

# Follow-Up of Condylar Fractures of the Mandible in 8 Patients at 18 Months After Transoral Endoscopic-Assisted Open Treatment

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**Purpose:** The results of endoscopic-assisted transoral approach for open reduction and miniplate fixation of condylar mandible fractures were evaluated 18 months after surgery.

**Patients and Methods:** The transoral endoscopic-assisted treatment of condylar fractures was performed in 8 consecutive patients from April 1998 to December 1999 at the University Hospital Freiburg. Four of 8 condylar fractures were dislocated, and 6 of the 8 patients had additional mandibular fractures.

**Results:** Anatomic reduction was achieved in all patients without facial nerve damage. There were no signs of bony resorption and good temporomandibular joint function 18 months after surgery. In 4 patients, the transoral management of condylar fractures was facilitated by angulated drills and screw drivers. Transbuccal stab incisions were not needed in these 4 patients. In all 8 patients, visible scars were avoided.

**Conclusions:** The endoscopic-assisted transoral approach proved to be a reliable surgical method for condylar fractures when dislocation with lateral override was present.

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Fractures of the mandibular condyle are common and account for 9% to 45% of all mandibular fractures.<sup>1-3</sup> Closed reduction is the method most widely used even for the treatment of dislocated condylar fractures.<sup>4</sup> Anatomic reduction is difficult to achieve. Rehabilitation and temporomandibular joint (TMJ) function depend on functional adaptation of the altered condylar morphology. For the open treatment of condylar fractures, many techniques have been described. Miniplate fixation is an established technique to avoid maxillomandibular fixation (MMF).<sup>5-8</sup> Ex-

traoral approaches such as preauricular, retromandibular, and submandibular approaches have the risks of facial nerve damage and the creation of visible scars.<sup>9,10</sup> Due to those possible complications, the indication for open or closed treatment is controversial.<sup>5,9,11,12</sup> Using an endoscope, superior visibility in regions of limited exposure can be obtained. This enables transoral open reduction of condylar process fractures. The risk of facial nerve damage is minimal, and visible scars are avoided via a transoral approach.<sup>13-17</sup> The surgical technique for the transoral endoscopic-assisted treatment of mandibular condyle fractures is demonstrated. The purpose of this study was to assess the long-term outcome of endoscopic open reduction of mandible condyle fractures.

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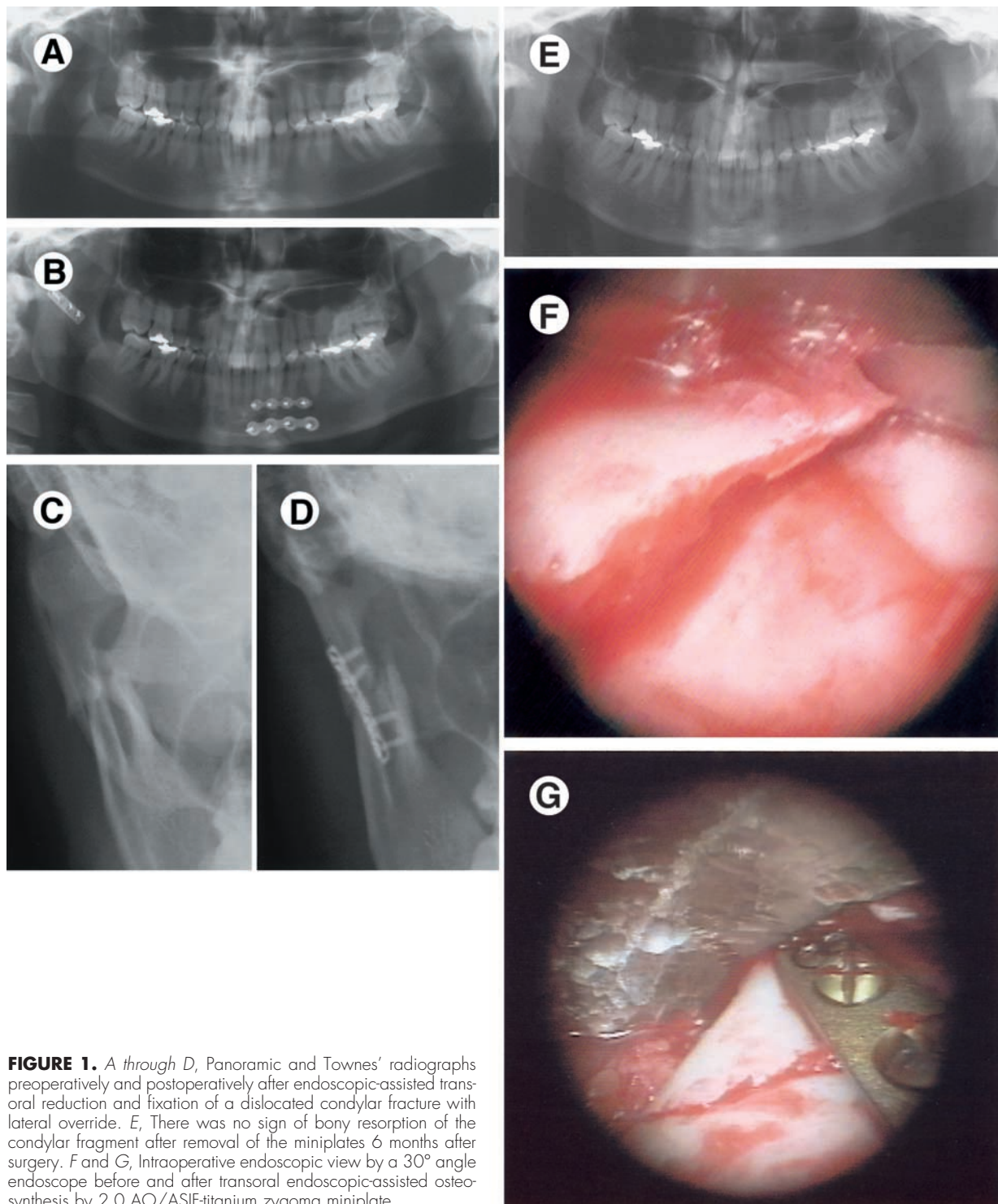
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## Patients and Methods

