

STABILITY OF ANTERIOR MAXILLARY OSTEOTOMY USING MICROPLATES

Original
Article

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ABSTRACT

Introduction Dentofacial deformity represents a great challenge faced by maxillofacial surgeons, maxillary protrusion, open bite, and/or deep bite can be corrected by anterior maxillary osteotomy however there is great controversy regarding stability of the osteotomized segment using different fixation systems

Aim of the study the aim of the study is to evaluate microplate fixation system for stability of anterior maxillary osteotomy.

Patients and methods patients presented with maxillary protrusion were managed by anterior maxillary osteotomy using microplate system for fixation and all cases followed clinically and radiographically at least for one year

Results Number of the patients was 12 (11 females and one male) all of the patients presented with maxillary protrusion that was corrected using anterior maxillary osteotomy, postoperative angular and linear measurements showed significant difference when compared with preoperative measurements, while there is no significant difference among all postoperative periods. Also bone density increased gradually using gray scale measurement

Conclusion Using microplate system for fixation of anterior maxillary osteotomy may lead to stable results with good bone healing and absence of palpability.

Key Words: Anterior, maxillary . osteotomy, microplate, fixation

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INTRODUCTION

Dentofacial deformities have greater incidence, and affect patients seriously as regards their sociality, personality and their eating habits^[1], many procedures are used for management of the facial deformities, and anterior maxillary osteotomy is one of these procedures that is used frequently for corrections of many facial deformities as skeletal maxillary protrusion, maxillary hypoplasia, and open bite, anterior maxillary osteotomy can be used solely or in combination with other osteotomy as genioplasty, sagittal split or lefort osteotomies^[2]

There is a lot of methods used for fixation after maxillary osteotomy, such as intraosseous wiring, however wiring does not provide enough rigidity also it only aids in two dimension stability, also miniplates can be used for osteotomy fixation where they provide much stability however the miniplates are complicated with palpability, mucosal laceration and plate exposure^[3]

the later complications may be managed by using microplates, however their efficacy for anterior maxillary stability is not confirmed through the literature

AIM OF THE WORK

The aim of this work is to study the effect of microplates

for stability of anterior maxillary osteotomy

PATIENTS AND METHODS

This study was accomplished in department of oral and maxillofacial surgery FACULTY OF ORAL AND DENTAL MEDICINE SOUTH VALLEY UNIVERSITY from January 2018 to January 2022. The ethical approval for this work was obtained from the ethical committee of FACULTY OF MEDICINE SOUTH VALLEY UNIVERSITY, where all the patients presented with anterior maxillary skeletal excess were managed after obtaining their consent for operation, the patients affected with bone disease or immune compromised were excluded

The patients were assessed using lateral cephalometric and panoramic x ray also anteroposterior and lateral profile views are recorded along with dental occlusion, all the laboratory investigations were requested and patients fitness for general anesthesia was assured.

All the patients anaesthetized by nasotracheal intubation, after vasoconstriction injection circumvestibular incision was made extending from the right to the left maxillary first molars 5 mm above mucogingival line, the muco-

periosteum was retracted to expose the floor of the nose and anterior maxillary bone above apices of the anterior teeth, and the 1st premolar extracted bilaterally and the maxillary bone removed transversely using LINDMAN bur with normal saline irrigation with aid of palatal tunneling also bone removed above 5 mm away from the apices of anterior teeth then the premaxilla segment was repositioned to its optimum position and fixed to the posterior maxilla initially by interdental wiring, and with keeping good occlusion the segment fixed by microplate system bilaterally (0,5mm thick microplate, and 1.5mm microscrew ARAB ENGINEER COMPANY EGYPT, (figure1,2)



