



Management of Fractures of Anterior Mandible – A Comparison of Various Methods of Fixation

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ABSTRACT

To evaluate the effectiveness & treatment outcome of various internal fixation was carried out by methods used for the management of anterior mandibular fractures. The present retrospective study included 40 patients of all the age groups, having fractures of an anterior mandible (symphysis & parasymphysis). All the patients were divided into 4 groups according to the different methods of fixation. In group-I fixation was carried out by two titanium miniplates, in group-II by 3-D plates, in group-III fixation was done by lag screw and in group-IV fixation was done by transosseous wiring. These fixation methods were compared by assessing discrepancy in the occlusion, presence of anesthesia or paresthesia, evidence of infection and loosening of screws or plates. All the patients underwent open reduction and internal fixation (ORIF) of fractured segments with under general anesthesia during the period from 2015 to 2021. It is seen that in group-I out of 12 patients, one patient was observed with occlusal discrepancy, two patients had infection and two patients were seen with paresthesia post-operatively. However, seven out of 12 did not have any complication post-operatively. In group-II out of 10 patients, one patient had infection and one patient reported with loosening of the screw postoperatively after three months, whereas eight patients were not observed with any complication. In group-III out of eight patients, two patient was developed paresthesia whereas other six patients did not have any complications. In group-IV out of 10 patients, four patient was observed with occlusal discrepancy and two patient had infection. The remaining four patient did not have any post-operative complications.

Keywords: Anterior mandibular fractures, Methods of fixation, 2 miniplates, 3D plates, lag screw, transosseous wiring

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INTRODUCTION

The diagnosis & treatment of maxillofacial injuries is important because of the involvement of a complex anatomical region. The mandible is the second most commonly fractured bone of the maxillofacial skeleton because of its prominent position and anatomic configuration [1]. The most common site of mandibular fractures in adult patient is symphysis and parasymphysis, followed by condyle, body and angle [2]. Anterior mandibular fractures (AMFs) are defined as mandibular fractures that involve a region bounded bilaterally by vertical lines just distal to the canine teeth (parasymphysis) or linear fractures that run in the midline of the mandible (symphysis) [3]. Aim of mandibular fracture treatment is the restoration of anatomical form and function, which particulate to establish the occlusion [2]. Many methods have been utilized for the treatment of anterior mandibular fractures with either closed reduction or open reduction and internal fixation (ORIF) using different forms of fixation such as Transosseous wiring, Miniplates, Lag screws, 3D plates, Reconstruction plate. However, there are ongoing controversies regarding the optimal internal fixation technique required for the anterior mandibular fractures. 2

Gordon (1943) introduced use of Transosseous wiring for maxillofacial injuries. It only serves the purpose of realignment of parts of the fractured bone segments. It also necessitates 3-6 weeks of intermaxillary fixation. Lag screw technique was first described by Brons and Boering in 1970 as a reliable, stable and safe method of internal fixation for anterior mandibular fractures. The major advantage of the lag screw is that it can be applied more rapidly without decreasing the rigidity, and it allows a more anatomically accurate reduction as displacement of bone fragments is high during placement of bone plate. 5. Recently modifications of Miniplates based on Champy's principle like 3D plating system have been developed to meet the requirements of semirigid fixation with lesser complications. Various research

have shown that the 3D plating system offers more favourable biomechanical behaviour than the conventional miniplates in terms of stability and strain resistance and lesser overall complication rate. This retrospective study of 30 patients of anterior mandibular fractures was aimed to compare four different treatment modalities like 2mm Titanium miniplate, 3D titanium miniplate, Lag screw and Transosseous wiring.

MATERIAL AND METHODS

The present retrospective study included 40 patients of all the age group, having fractures of anterior mandible (symphysis & parasymphysis). The study was divided in 4 groups according to the different methods of fixation. Patients were treated by four different modalities like 2-titanium miniplates, 3-D titanium miniplates, lag screw and transosseous wiring. These fixation methods were compared by assessing discrepancy in the occlusion, presence of anesthesia or paresthesia, evidence of infection and loosening of screws or plates.

INCLUSION AND EXCLUSION CRITERIA:

INCLUSION CRITERIA:

(1) Patients having fractures of anterior mandible (symphysis & parasymphysis). (2) Patients who were treated within a week after trauma were included in the study. (3) Patients with good general health without any systemic disease. (4) Displaced fractures & non comminuted fractures in which closed reduction was not sufficient enough to reduce the fracture.

