

Modified locking plate for the management of subcondylar fractures: series of 20 cases.

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Abstract:

INTRODUCTION: Management of condylar fractures had generated great deal of discussion and controversy than any other fields of maxillofacial trauma. Condylar fractures account for a total of 25% to 35% of all the mandibular fractures. The current scenario of management of condylar fractures had moved towards open reduction and internal fixation by using different plating systems. Single and two miniplates placed along the fractured condyle could not totally neutralise the dynamic osteosynthesis of the condyle which showed the way towards the usage of three dimensional plating system. Diminution of micro movements between implant and the bone interface increases the implant stability which lead to the shift of era towards the locking plates.

MATERIAL & METHOD: all the patients with maxillofacial trauma were screened from the causality and were included in the study. In the present study three dimensional delta locking plates were used in 20 cases of subcondylar fractures of the mandible.

RESULTS: out of 20 the cases fracture reduction was satisfactorily achieved by 80% with a mean mouth opening of 34.3mm. Occlusion was 100% achieved with a satisfactory result towards mandibular deviation.

CONCLUSION: The purpose of the present article is to evaluate the efficiency of three dimensional locking plates for the management of condylar fractures.

Key words: condyle fracture, dynamic osteosynthesis, delta plate, locking plate.

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I. Introduction:

Fractures of the mandibular condyle had been providing challenges to the surgeons and they account to a total of 17.5 to 52% of all the mandibular fractures^[1]. Curved nature of the mandible creates greater strains in the certain areas of the mandible of which the condyle occupies the superior position. The treatment either conservative or surgical should aid in reduction of morbidity, complications and elevate the functional and aesthetic results of the patient. Their lies a running debate between conservative and surgical management of the mandibular condyle fractures and era had moved towards open reduction and internal fixation due to the friendly plating systems which are currently available. In the study conducted between single versus double plating system for the condyle fracture the double plating system showed an intimate rigidity of the fractured segments^[2].

The space available in the condylar segment poses a problem for the fixation, which lead to the development of the three dimensional plating system. The 3D plates provide an additional stability during healing. According to Ellis and Graham locking plates add an advantage of a) reduces the micro movements between the bone and plate interfaces b) decreases the risk of screw back out c) provides positive stop for locking screws d) reduces plate contouring e) increases the construct stability^[3]. 3D locking plates has been designed with a positive hypothesis to overcome the problems posed by the conventional plating system

Various plate osteosynthesis systems are available; the need of ideal plating system is required for the successful treatment outcome. Keeping the above mentioned advantages of the locking 3D plates, this study is aimed to evaluate the role of 3D locking plates for the management of mandibular condylar fractures.

II. Methodology:

A prospective clinical study was performed in the department of oral and maxillofacial surgery, of our institution in a span of two years from May 2014 to June 2015. All the trauma patients diagnosed to be with

mandibular condyle fractures, who reported to the emergency unit of our College were screened for inclusion in the study.

Inclusion criteria

1. Patients with sub condylar fractures.
2. Patients with or without other associated fractures.
3. Patients with age ranging from 16- 60 years.

Exclusion criteria

1. Patients with high condylar fractures.
2. Patients who were medically compromised.
3. Patients with age greater than 60 years and less than 15 years.

Method of data collection: 20 patients with mandibular condyle fractures requiring open reduction and internal fixation were included in the study. Out of 20 patients, 18 were male and 2 was female patient with an age ranging from 17- 52 years were included in the study.

Detailed history, clinical examination, radiographic examination was conducted for all the patients. Panoramic radiographs and 3D CT scans were done for all the patients. 10 cases were approached through the standard pre auricular approach and 10 through the retro mandibular approach.

The titanium 3D locking plate of 2mm thickness was used in the study. The total length of the plate is 22mm with a width of 13mm. The screws are of 6mm length. These measurements were based on the prefabricated template which is prepared over the cadaveric mandible” (Figure 1)”. Risk and benefits of the procedure were explained to the patients and written informed consent was obtained from all the patients. All the analysis is done using SPSS version 18. A p-value of <0.05 is considered statistically significant. Comparison of two groups was done using Student t- test and Mann- Whitney test.

