



Open Versus Closed Reduction of Mandibular Condyle Fractures: A Review of the Literature

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ABSTRACT:

The treatment of condylar process fractures has generated a great deal of discussion and controversy in oral and maxillofacial trauma and there are many different methods to treat this injury. For each type of condylar fracture, the techniques must be chosen taking into consideration the presence of teeth, fracture height, patient's adaptation, patient's masticatory system, disturbance of occlusal function, deviation of the mandible, internal derangements of the temporomandibular Joint (TMJ) and ankylosis of the joint with resultant inability to move the jaw, all of which are sequelae of this injury. Many surgeons seem to favor closed treatment with

maxillomandibular fixation (MMF), but in recent years, open treatment of condylar fractures with rigid internal fixation has become more common. The objective of this review was to evaluate the main variables that determine the choice of method for treatment of condylar fractures: open or closed, pointing out their indications, contra-indications, advantages and disadvantages.

Introduction

Fracture of condylar processes is one of the most common fractures of mandible and deserves special consideration due to its anatomic differences and healing potential. The management for these fractures also differs based on patient's age, level and extent of the fracture, degree of displacement and medical status.¹ The fractures of the condyle have been treated by either open or closed methods. The choice of treatment has remained debatable. Traditionally closed methods have been preferred due to the relative technical ease, lack of surgical complications and lack of patient morbidity.

However, since the arrival of new surgical techniques for open reduction and internal fixation the open methods have gained more attention. Although open reduction and fixation remains technique sensitive, it allows accurate reduction of the fracture segments and early mobilization of the patient's jaw.² Literature still remains inconclusive due to inappropriate standardization of data collection as well as randomization of the patients treated.

Indications for Management

Indications for management suggest that if a patient has an acceptable range of motion, good occlusion, and



minimal pain, observation or MMF is preferred, no matter what the level of fracture. Condylar head fractures (intracapsular); whether single fragment, medial pole or comminuted, should be managed in the same manner. Zide points out that condylar displacement and ramus height instability are really the only indications for the ORIF (open reduction and internal fixation) of mandibular condyle fractures. Thus, for displaced or unstable low condylar neck or subcondylar fractures, ORIF is indicated.³

Zide and Kent's 1983 Indications for Open Reduction⁴

Absolute

- Displacement into middle cranial fossa
- Impossibility of obtaining adequate occlusion by closed reduction
- Lateral extracapsular displacement
- Invasion by foreign body

Relative

- Bilateral condylar fractures in an edentulous patient without a splint
- Unilateral or bilateral condylar fractures where splinting cannot be accomplished for medical reasons or because physiotherapy is impossible
- Bilateral condylar fractures with comminuted midfacial fractures, prognathia or retrognathia
- Periodontal problems
- Loss of teeth
- Unilateral condylar fracture with unstable base

Zide's 1989 Indications for Open Reduction⁵

Absolute

- Fracture into middle cranial fossa
- Foreign body in the joint capsule
- Lateral extracapsular deviation
- Inability to open mouth or achieve occlusion after one week
- Open fracture with potential for fibrosis

Possible Indications

- Bilateral or unilateral condylar fractures with a crushed midface
- Comminuted symphysis and condyle fracture with tooth loss
- Displaced fracture resulting in open bite or retrusion in mentally retarded or medically compromised adults
- Displaced condyle with edentulous or partially edentulous mandible with posterior bite collapse

Kent, Neary, Silva, and Zide's 1990 Indications for Open Reduction¹⁶

- Displacement into middle cranial fossa
- Tympanic plate injury
- Impossibility of obtaining adequate occlusion
- Lateral extracapsular displacement
- Invasion by foreign body
- Failure to obtain segment contact because of intervening soft tissue
- Blocked mandibular opening
- Facial nerve paresis secondary to initial injury
- Contraindicated intermaxillary fixation
- Open Wounds From Initial Injury

Aaoms Special Committee on Parameters of Care Indications For Open Reduction⁷

- Physical evidence of fracture
- Imaging evidence of fracture
- Malocclusion
- Mandibular dysfunction
- Abnormal relationship of jaw
- Presence of foreign bodies
- Lacerations and/or hemorrhage in external auditory canal
- Hemotympanum
- Cerebrospinal fluid otorrhea



