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**A STUDY OF PSYCHMOTOR SKILLS FOR MINIMALLY INVASIVE SURGERY: WHAT DIFFERENTIATES EXPERT AND NON-EXPERT PERFORMANCE?**

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*Background:* Advanced psychomotor skills are needed to perform minimally invasive surgery (MIS) safely. Both the measurement and assessment of laparoscopic skills are important to assure high quality of skills. Therefore, aspects that indicate the difference between performances at various levels of proficiency need to be defined. Ideally, measurement and assessment of MIS skills should be done in an automatically and objectively. The goal of this study was to investigate nine motion-related metrics for their relevance to assess psychomotor MIS skills during the performance of a “labyrinth” task.

*Methods:* Thirty-two surgeons and medical students divided into three groups according to their level of experience in MIS (experts (>500 MIS procedures), intermediates (31-500 MIS), novices (no experience in MIS)) performed the labyrinth task in the D-box simulator (D-BOX Medical, Lier, Norway). The labyrinth task required bimanual maneuvering and threading of a needle through a labyrinth of ten holes. The nine motion-related metrics used to assess MIS skills of each participant were: time, bimanual dexterity, path length, angular length, depth perception, response orientation, motion smoothness, number of sub-movements, and average velocity. A formula to calculate a measure for bimanual dexterity was defined in this study. The other metrics have been found in other studies.

*Results:* Experts (n=7) and intermediates (n=14) performed significantly better than the novices (n=11) for time and metrics related to instrument movement (path length, angular length, depth perception and response orientation). The experts were found to have significantly better bimanual dexterity, which was indicated by more simultaneous movements of the two instruments, compared to the intermediates and novices. The experts also performed the task with a shorter instrument path length (the non-dominant hand) than the intermediates.

*Conclusions:* The performance of an expert surgeon can be distinguished from a novice by metrics like time and path length. An experienced surgeon in MIS can be differentiated from a less experienced one by the higher

ability to control an instrument in the non-dominant hand and more coordinated and simultaneous movements of the two instruments.