IN VITRO THREE DIMENSIONAL BIOMECHANICAL COMPARISON OF TWO INTERNAL FIXATION METHODS IN EQUINE ADULT RADII

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ABSTRACT

Radius fracture configurations conducive to internal fixation most often contain a spiral or oblique fracture of the distal diaphysis. The location and fracture configurations are biomechanically challenging because of the limited amount of bone available distally for screw purchase and the complex three dimensional (3D) loading and unconstrained motions that occur in the distal radius.

Development of an in vitro loading-measurement system that mimics in vivo unconstrained 3D relative motion of long bones, applies uniform load components over the entire length of a test specimen, and measures 3D relative motion to directly determine construct stiffness was verified. Stiffness results were comparable in magnitude to those theoretically predicted, and were consistently higher than results in the literature due to elimination of potting-fixture-test machine finite stiffness. Construct failure configurations were always reproducible with theoretical failure modes for bone.

Biomechanical properties of the dynamic condylar screw (DCS) implant system and the double broad dynamic compression plate (bDCP) construct used to repair distal oblique diaphyseal osteotomies and ostectomies in adult cadaveric radii were compared. No statistical difference was observed between the DCS implant system and the bDCP construct stiffness during axial compression, torsion, or four-point bending; intact radii displayed the greatest stiffness. Torsion and four-point bending failure loads were not statistically different for the DCS implant system when compared to the bDCP construct.