Esthetic and functional advantages of subapical anterior segmental maxillary osteotomy in treatment of dentofacial deformity

Mohammed S. Shahine[a], Ibraheem M. Mwafey[b]

[a] Department of General Surgery (Maxillofacial Unit), Assiut University, [b] Department of Oral Medicine, Periodontology, Oral Diagnosis and Dental Radiology, Faculty of Dentistry, Al-Azhar University (Assiut Branch), Assiut, Egypt

Correspondence to Mohammed S. Shahine, Department of General Surgery, Faculty of Medicine, Assiut University, Assiut 71515, Egypt. Tel: +20 102 555 5420; fax: +20 882 333 327; e-mail: msafwat67@aun.edu.eg

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Aim
This study aims to investigate the effect of anterior segmental maxillary osteotomy in treatment of maxillary prognathism with good molars occlusion.
Patients and methods
This study includes 20 patients diagnosed with dentofacial deformities – maxillary prognathism visiting maxillofacial surgery outpatient clinic in Assiut University Hospitals during the period between January 2017 and December 2021.
Results
The common complications which occur is wound infection which occur in two (10%) cases, then postoperative relapse which occur in one (5%) case, palatal mucosal tear which occur in one (5%) case, and unfavorable nasolabial esthetic which occur in one (5%) case.
Conclusion
Anterior segmental maxillary osteotomy is a recommended treatment modality of choice in patients with maxillary and/or dentoalveolar protrusion.

Keywords:
anterior segmental maxillary osteotomy, dentofacial deformity, palatal mucosal tear, postoperative relapse

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Introduction

The first reported anterior segmental maxillary osteotomy was performed in 1921 by Cohn-Stock [1], wherein a wedge of palatal bone was removed through transverse palatal incision and the anterior maxillary segment was retracted through elastic force. Several approaches for anterior maxillary osteotomy have been done like Wassmund's [2] technique introduced in 1927, Wundere's [3] technique in 1963, and Cupar's technique in 1954. These are the most preferred approach by many surgeons as it allows access for bone removal under direct visualization through the nasal floor. The bone from the lateral, superior, and posterior palatal surfaces are removed in slice until the premaxilla segment is placed in predetermined position as indicated by prefabricated splint. This maneuvering of bone removal by a trial and error method increases the operating time, leading to prolonged kinking on the palatal pedicle with resultant compromise to the vascularity of the anterior segment. Subapical anterior maxillary segmental osteotomy has been developed to avoid unpredictable postoperative nasal changes after anterior maxillary osteotomy [3].

Patients and methods

This study includes 20 patients diagnosed with dentofacial deformities – maxillary prognathism visiting maxillofacial surgery outpatient clinic in Assiut University hospitals during the period between January 2017 and December 2021.

Inclusion criteria

Anterior vertical maxillary excess in cases with acceptable posterior occlusion, maxillary anterior protrusion of anterior teeth (prognathism) with normal incisor axial inclination to bone and acceptable posterior occlusion, and anterior open bite without vertical maxillary excess and normal posterior occlusion.

Exclusion criteria

Age below 18 years before full maturity of craniofacial skeleton.

(1) Patients' assessment by history taking and clinical examination either extraoral examination for facial shape, and profile, and intraoral examination for class of occlusion, deep bite or open bite for all patients were done.
(2) Cephalometric radiography which is the main and standard imaging diagnostic tool. It helps in diagnosis of class of occlusion.

(3) Panoramic radiography that helps in assessing the deformity.
(4) Laboratory investigations: complete blood count, coagulation profile (prothrombin time and concentration), kidney function tests, liver function tests, blood calcium level, and random blood sugar.
(5) Presurgical dental management: root canal treatment of carious teeth, dental scaling, management of periodontal and gingival problems, extraction of unerupted or impacted teeth and persistence of good oral hygiene.
(6) Patient counseling and consent: a written consent for the procedure, as well as for the need of medical photography, was explained to patients and signed.

Operative technique

Under general anesthesia, supine position, nasal intubation and hyper extension of the neck, the first premolar maxillary teeth are extracted at the time of surgery and osteotomies are performed through these spaces. An upper sulcus mucosal incision is applied in the buccal side of the maxilla above the roots of the incisors. This incision is extended to the distal section of the first premolar tooth bilaterally. The horizontal osteotomy of the anterior segmental osteotomy should be kept at least 5 mm above the canine roots. Some bone has to be removed to allow for adequate repositioning of the anterior segment. These 'ostectomies' are usually of a trapezoid shape at either end of the segment (Fig. 1). At least 1 mm of bone should be preserved around teeth roots at all times. The osteotomy is done carefully while protecting the surrounding soft tissues, then downfracture of the anterior maxillary segment is done and repositiong of it in the new position, fixation with miniplates and screws were done (Figs 2 and 3).

