Management of Subcondylar Fracture through Intraoral Approach with Rigid Internal Fixation

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Abstract

Background In Oral and Maxillofacial Surgery, the majority of the condylar fractures are treated by closed reduction with generally satisfactory long term results. But in such cases of closed reduction, patient will be uncomfortable owing to long term application of inter maxillary fixation (IMF). Where as, Disadvantages of extra oral open reduction and fixation of condylar fracture includes facial nerve damage, facial scars etc. which are surely eliminated by the intraoral reduction and rigid fixation.

Aims and Objectives The present study was conducted to determine the efficacy of reduction and fixation of low subcondylar fractures through intra-oral approach.

Methodology In this study, ten patients with low subcondylar fracture, reported to department of Oral and Maxillofacial Surgery, P.M.N.M. Dental College and Hospital Bagalkot were included. These patients were treated by open reduction and internal fixation through intra-oral approach. All the patients were evaluated postoperatively for mouth opening, occlusion and mandibular deviation with regular radiographic examination for 6 weeks.

Results All operated patients followed for 6 weeks, maximum mouth opening was more than 40 mm in seven patients (range from 40 to 50 mm) and less than 40 mm in three patients. Occlusion was satisfactory in all and none of

the patients showed deviation of mandible on mouth opening. Statistical analysis showed that postoperative mouth opening was significant (t value = 7.88, P = (0.000) < 0.05) and the test result was significant (S) at 5% level of significance. Statistical analysis of deviation of mouth opening was nonsignificant [t value = 1.96, P value (0.081), 0.05]. For occlusion standard photographs were obtained at sixth week and found minor occlusal corrections in two patients are treated by elastic traction for few days.

Discussion and Conclusion Open reduction with internal fixation through intraoral approach has proved to be safe for early function and also effective by avoiding the patient discomfort due to long term intermaxillary fixation, psychological effect, facial nerve damage, facial scar and weight loss.

Keywords Condylar fracture · Osteosynthesis · Mandibular crest · Intra-oral approach

Introduction

One of the relatively difficult fractures to reduce in mandible is fracture of condyle and there are various treatment modalities for the same but no consistent treatment of condylar fracture has gained universal acceptance. Treatment of condylar fractures remains one of the most controversial issues in maxillofacial trauma with regard to classification, diagnosis, and treatment.

There is still controversy about fractures of the condylar process in adults: should they be treated by open or closed reduction? Inadequate restoration of vertical height, which is often seen after conservative treatment like long-term intermaxillary fixation, may cause malocclusion or loading

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of the contralateral condyle, with resultant occlusal and adaptive changes. Open reduction and internal fixation allow good anatomical repositioning and immediate functional movement [1].

The first reports in literature of open reduction of condylar neck fractures through use of an intraoral approach were by Silverman in 1925 and Aison in 1926. In 1964, following Obwegeser's principles of avoiding visible scars and using his approach to the mandibular ramus, Steinhauser described transoral open reduction and wire osteosynthesis of low condylar neck fractures. Pape et al. and Horch et al. were the first to report greater series of intraoral reduction and miniplate osteosynthesis [1].

The option for open reduction treatment of fractures of the mandibular condyle has become more accessible since osteosynthesis materials are developed in the past few decades. Rigid internal fixation allows good anatomic reduction and the possibility of immediate function of the lower jaw, without the use of long lasting and uncomfortable intermaxillary fixation. The use of angle drills, screwdrivers, and special illuminated hooks can facilitate the procedure, eliminating the need for an extraoral incision and the use of a trocar to place the screws [2].

Krenkel and Eckelt have described their design of solitary lag screws for fixation of the condylar fractures. They claim that by applying axial compression across the fracture line, rigid fixation leading to good bone healing and immediate postoperative function can be achieved [3]. Risk of facial nerve damage and visible scars can be reduced by such minimally invasive techniques [4].

Aim of the present clinical study is to determine the efficacy and restore of early function along with avoidance of long term intermaxillary fixation, facial scar, and the facial nerve damage. Also to evaluate the viability of an intraoral approach after reduction and fixation of laterally displaced low subcondylar fractures of ten patients from September 2006 to September 2008.