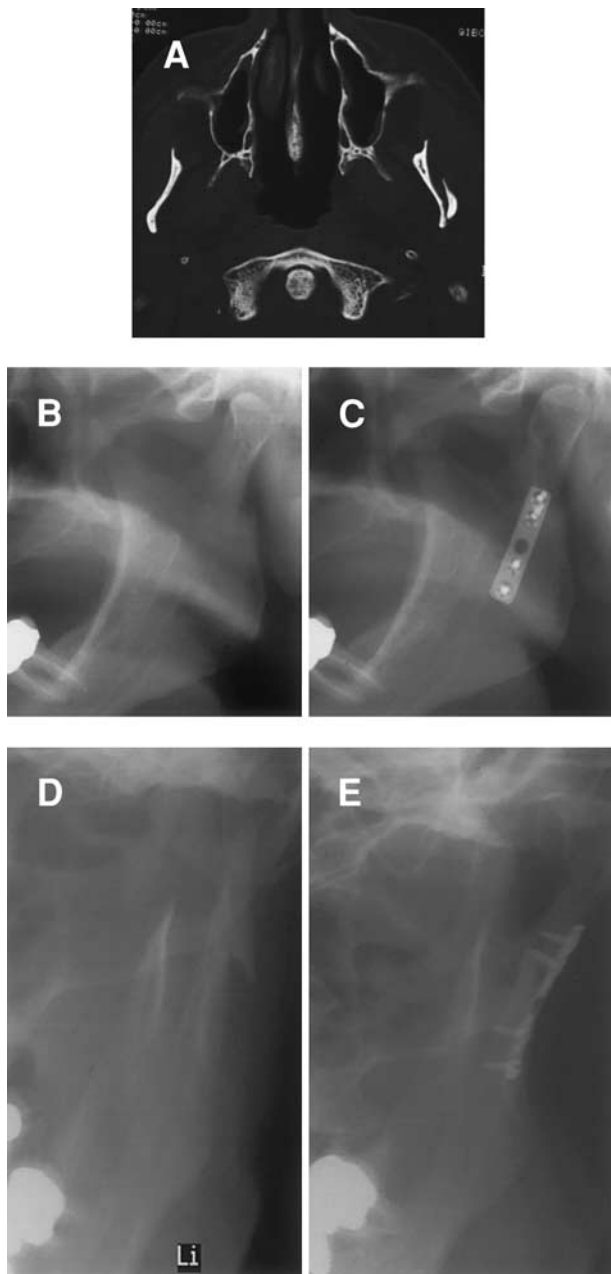
Thirty-eight patients with condylar fractures presented to the University Hospital of Freiburg between April 1998 and December 1999. Twenty-one patients with nondislocated fractures, high condylar intracapsular fractures, or fractures without functional impairment such as malocclusion and limitation of mouth opening were treated closed by MMF. Pa-



