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## ORIGINAL ARTICLE

# Comparing the coracoclavicular loop technique with a hook plate for the treatment of distal clavicle fractures

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**Background:** Treatment of displaced distal clavicular fractures is still controversial. This study reports the utility of a new coracoclavicular (CC) loop technique for acute displaced distal clavicular fractures and compared its surgical outcomes with those of the hook plate method.

**Methods:** In this retrospective study, a total of 23 patients with acute displaced distal clavicular fractures were treated with a new CC loop technique at a single institution from 2010 to 2014. Another group comprising 49 patients treated with a hook plate was compared with the CC loop group regarding clinical and radiologic outcomes.

**Results:** Seventy-two patients with at least 1 year of follow-up after both operations were included in this study. The Constant score was significantly greater in the CC loop group (95 vs 87,  $P = .009$ ) at final follow-up. Moreover, the complication rate was significantly lower in the CC loop group (0% vs 24.5%,  $P = .007$ ). The University of California, Los Angeles shoulder score and radiologic nonunion rate revealed no significant differences between the 2 groups.

**Conclusions:** The new CC loop technique had better clinical outcomes and lower complication rates compared with the hook plate technique.

**Level of evidence:** Level III; Retrospective Cohort Design; Treatment Study

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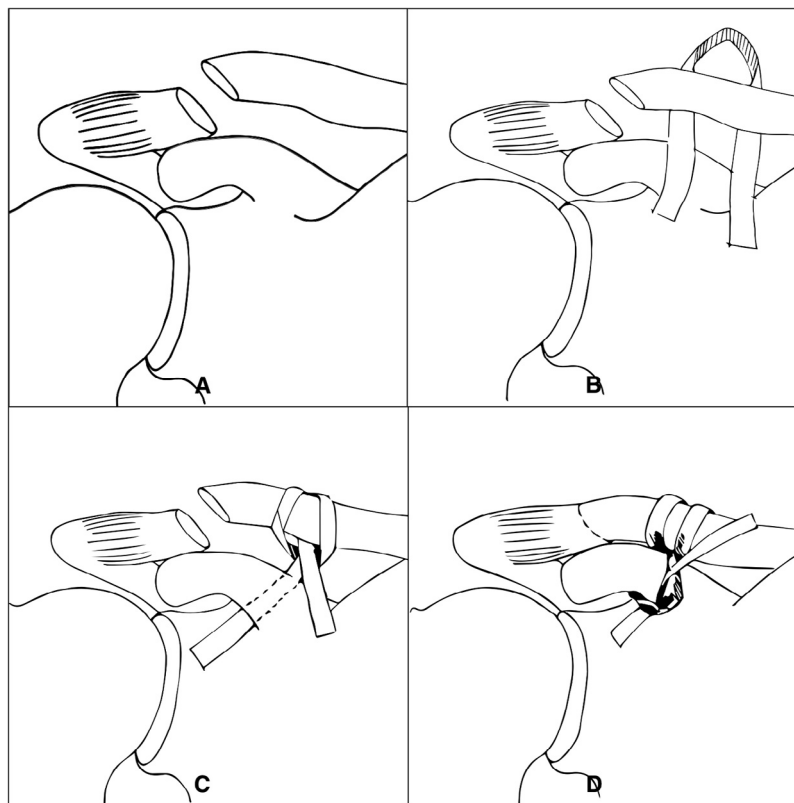
**Keywords:** Distal clavicle fracture; clavicular hook plate; coracoclavicular loop; Constant score; Neer type II; Neer type V

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Distal clavicular fractures account for 15% of all clavicular fractures and 50% of all un-united clavicular fractures.<sup>24</sup> Neer<sup>23</sup> initially described the fracture classification, and Allman<sup>1</sup> subsequently modified it into 5 types. According to the classification, type II and type V distal clavicular fractures are associated with a coracoclavicular (CC) ligament tear or avulsion fracture of the ligament insertion site and are characteristically unstable.<sup>4</sup> Because of the high nonunion rate noted with nonoperative treatment of displaced distal clavicle



**Figure 1** Illustrations of coracoclavicular loop technique in right shoulder. (A) Before coracoclavicular looping. (B) Folded Mersilene tape passed behind proximal clavicle. (C) Cow-hitch knot with Mersilene tape looped over proximal clavicle. (D) Reduction of fracture and tying of knot.

fractures, surgical treatment has been suggested.<sup>22,24</sup> Many surgical reconstructive methods have been reported, which include transacromial K-wire fixation,<sup>13</sup> a transacromial Knowles pin,<sup>10</sup> plate fixation with or without suspensory fixation,<sup>28</sup> a CC screw,<sup>18</sup> a CC loop,<sup>5</sup> and a hook plate.<sup>12</sup>

The hook plate provides reliable fixation between the distal clavicle and acromion with the benefit of a high union rate and is one of the most popular methods for treating this fracture.<sup>16</sup> However, the hook plate is also associated with complications such as impingement syndrome, subacromial osteolysis, acromioclavicular joint arthrosis, and proximal clavicular fracture.<sup>9</sup>

Because of high complication rates (up to 50%) with the hook plate technique,<sup>17</sup> we developed a technique with a single cow-hitch CC loop for treating patients with displaced distal clavicular fractures (Fig. 1). This technique involves fixation of the clavicle to the coracoid and avoids subacromial space violation, theoretically causing less interference with shoulder motion. The purpose of this study was to describe a new CC loop technique and report its surgical outcomes. We hypothesized that this technique could offer better surgical outcomes than the hook plate in patients with acute distal clavicular fractures. The radiologic outcomes, functional outcomes, and complication rates are reported.

## Materials and methods

A retrospective comparative study was performed in a single medical center. Regarding the CC loop group, a total of 26 patients with acute displaced distal clavicle fractures treated with the CC loop technique from January 2010 to December 2014 were reviewed in this study. The inclusion criteria for the CC loop group were patients with acute displaced distal clavicle fractures requiring surgery who received open reduction and internal fixation with a new CC loop technique and who were followed up for at least 12 months. Patients with a history of shoulder surgery, previous shoulder functional impairment including rotator cuff tears, limited shoulder range of motion, symptomatic shoulder arthritis, and incomplete follow-up were excluded. Finally, 23 patients (7 female and 16 male patients; mean age, 42.4 years) were enrolled as the CC loop group.

A consecutive series of 56 patients with distal third clavicle fractures were surgically treated with hook plates from January 2010 to December 2014 and joined the study as the hook plate group. The inclusion criteria, exclusion criteria, and follow-up time for the hook plate group were the same as those for the CC loop group, and these patients were also followed up for at least 12 months. In our institute, removal of the hook plate was suggested after evidence of fracture union was found or when hardware irritation was suspected. Patients with retention of the hook plate at final follow-up were excluded. Altogether, 3 patients with retention of the hook

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