Can the AAOS/OTA Hip Fracture Skills Simulator Measure Your Surgical Skill? Construct Validation of a Computer-Based Force-Feedback Simulation Platform

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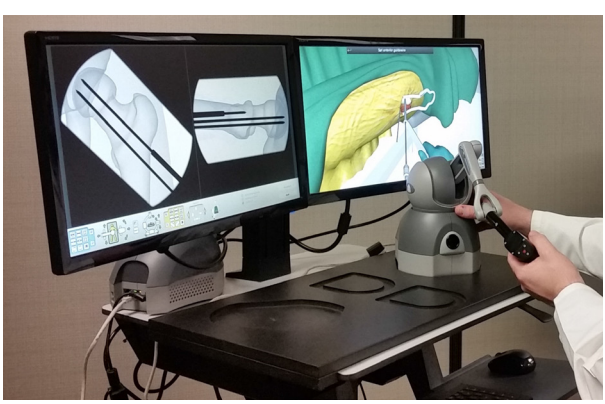
Background/Purpose: Surgical simulation training is well-established in scope-assisted surgery. Recent interest in increasing the role of surgical simulation in the training of orthopaedic residents has led to the development by the AAOS and OTA with an industry partner of a computer-based force-feedback simulation platform designed to teach motor skills associated with percutaneous, fluoroscopically guided procedures. This study seeks to validate this platform by determining if it is capable of differentiating between novice, intermediate, and experienced practitioners based upon defined metrics measured and recorded by the program during motor skills exercises. Our hypothesis was that the simulator would differentiate between users of different experience levels.

Methods: With IRB approval, 48 volunteer participants were recruited including medical students (Group I, n = 15), junior orthopaedic residents (Group II, PGY [postgraduate year] 2-3, n = 9), senior orthopaedic residents (Group III, PGY 4-5, n = 10), and attending orthopaedic surgeons and fellows (Group IV, n = 14). Each participant performed the task of placing 3 guidewires (inverted triangle construct) in a valgus-impacted femoral neck fracture (OTA 31-B1) using the simulator. After a basic introduction to the simulator, each participant completed the task of placing the 3 pins. Performance metrics included pin distance to defined ideals at inferior, anterior, and posterior femoral neck, distance to the femoral head articular surface, simulated fluoroscopy time, overall time to task completion, and distance to ideal starting point on lateral cortex. Unpaired *t* tests were used to compare the groups.



Results: The more experienced surgeons (Groups II, III, IV) outperformed the novices (Group I) on 12 of the 17 measured variables (number of fluoroscopy shots, distance of all 3 guidewires to joint surface,

distance of guide wires to cortex, distance of starting point on lateral cortex to ideal, and parallelism of wire placement; $P < 0.05$). Time to completion, fluoroscopy time, and number of wire penetrations of the joint surface for each of the 3 pins was similar between groups ($P > 0.05$).

Conclusion: This study demonstrates construct validity of the AAOS/OTA Hip Fracture Simulator in its ability to distinguish between novice and experienced surgeons for 12 of the 17 measured parameters ($P < 0.05$), implying that that the simulator measures elements of surgical skill specific to this task. A valid computer-based simulation platform capable of simulating both fluoroscopic images as well as tactile feedback during percutaneous procedures, without exposure to ionizing radiation to patients or surgeons, has the potential to improve surgical education in orthopaedic trauma by facilitating the tracking of performance and evaluation of novel teaching techniques via computer-based skills assessment. This initial validation is encouraging in terms of potential for this system to have utility in orthopaedic education.

See pages 49 - 106 for financial disclosure information.