Methodology

Ten patients reporting to the unit of oral and maxillofacial surgery, P.M.N.M. Dental College and Hospital Bagalkot with low subcondylar fractures of mandible were included in the study.

Among ten patients, six patients had sub condylar fracture on left and four on right side. Nine patients were associated with parasymphysis and one with body of the mandible. Preoperatively, the duration of fractures of patients was recorded with the average of 7.2 days. Level

and type of fracture in each patient was classified as a low subcondylar fractures by using Krenkel and Lindahl systems respectively. A detailed history with clinical examination, OPG, CT scan coronal section (if necessary) was advised and the findings were recorded. Preoperative mouth opening (interincisal mouth opening) was recorded with the range of 9 and 27 mm (Mean of 17.3 mm, Standard deviation of 6.14) and also the deranged occlusion was noticed in all most all the patients. Patients are advised for the consent under general anesthesia and planned for the open reduction and rigid internal fixation through intraoral approach by using either lag screw or miniplate osteosyntheses.

Classifications

[Classification of fractures according to Krenkel]

1. High
2. Medium
3. Low [1].

[Classification of fracture according to Lindahl]

1. Anatomic site: Head, neck, subcondylar.
2. Relationship of condylar fragment to mandible:
 - a. Undisplaced.
 - b. Deviated.
 - c. Displaced with medial overlap of condylar fragment.
 - d. Displaced with lateral overlap of condylar fragment.
 - e. Anteroposterior over lap of condylar fragment.
3. Relationship of condylar head to fossa:
 - a. No displaced.
 - b. Displaced.

Aims and Objectives to evaluate,

- (1) Clinically
 1. Occlusion
 2. Mouth opening (interincisal distance)
 3. Deviation
 4. Duration of fracture
- (2) Radiographically
 1. Location and type of fracture (Table 1)

Inclusion criteria for the study;

- (1) Patients with laterally displaced low subcondylar neck fractures [5].
- (2) With or without associated other maxillofacial fractures [6].

Table 1 Preoperative analysis

Number of cases	Duration of fracture (in days)	Type of fracture	Degree of displacement
1	6	Subcondylar fracture	Laterally displaced
2	4	Subcondylar fracture	Laterally displaced
3	10	Subcondylar fracture	Laterally displaced
4	6	Subcondylar fracture	Laterally displaced
5	7	Subcondylar fracture	Laterally displaced
6	8	Subcondylar fracture	Laterally displaced
7	9	Subcondylar fracture	Laterally displaced
8	9	Subcondylar fracture	Laterally displaced
9	7	Subcondylar fracture	Laterally displaced
10	6	Subcondylar fracture	Laterally displaced

- (3) Patients with history of head injury, epileptic and panfacial fractures.
- (4) Patients with Hyperkeratosis and keloid formation.
- (5) Patients who are conscious about extraoral incision scar.

Exclusion criteria for the study;

- (1) Oral submucous fibrosis.
- (2) Medially displaced high condylar neck fractures [5].
- (3) Medically compromised patients for general anesthesia.

Surgical Procedure

Preoperative orthopantomograph (OPG) was advised for the individual patient (Figs. 1, 2) to locate the fractures. The other fractures which are associated with subcondylar fracture are reduced and fixed first and then followed by subcondylar fracture. 2% lignocaine hydrochloride with 1:80,000 adrenaline injected in the lower buccal and labial vestibular regions. Crevicular incision was made at 2nd and 3rd molar region, running posteriorly over the external oblique ridge and further extension along the anterior border of ramus (basically the same as the technique for

Fig. 1 Preoperative OPG of right subcondylar with left parasymphysis fracture

Fig. 2 Preoperative OPG of left subcondylar with left parasymphysis fracture

sagittal splitting osteotomy for mandibular prognathism) [6, 7]. A mucoperiosteal flap was reflected to expose the anterior and lateral part of the ramus to visualize the fracture fragments by using Ryon's ramus retractor. The condyle retractor along with fiber optic light was used to visualize and stabilize the fracture fragments. After reduction of fracture fragments an occlusion was maintained with elastic traction and followed by fixation of fragments by using the accurate lag screw (Figs. 3, 4). Later elastic traction was released to check for the maximum intercuspatation, and the free mouth opening without any disturbance which confirms the anatomical reduction and fixation of fragments. Surgical wound was closed by using vicryl 3-0 suture material and followed by irrigation by povidone-iodine (5%) solution. Post operatively, the guiding elastics are advised in case of need otherwise an effective physiotherapy was advised. The patient was followed for 6 weeks to evaluate interincisal mouth opening, occlusion and the deviation of mandible.

