APPLICATION FOR 2006 SCIENTIFIC PROGRAM
ABSTRACT DEADLINE DATE IS January 1, 2006

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TITLE: Mechanical Evaluation of Clavicle Fixation Devices

ABSTRACT:

Fractures of the clavicle are frequently seen in clinical practice. Studies have shown clavicles are involved in 15% of all fractures. Frequently viewed as a simple fracture to manage, one must remember not all clavicle fractures are the same.

The purpose of this study is to compare the mechanical strength and stability of three newer generation implants for fixation of clavicular fractures. In review of the literature, there are only three articles available that study the biomechanics of clavicle fixation. However, these older studies do not include any of the more recent implants, which have subsequently become the more common, "standard of care" methods of fixation. With such a variety of fixation choices as well as a dearth of biomechanical clavicle studies, the goal of our research will be to improve the operative treatment and ultimately the patient outcome from this common and sometimes difficult fracture.

A cantilever-bending test was selected to replicate the biomechanical environment of the upper extremity girdle immediately after fracture fixation. Five constructs of each design were evaluated: Acumed pre-contoured clavicle plate with bicortical screws (BI), Acumed pre-contoured locking clavicle plate with unicortical screws (UNI), and the Depuy Rockwood Clavicle pin (PIN). Each implant was applied to a synthetic clavicle using the manufacturers recommended technique. The medial end of the clavicle was rigidly clamped to the base of the mechanical testing machine and a downward force was applied to the lateral superior tip of the clavicle until failure. Stiffness, yield displacement, yield load, ultimate displacement and ultimate load were calculated for each trial. There were no differences between the UNI and BI groups for any of the outcome measures tested. However, significant differences were observed in nearly every outcome measure between PIN and the two plate groups (UNI and BI). The differences were primarily due to the fact that the PIN relies on axial compression to provide fixation and provides little, if any, torsional stability.

In conclusion, locking versus nonlocking constructs appear to provide similar rigid fixation in cantilever bending. However, it is unknown how much torsional load is applied to the clavicle shaft during normal activities of daily living. Therefore, we cannot project that the lack of torsional strength of the clavicle pin would increase the in vivo result of a nonunion. We can underscore that the locking and non-locking constructs performed almost identical. The data illustrates the strength of single cortical fixation in the clavicle, and therefore provides surgeons and ultimately their patients with a more rapid fixation technique and lower risk of intraoperative complication.

Abstract Classification

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