Virtual surgery replaces traditional wetlab courses

Klaus Lucke
Pippa Wysong and Sean Henahan in Washington, DC

VIRTUAL reality training systems are now becoming available in many areas of ophthalmic surgery. The developers say the systems will improve training, provide a system of objective assessment, and, ultimately, improve patient safety.

Diagnosing uveitis online

In a different twist on the use of computer technology, researchers from the University of Heidelberg presented a study at ARVO describing a website based questionnaire that can assist with the diagnosis of secondary forms of uveitis. According to Ute Weihler MD, users answer 25 questions that ask for ophthalmic findings and symptoms. As more information is entered, users are shown pictures to help further define what the problem is. At the end, if enough information is entered, a possible diagnosis is suggested, along with suggestions for further investigation and laboratory tests.

The program was tested to see if correct diagnoses could be made of the eyes of 55 patients. They all had characteristic features of secondary forms of uveitis and had already been seen by ophthalmologists at the centre. The website results were compared to the actual diagnoses.

The study found a good correlation between the actual diagnosis of the patient and the diagnosis found by the program. In 76% of the cases the correct diagnosis was calculated as most probable, among other options. In 38% only the correct diagnosis was found, among other probable diagnoses.

The program is meant to help in the primary work-up of uveitis patients by physicians who rarely work with this condition. It can be found in German and English, at the researcher centre’s website www.uveitiscenter.de in the DiagnoseFinder section.

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Virtual drylabs

Dr Lucke reported that he has been using the system for the last three years for vitreoretinal training at his institution in Germany. Indeed, he used the system for a long time and still get anxiety if I touch the retina, although it is only a simulation. It trains everything we need,” said Dr Lucke, Augenklinik Universitätsklinik and FreeView Vision Centre, Bremen.

The course of the virtual surgery is not predefined but is dependent on the way the surgeon works. Tissue reaction is individually computed in each training session.

The system allows bimanual navigation in three-dimensional space. Surgeons can perform delicate maneuvers within the posterior segment such as peeling the ILM. It is designed to improve dexterity, tremor control, and familiarity with the instrumentation.

Virtual reality training systems at the 2005 Congress of the ASCRS.

Pippa Wysong and Sean Henahan

Virtual drylabs

Virtual drylabs

Simulations of difficult cases

Dr Lucke emphasised that beyond offering basic skills training, the system also enables trainee surgeons to become familiar with handling rare cases and possible complications.

“The way we have learned ophthalmic surgery has been to read, to observe, and then to operate on pigs’ eyes. Then a young surgeon hits the road, the patients carry the risk.”

He compared the virtual training system to flight simulators that are an established part of pilot training, for all levels of flying. Pilots train on standardised systems, and undergo regular proficiency checks. Moreover, the systems themselves and those who design them also undergo regular evaluations.

“We have not had this in our field. In aviation the result of simulator-based training has been one of the safest technologies we depend on. I would not step on board a plane if I didn’t know the pilot had trained on a simulator and had demonstrated proficiency, before serving passengers. We now have something that will help ophthalmologists get there.”

We think systems like this will improve our training in the future. It is a fascinating development that is long overdue in our field.”

Diagnosing uveitis online

Virtual drylabs

Simulations of difficult cases

Virtual drylabs

Simulated cataract surgery

Microscope adjustment
Sculpting the lens
Rotating the lens

Cracking
Rotating with the photo
Aspiring lenses
Ophthalmic Surgery Simulator for staff training. The system is scheduled to be installed on the Orbis plane this summer.

Virtual cataract surgery
An additional module that offers virtual training of anterior segment surgery techniques is also in development and will be released in October. The module will allow training in all aspects of surgery from capsule/irrigation to phacoemulsification and lens extraction.

Researchers at Sweden’s St Erik’s Eye Hospital, Karolinska Institute, have developed a prototype cataract surgery simulator designed to reduce the amount of training time needed by new ophthalmic surgeons. Wamidh Simawi, MD described the device at the annual meeting of the Association for Research in Vision and Ophthalmology (ARVO).

“It’s a very nice and effective instrument for cataract surgery education,” he told Eurotimes in an interview.

The device allows for a virtual and tactile representation of phacoemulsification cataract extraction. It consists of a hand piece, a nuclear manipulator, and two foot pedals, one of which is for X-Y-Z and zooming. It also simulates irrigation, aspiration and phacoemulsification control. The user looks through a 3D binocular microscope to see the virtual eye he is working on, plus a pair of headphones that carries the sounds for irrigation, aspiration, and phacoemulsification.

Dr. Simawi said it looks like cataract surgery, it feels like cataract surgery, and it even sounds like cataract surgery, but it’s all done with a computerized simulator. The device involves all the senses.

There is also a separate monitor displaying what the user sees, which can be viewed by an instructor wanting to watch how well a student does. The device can be used to monitor and record how well trainees perform the virtual surgeries. Plus, each cataract operation can be made to be different.

“It can be a good instrument to measure the parameters and variables. We can create our patient, we can create a usual senile cataract, and we can create a complicated cataract,” he said.

Ten experienced ophthalmic surgeons did a series of virtual procedures with the device. Their performance was compared to that of trainees who, not surprisingly, did not perform as well. It demonstrated that variables on the device can be used to distinguish performance levels. However, trainee ophthalmologists improved over time after practising with the device.

“After each virtual operation they get better knowledge and better concentration and better results,” Dr. Simawi said.

So far, the device has been three years in the making and has used input from a mix of ophthalmologists, computer programmers and computer graphics artists.

Dr. Simawi noted that at first the graphic artists didn’t understand the details. They thought it would be something like a game. Teamwork has made the images accurate.

He added that the goal of the virtual training system is to teach beginning surgeons in a stress-free environment, increasing their surgical knowledge and surgical skills. Other aims include reducing the costs of surgical education, the screening of potential surgeons, and improving the skills of established surgeons in dealing with challenging cases.

“With this machine, we will show that we can make the training period shorter, and decrease the incidence of complications,” Dr. Simawi said.

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Project Orbis the humanitarian organisation now uses the EYESI.