Dokumenttyp: journal article

Autor(en) des Beitrags:
Wilhelm, D; Reiser, S; Kohn, N; Witte, M; Leiner, U; Mühlbach, L; Ruschin, D; Reiner, W; Feussner, H

Titel des Beitrags:
Comparative evaluation of HD 2D/3D laparoscopic monitors and benchmarking to a theoretically ideal 3D pseudodisplay: even well-experienced laparoscopists perform better with 3D.

Abstract:
Though theoretically superior to standard 2D visualization, 3D video systems have not yet achieved a breakthrough in laparoscopy. The latest 3D monitors, including autostereoscopic displays and high-definition (HD) resolution, are designed to overcome the existing limitations. We performed a randomized study on 48 individuals with different experience levels in laparoscopy. Three different 3D displays (glasses-based 3D monitor, autostereoscopic display, and a mirror-based theoretically ideal 3D display) were compared to a 2D HD display by assessing multiple performance and mental workload parameters and rating the subjects during a laparoscopic suturing task. Electromagnetic tracking provided information on the instruments’ pathlength, movement velocity, and economy. The usability, the perception of visual discomfort, and the quality of image transmission of each monitor were subjectively rated. Almost all performance parameters were superior with the conventional glasses-based 3D display compared to the 2D display and the autostereoscopic display, but were often significantly exceeded by the mirror-based 3D display. Subjects performed a task faster and with greater precision when visualization was achieved with the 3D and the...
mirror-based display. Instrument pathlength was shortened by improved depth perception. Workload parameters (NASA TLX) did not show significant differences. Test persons complained of impaired vision while using the autostereoscopic monitor. The 3D and 2D displays were rated user-friendly and applicable in daily work. Experienced and inexperienced laparoscopists profited equally from using a 3D display, with an improvement in task performance about 20%. Novel 3D displays improve laparoscopic interventions as a result of faster performance and higher precision without causing a higher mental workload. Therefore, they have the potential to significantly impact the further development of minimally invasive surgery. However, as shown by the custom-built 3D mirror display, this effect can be improved, thus stimulating further research.