**FIGURE 1.** *A through D*, Panoramic and Townes' radiographs preoperatively and postoperatively after endoscopic-assisted transoral reduction and fixation of a dislocated condylar fracture with lateral override. *E*, There was no sign of bony resorption of the condylar fragment after removal of the miniplates 6 months after surgery. *F* and *G*, Intraoperative endoscopic view by a 30° angle endoscope before and after transoral endoscopic-assisted osteosynthesis by 2.0 AO/ASIF-titanium zygoma miniplate.

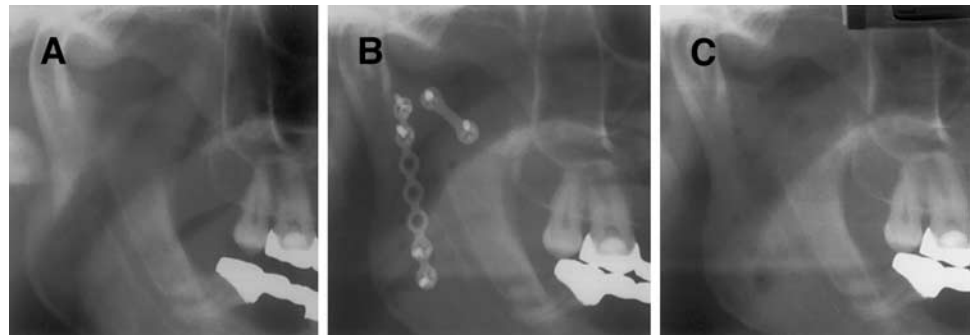
tients younger than 14 years were also treated closed. All older patients with malocclusion and additional mandibular fractures were treated by open reduction and internal fixation. Seventeen consecutive of the 38 patients with condylar fractures were treated by open reduction. Nine of the 17 patients with medially dislocated and comminuted fractures were treated via a submandibular approach.<sup>15</sup> Of the 17 patients with

laterally and moderately dislocated fractures, 8 were treated via a transoral approach with endoscopic guidance. The mean age of the 8 patients was 34 years. The type of fracture, degree of dislocation, and result of reduction were endoscopically evaluated intraoperatively and by panoramic and Townes' radiographs preoperatively and postoperatively. At 6 and 18 months after surgery, occlusion, function of the



**FIGURE 2.** A, Preoperative computed tomography scan of a dislocated right condylar fracture with lateral override. B through E, Panoramic and Townes' radiographs preoperatively and postoperatively after endoscopic-assisted transoral reduction and fixation of the dislocated condylar fracture with lateral override.

**FIGURE 3.** A through C Panoramic radiographs preoperatively and postoperatively after endoscopic-assisted transoral reduction and fixation of a dislocated condylar fracture with lateral override. After removal of the miniplate 12 months after surgery, there was no sign of bony resorption of the condylar fragment. Due to the lamellar type of the fracture, an initially inserted 2.0 zygoma plate could not be used.



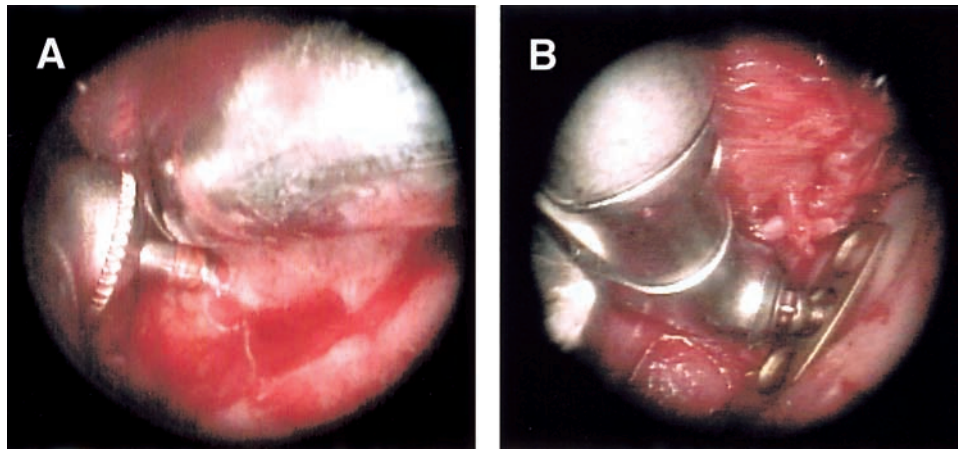
mandible, and TMJ function were evaluated by measurements of maximal incisal opening, deviation on mouth opening, and degree of lateral and protrusive excursion. The presence of TMJ clicking and pain were also evaluated.

