

AbstractID: 8152 Title: Integration of kV image-guidance with arc therapy for radiotherapy of the prostate

Purpose: To assess the feasibility of on-line kV image-guidance and fluoroscopic monitoring during arc therapy.

Method and Materials:

A pelvis phantom with anthropomorphic prostate and seminal vesicles was implanted with 3 gold fiducial markers. CBCT imaging was performed before and during delivery of a prostate treatment plan using volumetric modulated arc therapy (VMAT). Both CBCT images were assessed for image quality based on noise. The gold fiducials were segmented in the guidance CBCT volume and subsequently localized in each projection image taken during the VMAT delivery. Since the phantom is rigid and was not moved between images, no movement of fiducials in each projection image is expected. Any movement was defined as tracking error. A clinical action level of 3 mm was used to designate if the tracking error was significant.

Results:

CBCT image noise (1 S.D.) increased from 10.4 HU to 20.6 HU due to increased scatter onto the kV detector as well as interference patterns induced by the MV beam pulses. The frame-by-frame tracking error below a 3mm clinical action level was 96.6% for the CBCT acquired for setup correction before the VMAT delivery. This value decreased to 88.7% for the CBCT volume captured concurrently with the VMAT delivery.

Conclusions: Arc therapy promises to deliver highly conformal dose distributions quickly and efficiently. Simultaneous kV imaging allows for the capture of a residual image as well as an opportunity for fluoroscopic monitoring of the patient's position during treatment. CBCT image quality is degraded during VMAT delivery but image quality is still suitable for assessment of residual setup error as well as intra-fraction motion.

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