Fixation of Mandibular Angle Fractures With a 2.0-mm 3-Dimensional Curved Angle Strut Plate

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Purpose: The aim of this study was to evaluate our experience and complication rate with the use of a 3-dimensional 2.0-mm curved angle strut plate for mandibular angle fracture fixation.

Patients and Methods: This was a retrospective evaluation of 37 patients with noncomminuted mandibular angle fractures fixated with a transorally placed curved 2.0-mm strut plate. Postoperative intermaxillary fixation was used in 5 patients for a mean period of 22 days. A nonchewing diet was prescribed for 6 weeks. Records were reviewed for demographic information, medical history, fracture characteristics, operative management, and complications.

Results: Two patients developed infections requiring plate removal and reapplication of fixation. Both of these patients had a molar in the fracture line that was left in place during the first operation. One patient developed a mucosal wound dehiscence without consequence. After a mean follow-up period of 10 weeks, 39.4% of patients with a postinjury/pretreatment inferior alveolar nerve deficit reported a return to normal sensation. All patients who developed a sensory deficit as a result of surgery reported full recovery of sensation. A persistent sensory deficit appeared to be related to fracture displacement.

Conclusion: Fixation of noncomminuted mandibular angle fractures with a 2.0-mm curved angle strut plate was predictable. This plate is low in profile, strong yet malleable, facilitating reduction and stabilization at both the superior and inferior borders. Development of a postoperative infection appeared to be related to failure of removal of a molar in the fracture line. The infection rate of 5.4% found in this study compares favorably with that seen with reconstruction plates. Use of this plate did not appear to cause a permanent sensory deficit in this study.

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Despite many advances in internal fixation, angle fractures remain among the most difficult and unpredictable fractures to treat compared with those of other areas of the mandible. The large number of studies on mandibular angle fracture treatment attests to the fact that no single approach has been shown to be ideal, and that treatment of mandibular angle fractures remains conceptually controversial, with a bothersome complication rate. During the last decade significant attention has been placed on fixation of angle fractures using a variety and combination of transorally placed small plates secured with monocortical screws.[1-14] Fixation using such plates has been shown to simplify surgery and reduce surgical morbidity but failed to surpass the predictability of rigid fixation with 2.4 mm and reconstruction plates.[15-18]

Although there have been a number of studies on linear and curvilinear plates for mandibular fracture fixation, there have been only a few reports on the use of low profile 3-dimensional (3D) strut or mesh plates.[1,6] In fact, the majority of studies on strut plates were in vitro biomechanical studies,[18,19] some of which were using a sagittal ramus split osteotomy

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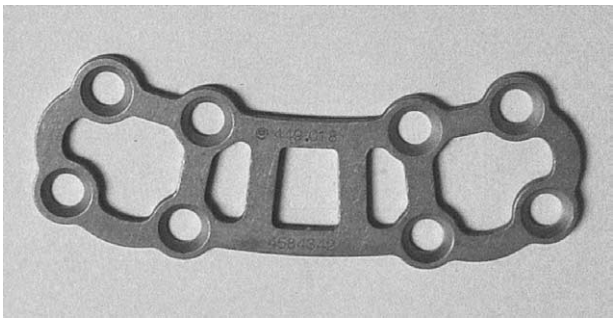

FIGURE 1. Titanium 2.0-mm curved angle strut plate (Synthes Maxillofacial, Paoli, PA). Plate is 0.9-mm thick, 39.2-mm long, and 13 mm in height. Plate is fixated with 8 monocortical screws.

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rather than a fracture model.[20] The geometry of 3D strut plates conceptually allows for an increased number of screws, stability in 3 dimensions, and resistance against torque forces while maintaining a low profile and malleability.[19]

To the best of our knowledge there have been no studies on the clinical use of strut plates for mandibular fractures specifically, and only 2 publications describing the clinical use of 3D strut plates in oral and maxillofacial surgery in general.[6,21] In 1 report a large group of patients undergoing mostly midface and orthognathic surgery was described.[21] In another article, individual cases of mandibular and midfacial fractures were reported using miniplates designed primarily for the midface.[6] The goal of our study was therefore to evaluate and describe our clinical experience and complication rate with a 2.0-mm curved multidimensional strut plate specifically designed for the mandibular angle. Outcome parameters evaluated included infection rate, hardware failure rate, wound problems, and malocclusion. Information on fracture displacement, time between injury and immobilization and treatment, the type and duration of intermaxillary fixation, and subjective inferior alveolar nerve status were also gathered.

Patients and Methods

This was a retrospective study of 37 patients with mandibular angle fractures treated with a curved 2.0-mm angle strut plate (Fig 1) by the Oral and Maxillofacial Surgical Service at the Texas Medical Center. The records were reviewed for demographic information, medical history, fracture characteristics (location, displacement, and mobility), type and duration of immobilization, associated injuries, inferior alveolar nerve sensory examination, perioperative course, and follow-up. Patients with extensive overlying soft tissue injuries, fracture comminution, or previous mandibular fractures or osteotomies involving the mandibular canal were excluded. The degree of fracture displacement was determined on a panoramic radiograph by assessment of the alignment of the mandibular canal. Whenever alignment of the mandibular canal was maintained across the fracture line, it was considered a nondisplaced fracture. Fractures in which malalignment of the canal was less than 50% of the height of the canal were considered minimally displaced. Fractures in which malalignment was greater than 50% but less than the entire height of the canal were considered moderately displaced (Fig 2). Fractures in which mal-alignment was greater than the height of the canal were considered to be severely displaced. All plates were placed through a transoral approach and fixated with 8 monocortical screws. Instrumentation and screw placement were carried out by standard percutaneous technique using a trocar (Fig 3). The contralateral fractures were treated closed in the case of a condylar or subcondylar fracture or fixated with a variety of linear plates. Postoperative intermaxillary fixation was applied only in those patients who had a concurrent subcondylar fracture. A pressure dressing was placed for 24 to 48 hours. No drains were used. A nonchewing diet was prescribed postoperatively for 6 weeks.

Results

The mean age of the 37 patients was 28.6 years (range, 15 to 62 years). There were 32 males (86.4%) and 5 females (13.5%). Mean follow-up was 10 weeks (range, 4 to 40 weeks). The most common etiology was interpersonal violence (81.1%), followed by falls (10.8%) and motor vehicle accident (8.1%). The most prevalent systemic illnesses were diabetes (8.1%), hepatitis (8.1%), and hypertension (5.4%). A large number of patients admitted to consuming a significant amount of alcohol (78.1%) and cigarettes (46.5%).

All but 2 patients had displaced fractures. A second fracture was present in 62.1% of patients, the most

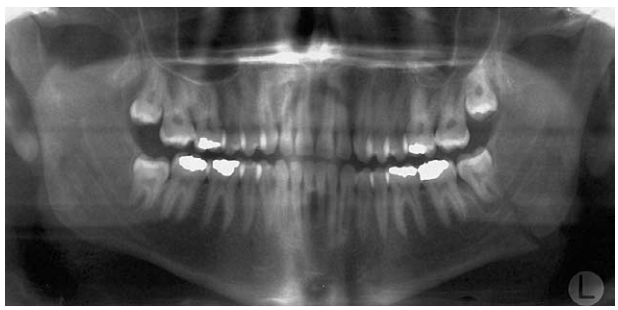

FIGURE 2. Example of a moderately displaced mandibular angle fracture. Degree of displacement is determined at the level of the mandibular canal.

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