- Effusion
- Hemarthrosis

Discussion

A number of studies have been done recently that have compared MMF with ORIF of mandibular condyle fractures. In 1999, Hidding et al⁸ compared the postoperative findings of 20 patients treated with ORIF to 14 who were managed conservatively over a period of 5 years. The conservative group was treated with maxillomandibular fixation for 2 weeks and then postoperative physiotherapy. The ORIF group was managed with wire or rigid osteosynthesis and then maxillomandibular fixation for 2 weeks. They found that deviation on opening occurred in 64% of patients treated conservatively compared with 10% managed with ORIF. No differences were found in headaches, mastication, or maximum interincisal opening between groups. Radiographic findings noted anatomic reconstruction in 93% of ORIF patients but only 7% of the conservative group. Konstantinovic and Dimitrijevic⁹ reviewed 80 patients with unilateral mandibular condyle fractures, managed surgically with wire osteosynthesis, and 54 treated conservatively. The patients were examined clinically and radiographically 1 or more years after completion of treatment (mean 2.5 years). The radiographic evaluation was performed by obtaining posteroanterior views of the mandible, recording data on a computer, and comparing the treated side with the non-injured side for the percentage of reduction achieved. No statistically significant differences were found between groups for maximal mouth opening, deviation on opening, or protrusion. Oezmen et al¹⁰ evaluated 30 patients with healed condylar fractures 6 to 24 months after treatment. Ten were managed conservatively and 30 by ORIF. The patients were evaluated clinically, radiographically, and with magnetic resonance imaging (MRI). The MRI examination revealed 3 cases (30%) of disc displacement in the conservative group but only 2 (10%) in the ORIF group. Seven patients (70%) in the conservative group were noted to have disc remodeling compared with 2 (10%) in the ORIF group. The MRI was also able to identify 8 patients (80%) in the conservatively treated group with malaligned or deformed condyles, but none (0%) for the ORIF group. The functional component of the clinical examination

revealed similar results for both groups. Worsae and Thorn¹¹ reported the complications associated with surgical versus nonsurgical treatment of unilateral low subcondylar fractures in 1994. For 101 dentate patients, of whom 61 were treated with MMF for 4 weeks and 40 were treated with open reduction and wire osteosynthesis for 6 weeks, 52 returned for examination a mean of 2 years after treatment. A complication rate of 4% was noted for the 24 patients in the surgical group, all occurring in 1 patient, this included malocclusion, impaired masticatory function, and pain located to the joint or masticatory muscles. A complication rate of 39% was noted for the 28 patients in the nonsurgical group. These occurred in 11 patients and included 3 with mandibular asymmetries, 8 with malocclusions, 3 with reduced interincisal openings, 2 with persistent headaches, 6 with pain located to the joint or masticatory muscles, and 6 with impaired masticatory function. In 2000, Haug and Assael¹² reported the long-term postoperative results of 10 patients treated with MMF and 10 by ORIF. The patients were examined for gender, race, diagnosis, age at injury, time since operation, and etiology of the fracture. Each group was assessed by 2 blinded investigators for maximum interincisal opening, right lateral excursion, left lateral excursion, protrusive movement, deviation on opening, scar perception, motor function, sensory perception, contour perception, occlusion, and perception of pain. There were no statistically significant differences between the ORIF and MMF groups for ranges of motion, occlusion, contour, and motor or sensory function. The ORIF group was associated with perceptible scars, and the MMF group with chronic pain. Throckmorton et al¹³ assessed changes in masticatory patterns after bilateral fractures of the mandibular condylar process. They examined incisor movements in 3 dimensions, along with the activity of the temporalis and masseter muscles during mastication. Evaluations were performed at 6 weeks, 6 months, and 1, 2, and 3 years with a jaw-tracking device and electromyogram. Six patients were treated by ORIF, 14 treated with closed, and 2 treated with a combination of both. The authors noted that although the population sample sizes were too small to provide statistically significant comparisons, no perceivable differences existed between the closed and ORIF groups for mandibular motion or muscle activity. Ellis group^{14,15} evaluated the rate of recovery of



