Use of a commercial linac QA device for RapidArc routine quality assurance

R. Popple, I. Brezovich, J. Duan, S. Shen, and X. Wu

Department of Radiation Oncology, The University of Alabama at Birmingham, Birmingham, Alabama

BACKGROUND

Two commercial implementations of intensity modulated arc therapy have recently become available and are entering clinical use. However, quality assurance standards for these systems are still evolving. We have investigated the use of the QA BeamChecker Plus (Standard Imaging, Madison, WI) for use with RapidArc (Varian Medical Systems, Palo Alto, CA).

METHODS AND MATERIALS

The QA BeamChecker Plus is a routine quality assurance device comprised of 5 ionization chambers embedded within a block of water equivalent buildup material. The chambers are located in the center of the device (at central axis) and at ±7.5 cm along the radial and axial axes.

We obtained a CT scan of the device at 3 mm slice spacing. The external contour was outlined, as was the buildup material and the 5 constancy chambers. Due to high-density structures, there were significant artifacts in the scan. Therefore, the CT number of the buildup material was set to water-equivalent (0 HU). We created target volumes around each chamber, and also contoured two avoidance structures, one lateral and one anterior.

A treatment plan was created using the Eclipse (Varian Medical Systems) arc optimization software. The target dose for the chambers was 62.5 Gy for the center and 50 Gy for the remaining four. The lateral avoidance was constrained to a maximum of 7.5 Gy and the anterior avoidance to a maximum of 40 Gy with no more than 50% exceeding 15 Gy. During optimization, the priorities were adjusted to generate uniform dose in the chamber volumes. After optimization, the plan was renormalized such that there was significant gantry and dose rate modulation. The gantry speed and dose rate of the plan are shown below.

The RapidArc plan was delivered using the 6 MV photon beam of a Clinac iX to the QA BeamChecker Plus in the rotational mode. The Varian treatment table has movable support rails, which can result in significant attenuation. The plan was delivered with the rails in the center.

RESULTS

Pre-clinical testing

During pre-clinical testing, the plan was delivered to the device 11 times over the course of 6 days.

Clinical use

After pre-clinical testing, the plan was delivered daily by radiation therapists.

CONCLUSIONS

The Standard Imaging QA BeamChecker Plus can be used to verify consistent RapidArc delivery for daily system quality assurance. Future work is necessary to evaluate the types of errors that this type of device can identify.