Clinical Evaluation of 3 Types of Plate Osteosynthesis for Fixation of Condylar Neck Fractures

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Purpose: The goal of this study was to evaluate outcomes in patients who had condylar neck fractures treated with 3 different plating techniques.

Patients and Methods: A retrospective study was performed on 37 patients with 40 fractures of the condylar neck that were reduced and stabilized using an approach involving exposure of the facial nerve. Stabilization was achieved with a single miniplate (17 fractures), a minidynamic compression plate (13 fractures), or double miniplates (10 fractures).

Results: Plate fracture or screw loosening was exclusively observed in cases stabilized with either a single miniplate or a minidynamic compression plate. No cases of inadequate stability were observed when 2 miniplates were used.

Conclusions: The 2-miniplate fixation technique provides functionally stable fixation for fractures of the condylar neck.

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Although there is still controversy about therapy for condylar fractures in adult patients, many surgeons favor open treatment of displaced condylar fractures, because such reduction and rigid fixation allows for good anatomic repositioning and immediate function.¹ Numerous methods of open reduction and osteosynthesis of condylar neck fractures have been described. However, very few studies have assessed plating techniques for such fractures. Hammer et al² reported on complications associated with different types of plates in fractures of the condylar neck. However, it was difficult to accurately assess treatment results of the different plating techniques because the number of cases in their study was very limited. Using an in vitro model, Choi et al³ demonstrated that a 2-miniplate system applied to the anterior and posterior regions of the condylar neck was more stable than a single-plate system. There are no clinical studies that have proved the usefulness of a 2-miniplate system. Therefore, the goal of this study was to evaluate a sample of patients who had condylar neck fractures treated with 3 different plating techniques and to demonstrate which plating technique provides functionally stable fixation for fractures of the condylar neck.

Patients and Methods

Thirty-seven adult patients whose condylar neck fractures were treated by open reduction were included in this study. Three of these patients presented with bilateral condylar fractures. The male-to-female ratio was 4:1 and patient ages ranged from 18 to 71 years (mean, 37 years). The use of open treatment was based both on the presence of shortening of the ramus associated with premature molar contact and on radiologic findings that showed a condylar neck fracture with displacement or dislocation. All fractures were classified according to Spiessl and Schroll⁴ into types I to VI (Table 1). Two fractures were classified as type II, 28 fractures as type III, 3 fractures as type IV, and 7 fractures as type V. The high condylar neck fracture was defined as a fracture with a fracture line extending over the sigmoid notch. Twenty-
one patient had an additional parasymphysial or symphyseal fracture of the mandible, and 2 patients had an additional contralateral angle fracture. Both the condylar fracture and the additional fracture were treated during the same session. The time between injury and operation ranged from 2 to 17 days (mean, 7 days).

All patients underwent open reduction and rigid fixation of the condylar fractures using the surgical procedure described by Choi and Yoo.5 The approach was similar to that used for a standard parotidectomy. The extent of the incision and the branches of the facial nerve dissected depended on the location of the condylar fracture. For low condylar fractures, the incision was placed just below the lobe of the ear and behind the posterior border of the mandible, and the buccal and marginal branches of the facial nerve were frequently dissected and retracted after the main trunk of the facial nerve was exposed. For high condylar fractures with dislocation out of the fossa, the incision was extended superiorly to the preauricular area, and the temporal, zygomatic, and buccal branches of the facial nerve were dissected and retracted after exposing the main trunk of the facial nerve. Once the nerve had been retracted, the fracture site was readily exposed.

Initially, stabilization was achieved using a single miniplate on the posterior region of the condylar neck. Plate and screw failures later indicated the need for a sturdier type of osteosynthesis; accordingly, stabilization was achieved with either a minidynamic compression plate in the posterior region or a miniplate applied in both the posterior and anterior regions of the condylar neck. A single miniplate was used in 17 fractures, a minidynamic compression plate was used in 13 fractures, and a double miniplate was used in 10 fractures. Maxillomandibular fixation (MMF) was not used postoperatively in any of the patients. A soft diet was permitted until postoperative day 21. All plates and screws used in this clinical study were made of titanium alloy (Osteomed M3 rigid fixation system, Osteomed Co, Addison, TX).