mandibular motion in 136 patients, of whom 74 were treated by closed methods and 62 by ORIF with a minidynamic compression plate. Testing was accomplished at 6 weeks, 6 months, and 1, 2, and 3 years post surgery with a jaw-tracking device and radiographs that were traced, digitized, and assessed. Ellis and coworkers concluded that patients treated with ORIF had greater mobility than those treated by closed reduction. Subsequently, they reviewed the changes in condylar position after being managed by a closed approach and with ORIF. Sixty-five patients over the age of 16 underwent closed treatment and were evaluated with Towne's and panoramic radiographs before treatment, immediately after the placement arch bars, and at 6 weeks. Condylar position at each interval was evaluated in the coronal and sagittal view. A statistically significant difference was noted in the coronal position between initial examination and after the placement of arch bars, but not after 6 weeks or between any of the intervals for the sagittal position. Although statistically significant differences may not have been observed, great variability existed within groups, with standard deviations ranging from 2 times to more than 60 times the mean. Radiographs of 61 patients treated by ORIF were evaluated using similar techniques and time intervals as for the closed investigation. The nonfractured condyle was used as a control, and an additional set of images were obtained at 6 months postoperatively. No statistically significant differences were noted between the control and operated sides postoperatively, yet between 10% and 20% of the condylar processes had postsurgical changes in position of more than 10°. These reports indicate that condylar position is not static postoperatively for either closed management or treatment by ORIF. In 2000, Ellis et al¹⁶ assessed the occlusal results of 142 patients with unilateral neck or subcondylar fractures— 77 treated with ORIF and 65 with closed reduction. The investigators concluded that after 3 years, patients treated with closed reduction had a significantly greater percentage of malocclusion (22.2% to 28.6%) than did those treated by ORIF (0%). The next in Ellis series¹⁷ was a comparison of postoperative measures of mandibular and facial morphology on one hundred forty-six patients, out of which 81 treated by closed reduction and 65 by ORIF, were assessed with Towne's and panoramic radiographs taken at several intervals and by posteroanterior cephalograms taken at 6 weeks,

6 months, and 1, 2, and 3 years. The authors found that patients whose condylar process was treated by closed reduction had shorter posterior facial and ramus heights on the side of the injury, and more tilting of the occlusal and bigonial planes toward the fractured side, than those treated by ORIF. Most asymmetry was present by 6 weeks. Surgical complications were addressed by Ellis et al¹⁸ during a prospective evaluation of 178 patients. Ninety-three patients treated by ORIF and 85 treated by closed methods were included and assessed for intraoperative hemorrhage and/or encounter with the facial nerve, wound infection, Frey's syndrome, salivary fistula, seventh nerve palsy, and quality of surgical scar. Evaluations were made at several intervals. Facial nerve weakness was found to occur at a rate of 17.2% for the ORIF group at 6 weeks but totally resolved by 6 months. Incisions were considered to have become wide or hypertrophic 7.5% of the time. No other problems were identified. The latest in Ellis series¹⁹ was an evaluation of postoperative bite forces. This investigation included 155 patients, 91 treated closed and 64 treated by ORIF. Maximum bite forces were measured at 4 different tooth positions with a standard transducer at the same time intervals as for the previous investigations. Moreover, electromyographic measurements of the masseter muscle were also taken during bite force measurement, and working/balancing side ratios were calculated. No differences were noted between groups for maximum bite forces at any time period during the study. Bite forces recovered between the 6-week and 6-month periods. The working/balancing electromyogram ratios were greater on the side opposite the fracture, but no statistically significant differences were noted between experimental groups.

Conclusion

In summarizing the outcomes of literature regarding the closed reduction versus open reduction of condylar fractures, Open reduction has been associated with scar development and temporary (6 months) paralysis of facial nerve branches, whereas the closed approach is associated with numerous problems. These include chronic pain, malocclusion, asymmetry, limited mobility, and gross radiographic abnormalities. These results suggest that under similar indications and conditions, ORIF is the preferred approach for the management of condylar fractures.



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