The ethical clearance was taken from the ethical board with IRB number MDC_T_ D138802019 with date of approval on July 17th 2016. All the copy rights are reserved to our institution.

III. Results:

The results includes the analysis of parameters which includes fracture reduction, inter incisial mouth opening, occlusion and deviation of the mandible.

FRACTURE REDUCTION:

There was good reduction achieved for all the patients in the immediate post operative period. At the end of 6 months we have recorded 4 cases with non satisfactory reduction, which accounts to 20%. In one case there was over riding of the fractures segments and in other case there was deviation of the fractured segment (table 1). Fracture reduction was evaluated periodically at a timely interval of 1st post operative day, 1 month, 3 months and 6 months post operative period.

MOUTH OPENING:

There was good amount of mouth opening achieved for all the patients at the end of 6 months post operative period. In the 1st post operative period the mean mouth opening achieved for all the cases was 20.9 mm. At one week post operative period the mean mouth opening achieved was 26.6mm. At 1 month post operative period the mean mouth opening achieved was 31.4mm. At the end of 3 months post operative period the mean mouth opening achieved was 33.2mm. At the end of 6 months post operative period the mean mouth opening achieved was 34.3mm. (table 2).

OCCLUSION:

Of all the 20 cases there was 80% satisfactory occlusion and 20% had deranged occlusion on the 1st post operative day. At the end of 1 month there was satisfactory occlusion achieved by 90% and deranged occlusion by 10%. At the end of 6 months 100% satisfactory occlusion was achieved (table 3). Post-operative occlusal derangement was noticed in 2 patients, which was corrected using guiding elastics for two weeks. All the patients in their further follow up showed no occlusal derangement.

DEVIATION OF THE MANDIBLE:

Deviation of the mandible was noted in all the patients pre operatively and in 6 cases there was deviation post operatively and elastic traction was placed, one case had taken 2 weeks post operatively for the correction of midline shift where as other case had taken 3 weeks of post operative period. Only one patient showed a permanent midline shift by 2mm (table 4).

In the 1st post operative period 30% patients showed midline shift towards the effected side. In the 15th post operative period the midline shift was reduced to 20%. In the end of 1 month post operative period the midline shift was reduced to 10% and this was persistent in the 6 months post operative period.

Facial nerve weakness was recorded in 3 out of 10 cases of pre auricular approach by using House-Brackmann facial nerve grading system (HBFNGS). Complete recovery of the weakness was noted in 3 months post operative period and there were no permanent palsy recorded in any of the cases.

STATISTICS

All the analysis is done using SPSS version 18. A p-value of <0.05 is considered statistically significant. Comparison of two groups was done using Student t- test and Mann- Whitney test.

IV. Discussion:

In the entire spectrum of maxillofacial trauma the mandibular condyle fractures creates much of the debate and controversies than any other fractures of the facial skeleton. Management of these fractures remain controversial and a consensus about the best approach and choice of reduction is difficult to achieve.

According to Killey the condyle fractures account for 17.5 to 52% of all the mandibular fractures and 62 to 70% in accordance to Zide^[4]. Sawazaki stated that the condyle fractures recorded more in the age group of 20 to 40 years with a mean age of 30 years^[5] and Lee assured that the condyle fractures peaks in the age group of 25 to 34 years with a mean age of 42 years^[6]. In the present study the patient's age ranges from 17 to 52 years with a mean age of 29 years which was found to be similar to the study done by Sawazaki.

Croce and Babatunde stated that the Condylar fractures have a vast gender predilection with a male to female ratio of 10:1^[7]. In the present study 90% of the cases were males which coincided with the study done by the Croce and Babatunde et al. In the study done by Bradley the major etiologic factor for the condyle fractures was road traffic accidents (47%) of cases, followed by interpersonal violence (27%) of cases and fall (26%) of cases^[8], similar study was done by Vijay Ebenezer of which road traffic accidents account for 59%, interpersonal violence by 22% and fall in 12% of all the condylar fractures^[9]. In contradiction to these studies the present study showed a 90% association with road traffic accidents.

