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Orthosurgical Correction of Severe Vertical Maxillary Excess: Gummy Smile

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<http://dx.doi.org/10.5772/intechopen.80384>

Abstract

Gummy smile which is commonly described as excessive gingival display in full smile has become a major esthetic concern for patients and healthcare providers in recent years. Because of the complex etiologic factors and severity of this orofacial deformity including skeletal, dentoalveolar, muscular, and gingival, it is essential that a differential diagnosis be established so that a relevant therapy can be selected from a wide range of treatment options. The complex etiologic factors of this dentofacial deformity necessitates coordination between a team of health care providers, especially between orthodontist and maxillofacial surgeon, to improve diagnosis and treatment planning, accurately predict the outcome, and minimize orthosurgical complications. In this chapter, the author will present several clinical cases and briefly review available treatment modalities for excessive gingival display in full smile. Emphasis will be put on orthosurgical treatment of severe vertical maxillary excess as the optimal solution to restore facial balance and harmony, attractive smile, and patients' satisfaction.

Keywords: gummy smile, vertical maxillary excess, dentofacial deformity, orthosurgery, interdisciplinary approach

1. Introduction

Orthosurgical correction of dentofacial deformities aims to obtain more harmonious and esthetically pleasing facial proportions in addition to normal and stable functional occlusion. Facial esthetics cannot be considered apart from an attractive smile and vice versa.

Despite the variety of ethnic, racial, and individual perception of facial attractiveness and a pleasant smile, there are general consensus among health care professionals that harmony and

balance of the facial features are equally important as intrinsic dentogingival, lips, and perioral soft tissue components to be considered before designing a beautiful smile [1–3].

Gummy smile caused by vertical maxillary excess and dentofacial disharmony cannot be treated satisfactorily with adjunctive nonsurgical approaches such as botulinum toxin injection or a crown lengthening procedures or temporary anchorage devices (TDAs). An ideal treatment option for vertical maxillary excess (VME) is the reduction of the maxillary vertical excess by LeFort I osteotomy with superior maxillary repositioning [4, 5]. However, when gummy smile is not associated with severe skeletal discrepancy in three dimensions (3Ds), intrusion of anterior teeth using TDAs may be indicated provided that the anterior esthetic occlusal plane and smile arc are well preserved [6, 7].

Many nonsurgical orthodontic treatment modalities proposed to treat gummy smile in adult patients with severe skeletal facial problems were of limited use with no benefit on the skeletal vertical discrepancy [8]. Depending on the magnitude and severity of the gummy smile, combined orthosurgical techniques offer better esthetics and long-term stability [9].

Increased vertical dimension in class III cases is the most important and deciding factor to be considered when formulating a treatment planning and deciding the technique of orthognathic surgery [10].

Computer simulation of orthosurgical outcome which was once of great concern that showing predictions to patients might lead to unrealistic expectations and disappointments. Nowadays, image prediction is becoming more likely satisfying and acceptable as it allows patients to visualize possible soft tissue profile changes and help them to decide whether surgery would be worth in terms of the additional risk and cost [11, 12].

2. Orthosurgical treatment modalities of vertical maxillary excess: gummy smile

Because not all dentofacial deformities are alike, different treatment modalities were developed and advances in surgical orthodontics added a new dimension to the health profession and assured patients' satisfaction. The following case series intended to share experience with colleagues and students.

2.1. Case #1

A healthy patient (39 year 9 month old) presented with a chief complaint of "I am not happy with my smile, arrangement of my teeth, and prominent chin." cursory examination revealed that the patient has skeletal and dental class III malocclusion with reverse overjet, narrow maxilla, long face, concave profile, and gummy smile. The case was complicated by old extraction of lower left first molar. Thorough clinical examination and diagnostic data collected assured limitation of orthodontic treatment alone to achieve treatment objectives and therefore,

combined orthosurgical correction was suggested and the patient agreed after detailed discussion and joint meeting with the clinicians.

2.1.1. Diagnosis, treatment objectives, and treatment planning

Figures 1 and **2** explain the extra-oral, intra-oral clinical examination and radiographic assessment of the dentofacial components in 3Ds.