Results

Out of ten patients, lag screw has been placed optimally in eight patients [3] and miniplate osteosynthesis in two patients. Postoperatively, the occlusion was normal in all

Fig. 3 Right subcondylar fracture reduction and lag screw osteosyntheses

Fig. 4 Left subcondylar fracture reduction and lag screw osteosyntheses

the patients except in two patients a minor correction was needed, one with an anterior open bite and another with a posterior cross bite which was corrected by the guiding elastics. Active mobilization with an early function was seen in all the patients. Post operative radiographs advised and revealed a good repositioning of the condyle (Figs. 5, 6). No intraoperative and postoperative complications such as bleeding, discomfort, wound infection and loosening of

Fig. 5 Postoperative OPG of right subcondylar lag screw osteosyntheses

Fig. 6 Postoperative OPG of left subcondylar lag screw osteosyntheses

lag screw or miniplate were observed in any of the patients in this series.

The sixth week of post operative day as recorded, maximum mouth opening was more than 40 mm in seven patients (range of 40–50 mm) and less than 40 mm in three patients. Occlusion was satisfactory in all and none of the patients are showed deviation of mandible on mouth opening. Proper anatomical position of fracture fragments was performed with early restoration of function by open reduction with rigid internal fixation through intraoral approach (Table 2).

Excellent mouth opening (more than 40 mm) was observed in seven patients. In three patients comparatively less than 40 mm was observed. Statistical analysis showed that postoperative mouth opening treatment was significant [t value = 7.88, P value (0.000) < 0.05] (Table 3).

t value = 7.88 and since P value (0.000) < 0.05, the test result is significant (S) at 5% level of significance and we reject the null hypothesis i.e. preoperative and postoperative mouth opening treatment are significant.

Standard photographs of the patient's occlusion were obtained at 6 weeks and found minor occlusal corrections in two cases [8].

Deviation was present in three patients preoperatively (Mean 0.30). None of the patient had deviation or pain during maximum mouth opening, chewing and on lateral movements postoperatively (Mean 0.00). Statistical analysis showed that deviation of mandible on mouth opening

Table 2 Postoperative depicting results

Number of cases	Interincisal distance or mouth opening (in mm)		Occlusion (deranged/normal)		Deviation of mandible on mouth opening	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
1.	18	40	Deranged	Normal	Absent	Absent
2.	10	50	Deranged	Normal	Absent	Absent
3.	14	41	Deranged	Normal	Absent	Absent
4.	27	48	Deranged	Normal	Present	Absent
5.	9	17	Deranged	Normal	Present	Absent
6.	13	28	Deranged	Normal	Absent	Absent
7.	18	38	Deranged	Normal	Present	Absent
8.	16	40	Deranged	Normal	Absent	Absent
9.	23	42	Deranged	Normal	Absent	Absent
10.	25	40.5	Deranged	Normal	Absent	Absent

'*t*' test and two-tailed ('*P*' value)

Table 3 Statistical analysis of mouth opening

Mouth opening	Mean	Standard deviation
Preoperative	17.3	6.14
Postoperative	38.45	9.55
Average	21.15	8.47

Table 4 Statistical analysis of deviation of mandible

Deviation of mandible on mouth opening	Mean	Standard deviation
Preoperative	0.30	0.48
Postoperative	0.00	0.00
Average	0.30	0.48

treatment was nonsignificant [*t* value = 1.96, *P* value (0.081) < 0.05] (Table 4).

'*t*' value = 1.96 and since *P* value (0.081) < 0.05, the test result is not significant (NS) at 5% level of significance and we accept the null hypothesis i.e. preoperative and postoperative deviation of mandible on mouth opening treatment are non-significant.

Biostatistical Graph Analysis

See Figs. 7, 8, 9.