Figure 1 Anterior maxillary osteotomy fixed microplate

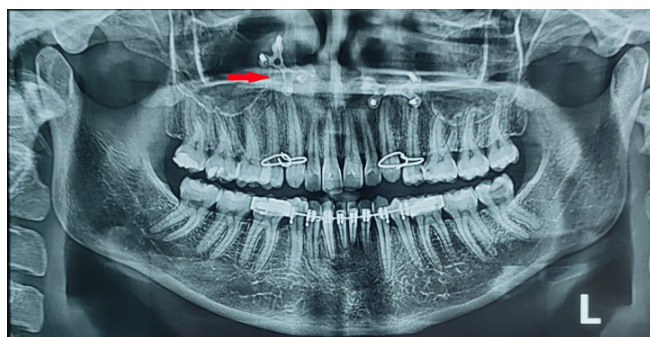


Figure 2 showing fixation of anterior maxillary osteotomy using microplate (red arrow)

The patients followed after surgery weekly for the 1st month and cephalometrics were requested at the 1st month after disappearance of facial edema 6th month and after one year at least The stability of the osteotomy was evaluated through measurements of different angles as SNA,

nasolabial and interincisal angles also horizontal (S-N) and vertical (S-N perpendicular) reference lines were determined to measure the vertical and horizontal distances for points ANS (anterior nasal spine) A point, UI (upper incisor edge) using DIGIMIZER software as in figure 1 after calibration using the ruler in cephalometric x ray (figure 3-5)

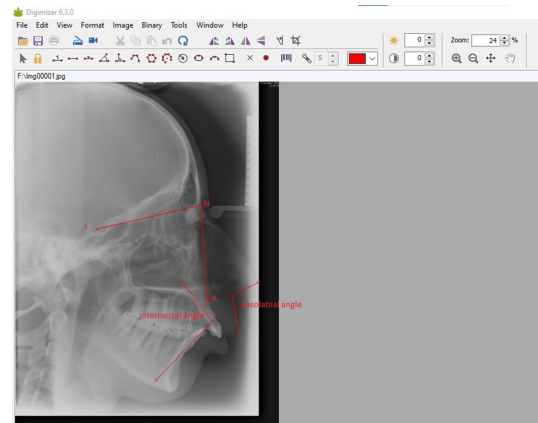


Figure 3 showing the measured angles including SNS, interincisal and nasolabial angle using Digimizer software

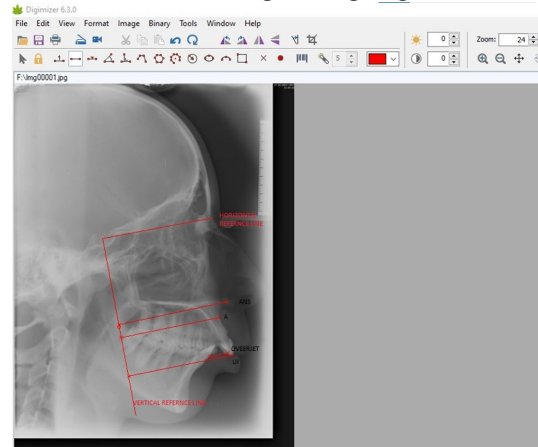


Figure 4 showing measured horizontal reference lines V-ANS, V-A, overjet and V-UI

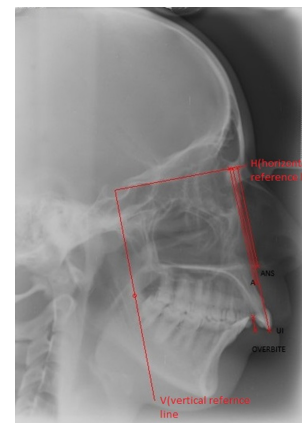


Figure 5 showing measured horizontal reference lines H-ANS, H-A, overbite and H-UI

Panorama x-ray films also done at 1st month, 3rd month and 6th month taking the same factors for each patient where bone healing was evaluated radiographically using gray scale measurements. Through IMAGE J software (figure 6) All the data, were analyzed using ORIGIN PRO8.5 software

