

Validation of a Virtual Reality Knee Arthroscopy Simulator for Surgical Training

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Summary:

Virtual reality knee simulators can successfully replicate knee arthroscopy (to the satisfaction of experienced arthroscopy surgeons) and can effectively discriminate between subjects based on arthroscopic experience.

Abstract:

Aims:

To demonstrate the face validity (extent to which the simulator resembles reality, determined subjectively by subjects) and construct validity, (ability to objectively differentiate between subjects with varying levels of arthroscopic experience) of a virtual reality arthroscopy knee simulator (ARTHROMentor®), and to assess its effectiveness as an educational tool through a skills training programme.

Methods:

37 subjects of varying experiences were randomised prospectively to either a training arm or a control arm of the study. They all performed diagnostic knee arthroscopy on a simulator and subsequently completed a 5 point Likert-scale questionnaire to quantify their opinions. The simulator recorded objective data to assess proficiency. The 18 subjects in the training arm then underwent an arthroscopy skills training programme on the simulator and finally all subjects were reassessed in performing diagnostic knee arthroscopy.

Results:

86.4% participants agreed the simulator accurately reflected knee arthroscopy (proving face validity). The simulator was able to discriminate effectively between experts, intermediates and novices (establishing construct validity) for the following parameters: time taken to perform procedure ($p=0.09$), the path length covered by the arthroscope ($p=0.02$) and the path length travelled by the probe ($p=0.028$). Training on the simulator resulted in significantly improved performance in novices for completion time ($p=0.036$), roughness ($p=0.026$), and path length covered by the arthroscope ($p=0.008$).

Conclusions:

The results demonstrate that the simulator succeeds in emulating real arthroscopy, is acceptable to experienced arthroscopists and can discriminate between subjects according to arthroscopic experience, proving face and construct validity. Training on the simulator significantly improves performance compared to controls and may have implications for future surgical training.