EVALUATING THE ERGONOMICS OF SURGICAL RESIDENT LAPAROSCOPIC SIMULATION TRAINING USING A NOVEL COMPUTER PROGRAM

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Background

- Surgical ergonomics affect both patients and surgeons
- No standardized assessment or training for residents
- Automated assessment as a feasible intervention?

Methods

- **Residents across training years:**
  - Video recorded performing Fundamentals of Laparoscopic Surgery (FLS) tasks
  - Completed a musculoskeletal complaint survey
- **FLS ergonomics evaluated via:**
  - Rapid Upper Limb Assessment (RULA) from 1 – 7 (low to high-risk body positioning)
    - Graded by two human reviewers
    - Graded by a novel computer vision program
- **Survey evaluated via:**
  - Frequency of post-laparoscopic complaints by body region from 0 – 30 (low to high)

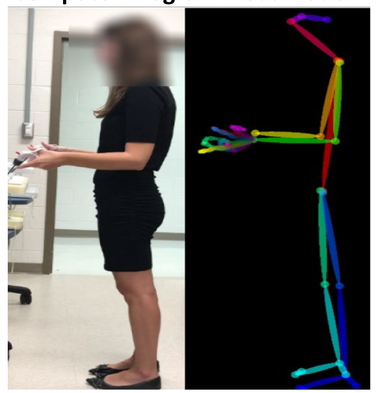
OUTCOMES:
- RULA scores by resident level
- Human vs. Computer scores
- Frequency of musculoskeletal complaints

Results

- Ten residents participated
  - 5 PGY 1 (lower level)
  - 5 PGY 2+ (upper level)
  - 60% female
- All residents:
  - Scored outside acceptable posture range (>2)
  - Complained of at least occasional MSK pain
- Human and computer scores did not correlate, yet all higher than acceptable
- Improved posture in upper level residents by human grader

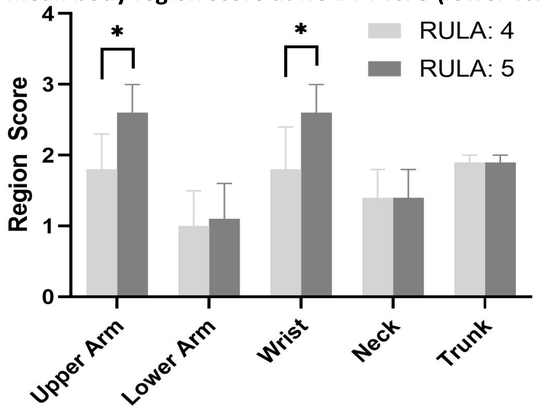
RULA Scores	Human	Computer
LL mean	6	4.11
UL mean	5.4	4.10
p value	*0.04*	0.39

Computer Program Visualization



- No correlation between musculoskeletal complaints and RULA score or resident level
- Computer assessment:
  - Upper arm and wrist positions greatest contributors to higher score (*p= <0.001)

Computer mean body region score at RULA 4 vs. 5 (lower vs. higher)



Conclusions

- Human and computer grading of resident ergonomics demonstrate unacceptable posture during simulated laparoscopy
- Posture improves with training level but not to an acceptable level
- Musculoskeletal complaints are common within surgical residents
- Automated computer assessment of ergonomics is easy to implement and provides specific body position feedback

Future Directions

- Validate computer program using a multi-institutional study
- Compare computer assessments to standardized measurements
- Utilize operating room footage to assess real-world ergonomics