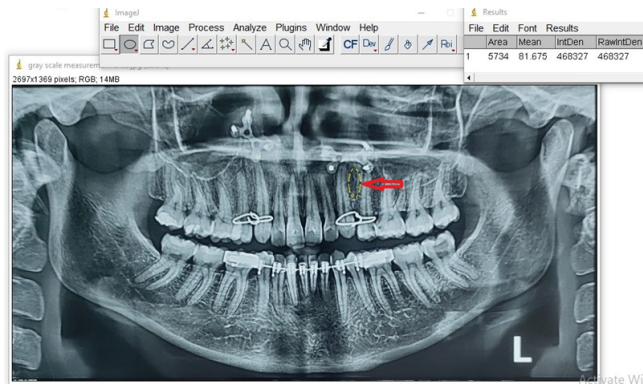


Figure 6 showing measurement of gray scale using image j software red arrow refers to region of interest

RESULT

Number of the patients was 12 one male and 11 females the mean age was 30.5 years and standard deviation was ± 4.27466 the prominent complaint was due to protruded maxilla and social implements, all the patients were managed under general anaesthesia using Cupar approach^[4]

The post operative was eventful (figures 7- 15) with good healing of the wounds and the oedema was subsided gradually and disappeared through the 2nd postoperative week, there was no wound dehiscence nor plate nor bone exposure and all the patients were satisfied, and the anterior maxilla was stable through the postoperative periods

As regards the angular measurement SNA angle there was significant difference ($P=1.03957E-6$) between the preoperative (87.4 ± 0.89443) and immediate postoperative (80.6 ± 1.34) however there was no significant difference between the postoperative immediate and the following post operative periods as regards the interincisal angle also there was significant difference ($P=0.02216$) between the preoperative (104.4 ± 6.10737) and immediate postoperative (118.4 ± 6.80441) however there was no significant difference between the postoperative immediate and the following post operative periods, as regards the nasolabial angle also there was significant difference ($P=0.00465$) between the preoperative (87.8 ± 2.04939) and immediate postoperative (106.8 ± 8.43801) however there was no significant difference among all the postoperative periods

As regards horizontal measurements extended from points A, ANS (anterior nasal spine), and UI (upper incisor edge) to the vertical reference line S-N perpendicular (V) the mean of V-A was 62 ± 4.63681 while the immediate postoperative A-V line was ± 50.616441 with significant difference $P = 0.02889$ when compared to preoperative also the 2ND and 3RD postoperative periods showed significant difference with the preoperative V-A line with $P=0.04485$ and $P=0.03203$ respectively while there is little difference among all the postoperative periods

As regards V-ANS was 63.58 ± 4.29907 while the immediate postoperative V-ANS was 47.4 ± 8.08084 with significant difference with preoperative V-ANS line also the second and third postoperative showed significant difference with the perioperative measurement where $P=0.01846$ and $P=0.02713$ respectively As regards preoperative V-UI line was $70 \text{mm} \pm 2.34521$ while the immediate postoperative V-UI was $52.3 \text{mm} \pm 28.59942$ with significant difference with preoperative V-UI line also the second and third postoperative measurements showed significant differences with the perioperative measurement where $P=0.06737$ and $P=0.06737$ respectively 0.01989

While no significant difference among the postoperative periods

As regards preoperative overjet it was $10.48 \text{mm} \pm 3.59889$ while the immediate overjet was $1.86 \text{mm} \pm 1.30115$ with significant difference with preoperative overjet $P=1.4319E-4$ also the second and third postoperative measurements showed significant differences with the perioperative overjet measurement where $P=7.11677E$ and $P=0.00165E-4$ respectively While all postoperative overjet measurements was stable

As regards vertical measurements extended from different points A, ANS (anterior nasal spine), and UI (upper incisor edge) to the horizontal reference line S-N (H), the mean of H-A was $58.78 \text{mm} \pm 5.99183$ while the immediate postoperative H-A line was 47.14 ± 5.3421 with significant difference $P = 0.03132$ when compared to preoperative measurement, also the 2nd and 3rd postoperative periods showed significant difference with the preoperative H-A line with $P=0.05416$ and $P=0.0891$ respectively while there is little difference among all the postoperative periods As regards preoperative H-ANS was $53.56 \text{mm} \pm 3.29666$ while the immediate postoperative H-ANS was $42.84 \text{mm} \pm 3.55007$ with significant difference with preoperative H-ANS where $P=0.01039$ also the second and third postoperative periods showed significant difference with the perioperative measurement where $P=0.04864$ and $P=0.0554$ respectively

