

## Key Publications

# Biomechanical Evaluation of a Pre-contoured Clavicle Plate

### Publication Excerpt

“Our study comparing the in-vitro biomechanical properties of a precontoured clavicle plate and 3.5-mm stainless steel LCDC plate using a cadaveric osteotomy model found no post-plating differences between the 2 plate types in the 4 modes tested. The precontoured clavicle plate may afford several potential advantages. It has the anatomic shape of the natural clavicle and, with available right and left clavicle fittings, may decrease operative time. With a lower profile and round ends, compared to the 3.5 mm LCDC plate, greater cosmesis and patient tolerance of the plate are possible. The lower modulus of elasticity of titanium compared to stainless steel may lead to less stress shielding. Further clinical investigations are necessary to evaluate the efficacy and any realized benefits of the Acumed clavicle plate.”

### Journal Abstract

Recent attention has been focused on the operative treatment of mid-shaft fractures of the clavicle. This study compares the in-vitro biomechanical properties of a preformed titanium clavicle plate (Acumed) to a Synthes 3.5 mm limited-contact dynamic-compression (LCDC) plate using a cadaveric osteotomy model. An osteotomy was performed on 7 pairs of human clavicles and were randomly plated with either a Synthes 3.5 mm LCDC stainless steel plate or an Acumed titanium precontoured clavicle plate. After plating, specimens were tested on an EnduraTEC material testing apparatus for axial compression and tension strength, as well as torsional strength in compression and tension. Biomechanical test results for plated specimens are reported for the LCDC plate and the Acumed plate, and the 2 plates are compared. This exploratory study supports investigations with larger sample sizes to determine if the Acumed precontoured plate differs from the LCDC plate in biomechanical properties and the clinical implications of such differences.

### Reference

Goswami T, Markert R, Anderson C, Sundaram S, Crosby L. Biomechanical evaluation of a pre-contoured clavicle plate. *J Shoulder Elbow Surg.* 2008;17(5):815-818.

# Nonoperative Treatment Compared With Plate Fixation of Displaced Midshaft Clavicular Fractures

## Publication Excerpt

“Operative fixation of a displaced fracture of the clavicular shaft results in improved functional outcome and a lower rate of malunion and nonunion compared with nonoperative treatment at one year of follow-up. Hardware removal remains the most common reason for repeat intervention in the operative group. This study supports primary plate fixation of completely displaced midshaft clavicular fractures in active adult patients.”

## Journal Abstract

### Background

Recent studies have shown a high prevalence of symptomatic malunion and nonunion after nonoperative treatment of displaced midshaft clavicular fractures. We sought to compare patient-oriented outcome and complication rates following nonoperative treatment and those after plate fixation of displaced midshaft clavicular fractures.

### Methods

In a multicenter, prospective clinical trial, 132 patients with a displaced midshaft fracture of the clavicle were randomized (by sealed envelope) to either operative treatment with plate fixation (sixty-seven patients) or nonoperative treatment with a sling (sixty-five patients). Outcome analysis included standard clinical follow-up and the Constant shoulder score, the Disabilities of the Arm, Shoulder and Hand (DASH) score, and plain radiographs. One hundred and eleven patients (sixty-two managed operatively and forty-nine managed nonoperatively) completed one year of follow-up. There were no differences between the two groups with respect to patient demographics, mechanism of injury, associated injuries, Injury Severity Score, or fracture pattern.

### Results

Constant shoulder scores and DASH scores were significantly improved in the operative fixation group at all timepoints ( $p = 0.001$  and  $p < 0.01$ , respectively). The mean time to radiographic union was 28.4 weeks in the nonoperative group compared with 16.4 weeks in the operative group ( $p = 0.001$ ). There were two nonunions in the operative group compared with seven in the nonoperative group ( $p = 0.042$ ). Symptomatic malunion developed in nine patients in the nonoperative group and in none in the operative group ( $p = 0.001$ ). Most complications in the operative group were hardware-related (five patients had local irritation and/or prominence of the hardware, three had a wound infection, and one had mechanical failure). At one year after the injury, the patients in the operative group were more likely to be satisfied with the appearance of the shoulder ( $p = 0.001$ ) and with the shoulder in general ( $p = 0.002$ ) than were those in the nonoperative group.

### Conclusions

Operative fixation of a displaced fracture of the clavicular shaft results in improved functional outcome and a lower rate of malunion and nonunion compared with nonoperative treatment at one year of follow-up. Hardware removal remains the most common reason for repeat intervention in the operative group. This study supports primary plate fixation of completely displaced midshaft clavicular fractures in active adult patients.

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## Reference

Altamimi S, McKee M, and the Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. *J Bone Joint Surg Am*. 2008;90: 1-8.

# Evaluation of Prominence of Straight Plates and Precontoured Clavicle Plates Using Automated Plate to Bone Alignment

## Publication Excerpt

“There are significant[ly] more bad fits with the straight plates compared to the precontoured plates in group A ( $p < 0.001$ ), B ( $p = 0.004$ ) and C ( $p < 0.001$ ). There is no statistical difference between the number of bad fits between precontoured plates in group A ( $p = 1.000$ ) and C ( $p = 0.695$ ).”

## Journal Abstract

Hardware prominence after plate fixation for clavicle fracture is a common complication. The aim of the study was to perform a 3D analysis of the prominence of different types of superior clavicle plates. An automated fitting of 3 straight and 10 precontoured plates was performed on 52 3D-CT-scan reconstructed cadaver clavicles. The mean and maximum bone-plate distance and maximum prominence was significant higher with the straight plates compared to the precontoured plates. The mean and maximum boneplate distance was significant[ly] higher with the precontoured DePuy Synthes plates compared to the precontoured Acumed plates but when evaluating the maximum prominence there was no significant difference between the most commonly used 8-holes plates. To conclude, precontoured plates of the clavicle diminish significantly hardware prominence. There exists a difference in hardware prominence between different brands of precontoured plates but this difference is limited and in most cases not significant.

## Reference

Van Tongel A, Huysmans T, Amit B, Sijbers J, Vanglabbeek F, De Wilde L. Evaluation of prominence of straight plates and precontoured clavicle plates using automated plate to bone alignment. *Acta Ortho Belgica*. 2014;80:301-308.



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