

Extracorporeal Fixation of Displaced Mandibular Condylar Fracture: A Report of 15 Cases with Review of Literature

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ABSTRACT

Background: The prevalence of a mandibular condyle fracture is relatively high compared with other types of mandibular fractures. Here we discuss the extracorporeal fixation of displaced mandibular condylar fractures, done in a series of 15 cases. We discuss the technique for this type of fixation as well as the criteria for the evaluation of the surgical outcome. We also review the literature on the possible advantages and disadvantages of this particular technique.

Keywords: Extracorporeal fixation, ORIF, Condylar fracture, Maxillomandibular fixation, Avascular necrosis.

INTRODUCTION

Even though the incidence of condylar fracture is as high as nearly 30%, the management has always been controversial¹. In line with the basic principles of trauma surgery regarding open reduction and internal fixation of displaced fractures, open surgical management has been recognized to be best for fractures of the body of the mandible and of the midface for more than three decades.² Basically there are three modalities of treatment, observation, closed reduction and open reduction with internal fixation (ORIF). Following the displacement of condylar fragment, the ramus of mandible is telescoped into the glenoid fossa. Hence even in case of open reduction most of the times it is difficult to locate and manipulate the displaced fragment. The second problem is to hold it in reduced position and fixation due to its proximity to important anatomical structures. For moderately displaced condylar fractures, closed reduction with rigid or elastic maxillomandibular fixation is still frequently selected. The reasons for this may be the difficult surgical access to the condylar area and the

frequently difficult repositioning of the proximal fragment.³

The delicate bony structures involved and the risk of damage to the surrounding tissues are challenging, regardless of the method of internal fixation used. Consequently, several publications have emphasized the acceptable functional results of conservative treatment in contrast to the risks of surgery.⁴ There are also chances of trauma to the temporomandibular joint which are far reaching in their effects and not always immediately apparent. Disturbance of occlusal function, deviation of the mandible, internal derangements of the TMJ, and ankylosis of the joint with resultant inability to move the jaw are all sequelae of this injury.⁵ With the introduction of the plate and screw system, that allow stabilization of these injuries, open treatment of condylar process fractures are becoming popular.⁶ Because extracorporeal reduction techniques for mandibular condyle fractures have not been widely practiced, comparisons between an extracorporeal approach and a closed treatment are extremely rare. A search of the PubMed database

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Fig 1: Showing preoperative occlusion.



Fig 2: CT Scan image showing fracture.



Fig 3: Showing condylar fragment.

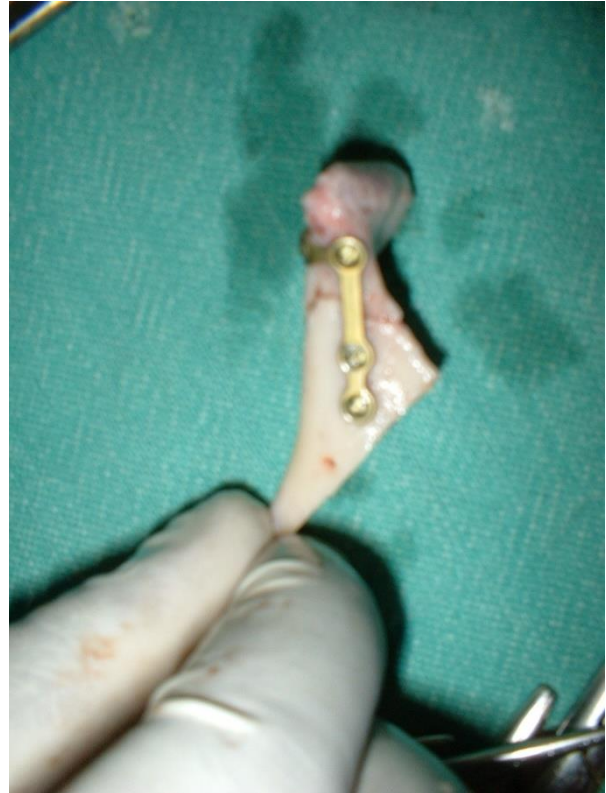


Fig 4: Fractured fragments were held manually in a reduced position and stabilized with wires or plates and screws.



Fig 5: Showing distal segments.



