

Eye Tracking Reliably Demonstrates Improved Speed and Accuracy During Standardized Accelerated Laparoscopic Training

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INTRODUCTION¹

- A key barrier to laparoscopic skill acquisition is the lack of standardization across training programs
- Reliably and inexpensively measuring improvement in speed and accuracy during training remains a challenge
- Eye tracking has been implemented as a training methodology in multiple high-risk environments and showed improvement in performance

PURPOSE

- **Study Questions:**
(1) Can a standardized accelerated laparoscopic training (SALT) program improve objective and subjective performance across learners with varying experience?

(2) Can eye tracking technology be used as a method for reliably tracking improvements in speed and accuracy?
- **Hypothesis:** We hypothesized that novice surgeons (medical students and residents) would have improved speed and accuracy in intracorporeal suturing after exposure to standardized laparoscopic training and that visual surrogates for lower cognitive load (decreased fixation duration and saccade duration on eye tracking) would correspond with improvement in skill

METHODS

- Novice surgeons were recruited and completed pre- and post- training self-assessment questionnaires
- Each performed a standard laparoscopic task (intracorporeal suture) prior to and after completing SALT intervention
- Speed measured as total task time
- Accuracy scored as presence of excessive instrument friction or collisions, poor spatial awareness or jittery instrument driving, needle drops, suture material breaks
- An eye tracking bar was used to measure gaze patterns and eyesight
- A t-test analysis was used to compare pre and post eye movement data¹⁵¹⁵

FIGURES



RESULTS

- 12 participants were recruited (7 medical students, 5 residents)
- Survey responses indicated self-perceived improvement in accuracy, depth perception, and instrument handling
- Medical students' speed improved by 63.7% after intervention, and residents improved by 17.6% after intervention
- No difference between pre and post intervention accuracy scores, though there was a non-significant trend towards improvement
- Significant decrease in fixation time by >60% ($p=0.0001$) and saccade duration ($p=0.0013$) after intervention, which suggests faster processing and enhanced attention to the goal-directed task at hand
- As exercise speed improved, fixation duration and saccade lengths decreased

CONCLUSION

- We found that participants developed more focused gaze strategies on their second attempt compared to a scattered visual search. We observed longer Fixation Durations ($p=0.009$) with the mean fixation duration increased from 551ms to 649ms (+18%). In eye tracking research, longer fixations indicate deeper cognitive processing and sustained visual attention.
- We found that participants developed more efficient, focused visual behavior on their second attempt. There was a trend towards reduced saccade rate ($p=0.066$). Saccade frequency decreased from 2.08/s to 1.80/s. Fewer saccades per second means less jumping from one visual target to another
- A limitation is the sample size ($n=12$), due to limited statistical power. Multiple trend-level effects ($p<0.10$) might increase in significance with a larger sample size

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