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Research Abstracts

Effects of Optical See-Through Head-Mounted Display Use on Performance and Situation Awareness During Simulated Laparoscopic Surgery Tasks

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Introduction: This study investigated the influence of using optical see-through (OST) head-mounted displays (HMDs) as a replacement of the conventional monitors for an extended duration, as required for laparoscopic surgery, on performance and situation awareness.

Methods: Twenty-four first- and second-year medical students (15 female and 9 male) completed three experimental sessions for the three different display combinations. The experiment scenario included two displays (surgical field and patient vitals) in three different combinations (both displays in the HMD, mixed displays (one on HMD and one on a conventional monitor), and both on conventional monitors). Participants were asked to monitor patient vitals for two adverse events, hemorrhage and tension pneumothorax, while performing a 1-hour laparoscopic suturing task, and select intervention accordingly.

Results: The suturing task performance was significantly worse when using the mixed displays compared to conventional monitors ($p = 0.021$). The performance when both displays were on the HMD was not statistically different compared to the other two display combinations. The reaction time to respond to the occurrence of tension pneumothorax was significantly faster when both displays were on the HMD compared to mixed displays ($p = 0.008$) and conventional monitors ($p = 0.024$). The level 1 situation awareness for the presence of the tension pneumothorax event was significantly worse when both displays were on the conventional monitors compared to both on the HMD ($p = 0.016$) and mixed displays ($p = 0.011$). Both reaction time and situation awareness showed no statistically significant difference when participants were presented with the hemorrhage event.

Conclusions: For this study, the OST HMD did not have a negative effect on the task performance, it also improved the reaction time to adverse events and situation awareness in some conditions compared to conventional monitors. Further research is needed to determine the optimal conditions that could improve the situation awareness.