As regards preoperative H-UI line was $87.8\text{mm} \pm 7.36206$ while the immediate postoperative H-UI was $71.1610.26781 \pm$ with significant difference with preoperative H-UI while $P= 0.04214$ line also the second and third postoperative measurements showed significant differences with the perioperative measurement where $P=0.04898$ and $P=0.04898$ respectively While no significant difference among the postoperative periods .

As regards gray scale of the preoperative gray scale in the suspected operative region was 128.1 ± 36.16767 while that of immediate postoperative was 87.2 ± 18.33515 with significant difference $P=0.04236$ when compared with that of preoperative periods and the 6th month postoperative difference while there is no significant difference between the 3 month ($P=0.99896$) and 6th month ($P=1$) when compared with the preoperative period .



Figure 7 showing lateral, anterior views with gum showing and sever overjet case1



Figure 8 showing lateral and anterior view with improved gum showing and normal overjet case1

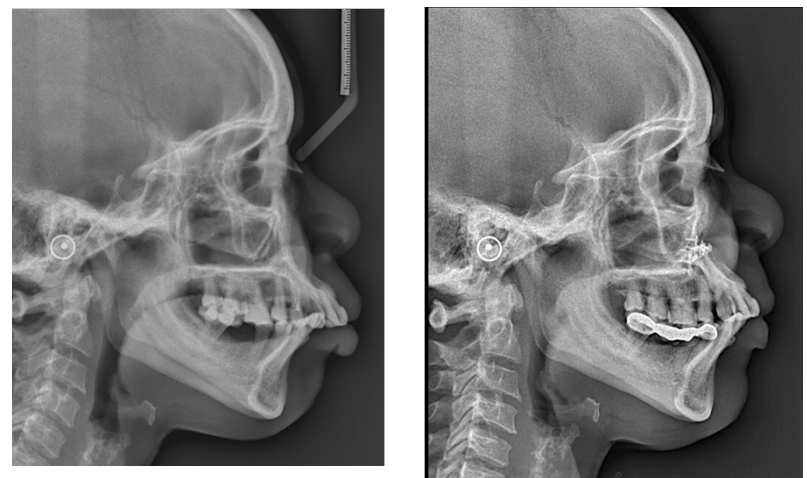


Figure 9 showing pre and post cephalometric analysis case1

TABLE 1 ANGULAR MEASUREMENT

MEASUREMNT	PREOPERATIVE	IMMEDIATE	6TH MONTH AFTER	ONE YEAR
SNA MEAN	87.4	80,6	80,8	80.7
STD	0.89443±	±1.34164	±1.30384	±1.30384
P	-	1.03957E-6	1.46687E-6	1.23053E-6
INTERINCISAL ANGLE MEAN	104.4	118.4	118.4	118.8
STD	±6.10737	±6.80441	±6.91375	±7.15542
P	---	0.02216**	0.02216**	0.01838
NASO LABIAL ANGLE MEAN	87.8	106.8	107.4	107.8
STD	2.04939	8.43801	8.26438	8.75785
P	-----	0.00465**	0.00359**	0.00302**

Table 2 HORIZONTAL REFERENCE LINE V-ANS (distance from vertical reference line to anterior nasal spine,V-A(distans from vertical line to point A ,V-UI(distance from vertical line to upper incisor edge)

