

# Short-term Results of Robinson Type 2B2 Clavicular Fractures Treated Conservatively or Surgically

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## abstract

The most frequently treated injuries, representing approximately 82% of all clavicular fractures, involve the midshaft clavicle. Historically, most acute displaced midshaft clavicular fractures were treated nonsurgically. However, the outcomes of nonsurgical treatment have recently been thought to be not as good as expected in the past, and the trend is to treat these fractures surgically. The goal of this study was to evaluate the short-term clinical outcomes of Robinson type 2B2 clavicular fractures treated conservatively vs with locked plate fixation. Among 59 patients included in the study, 30 patients (mean age, 45±13.7 years; range, 30-62 years) treated conservatively were designated as group A, and 29 patients (mean age, 38.8±11.1 years; range, 20-60 years) treated with locked plate fixation were designated as group B. All patients were evaluated using Oxford and Constant scoring systems at final follow-up. Mean follow-up was 18 months (range, 12-24 months). In group A, mean Constant score was 70.5±15.1 (range, 98-43) and mean Oxford score was 46.6±1.3 (range, 49-44) at final follow-up. In group B, mean Constant score was 89.2±8 (range, 100-77) and mean Oxford score was 46.5±1.2 (range, 48-44) at final follow-up. Callus was detected radiographically in both groups at 6-week follow-up. Patients in groups A and B started active range-of-motion exercises at weeks 6 and 3 after treatment, respectively. Locked plate fixation of Robinson type 2B2 clavicular fractures can be the first treatment option because of good clinical results, low complication rates, and good cosmesis. [*Orthopedics*. 2016; 39(2):e276-e279.]

Historically, most acute displaced midshaft clavicular fractures were treated nonsurgically with a high probability of fracture union, good functional outcomes, and a high level of patient satisfaction.<sup>3-8</sup> However, the outcomes of nonsurgical treatment have recently been thought to be not as good as expected in the past, and the trend is to treat these fractures surgically.<sup>9,10</sup> Other reasons for performing surgery are advances in implant technology and patients who desire to return to normal activities of daily living as soon as possible.<sup>11</sup> However, one study reported a 37% complication rate after surgical treatment of clavicular fractures, and 18% of patients required repeat surgery.<sup>12</sup> Of

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Clavicle injuries affect the medial clavicle, shaft, and lateral end. The most frequently treated injuries, representing approximately 82% of all clavicular fractures, involve the midshaft clavicle.<sup>1,2</sup> In contrast, frequencies

of medial and lateral end fractures are 18% and 2%, respectively.<sup>2</sup> According to the Robinson classification system, types 1, 2, and 3 fractures occur in the medial fifth, diaphysis, and lateral fifth, respectively.<sup>1</sup>

fering surgery to all patients can expose patients to the complications of surgery.<sup>12</sup> Further evaluation of the requirements for surgery must be conducted before offering routine open reduction and plate fixation.

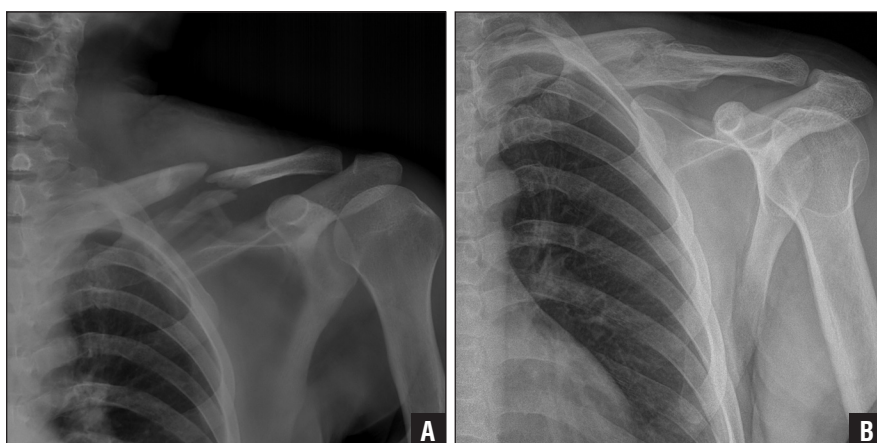
The goal of the current study was to evaluate and compare the short-term results of conservative treatment vs locked plate fixation in patients with Robinson type 2B2 clavicular fractures.

