AbstractID: 5038 Title: Patient Alignment using Megavoltage Cone-Beam CT

Purpose: The growing use of conformal radiotherapy techniques has motivated the development of in-room imaging systems capable of producing a patient 3D image that can be compared with the planning CT. We report on the Megavoltage Cone-Beam CT (MVCBCT) positioning accuracy and its first clinical use for alignment of head and neck patients.

Method and Materials: Using a standard treatment unit equipped with a flat panel detector, we compared a 2D setup technique using digitally reconstructed radiographs and portal images with a 3D setup technique using a diagnostic CT and MVCBCT. A gold seed placed at isocenter was imaged over time to measure the MVCBCT absolute positioning accuracy and stability. A Rando head phantom was imaged at 23 different locations in the treatment field to measure the capability of both setup techniques to determine shifts. A total of 18 MVCBCTs and corresponding pairs of orthogonal portal images were acquired on 8 patients undergoing treatment for head and neck cancers.

Results: The absolute positioning accuracy of MVCBCT was better than 1.5 mm over several weeks. The mean and standard deviations of the differences between applied and measured shifts on Rando were (0.0±0.5) and (0.0±0.9) mm for MVCBCT and portal imaging respectively. For patient images, bony anatomy and soft-tissue was visualized on MVCBCT while only bony structures could be used for alignment on portal images. The shift measurements made with the two methods were within 2 mm of each other in 68% of cases. However, differences as large as 4 mm were observed.

Conclusion: The phantom measurements indicate that portal imaging and MVCBCT have the potential to verify patient shifts with sub-millimeter precision. MVCBCT performed on patients showed translation shifts, rotations and anatomy deformations not always appreciated using portal imaging.

Conflict of Interest:
Research sponsored by Siemens OCS.