2.1.2. Treatment objectives

The objectives were directed to the listed problems to include: achieving esthetic facial features and pleasant smile; in addition to restoring normal occlusion in three dimensions (3Ds) as a prerequisite to ideal lip-teeth relationship. Retaining the treatment outcome is equally important, and all measures were taken to establish effective retention means before appliance removal.

Figure 1. Initial clinical (extra-oral and intra-oral) and radiographic examination that allow to formulate an appropriate treatment planning and setting the treatment objectives.

Figure 2. Jarabak and McNamara lateral cephalometric analysis, as adjunctive to clinical examination, to assess objectively the sagittal and vertical dentofacial deformity.

2.1.3. Treatment progress

2.1.3.1. Presurgical phase

Preparing the dentoalveolar arches for orthognathic surgery necessitated leveling and alignment of teeth, decompensating the retroclination of lower incisors, and achieving ideal arch form that allows surgical expansion through median maxillary split. **Figures 3** and **4** depict the sequence of orthodontic work and the simulation of surgical movements in 3Ds.

2.1.3.2. Postsurgical phase

Maintaining normal anterior overjet and overbite, plus ideal incisors, canines, and molar relationship during this phase is crucially important. The healing of bony parts during detailing of occlusion and any minor corrections if they ever exist is the key for success at this stage. Full-time wear of heavy elastics for 2 weeks after surgery to assure full dental interdigitation, arch symmetry, and stable treatment outcome. 4 month later, the appliance was removed, and the necessary retainers were constructed, the prosthodontist took good care of the four maxillary incisors upon the patient's request. Follow up for almost 5 years was planned, and the interdisciplinary approach yielded realistic adequate treatment outcome (**Figures 5–7**).

Figure 3. Treatment progress: decompensation of the incisor inclination and uprighting buccal teeth, leveling and alignment of teeth, flattening curve of Spee, restoring normal arch form, preparing model surgery, and constructing surgical hooks prior to surgery.

Figure 4. Models of the presurgical arches were constructed and mounted on semi-adjustable articulator, simulation of the surgical act included: superior maxillary repositioning and advancement, splitting the maxilla into two pieces for expansion, displaying final movements of the jaws and cant of the occlusal plane, and monitoring any possible occlusal interference to be resolved.

Figure 5. Pre- and postfrontal (PA) cephalometric analysis and occlusal view depicting the transverse surgical expansion of the maxilla with relevant min-plates in situ.

Figure 7. Pretreatment occlusion, presurgical orthodontic preparation, postsurgical occlusion, and final prosthetic reconstruction of occlusion.

2.1.4. Treatment results

The following photos and radiographs reveal the impeccable improvement in the harmony and balance of the facial form in 3Ds, successful surgical expansion, and superior repositioning of the maxilla resulted in ideal functional and static occlusion. Postoperative radiographs have shown a well seated condyle in the glenoid fossa in an appropriate physiologic rest position. Patient's satisfaction was rewarding (**Figures 8–10**).

Figure 8. Pretreatment, presurgical preparation phase, postsurgical phase, and postsurgical radiographs.

Figure 9. Pretreatment occlusion, presurgical preparation phase, surgical procedures, postsurgical phase to detail the occlusion, and posttreatment occlusion.

Figure 10. The final occlusion 5 year postretention focusing on the median maxillary surgical split to restore ideal arch form stable occlusion.

2.1.5. Conclusions

Attempt to treat dentofacial deformities without comprehensive data analysis and collaboration with other health care providers will not yield acceptable results and may need retreatment. Medical ethics obligate us to consider the patients' interest and welfare. This case, from the very beginning, was diagnosed as severe skeletal deformity in 3Ds and disproportionate dentoalveolar arches. The dentofacial imbalance and disharmony imposed the

orthosurgical treatment approach which was agreed upon by orthodontist and maxillofacial surgeon and readily accepted by the patient.

