High-Fidelity Orthopaedic Surgical Skills Models and Resident Performance in the Surgical Treatment of Tibial Plateau Fractures

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Background

- There is a gap between the skills required of an orthopaedic surgeon and resident opportunities to practice such skills in a realistic setting [1-3].
- A 2013 survey revealed that 80% of orthopaedic surgery residency program directors and 86% of residents believed surgical technique simulation should be implemented in residency training [2,4].
- However, 58% of those program directors and 83% of those residents felt surgical skill in simulation was not objectively measured [2,4].
- The use of low-fidelity Sawbones models in resident training has become commonplace but scant data exists measuring how the use of these models translates to the skills required in higher fidelity simulations and real world procedures.
- Therefore, the purpose of this study was to quantify the impact of low-fidelity simulation on resident surgical skills education.

Methods

- The study protocol was approved by the Naval Medical Center Portsmouth Institutional Review Board in compliance with all applicable Federal regulations governing the protection of human subjects, and was funded by the Department of the Navy Surgeon General Clinical Investigation Priority Research Funding.
- Fourteen orthopaedic surgery residents (PGY-1 through PGY-5) were separated into two, training-level-matched cohorts – an untrained control cohort (UCC) and a low-fidelity Sawbones training cohort (SAW).
- Together, both cohorts received didactic instruction from ABOS-certified orthopaedic trauma surgeons on Schatzker II tibial plateau fractures.
- The SAW group then first rehearsed open-reduction, internal-fixation once on radiopaque Sawbones models (Pacific Research Laboratories Inc. Vashon, WA).
- Both cohorts were then evaluated while performing the same procedure on high-fidelity cadaveric models (Rimasys GmbH Cologne, Germany).
- Surgical skill and knowledge were assessed using the objective structured assessment of technical skills (OSATS) tool, a 5 point Likert scale evaluating:
  - Respect for tissues
  - Time and motion
  - Instrument handling
  - Knowledge of instruments
  - Flow of operations
  - Use of assistants
  - Knowledge of specific procedure
- A post-simulation written exam and after-action survey were also given.

Results

- The mean overall OSATS score out of a possible 35 was 20.29 in the UCC cohort and 22.71 in the SAW cohort (Figure 1). This difference was found to be not significant (p=0.62).
- No significant difference was found between the written exam scores of the two cohorts (p=0.22) (Figure 2).

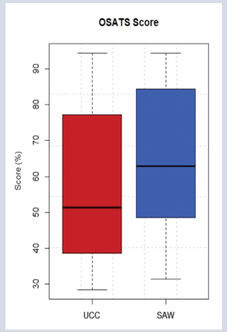

Figure 1: Average OSATS score for each cohort.

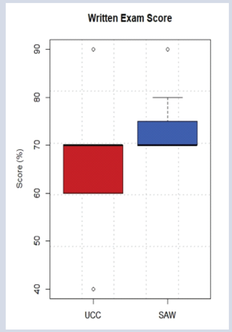

Figure 2: Average written exam score for each cohort.

- Despite there being no statistically significant differences in average overall OSATS scores, a near-linear positive relationship (R2 = 0.9737) existed between training year and average overall OSATS scores (Figure 3).

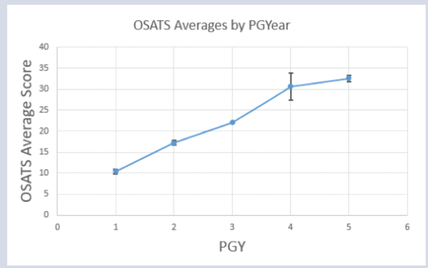

Figure 3: Average OSATS score stratified by year.

- 100% of subjects felt better prepared to perform this procedure after performing the surgery on high-fidelity cadavers.
- All study participants also noted in their after-action surveys that they felt using high-fidelity cadaveric models in a training environment prepared them for real-world performance better than using low-fidelity Sawbones models alone.

Conclusions

- The results of this study fail to demonstrate an advantage when training with Sawbones low-fidelity models prior to evaluation of surgical skill using high-fidelity cadaveric models.
- However, the study did demonstrate the value of high-fidelity models in resident education.
- Residents across both cohorts qualitatively felt the high-fidelity models offered a better educational opportunity for surgical practice than did the low-fidelity models, despite similar outcomes in practical evaluation of surgical skill following different training interventions.
- Many residents asked that this exercise be performed for other surgical procedures as it offers realistic training outside of the operating room environment.
- Some of the limitations of this work included:
  - A singular practical exam reviewer with possible confirmation bias
  - Some study participants acted as surgical assistants prior to completing their own practical exam, therefore seeing the procedure twice
  - Variability among cadaveric specimens due to age and fabricated fracture patterns
  - No soft-tissue practice on Sawbones models
- Continued work should consider the aforementioned error modes to better define significant differences between the training interventions employed.
- Future work comparing the impact of low-fidelity and high-fidelity training models on surgical skill is warranted.

References

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Disclaimers