Fig 6: Distal segments fixed with screw.



Fig 7: The assembled fragments were replaced.



Fig 8: CT scan images after fixation.



Fig 9: Post operative after six month.

using a combination of the search terms “condyle fracture” and “extracorporeal” revealed very few articles that specifically addressed this issue and described the technique.

In our institution we have treated 15 cases of displaced mandibular condylar fracture by extracorporeal fixation. In these cases the condylar fragment was removed and fixed with bone plate, screws and repositioned in the glenoid fossa and fixed with the ramal fragment with two screws. In three cases sub sigmoid osteotomy was carried out to retrieve the condylar fragment. The follow up period was 4 to 10 years. From our series of cases we observed that extracorporeal fixation carries low morbidity with satisfactory occlusal stability and functional benefit.

AIMS AND OBJECTIVES

To present fifteen cases of displaced mandibular condylar fracture surgically managed by extracorporeal fixation. To evaluate the post operative results in terms of occlusal stability, TMJ function and radiological findings

CASE REPORT

A series of fifteen cases that reported to Dept. Of Oral And Maxillofacial Surgery, Kanur Dental College, Kerala, India with displaced mandibular condylar fracture was selected for the study. Out of this ten cases were following road traffic accident and five cases were referred to our hospital following failure of closed reduction. All the cases had multiple mandibular fractures. Two cases had bilateral displaced condylar fracture. The patients had persistent open bite and mouth opening was restricted to 8 -11mm. At check-in, the patients were asked about their medical history.

The fracture site, fracture type, and the presence of a dislocation/displacement were evaluated by panoramic and Townes radiographs preoperatively. The fracture level was classified as either condylar head or condylar neck according to Lindahl's classification, and the type of fracture was classified as a simple or complex/compound fracture by Kruger's general classification. If the patient had both a condylar head fracture and a condylar neck fracture on the same side, he or she was classified as having a condylar head fracture. The preoperative occlusion and CT of one of our patient is shown in the figures (Fig 1 & 2)

We followed the following procedure for extracorporeal fixation. The mandibular ramus was exposed using a submandibular approach. A wire was passed through the angle of mandible and ramus was pulled inferiorly. In all 15 cases the condylar fragment was visualized but could not be mobilized. After dissection of the flap, a vertical subsigmoid osteotomy was carried out. The lateral pterygoid muscle was detached and condylar fragment freed. (Fig 3). It was held with a curved Kocher's forceps. Before the completion of the osteotomy procedure, a 4-hole bone titanium or resorbable plate was placed for future positioning of the explanted segment. The fractured fragments were held manually in a reduced position and stabilized with wires or plates and screws (Fig 4). The assembled fragments were replaced in situ and fixed to the distal segment in a predetermined position (Fig 5,6,&7). The surgical wound was closed in multiple layers. Postoperative care was similar in both the intraoral and extraoral approaches. Antibiotics and nonsteroidal anti-inflammatory drugs were prescribed for 7 days. The patients who had a smoking habit were strongly advised to stop smoking as the wound healed. In all cases, maxillomandibular fixation (MMF) was maintained for 1 week. This was followed by active jaw exercises.

RESULT

The follow up period was from 4-10 years. One case which was followed for 10 years showed complete resorption of the condyle was noticed though the occlusion and jaw movements were satisfactory. We included 3 broad criteria for post-operative evaluation following extracorporeal

fixation, occlusal stability, TMJ functions and six monthly radiographic evaluations. Two cases had minor occlusal discrepancy which was corrected by light occlusal traction for one week. All the 15 cases had satisfactory occlusion. Our cases were subjected to physiotherapy one week post operatively. A panoramic radiograph was traced for the evaluation of condylar resorption. Sensory nerve disorder was checked by a subjective evaluation. Occlusion and disc displacement were checked. In all the cases the occlusion was stable and jaw movements satisfactory. The post-operative occlusion and radiograph of one patient is shown.(Fig 8 & 9) After six months the mouth opening was between 35 mm to 43 mm and the mandibular movements like protrusion, retrusion and lateral excursion were satisfactory.