2.2. Case #2

A healthy female (24 year 5 month old) presented with apparent long face syndrome, convex profile, vertical maxillary excess causing gummy smile, incompetent lips, and deficient chin. Intra-oral examination revealed a class II division 1 malocclusion associated with narrow maxilla, deep palatal vault, micrognathia, moderate crowding mild anterior open bite, and distorted occlusal planes.

2.2.1. Diagnosis

Figures 11–14 exhibit the clinical and diagnostic aids that facilitate the formulation of appropriate treatment planning to achieve optimum treatment outcome.

2.2.2. Treatment planning and treatment objectives

Because of the diagnosed severe skeletal dentofacial deformity, joint consultation and thorough patient's data analysis took place by the orthodontist, and the maxillofacial surgeon, the treatment modality offered to the patient, after detailed discussion and displaying of the possible outcome, was a combined orthosurgical care which was willingly accepted.

Figure 11. Pretreatment facial, dentoalveolar, and radiographic photos.

Figure 12. Pretreatment lateral cephalometric analysis of McNamara confirming the long face deformity and retrognathic mandible. Tipped down occlusal plane buccally caused backward rotation of the mandible.

Figure 13. Pretreatment cephalometric analysis of Jarabak (sagittal, vertical, and dentoalveolar findings).

2.2.3. Treatment progress and results

Presurgical orthodontic phase intended to restore ideal arch form and dentoalveolar alignment (teeth decrowding, root parallelism, and occlusal plane leveling). This will facilitate the surgical mobilization of the arches in 3Ds; so that the appropriate canting of the occlusal plane and proper lip-teeth relationship secures satisfying treatment outcome (Figures 15 and 16).

2.2.4. Conclusions

When malocclusion is a consequence of facial musculoskeletal imbalance, any attempt to restore facial esthetics and beautiful smile by orthodontic dentofacial orthopedics alone will

Figure 14. Soft tissue and dentoalveolar surgical planning of the case, surgical mobilization of the maxilla, and chin to restore harmony and balance of the facial profile, in addition to dentoalveolar sagittal and vertical orthodontic movements.

Figure 15. Phases of treatment (facial esthetics, pleasant smile, and ideal occlusion).

relationship in 3Ds. Surgical hooks were then constructed to start up the surgical phase surgical mobilization of the arches and bring occlusion into normal treatment outcome, and **Figure 5** shows the end up with straightening of teeth within orofacial disharmony and unaesthetic smile. Formulating treatment planning in such cases needs mutual collaboration between different health care providers and in particular between orthodontist and maxillofacial surgeon from the very beginning if the treatment objectives and patient’s satisfaction are to be realized as in the case presented.

Figure 16. Radiographic representation of LeFort I osteotomy with maxillary superior repositioning and genioplasty for chin augmentation achieved treatment objectives and patient's satisfaction. Phases of treatment (facial esthetics, pleasant smile, and ideal occlusion).

2.3. Case #3

A healthy female patient (23 year old) presented with a chief complaint "I am frustrated with my elongated face, unaesthetic smile, and jam-packed teeth that prevent me from biting objects or chew food efficiently." She was reluctant to wear braces before, but is ready to go through orthodontic treatment to re-establish a pleasant dentofacial appearance.

Diagnosis clinical examination revealed typical long face features with increased lower facial height and almost straight profile. Vertical maxillary excess broke the balance and harmony of the facial parts that caused a clear gummy smile and tipped occlusal plane (**Figure 17**).

Intraorally, the sagittal relationship showed a class III malocclusion with negative overjet and a complex anterior open bite vertically, where second molars are in occlusion (pivoting) and crowded maxillary arch; the transverse relationship exhibited bilateral buccal crossbite, high palatal vault, and narrow maxilla contained in the normal mandibular arch form. There were extraction spaces in the lower arch as appears in the panoramic radiograph **Figure 1**.

2.3.1. Cephalometric assessment of vertical and sagittal features

Jarabak and McNamara lateral cephalometric analyses demonstrated the severe skeletal origin of the dentofacial deformity (**Figure 2**) that cannot be treated by orthodontic approach alone. The vertical maxillary excess caused severe gingival display during full smile and backward rotation of the mandible that surpassed any physiologic eruptive compensation of anterior teeth to develop anterior open bite (**Figure 18**).

