

Original Article

Surgical Correction of Anterior Vertical Maxillary Excess (Gummy Smile) by Compression Osteogenesis: A Preliminary Study

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Abstract

Aim: evaluation of surgically- assisted orthodontics in correction of increased anterior overbite and gummy smile. **Subjects and methods:** 5 patients with anterior vertical maxillary excess corrected by compression osteogenesis, after surgical exposure labial corticotomy cuts performed (1 supra-apical, and bilateral vertical cuts between maxillary canines and first premolars). Compression osteogenesis protocol followed the sequence: latency period then active traction and functional loading on transmucosal mini- screws followed by a consolidation phase. **Results:** showed decreased overbite with less gingival display within a period of time ranging between 4-6 weeks. **Conclusion:** Increased anterior overbite and gummy smile of skeletal etiology can be fixed under local anesthesia using surgically assisted orthodontics through anterior maxillary corticotomy and compression osteogenesis.

Keywords: Increased overbite, Anterior Maxilla, Labial corticotomy, Compression Osteogenesis.

I. INTRODUCTION

Patients suffering from gummy smile are challenged in treatment. According to the underlying etiological cause the treatment modality of a gummy smile is chosen. (I) Lip length and muscle tone. Which is usually treated by surgical lip repositioning or Botulinum toxin injection. (II) Clinical crown length, which normally is an average of 10-11mm. If it's <9mm, it's not esthetic, and this may result from either a short clinical crown or excessive gingival coverage whether it's healthy gingiva, that can be restored by restorative dentistry or treated by a simple perio-surgery. (III) Dentoalveolar extrusion of maxillary anterior teeth, which in turn can be treated orthodontically, surgically, or by a combination of both. (IV) Skeletal maxillary vertical excess treated orthodontically and/or orthognathically. This type is evaluated and determined clinically and on lateral cephalogram.^(4,9,20)

Orthodontic management alone requires a long duration of treatment and retention, appliance difficulties, and financial commitment, which may cause periodontal hyalinization and alveolar flexibility.^(2,12) Lengthy orthodontics might also end up with flaring, and anterior

teeth move out of the bony socket due to uncontrolled tipping and severe root resorption during retraction or even relapse.^(6,14) Maxillofacial orthognathic surgery carries several risks and complications, such as ischemia of bony segments which fail to heal due to total discontinuity of the bone marrow⁽²⁰⁾, infection that may be leading to osteomyelitis and possible generalized sepsis; physical failure due to malunion, dental problems 'unfavorable occlusion', injury to and eventual loss of teeth; and loss of sensation due to nerves' injuries.^(8,24) In addition to the typical risks of general anesthesia and hospitalization, airway problems, hemorrhage, soft tissue injuries 'tears, hematoma, and necroses.'^(15,19)

Compression osteogenesis is an osteoplasty technique based on and obverse of the distraction osteogenesis phenomenon. It's been shown the efficacy of this technique if applied through cortectomy along with orthodontic anchorage systems.^(3,11,22) The pre-clarified drawbacks of both major entities "Orthodontics & Orthognathics" can be easily overcome and avoided by performing corticotomy- assisted orthodontics.^(20,21,22,23)

This is evidentiary supported by many studies and authors

throughout the history of literature, that through surgically assisted orthodontics reduced treatment time, accelerated intrusion, corrected open bite and managed severe maxillary gingival exposure through active anchorage and also showed better post-treatment stability results. (5,7,10,16)

II. SUBJECTS AND METHODS

This study was conducted on five patients with anterior vertical maxillary excess seeking the correction of the gummy smile. They were all free from any systemic conditions that may affect normal healing and they preferred a treatment plan of a shorter duration of time guaranteed through surgical treatment modality versus the situation with orthodontic treatment alone. These patients were selected from the outpatient clinic of Oral and Maxillofacial Surgery Department and Orthodontics Department, Faculty of Dentistry, Cairo University. Eligible patients that passed the preoperative assessment were given a thorough explanation of the proposed surgical procedures and they were informed about possible complications including alterations in the anterior palate. All questions from the patient's side were fully answered and the patients signed informed consent before the enrolment in the study.