DISCUSSION

Fractures of the condylar process can cause facial asymmetry, and that the earlier in life a condylar process fracture occurs, the greater the resultant skeletal changes.⁷ The proposed reason for the development of asymmetries is an interference with growth, resulting either from injury to the condylar cartilage or from altered function. Destruction of the condyle in the adult is said to result in more subtle asymmetries because growth has ceased and the mandible has assumed its normal size and form. Recent studies provide increasing evidence that surgically treated condylar fractures have better results in terms of occlusion, masticatory function, mouth opening and bone morphology.^{8,9} Several surgical routes can access the condyle, each with advantages and disadvantages. Intra oral access greatly reduces the risks of facial nerve damage and scars, is technically difficult, requiring special training and dedicated instruments. Conversely, extra oral access allows straightforward fracture reduction and healing, but risks facial nerve injury and results in visible facial scars.^{10,11,12} Recently, the use of an endoscope has been introduced for the reduction of condylar fractures.¹³ The criteria for evaluation of surgical outcome are described by Walkar and Hyde.¹ The treatment objectives for mandibular condyle fractures are a pain-free mouth opening greater than 40 mm, free mandibular movement in any direction, restoration to the level of the original condition before injury, and no facial asymmetry

after reduction to the point that existed before reduction.^{14,15} To achieve these treatment goals, many techniques have been developed and introduced. However, there have been no clear and distinct standards to apply in specific cases. Extracorporeal reduction was introduced by Nam.¹⁶ This process can be described as follows: oblique osteotomy followed by extracorporeal reduction, and replantation. Chung and Nam modified the extra oral approach to the intraoral approach by the sagittal split osteotomy.¹⁷ The extracorporeal reduction technique has advantages that include easier reduction and anatomic restoration.¹⁶ Boyne reported slight resorption leading to flattening of condyle in a follow up period of two years after extra corporeal fixation. Since the condyle is used as a free graft the possibilities of resorption and avascular necrosis are always there. One of our cases with 10 years follow up had complete resorption of the condylar head but occlusion was stable. Though a difficult option but it is viable rather than not addressing the displaced condylar fragment. But the extracorporeal approach for a displaced condylar fracture has shown no aseptic necrosis and excellent temporomandibular joint function.¹⁵ Daniels et al reported that mandibular condylar grafts with the autogenous sternal head of the clavicle in juvenile *Macaca mulatta* allowed good mandibular function throughout the follow-up period and a histologically normal articular layer.¹⁸ Choung and Nam reported that there had been no significant complications after the extracorporeal reduction of 21 condylar process fractures.¹⁷ The indications for open reduction are extra capsular displacement of condyle, displacement into cranial fossa, presence of foreign body and failure of closed reduction.²

Excessive resorption might be expected according to Boyne et al.¹⁹ The mean severe resorption rate after the extracorporeal reduction of the mandibular condyle has been reported to be 27% to 89%.^{20,21} One possible cause of the condyle resorption in these cases is the loss of the periosteal blood supply in the explanted segments. The attachment of the lateral pterygoid muscle is important for the prevention of condyle resorption. However, compromising of the vascularity cannot explain wide variation of the resorption rate in the published studies.²² For the treatment of an excessively resorbed condyle, condylectomy and

reconstruction with a costochondral graft can be considered.²³

Although the closed treatment is generally recommended for children, many post treatment complications have been reported after a closed treatment in young patients.²⁴ Excessive condylar resorption or improper reduction often causes malocclusion.

CONCLUSION

Extracorporeal fixation is a suitable and effective method for management of displaced and dislocated condylar fracture. For reduction of a condylar head or neck fracture, many types of treatment options can be considered. The optimal treatment should be tailored to the patient's condition. Hence we feel the option for extracorporeal fixation should be taken only when the other options fail.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Hyde N, Manisali M & Aghabeigi et al. The role of open reduction and internal fixation in unilateral fractures of the mandibular condyle: a prospective study. British Journal of Oral & Maxillofacial Surgery (2002)40, 19-22.
2. Zide MF, Kent JN. Indications for open reduction of mandibular condyle fractures. J Oral Maxillofac Surg 1983; 41: 89-98.
3. Silvennoinen U, Iizuka T, Oikarinen K, et al: Analysis of possible factors leading to problems after nonsurgical treatment of condylar fractures. J Oral Maxillofac Surg 52:793, 1994.
4. Walker RV. Condylar fractures: non-surgical management. J Oral Maxillofac Surg 1994; 52: 1185-1188.
5. Raveh J, Vulllemin T, L&lrach K: Open reduction of the dislocated, fractured condylar process: Indications and surgical procedures. J Oral Maxillofac Surg 47:120, 1989