MEASUREMENT	PRE	IMMEDIATE	6TH MONTH	YEAR
V-ANS	63.58	47.4	47.9	0.02713
STD				
P	±4.29907	±8.08084	7.73305	0.02713
	-----	0.01487	0.01846	0.02713
V-A	62	50	50,2	50.8
STD				
P	±4.63681	6.16441	6.13172	6.97854
	-----	0.02889	0.04485	0.03203
V-UI	70	52.3	55.75	53.4
STD				
P	±2.34521	8.59942	10.04573	8.56154
	-----	0.01286	0.06737	0.01989
overjet	10.48	1.86	3.12	3.35
STD				
P	±3.59889	1.30115	1.86333	1.47309
	----	1.4319E-4	7.11677E-4	0.00165E-4

Table 3

MEASUREMENT	PRE	IMMEDIATE	6TH MONTH	ONE YEAR
H-ANS MEAN	53.56	42.84	45.12	45.32
STD				
P	±3.29666	±3.55007	±6.3065	±4.78665
	---	0.01039**	0.04864**	0.0554**
H-A MEAN	58.78	47.14	48.2	49.2
STD				
P	±5.99183	±5.3421	±6.34035	±6.01664
	-----	0.03132	0.05416	0.0891
H-UI	87.8	71.16	71.6	71.6
STD				
P	±7.36206	±10.26781	±8.90505	±8.90505
	-----	0.04214	0.04898	0.04898
OVERBITE	5.6	1.275	2.3	2.18
STD				
P	2.71017	0.34034	1.31149	0.68702
	-----	0.00665	0.03944	0.02245



Figure 10 showing lateral, anterior views with gum showing and sever overjet case2

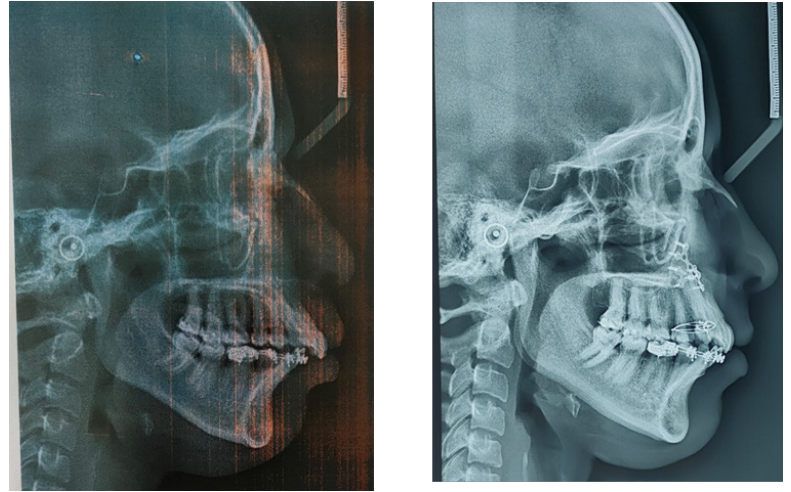


Figure 12 showing pre and pos cephalometric view case3



Figure 11 showing lateral , anterior view with improved gum showing and normal overjet case2



Figure 13 showing lateral, anterior view with gum showing and sever overjet case2



Figure 14 showing lateral , anterior view with improved gum showing and normal overjet case3

