

***Clinical and radiological evaluation of
3 types of plate osteosynthesis for fixation
of subcondylar fractures.***

Thesis

Submitted to Faculty of Oral and Dental Medicine in partial
fulfillment of master degree in

Oral and Maxillofacial Surgery

by

Mahmoud Mohamed Talaat Mohamed.
B.D.S (Cairo University) 1999

Supervisors

1- Dr. **Ragab Radwan El-
Beialy**
Professor of oral and
maxillofacial surgery
Cairo University

2- Dr. **Ahmed Abdel
Moniem Barakat**
Assistant professor of oral
and maxillofacial surgery
Cairo University

3- Dr. **Ashraf abdel
Fattah Mahmoud**
Assistant professor of
oral and maxillofacial
surgery
Al-Azhar University

Principle Supervisor:
Dr. Ahmed Abdel Moniem Barakat

Faculty of Oral and Dental Medicine
Cairo University
2007

Acknowledgement

First thanks to **Allah**

No words can express the effort and help of **Prof. Ragab Radwan Al-Beialy**, professor of oral and maxillofacial surgery, faculty of oral and dental medicine, Cairo University, for his great support, careful supervision and continuous advice and guidance which were the cornerstone for this work and helped me to overcome many difficulties.

I am also deeply grateful and would like to express my sincere thanks to **Prof. Ahmed Abdel Moniem Barakat**, professor of oral and maxillofacial surgery, faculty of oral and dental medicine, Cairo University, for his great help and continuous contributions.

I wish to express my deepest thanks, gratitude and profound respect to my honored Teacher, **Dr. Ashraf Abdel Fattah Mahmoud**, Associate professor of oral and maxillofacial surgery, faculty of oral and dental medicine, Al-Azhar University, for his meticulous supervision. I consider myself fortunate to work under his supervision. His constant encouragement and constructive guidance were of paramount importance for the initiation, progress and completion of this work.

Last but not least, I would like to express my endless gratitude to my dear patients for their cooperation in accomplishing my thesis, wishing them a good health.

Dedication

To the two candles who burned to
show me the way my mother and
my father.

List of content

Introduction	1
Review of literature	3
Aim of the work	32
Patients and methods	33
Results	47
Discussion	99
Conclusions	110
Summary	111
References	114

List of figures

No. of Fig.	Page	Comment
Fig (1)	P38	A photographic view showing the tray for open reduction and internal regid fixation for subcondylar fracture
Fig (2)	P47	percentage of condylar fracture level according to Krenkel's classification.
Fig (3)	P48	percentage of degree of displacement among condylar fractures.
Fig (4)	P49	percentage of incision types used to access condylar fractures.
Fig (5)	P53	percentage of immediate postoperative facial nerve affection.
Fig (6)	P54	percentage of facial nerve affection that last more than three months.
Fig (7)	P57	percentage of abnormal postoperative occlusion.
Fig (8)	P58	differences of immediate postoperative range of motion among three groups.
Fig (9)	P58	improvement of maximum mouth opening in the three groups.
Fig(10)	P59	comparison between three groups regarding lateral excursion to contralateral side.
Fig(11)	P60	comparative maximum and minimum ranges of deviation during opening in the three groups.
Fig (12)	P62	comparison between three groups regarding deviation during opening.
Fig (13)	P65	comparison between three groups regarding proper alignment.
Fig (14)	P66	comparison between three groups regarding Screw loosening.
Fig (15)	P66	percentage of plate bending six months postoperatively.
Fig (16)	P69	A ,Preoperative photoradiograph of panoramic view of case no two of group (I) showing right antromedial dislocated high condylar neck fracture. B , More closed view to the fractured condyle.