Discussion

Closed reduction is the technique of most frequently employed to treat condylar fractures in spite of all adversity of intermaxillary fixation. But vertical height is often inadequate after closed treatment, possibly leading to malocclusion or loading of the contralateral condyle;

Fig 7 Mouth opening **Fig 8** Occlusion

proper anatomical reduction is rarely achieved by this technique. Rigid internal fixation allows good anatomic reduction of the lower jaw, without the use of long lasting intermaxillary fixation [2]. Weight loss has been noted as one of the major side effects when intermaxillary fixation is used to treat patients with mandibular fractures [9].

First reports in the literature of open reduction of condylar neck fractures through intraoral approach by

Fig 9 Deviation of mandible on mouth opening

Silverman in 1925 and Aison in 1926. Pape et al. and Horch et al. are the first to report greater series of intraoral reduction and miniplate osteosynthesis for higher condylar neck fractures. A technique of intraoral open reduction and lag screw osteosynthesis of condylar fractures was described in 1989 by Kitayama [1].

A study of 25 consecutive patients with a total of 30 condylar process fractures were treated through an exclusively intraoral surgical access, as described by Trauner and Obwegeser (1957). All patients were approached intraorally following similar procedure for sagittal split osteotomy. Reduction and fixation was done by using noncompression, 4-hole miniplates with extensions were placed and fixed with monocortical mini screws (mini 5 and 7 mm). Of 30 fractures, 17 were fixed with one plate and 13 with two osteosynthesis plates. No patient presented immediate postoperative complications. In cases of early malocclusion, patients received intermaxillary fixation with guiding elastic traction for a mean 3 days. In all patients, postoperative intermaxillary fixation with guiding elastic traction was used to stabilize the occlusion. Mean mouth opening showed 48 mm (Standard deviation, 9) and also reduction achieved by this technique allows reconstruction of anatomic ramus height in combination with excellent functional results (Statistically analyzed by Student 't' test, significant difference was found between preoperatively and postoperatively 'P' value <0.05). They concluded that risk of facial nerve injury can be minimized with exclusive use of intraoral access [2].

In our study, the incision was basically similar to that of the approach for a sagittal ramus osteotomy [10]. Accessibility and visibility was achieved by using fiber optic light source followed by anatomical repositioning of subcondylar fracture fragments by using lag screw fixation according to Kitayama (1989) anatomical landmarks. Lag screw osteosyntheses was performed in eight patients. In one patient angulated miniplate (4 holes without gap) and in another patient straight miniplate (3 holes without gap) was placed.

Schon et al. (2002) used 4 holed angulated miniplate and screw drivers facilitated the transoral treatment of condylar fractures in 4 patients. In two patients, guiding elastic traction was applied for 5 days. After 6 months, mouth opening in those patients were more than 40 mm without significant deviation [4].

In our study, lag screws of 2 mm diameter with a range of 18–31 mm of length were used in eight patients. And in one patient angulated (1.5 mm miniplate with 1.5 mm × 8 mm screws, 4 holes without gap) and in other patient straight miniplate (2.0 mm miniplate with 2 mm × 8 mm screws, 3 holes without gap) were used. Postoperative intermaxillary fixation was maintained and guiding elastics are placed on the third day of surgery in case of need for the minor occlusal corrections in the range of 0–14 days. Soft liquid diet was maintained for 7 days after surgery [4]. Physiotherapy was started immediately after removing guiding elastics.

Conclusion

Complete avoidance of long term application of intermaxillary fixation was observed in these patients than those treated conservatively. Facial scar, facial nerve injuries which are the most common complications are seen in those patients treated by extraoral approach, but in other way which are minimized by intraoral approach. Reduced mouth opening, incidence of mandibular deviation on mouth opening towards fractured site, weight loss and discomfort are due to long term intermaxillary fixation was noted in those patients treated by conservatively. But where as rigid fixation and early function with excellent mouth opening and maximum intercuspation was observed in those cases which are treated by open reduction through intraoral approach. This clinical study is feasible for an early function without long term intermaxillary fixation, and secondarily it is an effective approach and technique to avoid extraoral incision scar and facial nerve damage.

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