VERT: An Innovation in Radiotherapy Training

Delivery of Radiotherapy is understood to be a complex, multi-stage, process. It is key that staff receive good quality training in order to deliver it efficiently and in an error free manner. Typically the training received by healthcare professionals is initially classroom based followed by, or integrated with, practical experience gained in clinical departments. However, once qualified the ever developing and changing nature of radiotherapy demands that they continue to train and learn new techniques throughout their careers.

In the classroom phase of initial training, radiotherapy is taught on the 'white board', that is diagrams, photographs and discussions are used to illustrate the processes that are used to treat patients. Following this it becomes necessary to move the students into a clinical environment but it there are difficulties in allocating sufficient time on clinical treatment machines for basic training of students or for staff development when introducing new techniques. Even where time is identified, the student experience is limited by the strict necessities of the clinical situations. For example, when observing a complex case, even though the trainee may not immediately understand the set-up, repeated attempts to explain and demonstrate are not possible given the risk of undermining the patient's confidence in the staff. Furthermore, slowing down the clinical throughput is not a luxury available in most busy departments!

Radiotherapy equipment is expensive and as previously stated the potential for errors occurring in the delivery process are very real and not insignificant. In the unfortunate situation when an error does happen, the patient, trainee and training staff could all potentially suffer a variety of radiation, mechanical and other injuries. This scenario is not dissimilar to a number of other professions or training situations, for example, such as an airline pilot learning to fly a passenger jet. Here a freshman pilot would not be expected to prove he can master the controls and then successfully land a plane with a cabin full of passengers! Furthermore pilots are not expected to rely on some brief instruction from the manufacturer of a new aircraft prior to flying it full of passengers. Of course the airline industry, the military and the space agencies use flight simulators for their training needs for basic instruction and on-going training for new equipment. Finally, it is worth reflecting on one of the greatest rescue missions of all. time. When severe equipment failure during the Apollo 13 mission left the crew in mortal danger, the chances of their safe return were certainly increased massively by their colleague running through the 'power-up procedures', in the command module simulator, that were custom designed under duress.

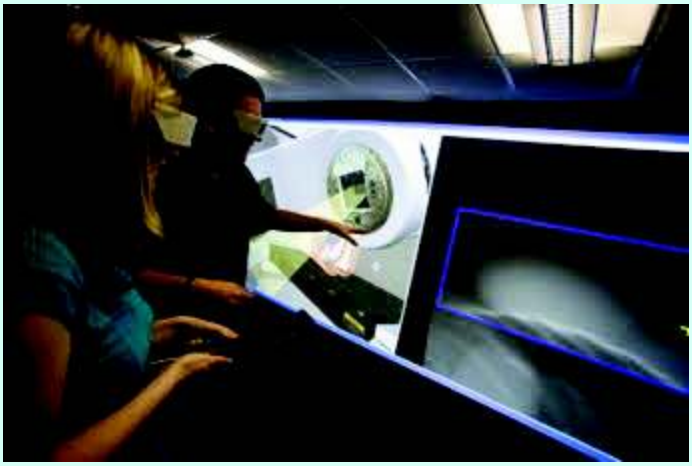

Image taken at Birmingham City University by Matt Wain and courtesy of Christie Digital

The Virtual Environment for Radiotherapy Training (VERT) system [1] is essentially a flight simulator for Radiotherapy trainees. Since 2004, it has been developed to provide a viable alternative to students having to gain experience on clinical equipment. The design team comprised of an experienced clinical Radiotherapy Physicist and two Computer Scientists. The virtual Linac is controlled via actual hand pendants and, using optional touch screen technology, all couch controls can be simulated. The virtual Linac 'does everything' its clinical counterpart 'does' except provide ionising radiation. Treatment plans can be loaded from any commercial treatment planning system using an integrated DICOM interface. Therefore, VERT provides the opportunity to practice controlling the Linac and setting a patient up, and even learning by making mistakes within a totally safe environment without any danger to the patient or any participant. Visualization of the treatment beams, dose distribution, internal anatomy, CT planning data in situ with the patient on the treatment couch within the

simulation provide the trainee with added insights into the complexity of radiotherapy. Features such as the 'Set-up Error' tool allow the trainees and tutors to use the system to explore dosimetric and geometrical consequences of incorrect set-ups and patient mis-alignments. Treatment modalities such as electron treatments, IMRT (including volumetric modulated arc therapy delivery) and IGRT processes have been implemented enabling the system to be used to help experienced professionals learn new techniques. Ongoing developments include simulation of physics dosimetry equipment and simulation of cone beam CT and associated image registration.

The National Radiotherapy Advisory Group (NRAG) in England were persuaded by the above argument for improving trainee experience by introducing simulation-based training and recommended in its 2007 report [2] the adoption of this approach. Subsequently, the Department of Health and National Cancer Action Team accepted their recommendation [3] and launched an 18 month program to roll-out VERT throughout England. This program provided auditorium based simulation VERT facilities at all 10 University providers of the clinical education/ radiotherapy degrees, and meeting room VERT systems at radiotherapy clinics. Details on the implementation of this VERT roll-out project, the use of VERT and student and tutor experiences are reported in the recent report Virtual Environment for Radiotherapy Training (VERT) Final Project Report [4].

Today, VERT is in use at over 60 institutions worldwide and is being used to teach the complex theoretical concepts of radiotherapy, the principles of treatment planning and treatment delivery.

References

[1] Immersive Visualisation Training of Radiotherapy Treatment. Phillips R, Ward JW, Beavis AW, Proceedings of Medicine Meets Virtual Reality 13, pp 390-396, January 26-29 2005, Long Beach

[2] *Radiotherapy: developing a world class service for England,* Report to Ministers from National Radiotherapy Advisory Group, 2007. *www.cancer.nhs.uk/radiotherapy/nrag.htm*

[3] Cancer Reform Strategy, NHS, 2007. *www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081006*

[4] Virtual Environment for Radiotherapy Training (VERT) Final Project Report, project leads Appleyard R and Coleman L. *doc-lib.sor.org/listtitles/title/vert*

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