

A simple user routine check program for XVI

Institution: **Lund University Hospital,
Radiation Physics, Lund, Sweden**

Purpose: An Elekta Synergy® linear accelerator equipped with a kV X-ray volumetric imaging (XVI) system has been used in our department since 2005. In this work we propose a simpler QA-procedure, mimicking the actual patient situation, which can be used more frequently, for instance on a weekly basis.

This information was originally presented at the 9th Biennial ESTRO Meeting on Physics and Radiation Technology for Clinical Radiotherapy, 8-13 September 2007, Barcelona Spain, e-mail: Andrej.Tomaszewicz@skane.se



Accuracy study



A simple user routine check program for XVI

Andrej Tomaszewicz, Crister Ceberg

Materials and methods

In order to test the system in a patient-like situation (eg. heterogeneous density), two different Alderson/Rando phantoms were used; one for the pelvis and one for the head-and-neck region. Reference CT images of the two phantoms were imported into the XVI software. Then, the phantom was set up on the treatment couch and scanned according to the same presets (ie. gantry rotation interval, kV, filter, and collimator settings) that were used for patients. The resulting cone-beam CT was automatically aligned to the reference CT using two different methods; the bone or grey value modes. The alignment was based on the volume within a user defined clip-box. The corrective table movement (displacement) calculated by the XVI software was scored. This QA procedure was repeated weekly or bi-weekly during a period of six months.

Results

The average and standard deviation of all displacements in the lateral, longitudinal and vertical directions are shown in the table for the four cases. It can be observed, that the two different alignment methods gave very similar results in all cases, which is due to the fact that the clip-box generally included bony structures as well. The average 3D distance between the methods was only 0.35mm for the head-and-neck case and 0.60mm for the pelvis case. The maximum displacement was 1.4mm for the head-and-neck case and 2.1mm for the pelvis case.

	Lateral mm (1SD)	Longitudinal mm (1SD)	Vertical mm (1SD)
Head-and-neck bone	-0.02 (0.40)	-0.78 (0.37)	0.44 (0.31)
H&N grey-value	-0.01 (0.37)	-0.88 (0.38)	0.43 (0.35)
Pelvis bone	1.18 (0.62)	-0.87 (0.63)	-0.62 (0.37)
Pelvis grey value	1.13 (0.44)	-1.13 (0.36)	-0.36 (0.17)

Conclusion

The proposed QA-method proved to be easy-to-use and provides a clinically relevant check of the total XVI function. The observed displacement values were generally very small, but in one case exceeded the tolerance level of 2mm, which was set in relation to clinical demands. Displacements smaller than 3mm are not corrected for in our clinical routine. These high values were, however, not persistent (ie. not observed on two consecutive checks) and did not cause any corrective maintenance of the equipment. The small standard deviations shown in the table is an indication of a good stability of the XVI system, which should be considered when deciding the QA frequency.