Fig (17)	P69	Preoperative photograph of the previous case showing malocclusion with anterior open bite and deviation of the midline toward right after 6 weeks of IMF.
Fig (18)	P70	Preoperative photoradiograph of coronal CT scan of the previous case showing right antromedial dislocated high condylar neck fracture.
Fig (19)	P70	Intraoperative photograph showing extracorporal reduction and assembly of the condylar process to the posterior part of the osteomatized ramus in the same case using single miniplate.
Fig (20)	P71	Intraoperative photograph showing reimplantation of condylar segment in its proper position by fixation to the remainder of the ramus using T-miniplate in the same case through modified Risdon approach.
Fig (21)	P71	One month postoperative photoradiograph of panoramic view of the same case showing plate bending with right antromedial dislocation of the condylar fracture (notice that the bone/screws interface doesn't show any failure).
Fig (22)	P72	Postoperative photograph of the same case at the end of the follow-up period showing adequate facial symmetry.
Fig (23)	P72	Postoperative photograph of the same case at the end of follow up period showing good mouth opening of 40 mm with 5 mm deviation toward right side.
Fig (24)	P73	A , Preoperative photograph of the previous case showing open bite and deviation of the midline toward right after 6 weeks of IMF. B , Six months postoperative photograph of the same case showing 1 mm anterior open bite.
Fig (25)	P74	Preoperative photoradiograph of panoramic view of case no four of group (I) showing left antromedial dislocated high condylar neck fracture.
Fig (26)	P74	Intraoperative photograph showing adequate reduction and fixation of the condylar segment using single miniplate in the same case (notice that we utilize both Retromandibular and Endaural approach).
Fig (27)	P75	Six months postoperative photoradiograph of panoramic view of the same case showing proper alignment and fixation of the fractured segments by single miniplate and four screws with adequate healing.
Fig (28)	P75	One week postoperative photograph of the same case showing good mouth opening.

Fig (29)	P76	One month postoperative photograph of the same case showing visible scar.
Fig (30)	P76	Postoperative photograph of the same case at the end of follow up period showing invisible scar.
Fig (31)	P77	Postoperative photograph of the same case at the end of the follow-up period showing minimal facial asymmetry.
Fig (32)	P77	Six months postoperative photograph of the same case showing maximum intercuspation with shifting of the midline toward left by 3 mm.
Fig (33)	P78	Postoperative photograph of the same case at the end of follow up period showing good mouth opening of 38 mm with 3 mm deviation toward left.
Fig (34)	P79	Preoperative photograph of case no. seven of group (I) showing malocclusion with anterior open bite and facial asymmetry with deviation of the midline toward left.
Fig (35)	P79	Preoperative photoradiograph of panoramic view of the same case showing right antromedial dislocated high condylar neck fracture.
Fig (36)	P80	Six months postoperative photoradiograph of panoramic view of the same case showing proper reduction and fixation by one miniplate with central bar and four screws.
Fig (37)	P80	Six months postoperative photograph of the same case showing maximum intercuspation.
Fig (38)	P81	Preoperative photoradiograph of panoramic view of case no. one of group (II) which is the case no. four of group (III) showing bilateral parasymphiseal and bilateral antromedial dislocated high condylar neck fracture.
Fig (39)	P81	Preoperative photograph of the same case showing presence of fistula in the preauricular region denoting infected condylar fracture.
Fig (40)	P82	A , Preoperative photograph of the same case showing persistence anterior open bite. B , Postoperative photograph of the same case at the end of follow up period showing chin deviation to the right side.
Fig (41)	P82	Preoperative photoradiograph of panoramic view of case no. Three of group (II) showing left subcondylar fracture with moderate displacement and right intracapsular fracture.
Fig (42)	P83	Six months postoperative photoradiograph of panoramic view of the same case showing proper alignment of the fractured segments reduced and fixed by two miniplates and eight screws.

Fig (43)	P84	Preoperative photograph of case no. four of group (II) showing anterior open bite.
Fig (44)	P84	Six month postoperative photograph of the same case showing satisfactory intercuspatation.
Fig (45)	P85	Preoperative photoradiograph of panoramic view of the same case showing left condylar neck fracture with moderate displacement.
Fig (46)	P85	Intraoperative photograph of the same case showing adequate reduction and fixation of left condylar neck fracture using two miniplates and eight screws through a modified Risdon approach.
Fig (47)	P86	One week postoperative photograph of case no. four of group (II) showing limited mouth opening.
Fig (48)	P86	Six month Postoperative photograph of the same case showing maximum mouth opening of 46 mm.
Fig (49)	P87	Six months postoperative photoradiograph of panoramic view of the same case showing proper alignment of the fractured segments reduced and fixed by two miniplates and eight screws.
Fig (50)	P87	Postoperative photograph of the same case at the end of the follow-up period showing adequate facial symmetry.
Fig (51)	P88	A , Preoperative photograph of case no. five of group (II) showing anterior open bite. B , more closed view of the same case showing anterior open bite and deviation toward left with left posterior open bite.
Fig (52)	P88	Preoperative photoradiograph of 3D-CT reconstruction of the mandible of the same case showing left medium subcondylar fracture with antromedial displacement.
Fig (53)	P89	Six months postoperative photoradiograph of panoramic view of the same case showing proper alignment of the fractured segments reduced and fixed by two miniplates and eight screws.
Fig (54)	P89	Six months postoperative photoradiograph of postero-anterior view of the same case showing proper alignment of the fractured segments reduced and fixed by two miniplates and eight screws.
Fig (55)	P90	Postoperative photograph of the same case at the end of the follow-up period showing adequate facial symmetry.
Fig (56)	P90	Six month postoperative photograph of the same case showing maximum intercuspatation.
Fig (57)	P91	Six month postoperative photograph of the same case showing 7.5 mm lateral excursion toward the right .
Fig (58)	P91	Postoperative photograph of the same case at the end of follow up period showing invisible scar.