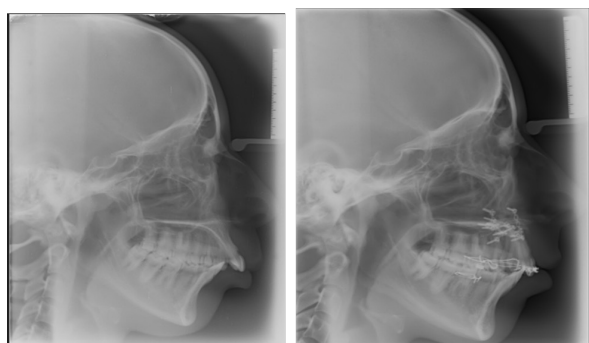


Figure 15 showing pre and pos cephalometric view case3

DISCUSSION

Anterior maxillary osteotomy is an effective method for management of maxillary excess while posterior occlusion is optimum^[5] Anterior maxillary osteotomy can be done using Wassmund technique ^[6] where labial and palatal mucosa left intact, while the alveolar bone osteotomy approached through vertical incision at the region of 1st premolar on both sides while labial bone osteotomy completed through tunneling of labial mucosa also palatal bone osteotomy is done through tunneling of the palatal mucosa with aid of midpalatal sagittal incision ,also anterior maxillary osteotomy can be done through transverse palatal incision and the blood supply is maintained by labial flap according to Wunderer technique ^[7] also the anterior maxillary osteotomy can be done using CUPAR^[4] where circumvestibular incision is done to expose the labial bone where bone osteotomized 5 mm above the dental apices and the palatal bone osteotomized through the vertical osteotomy on the premolar region

through this study CUPAR approach was used due to ease of bone osteotomy with good exposure and saving time according to the study of Gupta et al ^[2]

through this study the postoperative events as oedema ,pain ,tissue healing passed smoothly without complication and this can be explained by conservative and minimal mucoperiosteum dissection required to apply the microplates that have small size and need only little bone drilling , this finding is in accordance to the study of Panthagada and Saripalli ^[8] also intraoperative and postoperative stability was noted through this study and this is evidenced by stable angular and linear measurements used through this study in all postoperative follow up periods and this stable results can be explained by three dimensional stability provided by easily adaptable microplates also there is no muscular force or tension in anterior maxillary segments ,, also the anterior bite force between upper and lower anterior teeth is less than molar bite force as stated in the literature ^[9,10]

Microplate had an aesthetic effect due to low thickness profile and showed the least palpability in addition to decreased radiographic scattering on computerized tomography ^[11,12]

Through this study only three angular and four vertical and horizontal cephalometric measurements were used to evaluate the stability of anterior maxillary segment to facilitate the study and make its message more obvious, SNA angle used to evaluate the skeletal stability, nasolabial angle was used to evaluate soft tissue changes and interincisal angle to evaluate dental stability also horizontal and vertical dimensions for the point A, ANS, were used to evaluate stability of bone segment, while the vertical and horizontal measurements from UI points and overbite and overjet were used to evaluate dental stability, Digimizer soft ware was used through this study for orthodontic evaluation because it is an accurate and valuable software according to the study of Salvarzi et al ^[13],

Through this study the gray scale level increased gradually through the post operative periods and it was similar to that of perioperative at the third and 6th month indicating normal bone healing ,IMAGE J software used to measure the gray scale according to the study of Aditya et al ^[14] because it is accurate friendly use soft ware All the patients through this study were satisfied,SNA angle was reduced from 87,4 to 80.6 and this was similar to the study of Essa, E and. Elshall ^[5] also nasolabial angle increased from 87,8 to 106.8 and this is within the normal range of this angle according to the study of Park and Hwang ^[15].

where anterior maxillary osteotomy in their study on 30 patients lead to change of nasolabial angle from 94.9 to 109.03 , also the overjet through this study decreased from 10.48mm to 1,86mm and this lead to more improvement in aesthetics also over bite decreased from 5,6 to 1,2

also the vertical distance from anterior nasal spine was reduced from 53.56 to 42.84 and this significant decrease in vertical dimension not only due to set up of the pre-maxilla but also due to modification of the anterior nasal spine, and this leads to decreased gum showing. This finding was in accordance to the study of Venkategowda et al.^[16] and Garvill^[17]. Through this study panorama was requested at 1st, 3rd, and 6th month to detect earlier bone healing, while postoperative lateral cephalometrics were requested at 6th month intervals as this is recommended by multiple studies because this long intervals leads to more stabilization and adaptation of soft tissue.^[19-20]

CONCLUSION:

Using microplate for of anterior maxillary osteotomy may lead to stable results with good bone healing and absence of palpability. Declaration and patient consent. All the patient have consented for surgical procedures and publication of the photos for scientific purposes without their identifications in the literature.

Ethical approval

ethical approval for this study obtained from the ethical committee of Faculty of Medicine, South Valley University.