Postoperative care and follow-up: all patients were discharged with a set of instructions and a follow-up schedule.

The postoperative instructions include: medical treatment with broad spectrum antibiotics for 10–14 days. Intensive oral hygiene by mouth wash and teeth brush. Nutrition based on soft diet and fluids for a month. Stop smoking if any. Stick to the follow up schedule. The schedule of postoperative visits will be at 1 week, 1 month, 6 months, and 12 months postoperatively.

Possible complications

The most common complication is relapse during the early healing phase, oronasal or oroantral fistula, damage to the teeth roots, loss of vitality of teeth, palatal mucosal tear, persistant periodontal defect, unfavorable nasolabial esthetics, and nasal septal deviation.

Statistical analysis

Data analysis were accomplished using the Statistical Package for Social Sciences software program (SPSS), version 23.0, USA (Armonk, NY: IBM Corp). Statistical significance was accepted at a level of P value less than 0.05. Quantitative data are represented by mean and SD while qualitative data are represented by number and percentage. The study outcomes were analyzed using χ^2 test.

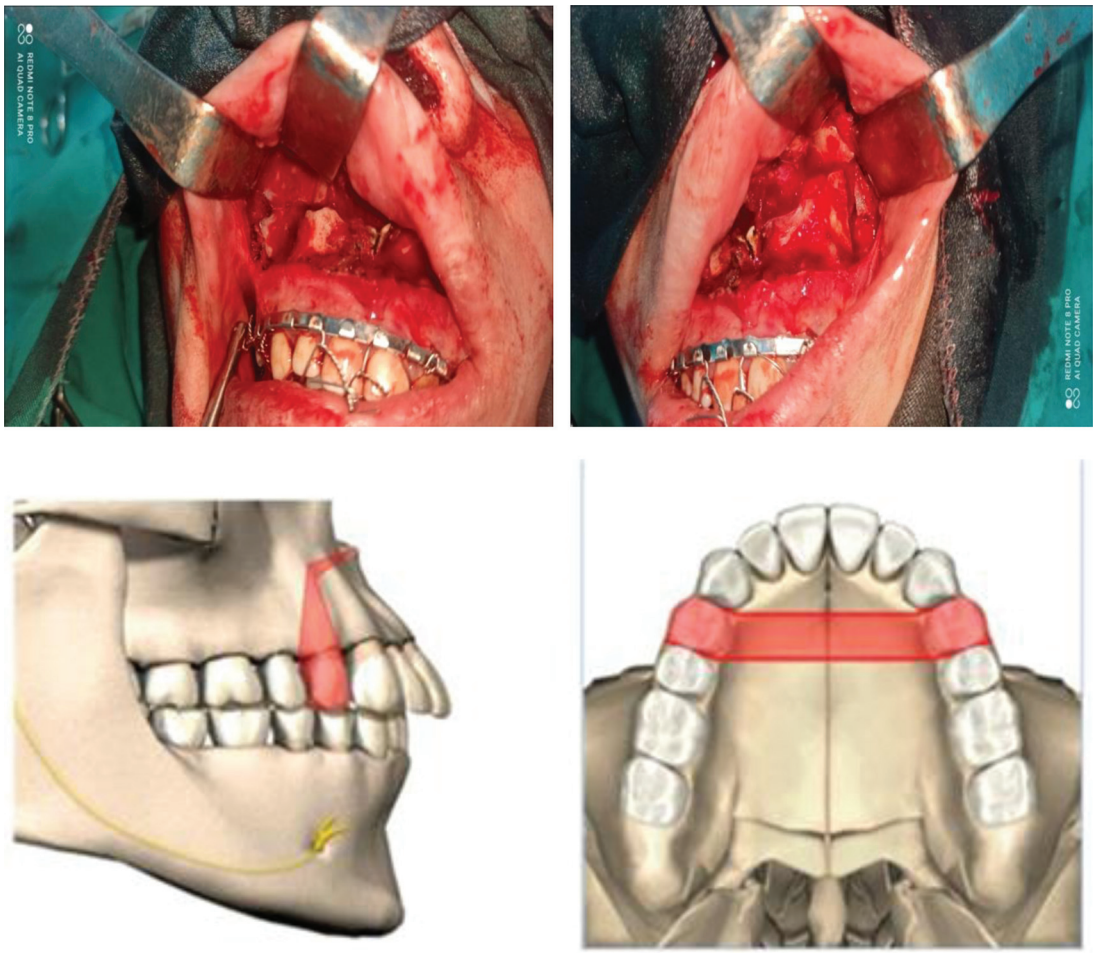
Ethical considerations

This project was approved by the committee of medical ethics–Faculty of Dentistry–Al-Azhar University (Assiut branch) (number: AUAREC20200001-09).

