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Clinical Paper

Trauma

A comparison of three treatment methods for fractures of the mandibular angle

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Abstract. The purpose of this study was to determine a practical and cost-effective treatment method for fixing mandibular angle fractures using miniplates. Patients were divided into three groups for comparison, based on the intraoperative plates and maxillomandibular fixation (MMF) used: group A, single miniplate fixation with MMF ($n = 37$); group B, double miniplate fixation with MMF ($n = 59$); group C, double miniplate fixation without MMF ($n = 38$). Details of the characteristics of the fractures and the treatments and outcomes were collected retrospectively and analyzed statistically. This study was based on 134 cases of isolated mandibular angle fracture. Of the surgically treated patients, 78.4% ($n = 105$) were completely free of complications. A detailed complication correlation matrix is given in the text. Besides screw loosening and malocclusion, no statistically significant difference was observed between the groups. The results of this study suggest that treatment with single miniplate fixation and MMF has a low incidence rate of complications, and this method of treatment is considered to be simple.

Key words: fracture; mandibular angle; miniplate; osteosynthesis.

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The urbanization and industrialization of modern society has led to an increased population and increased traffic, resulting in greater possibilities of maxillofacial trauma. Along with the nasal bone, the mandible is one of the most fracture-prone facial bones due to its projection and prominent position.[1] The mandibular angle, along with the condyle and body, is one of the most frequently fractured areas due to the presence of the mandibular third molar and its thin bony composition.[2] Clinicians are highly aware of the significant 0–32% possibility of postoperative complications in mandibular angle fractures.[3–6]

Various methods have been suggested to treat fractures of the mandibular angle, and many clinical results have been reported. Recently, the miniplate fixation method has most often been applied, due to its procedural simplicity and good clinical outcomes. Furthermore, efforts have been made to assist functional healing and minimize postoperative complications. After Michelet et al. introduced the use of non-compression plates and monocortical screws for the treatment of fractures of the mandibular angle in 1973,[7] Champy et al. asserted that the most stable fixation of the mandible could be achieved by placing a single miniplate and screws at the superior border of the mandible along the 'ideal line of osteosynthesis'.[8] On the other hand, Raveh et al. claimed that monocortical single miniplate fixation could never fully replace maxillomandibular fixation (MMF),[9] and Levy et al. argued that fixation with an additional miniplate at the inferior border of the mandible or on the buccal side of the mandibular angle was more effective

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and reliable.[10] Treatment methods for fractures of the mandibular angle are discussed continuously.

This study analyzed the outcomes and complications of the treatment of patients with a simple fracture of the mandibular angle in order to suggest practical and effective treatment methods for these fractures; treatment comprised fixation with one or two miniplates, with or without MMF.

Patients and methods

Patients

Subjects were selected among 313 patients with fractures of the mandibular angle, who attended the department of oral and maxillofacial surgery of a university dental hospital in South Korea between July 2006 and November 2013. Of these patients, 151 were diagnosed with simple non-displaced isolated fractures of the mandibular angle. Seventeen patients were excluded, thus 134 patients with simple non-displaced mandibular angle fractures, who underwent open reduction and fixation with one or two miniplates under general anaesthesia and who participated in at least 4 months of follow-up, were included in this study. The reasons for the exclusion of the 17 patients were as follows: two edentulous patients, seven patients for whom 4 months of follow-up was not possible, three patients with comminuted fractures, three patients with inflammation present at the fracture site, and five patients with a general condition impeding the healing process at the fracture site.

Regardless of other factors, patients were assigned to one of three different oral and maxillofacial surgeons depending on their appointment day. These three surgeons had an average 25 years of clinical experience (ranging from 19 to 30 years) and each performed a different treatment method on the mandibular angle fractures. Therefore, patients were categorized into three comparative groups based on the intraoperative plates and MMF used during the surgical procedure. One surgeon treated patients with single miniplate fixation and MMF (group A, $n = 37$), the second used double miniplate fixation with MMF (group B, $n = 59$), and the third used double miniplate fixation without MMF (group C, $n = 38$). A schematic diagram of the plate positions for isolated mandibular angle fractures is presented in Fig. 1.