Conflict of interest

No conflict of interest

Funding

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REFERENCES:

- 1- Eslamipour F, Borzabadi-Farahani A, Le BT, Shahmoradi M. A retrospective analysis of dentofacial deformities and orthognathic surgeries. *Ann Maxillofac Surg* 2017;7:73-
- 2- Gupta A, . Sharma S, Kataria , Bansal P , and Sharma R: Experience with Anterior Maxillary Osteotomy Techniques . A Prospective Study of 20 Cases: *J. Maxillofac. Oral Surg.* 2020-19(1):119–124
- 3- Frole A and Diecidue R J . Microscrew and microplate systems for select osteotomies in orthognathic surgery .oral surg,, oral medecine ,oral pathol 1993;75:276-91
- 4- Cupar I .Surgical treatment of alterations in form and position of the maxilla. *Osterr Z Stomatol*1954, 51:565
- 5- Essa, E and. Elshall M Long-term clinical and radiographic stability of anterior maxillary setback using bio-degradable Inion plates for osteosynthesis *Tanta Dental Journal* 2018, 15:44–51
- 6- Wassmund J *Lehrbuch der praktischen chirurgie de-Mundes und der Keifer*, (1935) vol 1. Barth, Leipzig, pp 260–282
- 7- Wunderer S (1963) Erfahrungen mit der operativen Behandlung hoch-gradiger Prognathien. *Dtsch Zahn Mund Kieferheilk* 39:451
- 8- Panthagada V.S and Saripalli R R K: Management of Maxillofacial Fractures Using Titanium Microplates – An Original Research Study ,*Journal of Dental and Medical Sciences* . 2023. 22-(2), 43-52
- 9-choi W and kimT: relationship between maximum bite force and facial skeletal pattern .*Korea journal ortho* 2003, 33(6)437-51
- 10- Mohammed A B and Mohammed AA profile of body mass index of upper Egypt children ; *Egyptian journal of oral and maxillofacial surgery* 2022, 13, ,(3)122-125
- 11- Mitchell, D,A,Macleod,. Bahzton SP: Multipoint Fixation At The Fi'ontozygomatic Suture With Microplates: A Technical Note. *Int. J. Oral Maxillofac. Surg.* 1995; 24: 151-152.
12. .Kelley P , Hopper R ,and Gruss J : Evaluation And Treatment Of Zygomatic Fractures: *American Society Of Plastic Surgeons*: 2007;120(7 Suppl 2):5S-15S
- 13- Salvarzi E , Choobineh A,Mehdi Jahangiri M, and KeshavarziS Application of Digimizer Image Analysis Software In Facial Anthropometry . *Iran J Ergon* 2020, 8(2): 61-71
- 14- Aditya V, Vandana KL. ImageJ software in periodontics: An insight. *J Dent Res Rev* 2023;10:182-
- 15- Park and Hwang (8. Park Je Uk, Hwang Young Sook et al Evaluation of the soft and hard tissue changes after anterior segmental osteotomy on the maxilla and mandible. *J Oral Maxillofac Surg* 2008-66:98–103
- 16-Venkategowda P, Prakash AT, Roy ET, Sadashiva Shetty K.S, Thakkar S, Maurya R: Stability of Vertical, Horizontal and Angular Parameters Following Superior Repositioning of Maxilla by Le Fort IOsteotomy: A Cephalometric Study *Journal of Clinical and Diagnostic Research.* 2017 .11(1): 10-14
- 17 Garvill J. Psychological factors in orthognathic surgery. *J Craniomaxillofac Surg* 1992; 20:28–33.
- 18-Radney LJ, Jacobs JD (1981) Soft tissue changes associated with surgical total maxillary intrusion. *Am J Orthod* 80(2):191–212
19. Mansour Stephen, Burstone Charles An evaluation of soft tissue changes resulting from Le Fort I maxillary surgery. *Am J Orthod* 1983, 84(1):37–47
20. Freihofer HP .The lip profile after correction of retromaxillism in cleft and non cleft patients. *J Maxillofac Surg*1976, 4:136–14