#### SURGICAL TECHNIQUE

The ascending ramus of the mandible was approached with an intraoral incision, similar to the surgical approach for sagittal split osteotomies in orthognathic surgery. For the creation of an optical cavity, the periosteum on the ascending mandibular ramus was elevated down to the mandibular angle, and the inferiorly inserting fibers of the temporalis muscle were stripped off the coronoid process. A 30°, 4-mm-diameter endoscope (Karl Storz, Tuttlingen, Germany) and a xenon light source were used. A suction and irrigation device allowed for irrigation of the endoscope tip in the limited optical cavity. The endoscope was inserted subperiostally along the ascending mandibular ramus and advanced cranially until the fracture became visible in the endoscope. (Fig 1). To facilitate repositioning of the condylar fragment, pressure on the molars of the mandible was applied to distract the TMJ region. A noncompression 2.0 AO/ASIF miniplate was used (No. 443.440/450; DCP Synthes, Paoli, PA) with at least 2 screws on each side of the fracture (Figs 1, 2). In subcondylar fractures, an additional second 2.0 AO-ASIF miniplate were used when possible (Synthes) (Fig 3).

#### REDUCTION AND FIXATION

Modified angulated elevators described previously were inserted for the mobilization and reduction of the proximal fragment.<sup>15</sup> After repositioning, the tip of an elevator was placed on the lateral surface of the proximal fragment to hold the fragment in place. Stab incisions and trochars were used for the transbuccal insertion of screws in 4 patients. In 4 additional patients, under endoscopic vision angulated drills and screwdrivers were used to avoid transbuccal stab incisions (Fig 4). Initially the plate was attached with the first screw to the condylar fragment. The fracture



**FIGURE 4.** A and B, Intraoperative view of angulated drill and screwdriver for the transoral drilling and insertion of screws without transbuccal step incision.

reduction was then facilitated by pulling the miniplate caudally using modified nerve hooks. The second screw was then inserted next to the fracture in the mandibular fragment. After the fracture fixation with 2 screws, the alignment of the fracture at the posterior border of the ascending ramus was controlled endoscopically, before osteosynthesis was completed. Any additional mandibular fractures were treated via an intraoral approach with miniplate fixation.

## Results

The 8 patients treated via the transoral approach had 3 condylar neck fractures and 5 subcondylar fractures. Four of 8 fractures were dislocated. Six of the 8 patients showed additional mandibular fractures (Table 1). In 2 of the 4 patients treated without transbuccal instruments, the type of fracture proved to be more complicated than expected. One fracture was severely dislocated, and in 1 patient, a bony fragment of the inferior aspect of the condylar fragment had to be removed. Due to the loss of the fragment and the lamellar type of fracture, the reduc-

tion was challenging (Fig 3). The reduction and fixation of the dislocated fracture were controlled endoscopically. The operating time for the transoral endoscopic-assisted treatment including MMF was maximum 3 hours 10 minutes in the patient in whom the fracture reduction was challenging. Due to the lamellar type of fracture, the noncompression 2.0 AO/ASIF miniplates (No. 443.440/450; Synthes) could not be used and the miniplate fixation had to be performed twice intraoperatively (Fig 3). Minimum operating time was 1 hour 50 minutes in a patient with a laterally dislocated fracture (Fig 2). The mean operating time was 2 hours 30 minutes, including intraoperative MMF. Postoperative movement of the jaw without MMF was allowed in all patients, except in 1 patient in whom guiding elastics were used for 5 days due to unstable occlusion. A soft diet was given for the first 7 days after surgery. After undisturbed occlusion was noted, the arch-bars used for intraoperative MMF for the treatment of additional mandibular fractures were removed at day 7 after surgery. Postoperative standard radiographs showed an adequate position of the condylar fragments in all 8 patients (Figs 1 through 3). Six and 18 months after