Figure 1

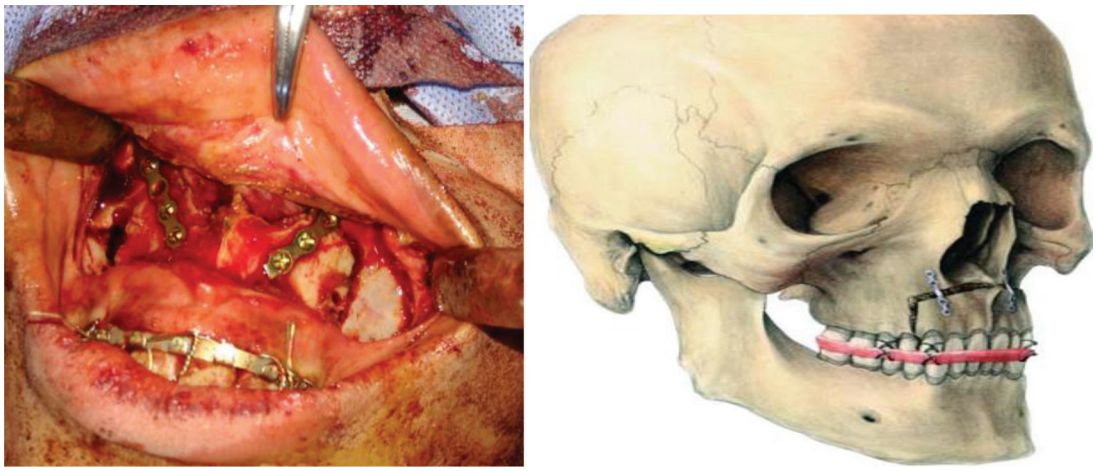
Cepholmeteric study.

Figure 2



Upper sulcus incision and fashioning of osteotomies.

Figure 3



Repositioning and fixation by miniplates and screws.

Results

This study was conducted on 20 patients suffering from class II malocclusion, visiting the outpatient clinic of maxillofacial surgery unit, Assiut University from January 2017 to December 2021.

Personal data

Among them, 18 patients were females and two were males. All patients aged less than 17 years old except three patients were older than 30 years. Two patients were smokers and no diabetic patients (Table 1, Fig. 4).

Patient satisification

All male patients were satisfied esthetically and functionally, while one female patient was not satisfied esthetically (Table 2).

Overall incidence of postoperative complications

The common complications which occur are wound infection which occurs in two (10%) cases, then postoperative relapse which occur in one (5%) case, a palatal mucosal tear which occur in one (5%) case, and unfavorable nasolabial esthetic which occur in one (5%) case (Table 2, Fig. 5).

Variables that may affect postoperative relapse

Variables that affect postoperative relapse are age greater than 30 years, males and smoking (Table 3).

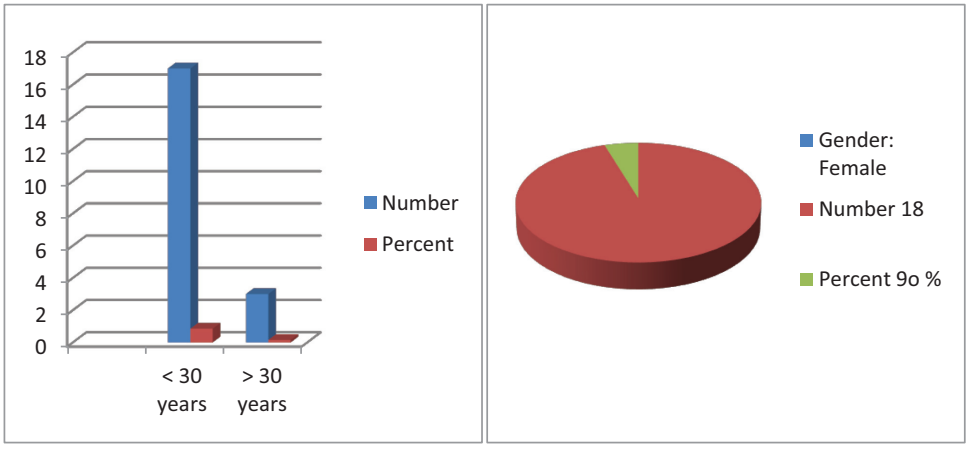
Variables that may affect wound infection

Variables that affect postoperative relapse are age greater than 30 years, and smoking (Tables 4 and 5).