Figure 17. Extra-oral and intra-oral photos showing the dentofacial deformity to be objectively assessed by other diagnostic aids (radiographs).

Figure 18. Lateral cephalometric analysis of Jarabak revealing vertical facial height excess, canted occ. plane, straight profile, deficient chin, and high gonial angle.

2.3.2. Problem listing

Data collection and analyses (**Figure 3**) endorsed the orthosurgical approach of treatment after joint patient's consultation with the health care team and her enthusiastic approval (**Figure 19**).

2.3.3. Treatment objectives

Realistic treatment objectives (**Figure 20**) were strictly reviewed to formulate the appropriate treatment planning, appliance design, and different presurgical orthodontics, surgical, and postsurgical phases of treatment (**Figure 21**).

Figure 19. Listing the complex discrepancies of skeletal, dentoalveolar, and soft tissue origin is to justify the orthosurgical approach of interdisciplinary treatment for the benefit of the patient.

Figure 20. Treatment objectives allowed clinicians to formulate proper treatment planning.

2.3.4. Treatment progress

Maxillary arch expansion with quad helix appliance initiated simultaneously with leveling and alignment of teeth. Almost ideal arch form was attained, and the occlusal planes were flattened. When the presurgical phase was accomplished, surgical hooks were constructed as shown in **Figure 22**. LeFort I maxillary osteotomy with superior maxillary repositioning then took place to be followed by postsurgical detailing of occlusion and prosthetic replacement of the missing teeth.

Figure 21. Model surgery and diagnostic set up possible for prosthetic construction.

2.3.5. Results and conclusions

Despite controversy, combined orthosurgical treatment of severe maxillary excess concomitant with facial skeletal disharmony remains the only treatment option. The treatment results as seen in **Figures 22–24** were remarkably promising and satisfactory.

2.4. Case #4

A healthy patient (24 year and 10 month old) presented with a chief complaint "I am unhappy with my unaesthetic smile, lack of biting on my teeth, and prominent chin." The necessary data were collected and analyzed, and the patient was informed that orthodontic treatment

Figure 22. Pre and post treatment cephalometric analysis and panoramic views.

Figure 23. Phases of treatment, pretreatment, presurgical, postsurgical, and post prosthetic replacement of extraction spaces.

Figure 24. Frontal and lateral photos of the face showing significant esthetic improvement and pleasing smile shaped by combined orthosurgical treatment.

alone cannot be of benefit to you. A combined orthosurgical treatment modality was offered, and a joint meeting with the maxillofacial surgeon was arranged; details of the treatment phases, surgical risk, and cost effectiveness were explained to the patient who showed great interest in undergoing the treatment in a positive manner. The following figures reveal the steps and efforts exerted by the healthcare team and the cooperation of the patient that made the achievement possible.

2.4.1. *Diagnosis*

The diagnostic significance of clinically examining the dentofacial deformities lies in observing the soft and hard tissues functioning, so any abnormality is detected, and further investigations are assigned. Esthetic smile is a function of oral and perioral muscles and their relationship to the teeth and gingiva. Clinical examination of the patient revealed the severity of the skeletal, dentoalveolar, and soft tissues components as listed in **Figure 25**. However, objective judgment of the deformity necessitated other diagnostic aids including radiographs and study models to measure the discrepancy and formulate appropriate.

2.4.2. *Treatment objectives*

To restore normal facial harmony and balance, correct the severe malocclusion, design a pleasant smile, and insure life-long postoperative stability.

2.4.3. *Treatment planning*

Because of the complexity and severity of dentofacial deformity, the healthcare team decided to follow the logic sequence of orthosurgical treatment phases, presurgical orthodontics to be followed by bimaxillary surgical phase. LeFort I osteotomy with superior repositioning of the maxilla intended to reduce the increased facial height and level the tipped back occlusal

Figure 25. Pretreatment extra and intraoral photos describing the severity of the dentofacial deformity and the problems to be solved.

plane; bilateral sagittal split osteotomy of the mandibular ramus to setback the prognathic mandible bringing narrower mandibular arch in favor of the normal transverse occlusion, anticlockwise rotation aided in correcting the open bite. Retentive means were designed to guarantee stable outcome (Figures 26–32).