Fig (59)	P92	Preoperative photoradiograph of coronal CT scans of case no. six of group (II) showing left medium subcondylar fracture with moderate displacement, symphyseal fracture, Leforte I fracture, with fractured left zygoma.
Fig (60)	P92	One month postoperative photoradiograph of postero-anterior view of the same case showing proper reduction and fixation of pan facial fractures.
Fig (61)	P93	Three month postoperative photoradiograph of panoramic view of the same case showing proper healing.
Fig (62)	P94	Preoperative photoradiograph of panoramic view of case no. seven of group (II) showing right body fracture with moderately displaced left subcondylar fracture.
Fig (63)	P94	Six months postoperative photoradiograph of panoramic view of the same case showing proper healing in spite the presence of loose screw.
Fig (64)	P95	Six month postoperative photograph of the same case showing maximum mouth opening of 43 mm.
Fig (65)	P95	Six month postoperative photograph of the same case showing edge to edge anterior relationship.
Fig (66)	P96	Preoperative photoradiograph of panoramic view of case no. one of group (III) showing right antromedial dislocated high condylar neck fracture.
Fig (67)	P96	Six months Postoperative photoradiograph of panoramic view of the same case showing loose screws with resorption of the condylar stump.
Fig (68)	P97	Preoperative photoradiograph of panoramic view of case no. two of group (III) showing right displaced parasymphiseal fracture with left moderately displaced subcondylar fracture.
Fig (69)	P97	Intraoperative photograph of the same case showing proper reduction and fixation of left subcondylar fracture using single DCP and four screws through a modified Risdon approach.
Fig (70)	P98	Six months postoperative photoradiograph of panoramic view of the same case showing proper healing.

List of tables

No. of tab.	Page	Comment
Tab. (I)	P44	Clinical & radiographic data and surgical approach performed in group (I).
Tab. (II)	P45	Clinical & radiographic data and surgical approach performed in group (II).
Tab.(III)	P46	Clinical & radiographic data and surgical approach performed in group (III).
Tab. (IV)	P47	distribution of age and sex in the three groups.
Tab. (V)	P48	Distribution of cases according to degree of displacement guided by Lindhal and Hollender ⁽⁷⁾ classification.
Tab. (VI)	P49	Distribution of cases according to type of incision.
Tab. (VII)	P52	Clinical follow- up in patients of group (I) one week postoperatively.
Tab.(VIII)	P52	Results of clinical follow - up in patients of group (II) one week postoperatively.
Tab.(IX)	P53	Results of clinical follow - up in patients of group (III) one week postoperatively.
Table (X)	P55	Six months postoperative clinical follow - up in patients of group (I).
Tab. (XI)	P56	Six months postoperative clinical follow - up in patients of group (II).
Tab. (XII)	P56	Six months postoperative clinical follow - up in patients of group (III).
Tab. (XIII)	P63	Clinical evaluation of functional & aesthetic parameters six months postoperatively in patients of group (I).
Tab. (XIV)	P63	clinical evaluation of functional & aesthetic parameters six months postoperatively in patients of group (II).
Tab. (XV)	P64	Clinical evaluation of functional & aesthetic parameters six months postoperatively in patients of group (III).
Tab. (XVI)	P67	Six months postoperative radiological follow - up in patients of group (I).

Tab. (XVII)	P68	Six months postoperative radiological follow - up in patients of group (II).
Tab.(XVIII)	P68	Six months postoperative radiological follow - up in patients of group (III).

Introduction

The condylar region is one of the most common site of mandibular fracture. It constitutes 21.1% of mandibular fractures in adult patients while it rises to 50% or more in children and teenagers. According to Silvennoinen⁽¹⁾ condylar fracture is more frequent in males than in females with a ratio 3:1 with mean age 31.3 years with highest frequency among patients aged 20 to 29 years. It is usually the result of a direct blow to the chin or to the lateral side of the jaw caused by traffic collisions, violence, accidental falls, and sports injuries.