## MATERIALS AND METHODS

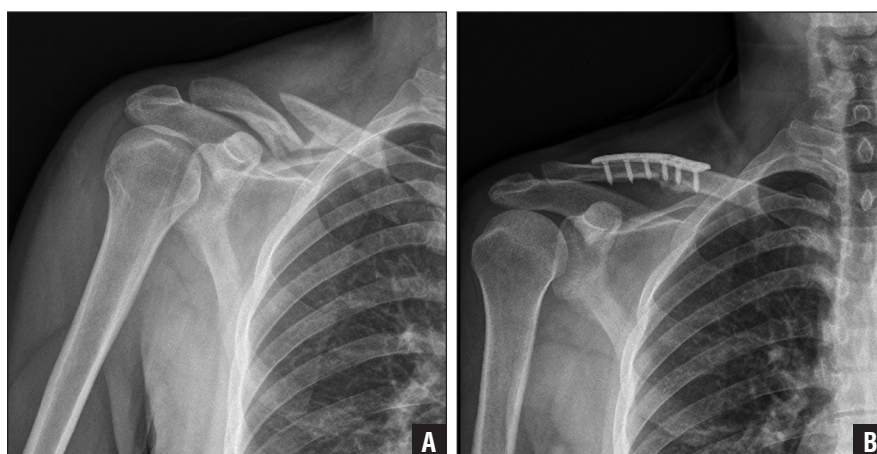
The records of patients who were treated for Robinson type 2B2 clavicular fractures from 2011 to 2014 were reviewed. A total of 67 patients with at least 1 year of follow-up were included. Four patients were lost to follow-up, and 4 patients were excluded because of open fractures. Thirty patients treated conservatively were designated as group A, and 29 patients surgically fitted with a locked plate and screws were designated as group B. All patients were assigned Constant and Oxford scores at final follow-up. Informed consent was obtained from all patients before treatment.

Figure-of-eight bandages were applied to the patients in group A for 6 weeks. On the day after application, each patient's neurovascular status was evaluated. Patients in this group were evaluated radiographically and underwent clinical examinations at weeks 1, 2, 4, and 6 (**Figure 1**). Active range-of-motion exercises were started at week 6.

In group B, 1 g of cefazolin prophylaxis was administered to patients 30 minutes preoperatively. Patients underwent surgery under general anesthesia in the beach-chair position. A straight incision was made over the fracture line. Butterfly or free fragments in comminuted fractures were fixed to the main fragment with a lag screw in 3 patients before fracture reduction and plate fixation. Fracture reduction was performed while taking care to minimize periosteal stripping. After reduction of the main fragments, a locked anatomic titanium-alloy compression plate was ap-



**Figure 1:** Anteroposterior radiographs of a left Robinson type 2B2 clavicular fracture before application of a figure-of-eight bandage (A) and 8 months after treatment (B).



**Figure 2:** Anteroposterior radiographs of a right Robinson type 2B2 clavicular fracture preoperatively (A) and 8 months postoperatively (B).

plied to the superior surface of the clavicle. A minimum of 6 cortices were fixed with 3.5-mm locked cortical screws on the medial and lateral sides of the fracture line (**Figure 2**). Autografts or allografts were not required intraoperatively.

A shoulder-arm splint was applied to the upper extremity of each patient for 3 weeks postoperatively. Passive shoulder exercises started on postoperative day 2, and active range-of-motion exercises started at week 3. Patients underwent clinical examination at weeks 1, 4, and 6. Shoulder-strengthening exercises started at week 6, depending on the presence of radiological and clinical healing. At the end of 3 months, all pre-trauma

movements and activities were permitted, excluding contact sports. At the end of month 6, unlimited activities were permitted.

All patients underwent radiographic examination upon admission. After applying figure-of-eight bandages to patients in group A, further radiographic examinations were performed to control fracture reduction, if required. Radiographic examinations were performed in patients in group B on postoperative day 1. Radiographic examinations were performed in both groups at 6-week follow-up.

Statistical analyses were performed to compare the groups' scores. The Oxford and Constant scores for both groups were

normally distributed, and Student's *t* test, the nonparametric version of Student's *t* test, and the Mann-Whitney test were performed. A *P* value less than .05 was considered statistically significant (95% confidence interval).