**Table 1. PATIENTS AND TYPE OF CONDYLAR PROCESS FRACTURE TREATED BY AN TRANSORAL APPROACH (N = 8)**

Patient	Fracture	Dislocation	Transbuccal	Age (yr)	Mandible No.
1	Condylar neck	Yes	Yes	37	No
2	Subcondylar	No	No	33	Yes
3	Condylar neck	Yes	Yes	38	Yes
4	Subcondylar	Yes	No	51	Yes
5	Condylar neck	No	Yes	29	Yes
6	Subcondylar	No	No	28	No
7	Subcondylar	No	Yes	28	Yes
8	Subcondylar	Yes	No	25	Yes

NOTE. Mandible number indicates additional mandibular fractures.

**Table 2. FUNCTION OF THE MANDIBLE AND TEMPOROMANDIBULAR JOINT 18 MONTHS AFTER ENDOSCOPIC-ASSISTED TRANSORAL TREATMENT OF CONDYLAR PROCESS FRACTURE (N = 8)**

Patient	Malocclusion	Mouth Opening (mm)	Deviation	Lateral Excursion, Right, Left (mm)	TMJ Clicking/Pain
1	No	46	0	6,6	No
2	No	57	0	5,5	No
3	No	44	0	5,6	No
4	No	43	0	5,5	No
5	No	52	0	4,3	No
6	No	45	0	3,4	No
7	No	41	0	4,4	No
8	No	50	0	5,5	No

surgery, anatomic reduction without signs of resorption or relapse of the condylar fragment were noted in standard radiographs and intraoperatively in 4 patients at the time of elective miniplate removal (Figs 1, 3).

At 18 months after surgery, the TMJ function was not impaired in any patient. All patients showed a mouth opening of more than 40 mm (Table 2).

There was no TMJ dysfunction. No significant deviation in mouth opening was noted in any of the 8 patients, and lateral excursion and protrusion were not limited. None of the patients had pain in the TMJ region. Signs of facial nerve damage were not noted postoperatively in any patient.

## Discussion

After closed reduction of dislocated condylar fractures, limited function of the TMJ with limited incisal opening, deviation on mouth opening and habitual luxation of the TMJ on the contralateral side may occur as long-term results of the deranged condyle morphology. Shortening of the ascending ramus with open bite deformity and malocclusion may add to the unsatisfying results.<sup>18,19</sup> To avoid those complications, open treatment of condylar fractures is performed.<sup>5,6,8,9,11,19,20</sup> The indication for open versus closed reduction of dislocated condylar fractures is discussed controversially in maxillofacial surgery as open reduction may cause damage to the facial nerve and visible scars.<sup>5,9,11,12,19</sup> Different approaches for the treatment of dislocated condylar fractures are described.<sup>13,15-17</sup> To minimize the risk of complications, endoscopic-assisted techniques using transoral incisions were performed.<sup>15,16</sup>

The transoral approach for the treatment of condylar fractures is not routinely used because the transoral management of dislocated condylar fractures may be difficult due limited visibility of the fracture site because of the coronoid process. When using endoscopic techniques with angulated scopes, the transoral treatment is facilitated.<sup>15-17</sup> In the 8 patients pre-

sented, after transoral approach to the condylar fractures, anatomic reduction and adequate postoperative function were achieved 18 months after surgery. Restoration of normal occlusion and TMJ function were found in the 8 patients after the transoral treatment. The surgical approach depends on the type and location of the fracture. In comminuted fractures and severely dislocated fractures, a better exposure of the fracture site may be needed for the 3-dimensional reduction and fixation of complicated fractures.<sup>15</sup> Therefore, an extraoral approach may be advantageous for the management of dislocated, comminuted and condylar neck fractures.<sup>13-15</sup>

The transoral approach in the presented clinical study was used for the endoscopic treatment of condylar fractures that were laterally or moderately dislocated. Angulated drills and screwdrivers facilitated the transoral management of condylar fractures without the need for transbuccal stab incisions.<sup>15</sup>

Compared with the submandibular approach, the transoral approach is less time consuming. Intraoral scars are invisible and the risk of facial nerve damage is minimal.<sup>15,16</sup> However, due to the mandibular anatomy, visibility of the dorsal aspect of the ascending ramus and control of fracture reduction may be difficult without an endoscope. Intensive training in endoscopic techniques and handling of the instruments is mandatory before the transoral approach for the treatment of condylar fractures is performed.

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