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Review

The role of multimedia in surgical skills training and assessment☆

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ABSTRACT

Introduction: Multimedia is an educational resource that can be used to supplement surgical skills training. The aim of this review was to determine the role of multimedia in surgical training and assessment by performing a systematic review of the literature.

Methods: A systematic review for published articles was conducted on the following databases: PubMed/MEDLINE (1992 to November 2014), SCOPUS (1992 to November 2014) and EMBASE (1992 to November 2014). For each study the educational content, study design, surgical skill assessed and outcomes were recorded. A standard data extraction form was created to ensure systematic retrieval of relevant information.

Results: 21 studies were included; 14 randomized controlled trials (RCTs) and 7 non-randomized controlled trials (Non-RCTs). Technical skills were assessed in 7 RCTs and 3 non-RCTs; cognitive skills were assessed in 9 RCTs and 4 non-RCTs. In controlled studies, multimedia was associated with significant improvement in technical skills (4 studies; 4 RCTs) and cognitive skills (7 studies; 6 RCTs). In two studies multimedia was inferior in comparison to conventional teaching. Evaluation of multimedia (9 studies) demonstrated strongly favourable results.

Conclusions: This review suggests that multimedia effectively facilitates both technical and cognitive skills acquisition and is well accepted as an educational resource.

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Introduction

Work patterns in the UK have changed with increasing reliance on shift systems and a reduction in training hours (as specified by the European Working Time Directive (EWTD)). Prior to the Calman report in 1993 a surgical trainee would have expected to work over 30,000 hours before becoming a consultant.[1] With the impact of changing working practices and the recent Modernising Medical Careers (MMC) reforms, training hours have now fallen to below 6000 hours.[2] The current model of seamless training from graduate to consultant status further reduces the period of generic training.

Surgical trainees are now also increasingly removed from normal working hours in which the majority of traditional operative experience is gained.[3] Increasing consultant accountability for patient safety, and greater diversity of available techniques within each speciality has also led to a reduction in training opportunities.[4]

The above mentioned changes have led to a rapid development of educational models designed to counter the impact of reduction in training time to attain surgical skills.[5] The most notable of these models has been simulation,[6] focussing on technical performance. Although these platforms demonstrate educational benefit, they can be cost intensive and bonded to schedules and location.[7]

Multimedia technology is an educational resource that can augment surgical skills training. Multimedia is media that uses a combination of different content forms, and can be defined as the integration of text, audio, images, animation, video, and interactivity content forms.[8] The use of media stimulates visual and auditory receptors, improving the understanding and transfer of complex temporal and spatial events.

The evidence base for multimedia has also grown and has been shown to be effective in disciplines including radiological education and surgical pathology.[9,10] The use of multimedia technologies has also been evaluated in areas of communication with positive results particularly with regards to pre-operative counselling, consenting[11] and patient comprehension.[11,12]

The advantages of multimedia include increased efficiency[13] and allowance for practice in a learner-centred environment with flexibility in time and location[14] and the potential to personalise instruction to individual needs.[14] This can be achieved by delivery of multimedia tools as standalone packages (DVD) via the internet ("e-learning). Additionally, increasing departmental budget constraints for courses may force trainees to "pick and choose" only mandatory courses. Travelling commitments in terms of time and cost may further deter trainees from attending courses. Multimedia could potentially solve some of these issues. Multimedia would therefore appear to be a suitable medium for surgical skills training.

There has been increasing backing from educators for implementation of innovative teaching methods that make use of multimedia.[15] There is also some evidence to suggest that surgical trainees in the UK are dissatisfied with traditional teaching methods[16] while there appears to be a growing interest with online multimedia augmented instruction.[17] The aim of this systematic review was to determine the extent to which the 'role of multimedia in surgical training and assessment' has been researched and to summarise the findings.

Materials and methods

This systematic review was carried out in accordance to the PRISMA statement[18] to aid transparent and complete reporting of our study.

A detailed electronic search was carried out on the following databases: PubMed/MEDLINE (1992 to November 2014), SCOPUS (1992 to November 2014) and EMBASE (1992 to November 2014). The following search terms were used: (Multimedia OR "computer learning" OR "internet learning") AND (surgery OR procedure) AND (teaching OR assessment OR education OR skills). One reviewer (US) independently performed the database search. The full text of relevant articles was retrieved and reviewed.

All original articles in the English language literature that evaluated the role of multimedia in the teaching, training or assessment of surgical procedures or surgical skills involving medical students, post-graduate surgical trainees and practising surgeons were included. All articles deemed clearly relevant were examined in full text. To be included, studies had to include the use of multimedia in surgical or skills/interventional procedures. All study types were considered eligible. Articles focussing primarily on 'simulation', 'virtual reality training' or teaching non-procedural aspects of surgery (i.e. anatomy, pathology, interpretation of diagnostic test); articles relating to dental surgery; and articles relating to patient education, consent or epidemiology were excluded. Articles evaluating participants of non-surgical backgrounds (i.e. physicians) were excluded. Non-English Language articles, articles published only in abstract form, reviews, opinion papers, single case reports and commentaries were also excluded.

One reviewer (US) independently reviewed all titles and available abstracts in the databases and included articles meeting with the eligibility criteria. Full text articles were then retrieved via online access or in print form. A standard data extraction form was created to ensure systematic retrieval of the following information: Year, Country, Discipline, Subject/skill assessed, Study type, Control & type, Population & Number, Multimedia description, Delivery method, Instructional Methods used, Study format, Method(s) of Assessment, Timing of assessment, Summary of main results/outcomes, Critical Appraisal, Risk of bias and Follow-up.

The main outcome parameters/measures assessed in this review were improvements in technical and cognitive surgical skills.

All data were initially collected by one reviewer (US). A second reviewer (CS) separately reviewed and extracted all data independently. Any disagreement over data extraction was discussed and a consensus reached. As a result of the significant variation in the heterogeneity of study methods and outcomes, no data synthesis or meta-analysis could be performed.