EXCLUSION CRITERIA:

(1) Patients with associated mandibular fracture other than anterior mandibular fractures. (2) Patients who were treated after a week were excluded from the study. (3) Patients having uncontrolled systemic disease.

STUDY DESIGN

40 patients of anterior mandibular fractures (parasymphysis & symphysis) were selected on the basis of inclusion & exclusion criteria of study. The study was divided in 4 groups according to the different methods of fixation used in the treatment of the anterior mandibular fractures. All the patients underwent open reduction and internal fixation (ORIF) of fractured segments under general anesthesia. Follow up of patients was done at the interval of 1st post-op day, after two weeks, after one month and after three months.

SURGICAL PROCEDURE

The patients selected for study underwent treatment of anterior mandibular fractures under general anesthesia. Local infiltration using 2% lignocaine with 1: 200000 was given at the fractured site to achieve hemostasis. The fractured site was assessed intraorally through a vestibular or lip mucosal incision between the two mental foramina, and the subperiosteal dissection was done to expose the fracture line till the lower border of mandible. The fractured segments were reduced in proper anatomic position by using boneclamp. Fixation devices applied after reduction of fractured fragments in different cases include: 2 miniplates, 3D mini plates, Lag screws, Transosseous wiring. After the fixation devices were placed properly with a minimum of screws on each side, the IMF was released and the occlusion was carefully checked before closure. The patients were followed up postoperatively for a minimum of 3 months for clinical signs of disturbed occlusion, segmental mobility, paresthesia, infection. A postoperative OPG was obtained to confirm the proper placement of fixation devices.

RESULTS

Out of 40 patients, 15 patients had complications such as occlusal discrepancy, infection, paresthesia & loosening of screw.

Group I:

In group-I, out of 12 patients, one patient was observed with occlusal discrepancy, two patient were observed with infection and two were seen with paresthesia post-operatively, However, seven patients did not have any complication post-operatively. (42%)

Group II:

In group-II, out of 10 patients, one patient had Infection and one patient reported with loosening of the screw postoperatively after three months, whereas eight patients were not observed with any complication. (20%)

Group III:

In group-III, out of 8 patients, two patient was observed with paresthesia whereas other six patients were not observed with any complications. (25%)

Group IV:

In group-IV, out of 10 patients four patient was observed with occlusal discrepancy and two patient had infection, the remaining four patient did not have any post-operative complications. (60%)

DISCUSSION

Trauma to the maxillofacial region commonly results in injuries to the soft tissues, teeth and major skeleton component of the face including the mandible, maxilla, zygoma, nasoorbitoethmoid complex and supraorbital structures [16]. Mandibular fractures accounts for 40-60 % of all maxillofacial injuries and their treatment is one of the most frequent forms of therapy provided by maxillofacial surgeons [5]. The main goal of treatment of mandibular fractures is to restore pre injury form and function with the least disability & shortest recovery period for the patient with minimum risk [2].

A successful treatment influenced by various factors such as location and complexity of the fracture, availability of various plating system and its geometry. Management of the anterior mandibular fractures with suitable fixation method may be challenging due to the displacement of mandible in inferior and posterior direction by the pull of the diagastric, geniohyoid and genioglossus muscles in symphysis and parasymphysis region [1].

Many methods have been utilized for the treatment of anterior mandibular fractures with either closed reduction or open reduction and internal fixation (ORIF) with Transosseous wiring, Miniplates, Lag screws or 3D Plates. Transosseous wiring provides only apposition of fragments. It prevents distraction of fractured fragments but it has no control over superoinferior and buccolingual rotation of fractured fragments. Hence due to micro mobility at fracture site, there are very high chances of infection [15]. Lag screw not only immobilized the fracture fragments but also produces a constant compression of the fractured area [5]. The absence of anatomical hazards, thickness of the bone cortices and curvature of the anterior mandible are all factors contributing to the suitability and success of using lag screw in this region [22]. Champy and other authors claimed that fixation with mini plates along the ideal line of osteosynthesis is required for maximum stability. In the anterior mandibular region, it appeared more advantageous to use two miniplates, because of presence of sharp curvature of the bone and the muscle attachment with different vectors of action. Use of miniplates have increased in maxillofacial surgery due to its easy adaptability, and placement along with use of intraoral approach [12].