After surgery, each patient was followed for at least 6 months; follow-up consisted of clinical and radiologic evaluation. Clinical evaluation included assessment of occlusion, maximum interincisal distance, mandibular deviation on mouth opening, facial nerve function, and presence of infection. Facial nerve injury was deemed to have occurred if the patient was unable to draw the lower lip and corner of the mouth downward, was unable to whistle, or was unable to completely close the eyelids or to wrinkle the brow. To assess the position of the condylar fragments and the state of the screws and plates, a panoramic and Towne’s position radiograph were taken of each patient.

### Results

The immediate postoperative radiographs showed excellent reduction in 39 of the 40 condylar fractures and insufficient reduction in 1 condylar fracture. Table 2 lists the complications encountered. Plate fractures were observed in 2 cases. Both of these had been stabilized with a single miniplate (Fig 1). Screw loosening was observed in 3 cases (Fig 2). Two of the 3 cases had been stabilized with a minidynamic compression plate, and one had been stabilized with a single miniplate. Screw loosening was always associated with a chronic infection, which caused a fistula. In these cases, hardware removal was performed. Plate bending was observed in 1 case that was stabilized with a minidynamic compression plate. When 2 miniplates were used, no plate fracture, bending, or screw loosening was observed.

Transient postoperative neuropraxia of the buccal or zygomatic branch of the facial nerve was observed in 7 patients; of whom, 4 had been stabilized with a single miniplate, 2 with a minidynamic compression

### Table 1. CLASSIFICATION OF FRACTURES OF THE HEAD AND NECK ON THE CONDYLAN PROCESS

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Fractures without displacement</td>
</tr>
<tr>
<td>II</td>
<td>Low fractures with displacement</td>
</tr>
<tr>
<td>III</td>
<td>High fractures with displacement</td>
</tr>
<tr>
<td>IV</td>
<td>Low fractures with dislocation</td>
</tr>
<tr>
<td>V</td>
<td>High fractures with dislocation</td>
</tr>
<tr>
<td>VI</td>
<td>Intracapsular fractures</td>
</tr>
</tbody>
</table>

Data from Spiessl and Schroll.4

### Table 2. COMPLICATIONS AFTER OPEN REDUCTION

<table>
<thead>
<tr>
<th>Complication</th>
<th>1 Miniplate (n = 17)</th>
<th>Minidynamic Compression Plate (n = 13)</th>
<th>2 Miniplates (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate fracture</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Plate bending</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Screw loosening</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Inadequate reduction</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Temporary facial nerve weakness</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
plate, and 1 with 2 miniplates. There was complete recovery within 3 months in all 7 patients.

The postoperative course was uneventful in 28 of 37 patients. Normal occlusion was maintained, and they had an interincisal distance of more than 40 mm and an absence of mandibular deviation during mouth opening. Malocclusion and mandibular deviation during mouth opening were observed in 6 of 37 patients, who had either plate fractures (2 cases), screw loosening (3 cases), or insufficient reduction (1 case). These 6 patients underwent functional treatment that consisted of tight MMF with elastics for 10 days followed by active jaw exercises. Three of 37 patients showed signs of disc displacement without reduction. Each of these patients had good occlusion, but limitation and mandibular deviation during mouth opening. After active jaw exercise, they could open their mouth more than 40 mm. Two of the 3 patients had been stabilized with a single miniplate, and 1 of the 3 had been stabilized with 2 miniplates.