Lindhahl gave an anatomical classification based on the level of fracture and divided the condyle into three anatomical sites condylar head, condylar neck and sub condylar region. Furthermore Lindahl and MacLennan gave a classification based on relationship of the fractured condyle with the glenoid fossa into undisplaced, displaced, deviated and dislocated^[10]. In the present study 8 out of 20 were displaced fractures, 6 were dislocated and rest were undisplaced fractures which were associated with the other facial skeleton fractures.

Trauma pose varying degree of restricted mandibular movement due to muscle spasm, odema and joint haemarthrosis, these factors lead to the mandibular deviation towards the injured side. 2 out of 20 cases in the present study showed limited mouth opening of 30mm with pre operative jaw deviation towards the affected side.

For decades their always a running debate between conventional wisdom and cutting edge research of the condyle fractures. Santler et al stated that there was no significant difference in mobility, joint problems, occlusion and pain between the surgical and non surgical treatment groups, the only significant difference noticed was subjective discomfort in closed reduction patients^[11]. Marker et al stated that closed reduction of the condyle fractures is non traumatic, safe, reliable with a few cases with functional disturbance^[12].

According to Ellis and Throckmorton patients whose condyle fractures were treated by closed method had significant reduction in posterior facial and ramal height on the side of injury, compared to patients treated by open methods^[13]. In the present study there was a segmental overlap by 4mm in 2 cases which lead to significant decrease in posterior facial height.

Pape et al was first to introduce single mini plate fixation for condylar fracture^[14]. Hammer et al based on clinical observation stated a high failure rate with a single miniplate system. Two mini plates over antero-lateral and postero-lateral borders of the condyle neck seemed to have the beneficial effect of restoring the tension and compression trajectories^[15]. Double plating system exceeded every functional force applied to the condyle including immediate functional loading. Throckmorton described mechanical loading to the condylar process during biting in invitro study and stated that the highest level of tensile strain occurred on the anterior and lateral surfaces and the highest compression strain along the posterior surface. The double plating system provided beneficial effect of restoring tension and compression forces by 4 times compared to single plating system^[16].

The shortcoming of the conventional plating system led to the development of 3D miniplates. The new 3D plating system for the condyle fractures has 3 main advantages a) Neutralization of changing strains at the anterior, lateral and posterior borders, b) The additional stabilization is provided by the compression miniplates c) A small manageable osteosynthesis plate. Due to the following advantages the 3D plating system was used in the present study.

3D condylar plate is shaped for adaptation in the anatomically constricted region of condylar neck. Plate is adapted with one arm parallel to the condylar axis and second arm parallel to the mandibular notch. Hence, this plate meets the criteria of 2 single miniplates with reduced hard ware. This plating system also provides dynamic and functionally stable osteosynthesis, due to reduced hardware; these plates provide lesser infection rate, lesser loosening of hardware and reduced exposure as compared to two 4-hole straight miniplates^[17]. Lauer et al compared biomechanical stability of delta, trapezoidal, DCP and mini plates and found that rigid

internal fixation with double mini plates showed the best stability in all directions except in posterior and anterior directions and the 3D plates resisted the highest loads [18]. Undt et al conducted a study by using 1mm thick 3D plating system and reported complications of plate fracture and plate distortion to overcome this in the present study the thickness of the plate was doubled to 2mm with no recorded hardware failure. The locking plate is usually implanted with locking (angle-stable) osteosynthesis screws from the 2.0/2.3-mm threadlock TS system, this gives you a maximum lateral range of angulation of 40° ($\pm 20^\circ$ in every direction). The locking feature keeps the screw exactly in the chosen angulation relative to the osteosynthesis medium. This provides a self-supporting structure that prevents resorption caused by pressing the bone against the plate when tightening the screws [19].

