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Clinical Paper

Trauma

Clinical outcomes of three different types of hardware for the treatment of mandibular angle fractures: a comparative retrospective study

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Abstract. A retrospective study was conducted to compare the clinical outcomes of three different types of hardware that are used in mandibular angle fracture fixation. Thirty patients were selected from the hospital database. The patients were categorized into the following groups: group A, in which a single 2.0-mm locking miniplate was used; group B, in which a single rigid 2.3-mm plate was used; and group C, in which a single lag screw was inserted. All patients were followed for 6 months. With regard to intraoperative variables, significant differences were found among the groups in the duration of surgery and cost. Group C had the shortest surgical time, followed by group A and then group B. Two patients, one in group A and one in group B, suffered an occlusal discrepancy after surgery. Of the group A patients, two exhibited wound dehiscence and one had an infection. One patient in group B had an exposed plate. Sensory nerve involvement was noted in three group C patients and one group B patient. The lag screw was associated with the fewest complications and exhibited all of the advantages of plating systems in the treatment of angle fracture. The lag screw involved the least hardware and a short operating time, however the differences were not significant.

Key words: mandibular angle fracture; clinical outcomes.

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Mandibular fractures are frequent injuries that are treated in maxillofacial departments and are caused primarily by assault and traffic accidents.[1] Mandibular angle fractures require particular attention because they make up 23–42% of all mandibular fractures[2] and have the highest postsurgical complication rate, which ranges from 0% to 32%; these are the most difficult mandibular fractures to treat.[3]

The ideal method for the treatment of mandibular fractures should have the objectives of a perfect anatomical reduction, functional stable fixation and painless mobilization of the injured segments,

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minimization of complications, and the achievement of immediate function.[4] The treatment of mandibular angle fractures requires an adequate understanding of the surgical anatomy, biomechanical forces at the angle, the state of occlusion, and the presence of a third molar in the fracture line. Additionally, the angle has limited intraoral access, which makes its treatment difficult. All of these factors may cause problems in the attainment of stable fixation of the fractured segments.[5]

Despite progress in treatment methods and fixation systems for maxillofacial trauma, the optimal method for the treatment of mandibular angle fractures remains controversial. Variable sizes, shapes, designs, numbers, and biomechanics of plates and screws with different combinations have been used for the treatment of mandibular angle fractures,[3,6,7] but even with the most popular methods, satisfactory results may not be achieved because the pterygomasseteric sling and masticatory forces can displace the fractured segments.[8]

Rigid plates (2.7-mm and 2.4-mm) were introduced for placement at the inferior border of the mandible for the treatment of mandibular fractures. Such plates provide sufficient rigidity to the fragments, adequate neutralization of functional forces even in the absence of compression, and prevent interfragmentary mobility and distraction in the tension zone and thus decrease the incidence of complications.[9] A study by Assael et al.[10] compared different types of plates and screws and reported that 2.7-mm diameter screws with 2.0-mm thick plates carried greater functional loads than 2.4-mm diameter screws with 1.6-mm thick plates. Additionally, the use of three screws on each side of the angular fracture and a single rigid plate has been claimed to provide adequate neutralization of functional forces and to prevent segment displacement in another study.[11]

The locking plate/screw system offers many advantages over other plating systems, including the ease of plate adaptation, minimal alterations in osseous and occlusal relationships during screw tightening, less screw loosening, and enhanced stability without transmitting excessive pressure to the underlying bone, which decreases the impairment of the blood supply.[12] It has been reported that intentional maladaptation of the plates affects the non-locking systems but does not affect the locking plates.[13]

Lag screw fixation is the best means of providing axial compression and load sharing across the fracture site, because all of the fixation forces are directed across the long axis of the screw with no metal-to-metal friction, providing better stability than any other method of fracture fixation because its effectiveness relies on securing the tension zone during function. A unique advantage of the lag screw over single plate fixation is that it can be inserted more rapidly.[7]

Fig. 1. Preoperative panoramic radiograph showing a severely displaced left angle fracture with right parasymphyseal fracture.

The purpose of this study was to identify any differences in postoperative clinical outcomes after fixation of mandibular angle fractures with single 2.3-mm rigid plates, single 2.0-mm locking plates, and the lag screw technique.

Patients and methods

Thirty patients with either isolated mandibular angle fractures or angle fractures with concomitant fractures elsewhere in the mandible were included in this study. The patients attended Al Zahraa University Hospital, Al Azhar University between October 2007 and October 2013. The indications for open reduction and internal fixation were displaced mandibular angle fractures and angle fractures associated with condylar fracture for which mobilization was necessary. Patients with infected fracture lines, comminuted fractures, or a systemic disease that could have interfered with healing (e.g., diabetes, chemotherapy) were excluded from this study.

All patients were informed about the proposed mode of treatment and provided written informed consent to undergo surgery. The local ethics review committee of Al Azhar University for Girls approved the identification and selection of patients who met the inclusion criteria from the hospital database to accomplish this study. Prior to surgery, full histories and clinical examinations were performed and recorded on a standardized sheet. Preoperative digital panoramic radiographs were used for the initial assessments of the following: the line or lines of the fractures, the location of the inferior alveolar canal, the presence of a tooth in the fracture line, and the degree of displacement (Fig. 1). Other necessary views, such as postero-anterior views or computed tomography (CT) (Fig. 2) were requested as necessary for each case. The diagnosis was established on the basis of each case's history and clinical and radiographic examinations, and the treatment plan was selected accordingly.

The selected patients were categorized into three groups, with 10 patients in each group, according to the type of hardware used for fracture fixation, as follows: group A included patients who were treated with single 2.0-mm locking miniplates, group B included patients who were treated with heavy non-locking 2.3-mm plates, and group C included patients who were treated with the single lag screw technique. In the process of allocating patients to the different groups, gender, medical histories, smoking habits, and the type and location of the fractures were matched, with the exception of a predominance of right angle fractures in group C (Table 1). All patients received intravenous antibiotics from the time of admission until discharge, followed by a 5- to 7-day course of oral antibiotics.

Surgical procedures

Under general anaesthesia, the fracture was exposed using an intraoral extended third molar incision. The third molars were not removed during the surgical interventions unless they were loose, fractured, luxated, or prevented an appropriate reduction. Arch bars with maxillomandibular fixation (MMF) were applied preoperatively in every patient, and if the occlusion was not perfect, manipulation of the fractured segments was performed after the exposure of the fracture line until proper occlusion was achieved. The MMF was secured, and reduction of the