Table 1 Personal data

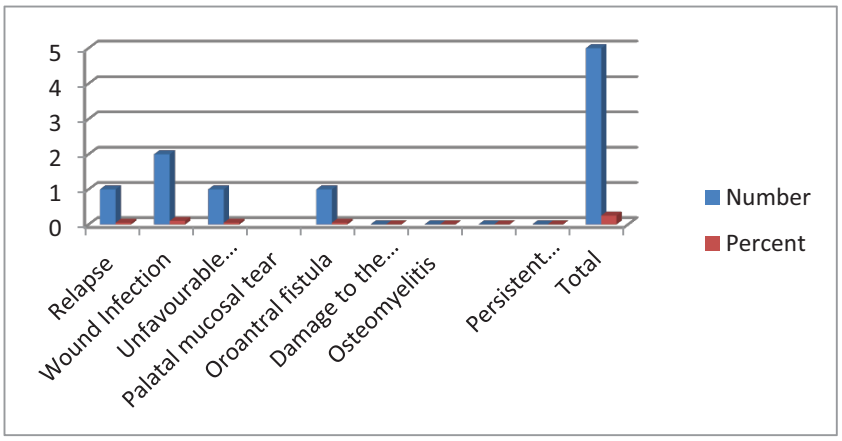
	n (%)
Age	
<30 years	17 (85)
>30 years	3 (15)
Sex	
Female	18 (90)
Male	2 (10)
Smoking	
No	18 (90)
Yes	2 (10)
Diabetes mellitus	
No	20 (100)
Yes	0

Figure 4



Age and sex.

Figure 5



Incidence of postoperative complications.

Table 2 Esthetic and functional patient satsification

	Esthetic	Functional
Males	2	2
Females	17	18

Table 3 Incidence of postoperative complications

Postoperative complications	*n* (%)
Relapse	1 (5)
Wound infection	2 (10)
Unfavorable nasolabial esthetics	1 (5)
Palatal mucosal tear	1 (5)
Oroantral fistula	0
Damage to the teeth roots	0
Osteomyelitis	0
Persistent periodontal defects	0
Total	5 (25)

Table 4 Variables that may affect postoperative relapse

	Age		Sex		Smoking	
	<30	>30	Male	Female	Yes	No
Relapse	0	1	1	0	1	0
No relapse	17	2	1	18	1	18
Total	17	3	2	18	2	18

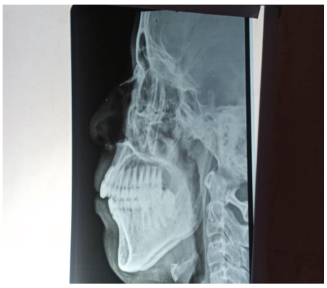
Table 5 Variables that may affect wound infection

	Age		Sex		Smoking	
	<30	>30	Male	Female	Yes	No
Wound infection	0	2	1	1	1	0
No wound infection	17	1	1	17	1	18
Total	17	3	2	18	2	18

Case presentations

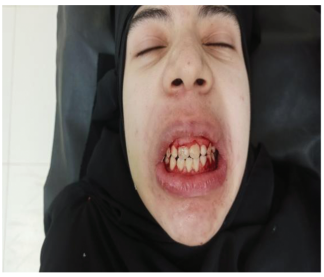
Case (1)

Preoperative photo.



Cephalometry.

Intraoperative photos.



Postoperative photos,

Case (2)

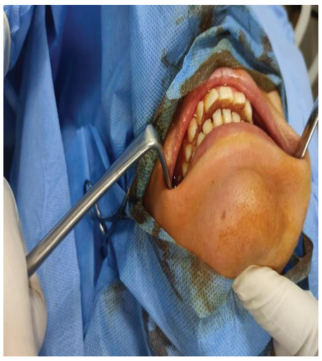
Preoperative photo.

Cephalometry.

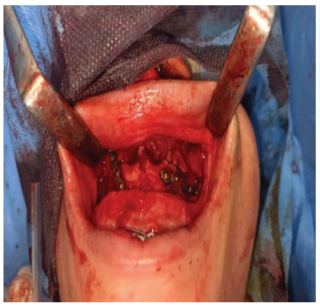
Intraoperative photos.

Postoperative photo.

