3D Virtual Simulation Added Value Through Process Optimization

MedIntel GmbH

Paul Krechting

Introduction

For the last 30 years, conventional treatment simulators have played a pivotal role in the planning of radiotherapy treatments. A conventional simulator comprises an isocentrically mounted diagnostic kV X-ray imaging system with an isocentrically mounted patient support system (couch). The radiation head of the unit is modified to include a rotatable diaphragm system with 2 orthogonal parallel pairs of radio opaque wires, which simulate the moveable diaphragms of a treatment unit. An optical system is used to project a correctly dimensioned image of the wires onto the patient's skin. The overall intention is that so far as practicable, all rotational and translational movements of couch, gantry and collimator on the linear accelerator are reproducible on the treatment simulator. In addition the latter permits high quality diagnostic kV imaging of the patient in the treatment position. Both X-ray film and analogue fluoroscopy are possible with later simulators offering digital spot imaging with digital fluoroscopic imaging. Although some conventional simulators incorporated a CT facility, the only high quality images obtainable are transmission images and consequently discriminating between some soft tissues is only possible with the introduction of contrast media.

Material & Methods

In the last few years, the concept of virtual simulation has developed as a viable alternative to localization of simpler treatments on a simulator. A virtual simulator consists of a CT scanner where the patient data is acquired, orthogonal lasers, flat couch top and a virtual simulation software package. The virtual fluoroscopy software package mimics the conventional simulator for treatment field definition, but also includes light field projection in three planes using the CT data. Thus additional information is available to the clinician when defining fields for simple radiotherapy and allows the visualization of surrounding tissue in greater detail than with orthogonal radiographs.

The perceived benefits and increased accuracy of localization using virtual simulation have been well documented [1-1].

Results

A significant advantage of introducing 3D Virtual Simulation is that workload on the CT scanner can be organized to be independent of a clinician attendance, thus avoiding "bunching" of patients, as occurs on the conventional simulator. The clinician is able to access the CT study data for localization purposes at their convenience, and utilize their time more efficiently by localizing a number of patients sequentially at a workstation rather than attending a conventional simulator for individual patients.

Conclusions

In conclusion, successful implementation of the Exomio 3D Virtual Simulation results in a more efficient use of time and providing additional data for localization. There has been a significant decrease in the time patients spend on a couch to acquire images for localization and verification and a more efficient use of the clinicians time for localization purposes.

[1] Aird EGA, Conway, J. CT simulation for Radiotherapy treatment planning. BJR 2002; 75: 937-949.