Discussion

Problems with proper reduction and fixation of condylar neck fractures using a single miniplate have been discussed by various authors.2,6-7,8 Hammer et al2 reported that plate failure or screw loosening was observed in more than one third (35%) of the group stabilized with a single adaptation miniplate. Others have also reported the fracture of miniplates used in condylar neck fracture fixation.6-9 The results of our clinical study agree with these findings. All of our cases in which plates fractured had been stabilized with a single miniplate. This suggests that the functional forces exceeded the rigidity of 1 miniplate. Ellis and Dean6 proposed that plates used in the management of condylar neck fractures should be stronger and thicker than adaptation miniplates. Thus, they treated 53 fractures with minidynamic compression plates, (a sturdier type of osteosynthesis) and reported that none of the plates fractured; however, 2 of them showed bending, and 3 had screws loosened. Our findings are in accord with these findings. The minidynamic compression plates did not fracture in our patients; however, bending of the plate in 1 case and loosening of screws in 2 cases occurred. The use of the minidynamic compression plates did not always ensure absolute fixation. On the other hand, inadequate stability causing either plate fracture or screw loosening was not observed when 2 miniplates were used. In 1 patient whose bilateral condylar fractures had been treated with a single miniplate on one side and with 2 miniplates on the other side, the single miniplate fractured, but the 2 miniplates remained stable (Fig 3). The findings in this case emphasize that in cases of condylar neck fractures the fixation should be performed with 2 miniplates. The greater thickness of the minidynamic compression plates applied at the posterior border of the condylar neck did not confer any benefits over the 2 miniplate system. This would imply that the efficacy of the 2
miniplate system is derived mainly from its ability to neutralize functional stresses that are imposed on the condylar neck. In vitro strain measurements of the condylar process showed that the highest level of tensile strain occurs on the anterior and lateral surfaces and the highest compressive strain on the posterior surface.10 The application of a miniplate at the posterior and anterior border of the condylar neck seems to have the beneficial effect of restoring tension and compression trajectories.

The mandibular condyle may be approached through a preauricular incision, a submandibular incision, a retromandibular incision, or an intraoral incision.5,8 In our experience these approaches are not useful for fixation of condylar neck fractures with 2 miniplates because, when they are applied, access is limited with respect to accurate placement. If screws are not placed vertically, but rather at very low angles against the plates, there is the possibility of insufficient or failed immobilization of the condylar fragment. Undt et al8 reported that the use of 2 miniplates correlated highly with a medial tilt of the condylar fragment from the postoperative position. The most likely explanation for this failure would be that the fragments were not aligned properly or that the screws were not placed vertically against the plates.

The present study showed that correct reduction and fixation of condylar fractures with 2 miniplates can be achieved by an approach in which the facial nerve is exposed. The advantage of this approach over other approaches is that the access is more better. It provides the most direct access to the fracture so that excessive retraction can be avoided and use of a transfacial trochar is not needed. Any condylar segment that has sufficient bulk to be internally stabilized with plate and screw fixation can be treated through this approach, placing the screws vertically against the plates. As seen in the immediate postoperative radiologic examination, reduction was very accurate in 97% of our patients. However, this approach has not received much discussion in the literature.

Zide and Kent11 used this approach for open treatment of condylar fractures. However, few others seem to favor this approach. The main reason for this is a risk of damage to the facial nerve. However, this risk is no greater than with any other extroral approach; 11% for Chossegros et al12 with a retromandibular approach, 37% for Tasanen and Lamberg13 with a submandibular approach, and 13% for Eckelt and Rasse14 with use of a lag-screw. In the current study, transient facial nerve palsy occurred in 7 (18%) of 40 fractures. There was no instance of permanent facial nerve palsy. With careful dissection, identification, and protection of the facial nerve, safe surgery is assured. The disadvantage of this approach is that the approach is not easy. Our experience indicates that the success of this procedure is closely related to the operator’s experience and skill. The decrease of operating time and neurologic complications in our patient series supports this premise.

Initially, our average operating time for the treatment of one condylar fracture was approximately 3.5 hours. Later, the average operating time dropped to 2.2 hours, when the approach became a routine method of fracture treatment. Of the 7 facial nerve palsies seen in this series, 4 occurred in the group stabilized with a single miniplate, 2 in the group with a minidynamic compression plate, and 1 in the group with a double miniplate. Although fixation with 2 miniplates might be a more traumatic procedure than single miniplate fixation, the rate of neurologic complications was lower with such fixation than with single miniplate fixation. This suggests that the complications were avoidable with increased experience.

References