

A systematic review of phacoemulsification cataract surgery in virtual reality simulators

Abstract

The aim of this study was to review the capability of virtual reality simulators in the application of phacoemulsification cataract surgery training. Our review included the scientific publications on cataract surgery simulators that had been developed by different groups of researchers along with commercialized surgical training products, such as EYESI® and PhacoVision®. The review covers the simulation of the main cataract surgery procedures, i.e., corneal incision, capsulorrhexis, phacosculpting, and intraocular lens implantation in various virtual reality surgery simulators. Haptics realism and visual realism of the procedures are the main elements in imitating the actual surgical environment. The involvement of ophthalmology in research on virtual reality since the early 1990s has made a great impact on the development of surgical simulators. Most of the latest cataract surgery training systems are able to offer high fidelity in visual feedback and haptics feedback, but visual realism, such as the rotational movements of an eyeball with response to the force applied by surgical instruments, is still lacking in some of them. The assessment of the surgical tasks carried out on the simulators showed a significant difference in the performance before and after the training.

Keywords

Cataract; Phacoemulsification; Surgery training simulator; Virtual reality