All of the patients were followed up regularly at 2, 4, 8, and 16 weeks postoperatively. An immediate postoperative panoramic radiograph was obtained on the first postoperative day. Two more follow-up radiographs were obtained at the second and fourth postoperative visits. Postoperative complications were classified as major or minor according to their conditions. Delayed union and non-union were considered major complications. Wound dehiscence, infection, malocclusion, screw loosening, and plate fracture were considered minor complications.

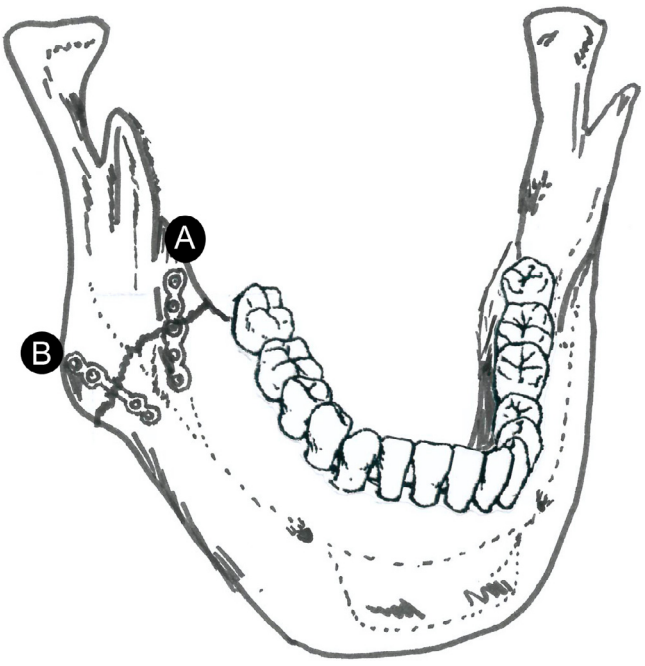

Fig. 1. Schematic diagram of the plate positions in the treatment of isolated mandibular angle fracture. In the case of single miniplate fixation, only plate A was placed, and in the case of double miniplate fixation, plates A and B were both placed.

The protocol, survey forms, and consent forms for this hospital-based retrospective study were approved by the necessary Institutional Review Board (IRB). Written patient consent was not required as this was waived by the approving IRB.

Surgical techniques

Single miniplate fixation with MMF

Under general anaesthesia, arch bars were applied, a vestibular incision was made above the fracture site at the mandibular angle, and a periosteal dissection was performed. During sub-periosteal dissection, the fracture line was detected, and the minimum possible dissection was done to the lower part of the mandibular angle in order to maintain adequate vascularization to the fracture site. Tooth extraction was performed if the tooth in the fracture line was fractured, there was severe mobility of the tooth, the tooth apex was exposed, or the tooth was interfering with the reduction procedure. Otherwise, reduction was done without extracting the tooth. Reduction of the margins of the fractured mandibular angle was performed, and monocortical fixation was done on the medial side of the external oblique ridge using one four-hole non-compression titanium miniplate with a thickness of 2.0 mm and screws of 6–8 mm in length (Fig. 2A and B). The MMF was retained for several days, with an average of 2 weeks.

Double miniplate fixation with MMF

For group B patients, in addition to the procedure described above for single miniplate fixation, the sub-periosteal dissection was performed all the way down to the inferior border of the mandible and a second miniplate was adapted and screwed to the inferior border of the mandibular buccal cortex with a transbuccal trocar (Fig. 3). The MMF was retained in the same manner as for the single miniplate fixation group.

Double miniplate fixation without MMF

For patients in group C, the surgical procedure was the same as for group B patients, comprising double miniplate fixation. However, no MMF was applied, and manual reduction was performed instead. Open reduction and miniplate fixation was