## RESULTS

Mean follow-up was 18 months (range, 12-24 months). Mean age of all patients was 41.9±12.8 years (range, 20-62 years). Mean age was 45±13.7 years (range, 30-62 years) in group A and 38.8±11.1 years (range, 20-60 years) in group B. At final follow-up, mean Constant and Oxford scores were 70.5±15.1 (range, 98-43) and 46.6±1.3 (range, 49-44), respectively, in group A, and 89.2±8 (range, 100-77) and 46.5±1.2 (range, 48-44), respectively, in group B. No patient who underwent surgery required revision surgery. Bone healing was radiographically detected in all fractures in both groups. There was no statistically significant difference between the Oxford scores of the 2 groups (*P*=.726). Constant scores in group B were better than those in group A (*P*=.012). There were no major complications in either group. However, 5 patients in group A had a deformity in the clavicular region due to callus formation. No deformity was detected in group B. Callus was detected radiographically in both groups at 6-week follow-up. Patients in groups A and B started active range-of-motion exercises at weeks 6 and 3 after treatment, respectively.

## DISCUSSION

The current study compares the early results of conservative treatment vs locked plate fixation for treatment of clavicular fractures. The patients were evaluated according to their Constant and Oxford scores, which are the most frequently used scoring systems for evaluating shoulder pathologies.

Some studies of adult patients who were treated conservatively report fairly moderate outcomes. For example,

Nordqvist et al<sup>8</sup> reported that 22 (32%) of 68 patients had unsatisfactory outcomes. In another study by Hill et al,<sup>9</sup> 16 (31%) of 52 adult patients who were treated conservatively had unsatisfactory outcomes. In contrast, studies on outcomes of patients with clavicular fractures treated surgically report satisfactory outcomes and lower rates of nonunion.<sup>11,13</sup> However, in these studies, multivariate analysis showed that the development of nonunion was the only independent factor that correlates with functional outcomes. Patients who underwent open reduction and plate fixation have less risk of nonunion.<sup>11</sup> This may explain the satisfactory outcomes of surgery to repair clavicular fractures in adults. When patients with nonunion were excluded, patients treated with open reduction and plate fixation had better functional outcomes compared with those treated conservatively, although the differences between their scores were not significantly different.<sup>11,14</sup> In the current study, nonunion did not occur in any patient. Therefore, this study's results are consistent with those of other studies.<sup>11,14</sup> A statistically significant difference existed between Constant scores, with the scores in group B being higher than those in group A. There was no statistically significant difference between Oxford scores in both groups.

Complications associated with both treatment modalities include cosmetic deformity, malunion, nonunion, pain, local tenderness, irritation, and limited motion. Other rare complications include residual nerve paresthesia, subclavian vessel compression, thrombosis, pseudoaneurysm, thoracic outlet syndrome, and brachial plexus neuropathy. Infection and hardware problems are complications of surgery. Reported infection rates range from 0% to 18%.<sup>15-18</sup> The frequency of painful, irritating hardware that requires removal is reported to be as high as 50% to 100%.<sup>16</sup> The reported frequency of refracture after plate removal is 0% to 8%.<sup>15,16</sup> Adhesive capsulitis is observed in

0% to 7% of patients postoperatively.<sup>19,20</sup> In the current study, no major complications were encountered in either group. However, clavicular cosmetic deformity due to aberrant callus formation was detected in 5 patients in group A. Because of the short follow-up period, no plates were removed.

There is no firm consensus in the literature on the optimum duration of immobilization; 2 to 6 weeks is recommended by the authors of 2 studies.<sup>19,21</sup> The current authors performed immobilization with shoulder-arm splints for 6 weeks and removed the splints during exercise.

Limitations of this study include its retrospective nature, small sample size, and short follow-up. Treatment selection based on physician preference is the most important limitation of the study. Only plates were used for fixation—other types of implants were not used in the surgically treated group. The absence of a control group for the surgically treated group is another limitation of this study.

## CONCLUSION

Surgery using locked plate fixation to repair Robinson type 2B2 clavicular fractures can be the treatment of choice because it achieves better cosmesis, fewer complications, and better outcomes.

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