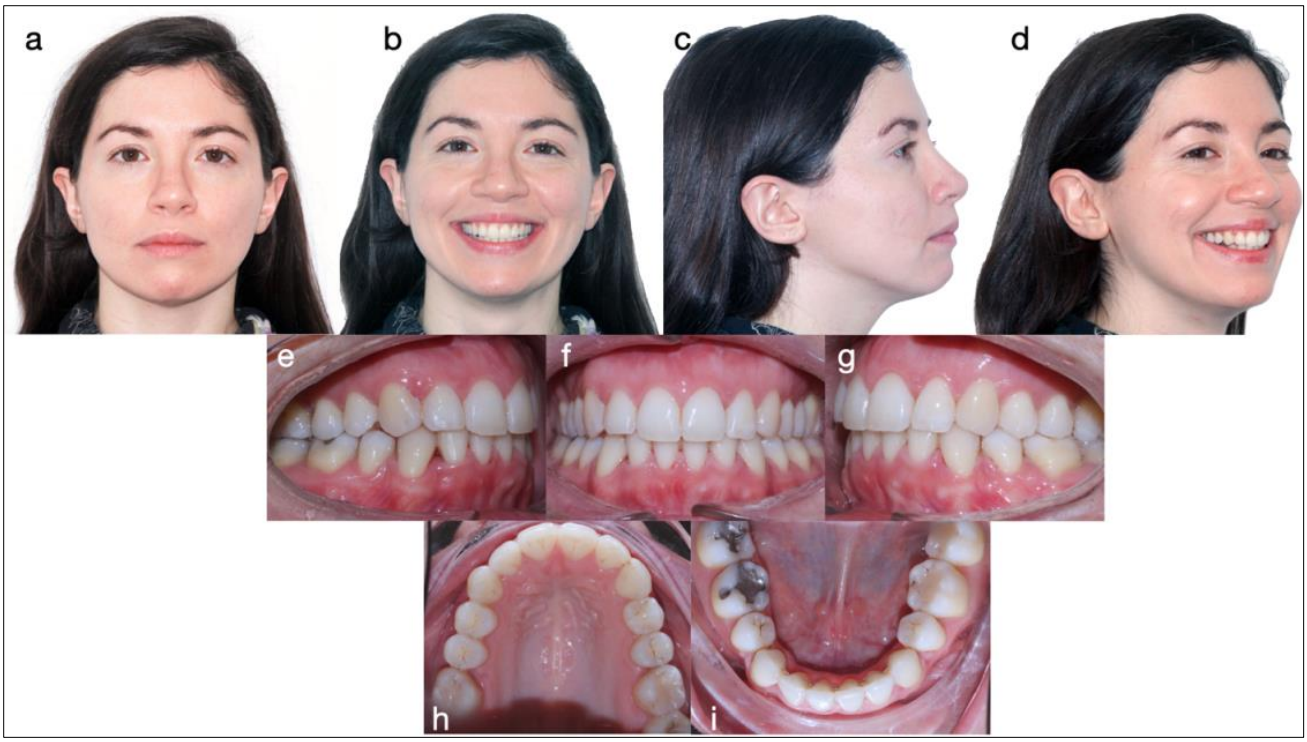

Fig. 8a-i: Extra and intra-oral photographs two years after the end of the active treatment

DISCUSSION

The achievement of a balanced facial aesthetics is one of the primary goals of orthodontic treatment. For nongrowing adult patients with excessive vertical growth of the maxilla, the ortho-surgical treatment should be the preferred option [27].

Vertical maxillary excess, a dentofacial deformity present in a large proportion of population, imputes an increased lower facial height due to increased maxillary height. This results in a clockwise rotation in the mandible, and the chin advances posteriorly and inferiorly.

Upwards repositioning of the maxilla has proved to be a useful method for treating patients with vertical maxillary excess. The upper lip line relationship to the incisor is the keystone in planning treatment that will achieve an attractive smile. Consequentially to maxillary impaction, the mandible suffers an anticlockwise rotation with the condyle as its center. This movement allows a forward movement of the pogonion with improvement in the chin prominence [28].

The vertical dimensions of the lower face change through maxillary impaction and mandibular autorotation. There are many reports in literature on the extent of lower facial height reduction in relation to maxillary impaction. Lee *et al*., [29], observed that the soft tissue followed the skeletal structures to almost the same extent after maxillary impaction [29, 30]. Schendel, Fish and Stroker [31-33], described a 1:1 ratio between lower-face shortening (cranial movement of the chin prominence) after maxillary impaction and mandibular autorotation. In their study, Wang *et al*., [34], concluded that the horizontal movement of the Pog point demonstrated high correlation with the vertical movement of the ANS point and the upper first molar, but not affected by the vertical movement of the PNS point. The horizontal movement of the Pog point was almost in 1:1 ratio to the vertical movement of the ANS point and the U6 point, suggesting that the ratio could be used to predict horizontal chin position [35].

It has been well documented that the Lefort I down-fracture technique with superior repositioning has excellent stability [36]. Tabrizi analyzed the stability of the superior maxillary repositioning on mandibular autorotation. His results highlighted that superior maxillary repositioning with mandibular autorotation is a stable procedure in orthognathic surgery, the significant relapse was related to the mandibular horizontal movement during bilateral sagittal split osteotomy procedures [36].

Therefore, orthognathic surgery should be considered the first option when a patient's chief complaint is about their facial aesthetics. The combined orthodontic and orthognathic treatment can not only improve a patient's facial appearance but can also improve his confidence and quality of life [37].

The patient presented in this case report, in addition to the maxillary vertical skeletal excess, showed significant proclination of both the upper and lower incisors. Orthodontic treatment goals for these patients include retraction and retroclination of the maxillary and mandibular incisors to reduce soft tissue prominence and convexity; extractions are often planned to create space for the front teeth to retract [38-42].

