AbstractID: 7132 Title: Performing Concurrent Kilovoltage Imaging while Delivering Megavoltage Treatment Beams

Purpose: To investigate the clinical feasibility of performing concurrent kilovoltage (kV) x-ray imaging while the patient at the treatment position was irradiated by megavoltage (MV) beams.

Method and Materials: Anatomical visibility and contrast details in kV images acquired with and without concurrent MV irradiations were compared. An on-board imager (OBI) mounted to the gantry of a Varian 21EX Linac with an electronic portal imager (EPI) was used in this study. A pelvis (Rando) and a contrast (Vegas) phantoms were placed near the treatment isocenter with a detector-to-isocenter distance of 50 cm. The effect of MV beam and its dose rate on noise-to-signal ratio (NSR), defined as the ratio of the standard deviation to the mean pixel value in a region-of-interest (ROI), and relative contrast, defined as the ratio of mean pixel values between the signal ROI and the background ROI, were studied based on Vegas phantom.

Results: Scattering MV beams and electronic noises due to kV detector scanning rate and MV beam pulse rate are two major factors affect the concurrent kV image quality. The calculated NSR increases as dose rate increases. Compared to kV images without concurrent MV irradiation, the NSRs of the contrast phantom were increased by a factor of 2.6 with 300MU/min MV beams and 4.5 with 600MU/min MV beams. However, the relative contrasts were increased by a factor of 1.02 with 300MU/min MV beam and 1.06 with 600MU/min MV beam.

Conclusion: It is clinically feasible to acquire concurrent kV images during treatment with MV beams. The kV image quality may be improved by minimizing MV scattering effect and by correcting electronic noises. The ability to take kV images with concurrent MV irradiation allows real-time verification and tracking of moving target during the gated treatment.

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