6. Konstantinovic VS, Dimitrijevic B: Surgical versus conservative treatment of unilateral condylar process fractures: Clinical and radiographic evaluation of 80 patients. *J Oral Maxillofac Surg* 50:349, 1992
7. Gilhuus-Moe O: Fractures of Mandibular Condyle in the Growth Period. Oslo, Norway, Universitetsforlaget, 1969: 118-11
8. Throckmorton GS, Ellis III E, Hayasaki H: Masticatory motion after surgical or nonsurgical treatment for unilateral fractures of the mandibular condylar process. *J Oral Maxillofac Surg* 62:127, 2004
9. Ellis III E, McFadden D, Simon P, Throckmorton G: Surgical complications with open treatment of mandibular condylar process fractures. *J Oral Maxillofac Surg* 58: 950, 2000a
10. Jacobovicz J, Lee C, Trabulsky PP: Endoscopic repair of mandibular subcondylar fractures. *Plast Reconstr Surg* 101: 437, 1998
11. Loukota RA: Endoscopically assisted reduction and fixation of condylar neck/base fractures e the learning curve. *Br J Oral Maxillofac Surg* 44: 480, 2006
12. Schneider M, Lauer G, Eckelt U: Surgical treatment of the mandibular condyle: a comparison of long-term results following different approaches e functional, axiographical, and radiological findings. *J Craniomaxillofac Surg* 35: 151, 2007
13. Haug RH, Brandt MT: Traditional versus endoscope-assisted open reduction with rigid internal fixation (ORIF) of adult mandibular condyle fractures: A review of the literature regarding current thoughts on management. *J Oral Maxillofac Surg* 62:1272, 2004
14. Hlawitschka M, Loukota R, Eckelt U: Functional and radiological results of open and closed treatment of intracapsular (diacapitular) condylar fractures of the mandible. *Int J Oral Maxillofac Surg* 34:597, 2005
15. Zachariades N, Mezitis M, Mourouzis C, et al: Fractures of the mandibular condyle: A review of 466 cases. Literature review, reflections on treatment and proposals. *J Craniomaxillofac Surg* 34:421, 2006
16. Nam IW: The condylar head and upper condylar neck fractures treated by Dr Nam's method. *J Korean Acad Oral Maxillofac Surg* 6:25, 1980
17. Choung PH, Nam IW: An intraoral approach to treatment of condylar hyperplasia or high condylar process fractures using the intraoral vertico-sagittal ramus osteotomy. *J Oral Maxillofac Surg* 56:563, 1998
18. Daniels S, Ellis E 3rd, Carlson DS: Histologic analysis of costochondral and sternoclavicular grafts in the TMJ of the juvenile monkey. *J Oral Maxillofac Surg* 8:675, 1987
19. Boyne PJ. Free grafting of traumatically displaced or resected mandibular condyles. *J Oral Maxillofac Surg* 1989:228-32
20. Iizuka T, Lindqvist C, Hallikainen D, et al: Severe bone resorption and osteoarthritis after miniplate fixation of high condylar fractures. *Oral Surg Oral Med Oral Pathol* 72:400, 1991
21. Pereira MD, Marques A, Ishizuka M, et al: Surgical treatment of the fractured and dislocated condylar process of the mandible. *J Craniomaxillofac Surg* 23:369, 1995
22. van Merkesteyn JP, Groot RH, van Leeuwen R, et al: Intraoperative complications in sagittal and vertical ramus osteotomies *Int J Oral Maxillofac Surg* 16:665, 1987
23. Papadaki ME, Tayebaty F, Kaban LB, et al: Condylar resorption. *Oral Maxillofac Surg Clin North Am* 19:223, 2007.
24. Norholt SE, Krishnan V, Sindet-Pedersen S, et al: Pediatric condylar fractures: A long-term follow-up study of 55 patients. *J Oral Maxillofac Surg* 51:1302, 1993.