• Diagnosis

Thorough routine case history collection along with clinical examination: (a) extraoral to evaluate lip competence, gingival and teeth showing at rest and during smiling, general profile. (b) intraoral examination of soft and hard tissue evaluation [overjet and overbite]. Supported by study models analysis, standardized clinical photographs and radiographic records in the form of Lateral cephalometry for angular and linear measurements. (Figure 1)

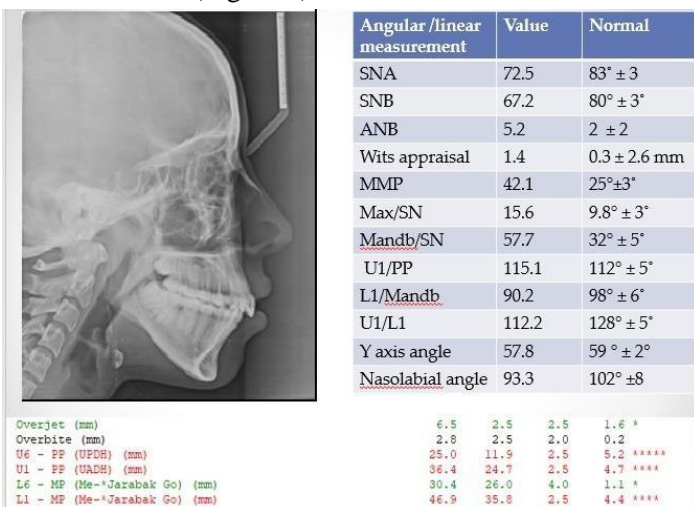


Figure (1): Showing preoperative lateralcephalometry x-ray of one case

Presurgical preparation: All the patients were encouraged and instructed to improve their oral hygiene

and heavy orthodontic wires were used to put anterior teeth in a monobloc, and that block using also heavy wires was ligated to the posterior teeth to prevent proclination as intrusion forces getactivated.

Surgical procedures: All surgical procedures were performed under local anesthesia. Transmucosal mini screws are implanted bilaterally in the alveolar bone at least 5mm above the assigned corticotomy line, between the long axes of roots of canines and lateral incisors, and between lateral and central incisors. After flap elevation, one horizontal and two vertical corticotomy cuts were performed 5mm above the apices of the anterior teeth extending from canine-first premolar teeth on one side to the corresponding contralateral, and two vertical interdental cortectomy cuts between canine and first premolar using a fissure Lindemann bur and a manual chisel and a surgical mallet respectively. (Figures 2,3)



Figure (2): Showing mounting of 4 transgingival mini screws



Figure (3): Showing the labial corticotomy cuts [Horizontal cut-two Vertical cuts between canine and first premolar bilaterally].

Postsurgical follow-up and assessment: Starting with a latency period of 3 days then postoperative visits held 3rd day postoperative for activation of functional loading, then the follow-up regimen was every other day of 1st week, then twice weekly till 4th week. Heavy elastic chains were used to start traction/intrusion and compression osteogenesis is activated between the mini screws on one end and the orthodontic wire on the other end. Active functional loading: - ranging between 1200-2400N divided bilaterally on the mini-screws, continued till the end of the active period and retention period. Tractional forces were calibrated to be equal bilaterally

for every single follow-up visit. Consolidation and retention started on the 4th week and continued till the 4th month postoperative.



Figures (4): clinical extra-oral frontal photographs comparing gingival and teeth display during smiling [preoperative, postoperative].

III. RESULTS

The amount of display of teeth and gingival became less, especially at rest. Extra-oral features became softer, and lips got closer to competence. (Figure 4,5) Lateral cephalometric digital analysis showed a decrease -of an average for the patients- of 7.5 mm in overbite, 6.15 mm in overjet. [Tables 1,2]

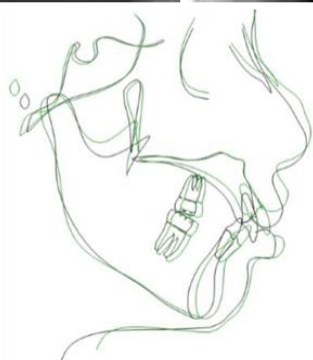


Figure (5): Showing digital superimposition of pre & post lateral cephalogram of one of the cases.

phase period

	Range	Average value
Time window	4-6 weeks	5 weeks
Amount of Intrusion	3.8- 4.7 mm	4.3 mm

able (2): Linear measurements and means of overjet, overbite and U1-PP post- operatively and after consolidation [retention phase].