Case (3)



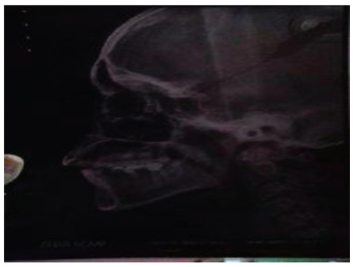

Preoperative photo. **Cephalometry.**




Intraoperative photos.

Postoperative photo.

Case (4)

Preoperative photo. **Cephalometry.**


Intraoperative photos.


Postoperative photo.

Discussion

Anterior segmental maxillary osteotomy is indicated in cases where substantial movement of the anterior teeth is required. It is frequently used for correction of maxillary prognathism with good posterior molar occlusion.

We chose subapical anterior segmental maxillary osteotomy as the existing molar relation was to be maintained. Furthermore, anticlockwise rotation of the maxilla indicated by the angle of inclination (J-angle: 91°) suggests that proclination of the upper anterior is due to the upward tipped maxilla. The vertical excess in the anterior region was attributed to the gummy smile even though the palatal plane was inclined upward. On the contrary, Le Fort I maxillary osteotomy would have disturbed the existing harmonious intercuspation and also Le Fort I maxillary osteotomy setback has a limited range and increased complications due to the risk of damaging the vascular structures posterior to the maxilla. Thus, correction of deformity by just moving the anterior maxilla was considered rather than Le Fort I osteotomy of the maxilla [4].

In this study, we founded an incidence of relapse equals 5% of all patients. In 2013 where they estimated the incidence of postoperative relapse by 10.9%. Higher incidences have been reported in other studies as by Freihofer, Wolford and colleagues, and Huang and Ross, where they founded relapse up to 25% of the cases [5,6,7]. This variation in the result may be due to different surgical techniques as those studies were conducted in the 70s and 80s [8]. Regarding the method of fixation, we have standardized the miniplates and screws as the method of fixation in our study. So that, the method of internal fixation will not be included as a separate variable of comparison in our study. As regard the effect of age on the incidence

of relapse, in this study, age seemed to have no significant effect on the incidence of relapse. This result matches the study done by Den Besten CA *et al.*, where age had no significant effect on the incidence of relapse. Other studies showed that younger patients have been reported to have a higher risk of late relapse compared with adults as the study done by Proffit *et al.* [9].

No patients in this study showed sloughing and even the ostectomized segment healed uneventfully. The possible explanation to the above finding could be seen in a study by Bell. In his study on revascularization and bone healing in ostectomized rhesus monkeys, he concluded that no single vessel is essential in maintaining the circulation to the anterior maxillary fragment [10]. Vessels from the palate, gingiva, floor of the nose, upper lip, and periodontal plexus form a freely anastomosing network which permits a variety of surgical techniques while still maintaining circulation to the anterior maxillary fragment.

Another most frequently encountered complication after anterior segmental maxillary osteotomy is palatal mucosal tear. According to Gunaseelan *et al.* [11], their study reported palatal mucosal tear in 11 patients out of 103 patients. All these patients had a small palatal lacerations in their free gingival margin because of excess mucoperiosteal tunneling in the palatal aspect. In this study, one patient had a small tear in mid palatal region. Though the healing of the osteotomized segment was uneventful, the importance should be laid on maintaining the integrity of the palatal mucoperiosteum during downfracture technique and its attachment to underlying osteotomized segment must be maintained with great care. Morris *et al.* [12] advocated the repair of such lacerations in a tension-free manner whenever possible and if primary repair is not possible as it might impact the blood supply of the maxilla, lacerations should be allowed to heal secondarily. In this study, primary suture was done, followed by antibiotics and nasal decongestants.

Regarding the postoperative wound infection, in this study we reported an incidence of surgical wound infection equals 10% of cases. The reported incidences range from 2.0 to 25.9%. The pooled incidence of postoperative infection was 9.6%. The low incidence of wound infection may be attributed to the use of prophylactic antibiotics preoperative, intraoperative, and postoperative. We used antibiotics against gram positive, gram negative, and anaerobic microorganisms. In their Cochrane systematic review regarding the use of antibiotics in relation to orthognathic surgery, Brignardello-Petersen and colleagues concluded that long-term antibiotic prophylaxis (before/during surgery and more than 1 day after surgery) probably decreases the risk of infection at the surgical site. Therefore, it is advisable to use long-term antibiotic prophylaxis, particularly in patients undergoing a surgical procedure that exceeds 3 h and in patients who smoke [13].

Conclusion

The results suggested that anterior segmental maxillary osteotomy is a recommended treatment modality of choice in patients with maxillary and/or dentoalveolar protrusion. The technique is simple, postoperative complications are minimal, and relapse is also limited.

Conflicts of interest

There are no conflicts of interest.

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