The present retrospective study included 40 patients with anterior mandibular fractures treated by four different modalities like 2-titanium miniplates, 3-D titanium miniplates, lag screw and transosseous wiring. These fixation methods were compared by assessing discrepancy in the occlusion, presence of anesthesia or paresthesia, evidence of infection and loosening of screws or plates. The study was divided in 4 groups according to the different methods of fixation used in the treatment of the anterior mandibular fractures. Group-I includes patients who were treated with 2-miniplate fixation. Group-II includes patients who were treated with 3-D titanium miniplates. Group-III includes patients treated with lag screw and group-IV includes patients who were treated with Transosseous wiring.

In this study, 33 patients were male whereas seven patients were female. (Table No.1) The fracture distribution in the present study showed that the unilateral fractures (38 fractures) were more common as compared to the bilateral (2 fractures) anterior mandibular fractures. (Table No.2)

It is seen that in group-I out of 12 patients, one patient was observed with occlusal discrepancy, two patient had infection and two patients were seen with paresthesia post-operatively. However seven out of 12 did not have any complication post-operatively. In group II out of 10 patients, one patient had Infection and one patient reported with loosening of the screw postoperatively after three months, whereas eight patients were not observed with any complication. In group III out of 8 patients, two patient was developed paresthesia whereas other six patients did not have any complications. In group IV out of 10 patients, four patient was observed with occlusal discrepancy and two patient had infection. The remaining four patient did not have any post-operative complications (Table No.7)

In this study, the Pearsons chi-square test (Table No.8) was done. According to chi-square test, the p-value (0.004) obtained is lesser than our chosen significance level (0.05). There was significant difference between group-1 & group-2. In group 2 there was relatively less overall complication rate as compared to other groups. The overall less complication rate compared to other fixation methods suggests that the 3D plate is more suitable for management of the anterior mandibular fractures. This study correlates with the study of Moiniftikarshapoo [21], Gokkulakrishnans [3].

3-D plate gives more stability as compared with other fixation systems like 2 miniplates, transosseous wiring and lag screw. The design of the plate does not allow movement at the upper and lower borders of the mandible with minimal torsional and bending forces, compared to champy's miniplate applied at the upper border area which can cause movement along the axis of the plate.

Table 1 Age/Sex Distribution

	BELOW 20 YEARS	20-29 YEARS	30-39 YEARS	40-49 YEARS	50-59 YEARS	60 YEARS	TOTAL
MALE	4	9	8	6	3	3	33
FEMALE	1	0	1	2	2	1	7
TOTAL	5	9	9	8	5	4	40

Table 2 Unilateral/Bilateral Distribution

UNILATERAL	BILATERAL
38	2

Table 3 Symphysis/Para symphysis Distribution

SYMPHYSIS	PARASYMPHYSIS
7	33

Table 4 Different methods of fixation, type of Fracture and number of operated patients

FRACTURE TYPE	Group-I (2-MINIPLATE)	Group-II (3-D PLATE)	Group-III (LAG SCREW)	Group-IV (TRANSOSSEOUS WIRING)	TOTAL
ANTERIOR MANDIBULAR FRACTURES (SYMPHYSIS & PARASYMPHYSIS)	12	10	8	10	
TOTAL					40

Table 5 Post-Operative Complication

		Complications				Total	
		Occlusal Discrepancy	Infection	Paresthesia	Loosening of screw		No Complications
	Group I	1	2	2	0	7	12
	Group II	0	1	0	1	8	10
	Group III	0	0	2	0	6	8
	Group IV	4	2	0	0	4	10
	Total	5	5	4	1	25	40

Table 6 Statistical Analysis

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.358 ^a	12	.004
Likelihood Ratio	12.562	12	.202
Linear-by-Linear Association	.148	1	.400
N of Valid Cases	30		

CONCLUSION

The author concluded in this study that 3-D titanium miniplate system is an effective treatment option for fixation of anterior mandibular fracture compared to Champy's miniplates, lag screw and transosseous wiring. 3D plate gives more stability as compared to other fixation systems like 2 miniplates, transosseous wiring and lag screw. The overall less complication rates compared to other fixation

methods suggested that the 3D plate is more suitable for management of the anterior mandibular fractures.

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