Linear measurements	Measurement range	Average value
Overjet	6.1- 2.4 mm	4.25 mm
Overbite	1.3- .5 mm	0.9 mm

IV. DISCUSSION

Patients with anterior vertical maxillary excess typically suffer from excessive gingival display in their clinical presentation, which comprises functional and esthetic issues. Throughout the literature, these patients have been managed using a spectrum of treatment modalities including either orthognathic surgeries alone or orthodontic treatment alone or with the help of surgical intervention ranging between extensive surgeries and minimally invasive modalities such as corticotomy.⁽⁹⁾ Corticotomy assisted orthodontics along with compression osteogenesis concept were tested and verified in management of anterior vertical maxillary excess and gummy smile in this study, with the help of orthodontic anchorage systems, the teeth can be moved in a block of bone in the desired direction of traction.

In alliance with this study, there are numerous examples in the literature showing the advantages and strength points of cortectomies and cortectomy-assisted orthodontics as conservative approach. Amongst which comes, Kole in 1959, when he introduced the “Bony-block technique”, relying on the reduction of the resistance of cortical plates through performing interdental and subapical cortectomies to correct deep overbite cases in a shorter period of time. Bell & Levy in 1972, replicated that technique on monkeys successfully. In 1975, Duker compared the pros & cons of osteotomies versus cortectomies, the approaches were called “bone block movement.” He concluded that, as less injurious to the periodontium, prevents devitalization of teeth and less aseptic bone necrosis, which also allies the study of this research work and justifies why cortectomy is chosen over ostectomy.⁽²⁾

Regarding the approach, either from buccal or palatal side, we preferred to conduct the surgery through the buccal side, likewise Bruce N. Epker in 1977 performed only through the buccal aspect- in accordance with this study, as operating through the palatal aspect showed many drawbacks such as bone necrosis, devitalization of the teeth, and anatomical changes in the osteotomized

Table (1) The amount of intrusion happened along the active

segment.⁽²³⁾ Neuman 1985 modified Bichlmayr's method also by performing labial corticotomies not palatal for the same acquaintances mentioned earlier.⁽²⁾

Concerning the time factor, surgically- assisted orthodontics reportedly show strong concordance with speeding up the process, as proven in this dissertation, the entire treatment span took 4-6 weeks of active traction followed by 3 months of consolidation. Suya 1991, reported corticotomy-assisted orthodontic treatment of 395 adult Japanese patients with the help of fixed orthodontic appliances were used with the completion of the treatment only in six to twelve months. (21) In 2000, Hajji also reported that corticotomy makes tooth movement faster because the bone blocks move with the tooth because the force applied to the tooth is transmitted into the osteotomy gap rather through the periodontal ligament.⁽⁵⁾ Later in the 2000s, Wilko et al adopted Duker's conclusion and created their concept known as Accelerated Osteogenic Orthodontics based surgical cortectomies.⁽²⁾ Uzuner and Darendeliler back in 2013, studied combining dentoalveolar surgical intervention with orthodontics, via either osteotomies or corticotomies causing changes in bone metabolism leading to the regional accelerating phenomenon, promoting the speed of orthodontic movement.⁽²³⁾ In 2018 by M. K. Karthikeyan et al. they adopted the concept 'Acceleration of Intruding Anterior Tooth by Alveolar Cortectomy', claiming that it has several advantages: reduced treatment time, enhanced intrusion and also gives post-treatment stability, which conforms to this study's concept and results.⁽¹⁰⁾

V. CONCLUSION

Compression osteogenesis is a valid and minimally invasive technique that can be used effectively to correct mild to moderate anterior vertical maxillary skeletal excess under local anaesthesia.

Conflict of Interest:

The authors declare no conflict of interest.

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Ethics:

This study protocol was approved by ethics committee, faculty of dentistry, Cairo university on: 26/10/2021, approval number 4-10-21. Clinical trials.gov ID: NCT06045871

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