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Muscle Activity Correlation With Surgeons' Self-Reported Workload And Performance In Robotic Training

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ABSTRACT

Studies have shown that muscle activity levels reflect work demands of operators performing physically and mentally tasks. Identifying work demands during the robotic surgery training is essential to ensure usability of teleoperation equipment and prevent surgeon musculoskeletal injuries and fatigue. The purpose of this project is to use physiological muscle activity sensors (electromyography (EMG)) to measure surgeons' work demands during robotic training and to quantify the relationship of these metrics. Eight surface EMG sensors were used to collect upper body muscle activity. Signals from eight participants (all right-hand dominant) during multiple training sessions were collected while performing simulated robotic assisted tasks on the da Vinci skills simulator. Subjective workload measurements (i.e. NASA-TLX) and performance scores were also collected. The results showed muscle activity for neck, shoulder, and left forearm are significantly correlated with self-perceived workload ($p<0.05$), especially the left forearm. This may be due to the usage (e.g., holding objects steady) or lack of positioning awareness of participants' non-dominant hand during the training. The results also showed left bicep activity is negatively correlated with performance score, which suggests that participants' non-dominant arm training and usage may lead to higher performance score. These results provide insight to surgeons' workload and to help optimize their performance.

Keywords: Electromyography(EMG), muscle activity, robotic surgery, workload, ergonomics