3D Accelerator in Radiation Therapy Training

From apprenticeship to virtual reality training

State-of-the-art new training methods are being used to help practitioners involved in the delivery of radiotherapy, including nurses, strengthen their knowledge of treatment planning using computer-controlled technology and virtual reality learning environment. A 3D computer-animated simulator was used in a groundbreaking training programme in a joint initiative by Aarhus University Hospital and Hull University, England.

The Learning Centre

Planning and delivering radiation therapy is a complex process involving physicians, physicists, radiographers and radiation therapists/nurses (RTTs). The starting point is that specialists must be able to understand spatial relationships in the patient’s anatomy. In the same way that pilots learn flying using a simulator, it was thought that it must be possible to train planning and treatment of radiation therapy in a simulator, too. In fact the data indicates that radiation nurses can get as much out of learning through simulation, as pilots can.

The aims were to:
- establish a Learning Centre with virtual learning tools, to be used by all staff working with radiation therapy;
- train an additional group of nurses to be radiation therapists;
- explore the possibilities and limitations of virtual training in the 3D accelerator with the results to be fed back to the University of Hull for developing the technology.

The Learning Centre consisted of a 3D acc, an IT-laboratory with full scale computer matching the clinical facilities, a classroom and a study room with library.

To achieve the best learning environment it was agreed that:
- educational material had to be clinical, actual and with anonymous patient data;
- exercises, training and learning could take place at the participants’ pace (Figure 1);
- mistakes would be allowed but without risk to patients;
- it would be possible to repeat practice;
- there would be time for questions and reflection without ethical and time considerations for patients;
- IT-programs in the Learning Centre had to correspond exactly to those used in the clinic, so they would be up to date and relevant.

Figure 1. Skill training with the pendant. Students are discussing the positioning of the patient.
**TRAINING**

The course for the project group consisted of 12 weeks of theory, 13 weeks with clinical virtual reality learning and 20 weeks with clinical learning/training.

In the 3D acc: it was possible to train with "transparent patients", flip and rotate them in all directions and see the beam directions. The consequences of the treatment planning for both tumour and the organs at risk could be visualised and discussed. (Figure 2)

The IT -laboratory was established in collaboration with the accelerator firm Varian. Participants can be trained in IT-tools and get exercises with treatment planning and Image Guided Radiation Therapy.

The course covers a scientific approach on how radiation therapy is carried out with computer-controlled technology combined with communication, care and observation of patients receiving radiotherapy. In this way, there can be specific identification of and intervention with radiation-related side-effects. To strengthen participants' knowledge and understanding of these areas the students work with real anonymous patient cases. The cases consist of copies of the patients' medical chart, a treatment plan and treatment cards. Treatment data are transmitted electronically to the IT lab and 3D accelerator. Participants work with pathology, prognosis, protocol treatment, side-effects and management of these treatments.

Subsequently, the consequences of treatment planning can be examined by the 3D accelerator. The students work in groups and teach each other through review and clinical example.

Curative treatment often requires daily treatments for 30-40 days, and patients need care and information. The interpersonal relationships and observation of patients for example, pains, weight loss and communication cannot be well taught in a virtual reality learning environment. This part of the work area must be learned in the clinical environment.

A formal evaluation with the project group elicited very positive feedback:
- "In the 3D accelerator, I have especially learned how fields are formed"
- "It's possible to practise again and again"

**WHAT NEXT?**

The project succeeded in doubling the training capacity. The virtual reality learning environment can now be considered as a new supplementary educational component positioned between theory and clinical training.

**Radiation Therapist Training**

Education for the radiation therapist must qualify the student to perform radiation therapy and care for patients. The course takes place over one year (equivalent to 60 ECTS points) and is based on a 3½ year health professional Bachelor Degree. After finishing the training course the students are accredited by the Danish Ministry of Health and are allowed to treat patients using the accelerators. They are considered contact nurses for the patients. The course includes 12 weeks of theoretical learning and 33 weeks of clinical learning.

"Does training with a 3D virtual environment give greater competence?"

- “Seeing doses in the organ at risk and the effect of wrong positioning in 3D is very instructive”
- “Amazing to find out what is happening inside the patient”
- "I was able to think in 3D, I thought, but now I am much better!"

The immediate feedback from the tutors in the clinic was that the participants in the project group were able to think about dose planning in a three-dimensional perspective. All participants passed the examinations and the examiners assessed the participants as "at least at the same level as before." Further investigation and documentation are however necessary.

**PERSPECTIVES**

The collaboration with the University of Hull on the further development of 3D accelerator is continuing. The system has subsequently been installed in other clinics, both nationally and internationally, especially in England. The interesting point to debate is “Does training with a 3D virtual reality environment give greater competence?” This work must be further developed and reviewed in the future. Working with the technology as a part of patient education will also be included.

Details of the references cited in this article can be accessed at www.cancernurse.eu/communication/eons_newsletter.html