In this particular case in which the dental protrusion was associated with a vertical excess of the maxilla, extractive orthodontic treatment alone was not recommended. As reported by Sarver [43], the orthodontic treatment with upper premolars extraction, increase the anterior gingival display. The increase in vertical gingival display after orthodontic treatment was associated with the amount of canine retraction, pre-treatment ANB and the amount of incisor retraction [44].

Orthodontists must be cautious: unfavorable soft tissue changes might result from orthodontic camouflage alone. Severe vertical maxillary excess, and upper lip incompetence are important factors to contraindicate orthodontic camouflage treatment. In addition, an undesirable increase in the nasolabial angle is common when performing camouflage orthodontics with premolar extractions [45]. The orthodontic camouflage treatment alone, in which maxillary and mandibular first premolars are extracted may exacerbate a patient's poor facial appearance. The retraction can extrude the maxillary incisors and make the upper lip incompetence more severe [46].

Precisely for this reason, the combined surgical-orthodontic approach was chosen, in order to obtain the maximum possible functional and aesthetic result; a meticulous planning and execution of the orthodontic correction of the dental protrusion and osteotomies for the surgical correction of the vertical excess of the maxilla were essential to obtain an optimal result from a functional and aesthetic point of view.

Even though surgical orthodontic treatment may be the ideal approach, the proposal for surgical treatment is not always well accepted by patients owing to costs, complications, and risks.

The other option for skeletal malocclusion is dental camouflage which involves repositioning of dentoalveolar structure to disguise the severity of skeletal problem [47].

Recently, miniscrews have been widely used in palatal skeletal anchorage because they are relatively easy to insert and remove, and force can be applied to them almost immediately. These devices have demonstrated potential for direct skeletal anchorage to move individual teeth or entire arches [48, 49]. Orthodontic intrusion mechanics, with skeletal anchorage or temporary anchorage devices [30–35], have demonstrated success. The use of screw mechanics for achieving the effect of a Le Fort I impaction of the maxilla was proposed by Lin *et al*., [12], in which multiple screws are necessary.

Kim [50], indicated that the center of mandibular autorotation after miniscrews assisted molar intrusion was located 7.4 mm behind and 16.9 mm below condylion, with lower standard deviation values. The author reported when the maxillary molar was intruded 1 mm, OB increased by 2.6 mm, SN-GoMe decreased by 2° and Pog moved forward by 2.3 mm. This may be because limited movement in the maxillary molar region after orthodontic molar intrusion would result in a more consistent pattern of mandibular rotation.

When analyzing the stability of molar intrusion with temporary anchorage devices, the greatest observed relapse was of 27.2% for first mandibular molars and 30.3% at the second lower molars after 1 year follow-up [51], a greater stability was observed for the maxillary molars after 1 year of follow-up, showing a relapse rate of around 12% [52-54], which showed a tendency to increase in the second posttreatment year, with values ranging between 13% [53], and 21% [55]. After 3 years, the greatest observed posttreatment values were 18% [51], for relapse, with 80% of these changes occurring during the first-year posttreatment. After the first year of follow-up, the mandibular counterclockwise rotation obtained tends to decrease [51, 52], suggesting that there is a clockwise rotation of the mandible in the long term [56].

In case of surgical-orthodontic treatment of maxillary vertical excess, significant differences in anterior facial height should be considered due to the different methods of surgical treatment used.

In cases of surgical procedures with maxillary intrusion, obtained values for changes in anterior facial height even −5.5 mm [57]. It appears that surgical methods could make major changes in anterior facial height compared to treatment with skeletal anchored molar teeth intrusion [58].

Regardless of the treatment method used, one of the effects of maxillary vertical excess treatment is the angular change in the position of the mandible. In cases treated by molar intrusion, the mandibular position changes as a result of mandibular autorotation; and the same mechanism is explanatory for mandibular positional changes

consequent to LeFort 1 orthognathic surgery. The variation reported in literature for this value with LeFort 1 fracture was −4.6 degrees, which suggests that it could be possible that surgical intervention allows greater angular values of mandibular autorotation than skeletal anchored molar intrusion [59].

Other authors reported a limitation in skeletal anchored orthodontics, stressing minimal change values in cephalometric skeletal measurement, soft tissue profile and smile arc of the patient [60].

Furthermore, orthodontic intrusion mechanics with skeletal anchorage come with a cost, such as prolonged treatment times, discomfort, premature loss of skeletal anchorage or screw fracture and increased risk of root resorption [60-63].

The choice of surgical orthodontic treatment in patients with maxillary vertical excess allows the correction of gummy smile with a substantial improvement in facial aesthetics and smile, ensuring stable results in the long term.

CONCLUSION

Patients with severe gummy smile experience excessive vertical maxillary growth, which causes excessive display of maxillary teeth and gingival tissue, despite a normal upper lip length. The excessive vertical maxillary growth is associated with a progressive backward rotation of the mandible, which makes the face longer and more deficient in the anteroposterior dimension.

This article reports the successful surgical-orthodontic treatment of a patient with a maxillary vertical excess, class II malocclusion and dental protrusion. Our results suggest that the combination of extraction orthodontic treatment with a LeFort I osteotomy is a useful technique for reliable superior repositioning of the maxilla for treatment of patients with severe gummy smile and dental protrusion.

In addition to improving the aesthetic appearance of the face and smile, the combined surgical orthodontic treatment allows for stable long-term results.

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Institutional Review Board Statement - Human and Animal Rights Statement

The authors read the Helsinki Declaration and the present work was conducted (retrospectively) according to its principles.

All procedures in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee, and with the 1946 Helsinki Declaration, and with its later amendments or comparable ethical standards.

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