In the present study 3D plates were used in 20 cases with a satisfactory reduction noted in all the cases in 6 months post operative period. One patient had a post recovery injury to the which lead to the deviation of the fractured condyle associated with joint pain. The mean post operative mouth opening achieved was 34.3mm. Satisfactory occlusion was achieved in 18 out of 20 cases; there was mild amount of occlusal derangement noted in two cases. Post operative Condylar movements were normal in all the patients. There was an osteolytic change in the condyle fragment in one of the case which was considered mainly due to the excessive muscle and periosteal stripping during the time of dissection. Present study showed satisfactory results with balancing all the objectives with minimal post operative complications.

The limitations of the 3D delta plating system is that it does not play any role is diacapitular fractures with a minimal role played in extracorporeal fixation as it causes more amount of osteolytic activity of the fractured condyle. The era had moved towards evolution of different plating systems, which includes Rhombic plating system, Lambda plating system, Synthes matrix mandible subcondyle plating system, all these plating systems had a common aim of neutralising the stress and strain forces in an 3D manner [20].

V. Conclusion:

Various methods of fixation were used for the management of the condylar fractures, and we have attempted in this study to review the potential benefits and complications recorded by the usage of 3D plating system. Although our series comprises of limited number of cases and a short follow up period, the results were more satisfactory, making us to conclude that the 3D plating system is effective in the management of the sub condylar fractures of the mandible.

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This is original work and was not a sponsored or financed in part or whole.

CONFLICT OF INTEREST: there are no conflicts of interest.

ETHICAL APPROVAL: the study was approved by the institutional ethical committee.

EC-IRB No - MDC-T-11388 02019

MAMATA DENTAL COLLEGE
GIRIPRASAD NAGAR, KHAMMAM
Ethical Review Committee & Institutional Review Board
Revision Report

The committee has looked into the proposed study topic of "Management of condyle fracture with 3D locking plate"

to be done by Dr. Kallu Anusha under the supervision of Dr. R. Sudhiv Department of OMFS

Mamata Dental College & Hospital, The committee is in complete perspective and is of the conscientious opinion that the study can be conducted with a mandatory WRITTEN INFORMED CONSENT from the subjects who have volunteered, for the study to avoid legal, moral or ethical encumbrances. It is pertinent to conduct the study under the strict supervision of the guide. Any complications arising shall be referred to the managed by the staff physician who is also a member of the expert panel. The inclusion and exclusion criteria method of selection of the patients, ramifications, expected complications review of literature have been critically analysed and consent given for proceeding with the study. The scientific study is of the current norms for research work in clinical studies.

6/1/20
Chairman Ethical Committee
Mamata Dental College
KHAMMAM-507 002

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FIGURES:

FIGURE I



Modified titanium locking plate with a thickness of 2mm, length of 22mm and thickness of 13mm. The length of screws used were of 6mm.

