The Implementation of a Cataract Simulator in Enhancing Residents’ Surgical Performance in Phacoemulsification Surgery

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Introduction

The aim of all surgical training is to shorten the learning curve of the beginning surgeon, in order to reduce the incidence of adverse events and complications. The use of virtual reality simulation in surgical training is a relatively new development. In ophthalmology, one of the most sophisticated virtual reality systems is the EyeSi ophthalmic surgical simulator (VRmagic, Gmbh, Mannheim, Germany) (Figure 1).

The “ICO-Ocular Cataract Surgical Competency Assessment Rubric (OSCAR)” – phacoemulsification (ICO-Oscar:phaco) rubric is an internationally validated and reliable assessment tool to assess performance during phacoemulsification surgery). This is the currently used assessment tool in our centre for grading the surgical performance of ophthalmology residents. To date there have been no studies comparing the EyeSi simulator performance to that of the ICO-Oscar:phaco assessment rubric.

Methods

We performed this study to answer the following questions: 1. Does EyeSi simulator performance correlate to currently used measures of surgical performance (ICO-Oscar:phaco assessment rubric)? (A can this be used as an assessment tool?) 2. Does EyeSi training improve surgical performance, as assessed by ICO-Oscar:phaco scores, surgical time and surgical complications? (Is it to does this improve performance as a training tool?)

Aims and hypotheses

We performed this study to answer the following questions:

1. Does EyeSi simulator performance correlate to currently used measures of surgical performance (ICO-Oscar:phaco assessment rubric)? (A can this be used as an assessment tool?)
2. Does EyeSi training improve surgical performance, as assessed by ICO-Oscar:phaco scores, surgical time and surgical complications? (Is it to does this improve performance as a training tool?)

All surgeons showed significant improvement in operation room performance post-simulator training (Figure 3).

• Mean improvement in surgical time of 14.5% (from 29.7 to 25.4 minutes, p = 0.003).
• Improvement in ICO-Oscar:phaco scores of 66.7% (53.3/100 to 88.8/100, p = 0.002).
• Most notable improvements in capsulorrhexis creation: mean improvement in OSCAR score of 104.9% (from 4.1/10 to 8.4/10, p = 0.000) post-simulator training.

Despite this limitation, the EyeSi cataract surgical simulator is an effective place for repeated concrete experience and active experimentation to occur with no risk of patient harm — but assessment scores may not be useful to allow feedback and reflection. Trainees may benefit more from reviewing training videos or video playback of simulator performance with an experienced trainer.

In conclusion: The EyeSi virtual reality cataract surgical simulator is an effective learning tool but a poor assessment tool; it should be used in conjunction with feedback and review by experienced trainers.

Figure 2: Correlation plots for ICO-Oscar:phaco scores pre- and post-simulator training to EyeSi simulator generated assessment scores.

Figure 3: Change in surgical performance pre- and post EyeSi training, as measured by surgical time, ICO-Oscar scores, and Capsulorrhexis-specific domains.

Figure 4: The EyeSi as a learning tool according to the Experiential theory of learning

EyeSi simulator performance scores not well correlated with ICO-Oscar:phaco scores

• Imperfect reproduction of real life operating conditions with the virtual reality simulator.
• EyeSi internal scoring system may not be an accurate representation of surgical skill.

Despite this limitation, the EyeSi cataract surgical simulator is an effective learning tool:

• Remarkable improvements in both surgical time and ICO-Oscar:phaco scores
• As well as scores for individual domains
• In keeping with previous studies showing improvements in error capsulorrhexis rates post-simulator training.

Experiential theory of learning (Figure 4) – EyeSi is good at creating a safe place for repeated concrete experience and active experimentation to occur with no risk of patient harm — but assessment scores may not be useful to allow feedback and reflection. Trainees may benefit more from reviewing training videos or video playback of simulator performance with an experienced trainer.

Discussion and Conclusion

Results

All surgeons showed significant improvement in operation room performance post-simulator training (Figure 3).

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There was no significant difference in complication rate pre- and post-simulator training (p = 0.67).

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