Displacement fractures are those in which the condylar head remains within the limits of the receptacle fossa. Degree of displacement may range from none to a wide malposition of fracture bone ends with marked overriding. Since fracture lines are usually oblique, the upward pull of three major masticatory muscles readily slips the fragments into an overriding position. When there is sufficient trauma to rupture the joint capsule and to expel the condylar fragments from the joint fossa, the condition is termed dislocation⁽¹⁾.

The diagnosis of condylar process fracture is based on clinical and radiological findings. Clinical signs such as jaw deviation, limitation during mouth opening, changes in occlusion, palpation through external auditory meatus or extraoral swelling of the preauricular region could be indicative of condylar process fracture⁽²⁾. Panoramic radiographs and conventional tomograms are excellent screening films demonstrating displacement of fractured condylar segments in

the anterior posterior direction but not in the medio-lateral dimension. Panoramic films have many advantages include its broad image, low radiation dose, and ability to be performed on patients who are unable to open their mouths. Other radiographic views are necessary to reconstruct a three dimensional image for diagnostic and therapeutic purposes. The open mouth reverse Towne's view is a useful adjunctive film since it is demonstrating displacement of fractured condylar segments in the medio-lateral direction⁽³⁾.

In contrast to other mandibular fractures condylar process fractures are generally treated by maxillomandibular fixation, duration of immobilization usually ranges from two to six weeks depending on the type of fracture, degree of condylar dislocation and age of the patient early mobilization of the jaw and functional rehabilitation are considered important⁽⁴⁾.

However, many methods for open reduction and internal fixation were used to treat these type of fracture including, intra-osseous wiring, K-wires, lag screws, and various types of plates. No absolute evidence tells the better method of fixation is addressed.

Review of the Literature

Anatomy of condyle and articulating fossa

Condylar head is elliptical in axial section and averages 10 mm in antro-posterior dimension by 20 mm in mesio-lateral dimension. Its greatest dimension is oriented perpendicular to the long axis of the ipsilateral mandibular body rather than the antro-posterior axis of the patient. The condylar head seats in the glenoid fossa of the temporal bone, which averages 15 mm in antro-posterior dimension by 23 mm in mesio-lateral dimension. Interposed between the condylar head and the glenoid fossa is the biconcave articular disk, which partitions the joint into an inferior joint space where hinge motion occurs and a superior joint space where translational motion takes place. The normal condyle-fossa articulation is complicated and precise. The anterior wall of the fossa at the articular eminence has an average slope of approximately 35° in the sagittal plane. This slope serves to guide the condyle through translation and contributes to the increase in interincisal opening that occurs past the initial hinge motion. The medial wall of the mandibular fossa has an average slope in the coronal plane of 15° (the Bennett angle), which interacts with the normal condyle to guide the mandible in lateral excursive movements.⁽⁵⁾

Fracturing of the condyle in particular is a preventive mechanism by which injury to the brain is avoided or diminished as the condylar neck constitutes the weakest region of the entire mandible and is therefore the most susceptible to fracture.. So, condylar fractures are often the result of indirect forces that transmitted along the mandible from distant sites such as the angle, body or symphysis. This

usually occurs when the mouth is opened at the time of injury so that some of the impacting force is transmitted along the mandible to its weakest link.⁽¹⁾

The TMJ as a whole is supplied by a very rich plexus of vessels that runs throughout the tissues of the area. There are vessels of assorted sizes and it is difficult to determine which nearby major vessel provides the largest contribution. Every named vessel within 2 or 3 cm gives off 1 or more articular branches. The density of the plexus increases as the articular surfaces are approached.

Condylar blood supply is mostly derived from 3 sources. A branch of the inferior alveolar artery courses upward through the neck of the condylar process, where it anastomoses liberally with vessels from the attached musculature. Another major component to the condyle and its articular surface is derived from the TMJ capsule, with its lush vascular plexus. There is also a large contribution of blood supply from branches of the lateral pterygoid muscle through its attachment at the pterygoid fovea. Of these 3 sources, the medullary blood supply from a branch of the inferior alveolar artery was found to be the most important source in man.⁽⁶⁾

Classifications of condylar fractures

Lindahl and Hollender (1977) ⁽⁷⁾ classified Fractures of the condylar region into four levels:

Level (I): fracture confined to capsule (Intracapsular fracture).

Level (II): fracture line present itself at the junction between head and neck of the condyle (condylar head fracture).