

Poster Presentation
Track 4: Implants for Trauma and Orthopedics-Joint ESB Track
4.6. Trauma Implants

Abstract: 7091

Citation: Journal of Biomechanics 2006; Vol. 39 Suppl. 1, page S526

A new test set-up to evaluate osteosynthesis implants of the proximal humerus

U. Schreiber¹, S. Eichhorn¹, O.M. Trapp², E. Steinhauser²

¹ *Clinic of Orthopedics and Traumatology, Dept. of Biomechanics, University Hospital Rechts der Isar, Technical University of Munich, Munich, Germany*

² *Traumacenter Murnau, Murnau, Germany*

Introduction: The incidence of fractures of the proximal humerus rises with the older growing population. Unfortunately it is unclear which is the optimal treatment for patients associated with osteoporosis. Reduction and stabilization of two and more fragment fractures can be achieved operatively with different implants. In order to evaluate the fixation strength of these implants a new in vitro method was developed.

Methods and Materials: The test set-up described can apply a dynamic load pattern onto a three fragment fractured humerus by simulating external forces such as the pull of the supraspinous and deltoideus muscles. These forces and the adaptation of the anatomical positions and angles of the muscles allow for induction of the glenohumeral reaction force according to the findings of Bergmann et al. [1]. The magnitude and ratio of the forces is derived from the descriptions of van der Helm [2]. Criteria for the evaluation of the different implants (intramedullary nails, conventional, and angle-stable plates) are the number of load-cycles up to failure and the change of interfragmentary positions. With an optical motion analysis system (SimiMotion, Germany) the interfragmentary motion is detected.

Discussion: Our set-up enables the simulation of different abduction and anteversion positions of the humerus. Testing of both cadaveric and artificial humeri can be done. Even reduction of motion in one plane is feasible with the simulation of two muscle forces and a fixed center of rotation. Implant specific clinical failure mechanisms are reproducible and the set-up allows comparison of the fixation strength of different implant types, such as plates and intramedullary nails.

Reference:

1. Bergmann G. Forces deltoid muscle and shoulder joint during arm abduction. *Berechnungssoftware: Shoulder1.exe*. www.biomechanik.de
2. van der Helm FC. Analysis of the kinematic and dynamic behavior of the shoulder mechanism. *J Biomech.* 1994(May); 27(5): 527-50.