2.4.4. Conclusions

Mutual collaboration between healthcare providers allows for the proper selection of treatment modality relevant to the dentofacial deformity presented. Bimaxillary surgery helped in

Figure 26. Pretreatment lateral cephalometric and panoramic radiographs (essential diagnostic aids).

Figure 27. Pretreatment lateral ceph (McNamara) analysis and soft tissue surgical planning (prediction).

Figure 28. Initial bonding followed by inserting leveling arch wires to prepare the case for surgery.

Figure 29. Postsurgical occlusion and the role of inter-maxillary elastics in stabilizing the occlusion and then setup retentive means.

Figure 30. Pre and post cephalometric and panoramic radiographs.

Figure 31. Post treatment cephalometric analysis reflecting the restrutural improvement of the profile.

Figure 32. Occlusion 3-year post retention. Pre and post treatment facial features.

restoring harmony and balance of the face and establishing an ideal occlusal relationship. Patient cooperation and her family support were a key factor in achieving the satisfactory treatment outcome. Follow up for 5 year post treatment confirmed the successful procedures performed.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this chapter.

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References

- [1] Rufenacht CR, Berger RP, Lee RL, Nixon RL, Ricci G, Shavell HM. Fundamentals of Esthetics. Chicago, Illinois: Quintessence Publishing Co, Inc.; 1992
- [2] Kallidass P, Srinivas S, Charles A, Davis D, Sushil Charravarthi NC. Smile characteristics in orthodontics: A concept review. *International Journal of Orofacial Research*. 2017;**2**:1-4
- [3] Linder-Aronson S, Woodside DG. Excess Face Height Malocclusion: Etiology, Diagnosis, and Treatment. Chicago, Illinois, USA: Quintessence Publishing Co, Inc.; 2000. pp. 73-90
- [4] Moldez MA, Sugawara J, Umemori M, Mtani H, Kawamura H. Long-term dentofacial stability after bimaxillary surgery in skeletal class III open bite patients. *The International Journal of Adult Orthodontics & Orthognathic Surgery*. 2000;**15**:309-319
- [5] Paik C-H, Park H-S, Ahn H-W. Treatment of vertical maxillary excess without open bite in a skeletal class II hyperdivergent patient. *The Angle Orthodontist*. 2017;**87**(4):625-633
- [6] Ishida Y, Ono T. Nonsurgical treatment of an adult with a skeletal class II gummy smile using zygomatic temporary anchorage devices and improved superelastic nickle-titanium alloy wires. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2017;**152**(5): 693-705
- [7] Iraelewicz-Djebali E, Chabre C. Gummy smile: Orthodontic or surgical treatment. *Revue d'Orthopédie Dento-Faciale*. 2015;**18**:102-120
- [8] Conley RS, Legan HL. Correction of severe maxillary excess with anterior open bite and transverse maxillary deficiency. *The Angle Orthodontist*. 2002;**72**:265-274
- [9] Proffit WR, Turvey TA, Phillips C. Orthognathic surgery: Hierarchy of stability. *The International Journal of Adult Orthodontics & Orthognathic Surgery*. 1996;**11**:191-204
- [10] Enacar A, Taner T, Manav O. Effects of single or double jaw surgery on vertical dimension in skeletal class III patients. *The International Journal of Adult Orthodontics & Orthognathic Surgery*. 2001;**16**:30-35
- [11] Proffit WR, Fields HW, Sarver DM, Ackerman JL. Contemporary Orthodontics. 5th ed. Canada: Elsevier-Mosby; 2013
- [12] Epker BN, JPM S, Fish LC. Dentofacial Deformities, Integrated Orthodontics and Surgical Correction. 2nd ed. St Louis Missouri, USA: Mosby-Year Book Inc.; 1996