FIGURE II

A. PRE OP
FRONTAL VIEW



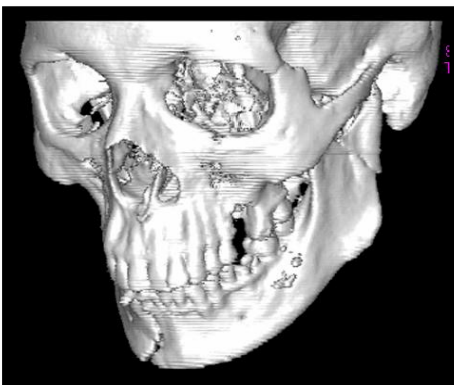
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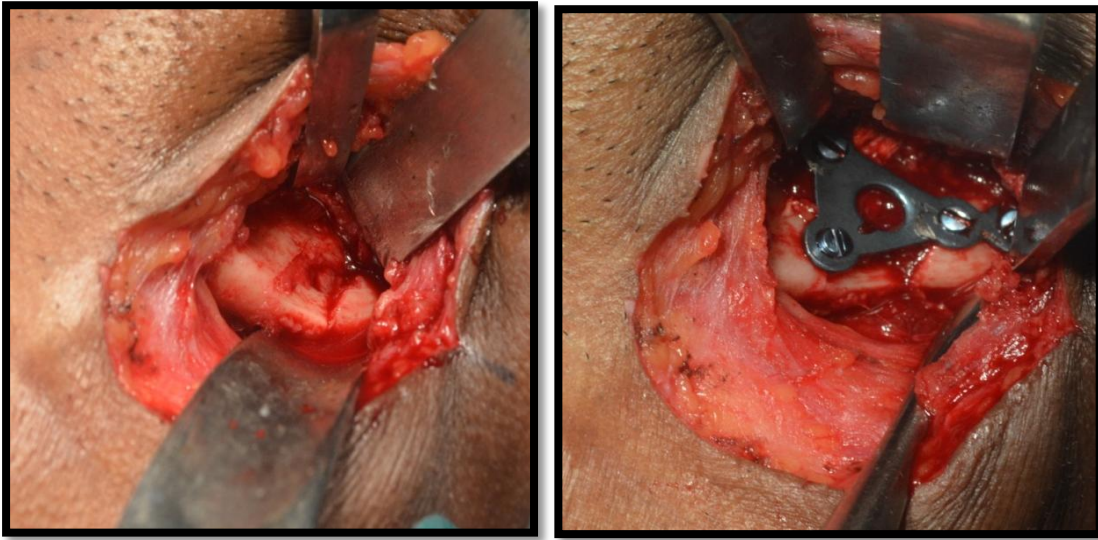
OPG



3D CTSCAN



B. INTRA OP



C. POST OP OPG



OPG



FIGURE III

A. PRE OP
FRONTAL VIEW



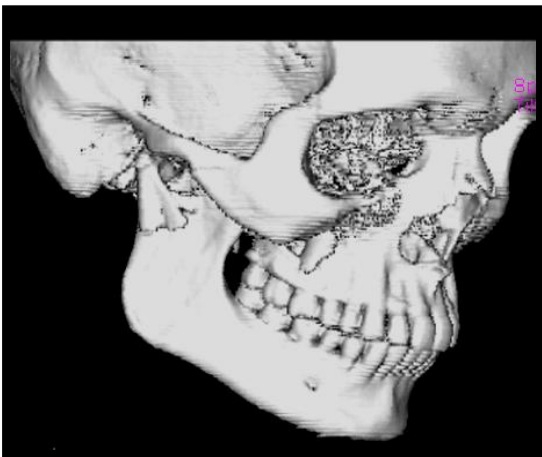
OCCLUSION



OPG



3D CT SCAN



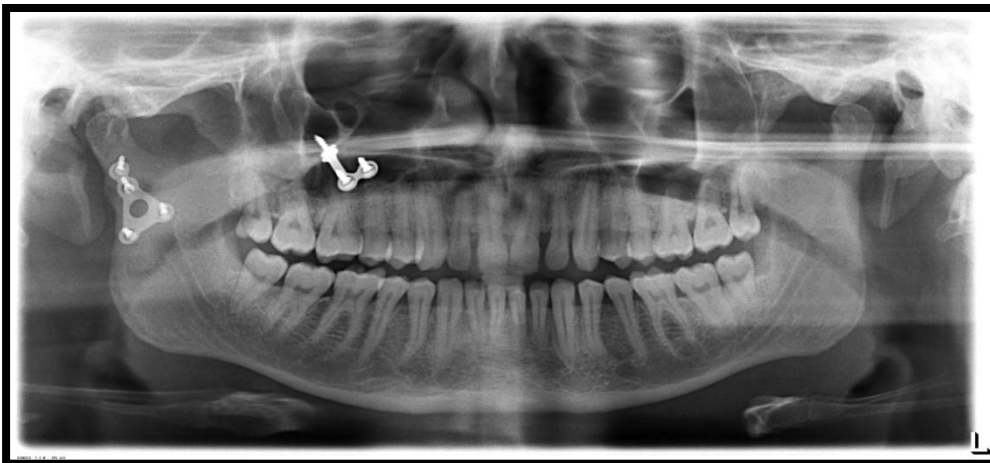
B. INTRA OP



C. POST OP



OPG



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