A NEW APPROACH
Technology set to revolutionise ophthalmology teaching
by Dermot McGrath in Berlin

Major advances in computer simulation and virtual reality technologies in recent years are likely to have profound implications for the way that ophthalmology is taught in universities and hospitals in the near future, according to Deepak P Edward MD, FACS.

“Surgical simulation is an exciting area of surgical education and it offers a lot of possibilities for training current and future generations of ophthalmologists. However, we must move forward with care and try to ensure that proper standards are put in place to monitor progress and to determine the utility of simulation training. Ultimately we need to address the question of whether simulation training will result in improved surgical performance. This is the Holy Grail that we need to work towards,” he said.

Dr Edward, a professor of ophthalmology at Northeastern Ohio Universities College of Medicine and Pharmacy and chair program director for the Department of Ophthalmology at Summa Health System, Akron, Ohio, said that surgical simulators provide an opportunity for trainee surgeons to gain confidence and competence in the same way that flight simulators are used by pilots.

“Ophthalmic surgery is a complex task and teaching skills can be challenging in scenarios where patient safety is the primary concern and errors can prove very costly. We have less and less opportunity to train surgeons in more ‘risky’ procedures on real patients, patients are more demanding, and there are limited opportunities to experience rare surgical events and crises. Simulators have an obvious role to play in these scenarios,” he said.

Dr Edward noted that traditional apprenticeship is a model where doctors have to wait for something to happen in order to be able to illustrate relevant techniques to trainees.

“Teaching in circumstances where these rare events happen can be a little complex and are maybe not the best educational environment as such. Training for teamwork is also somewhat rare and simulation can obviously help in this respect as well,” he said.

All trainees must pass through distinct phases in their progress towards becoming a surgeon, said Dr Edward.

“There is a stage of declarative knowledge, where we learn what to perform. This can be done in a classroom or a wet lab. We also have procedural knowledge that deals with how to perform certain procedures, and this can be done through observation, live surgery, wet labs and simulation. More advanced technical knowledge can also be learned in the operating theatre, surgical suite or possibly during simulation training.”

Looking at current training simulators on the market, Dr Edward said that ophthalmology is somewhat lagging behind other surgical procedures such as laparoscopy or craniotomy, which have been using sophisticated virtual reality training for years.

“One of the challenges with simulation is that there are very few eye simulators to evaluate. While we are lagging behind in development, this is not necessarily a bad thing because it is evident from other medical fields that the development has sometimes been too fast and there has not been a proper attempt to evaluate how this is really going to translate into better performance in the operating room.”

The high cost of current commercial simulation systems is another factor preventing their wider adoption, said Dr Edward, as is the lack of research funding to develop and investigate the utility of such training devices in hospitals and universities.

Devices such as the Eyesi eye surgery simulator (VRmagic AG) provide trainees with an immersive experience in cataract and vitreoretinal surgery. For anterior segment surgery, for example, the Eyesi platform includes a cataract eye interface, a cataract instrument set and foot pedals. The system’s training modules enable trainees to hone their skills in various phases of the cataract operation such as capsulorrhexis, hydrodissection and phacoemulsification. Complex interaction between instruments and discrete tissue and intraocular structures can be experienced in real time.

Another system, the Sensimmet Virtual Phaco Trainer for Cataract Surgery (from ImmersiveTouch www.immersivetouch.com), provides a portable, haptic and touch feedback system that is particularly useful for capsulorrhexis practice, said Dr Edward. The PhacoVision system (Melerit Medical) allows the simulation of phacoemulsification, lens cracking and aspiration of lens materials. The development of this product is currently dormant.

While virtual eye surgery systems such as the Phaco Trainer and the Eyesi include metrics to objectively evaluate the user’s skills, the role of the instructor remains critical to the entire training process, insists Dr Edward.

“As an instructor, you cannot just leave the resident with the simulator and hope that your job is done and walk away. There is a lot of instruction that can go hand-in-hand with the simulator, especially in teaching trainees how to hold instruments and manipulate them and avoid bad habits before they enter the operating room. The data can then be saved and evaluated later by the resident and instructor,” he said.

One of the key obstacles to more widespread adoption of simulation training technologies is the need for data-driven validation of the training modules, said Dr Edward. While simulators may appear to improve surgical skills as measured by the simulator and wet-lab performance, there is still a paucity of data showing improved operating room performance as a result of their use.

Looking to the future, Dr Edward urged the creation of a committee structure within the International Council of Ophthalmology and other ophthalmic organisations in order to develop clear and coherent standards and validation procedures for surgical simulation systems.