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During-Treatment Imaging Feasibility for Intrafraction Stereotactic Spine Treatment Evaluations

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2022 Annual Meeting Abstracts
General ePoster Viewing (GePV)

MEDICAL PHYSICS

I have a research agreement with RaySearch on proton treatment planning and RayIntelligence

PO-GePV-M-154, During-Treatment Imaging Feasibility for Intrafraction Stereotactic Spine Treatment Evaluations: M Liu[1]*, D Drake[2], D Lack[3], M Sigler[4], J Sliwinski[5], K Barton[6], D To[7], I Grills[8], J Liang[9]</sup>,(1) William Beaumont Hospital, Troy, Troy, MI, (2) William Beaumont Hospital, Royal Oak, MI, (3) William Beaumont Hospital, Troy, Troy, MI, (4) Beaumont, Troy, MI, (5) William Beaumont Hospital, (6) Varian, Troy, MI, (7) Beaumont Health, Center Line, MI, (8) Beaumont Health System, Royal Oak, MI, (9) William Beaumont Hospital, Troy, MI

Purpose: On Elekta linacs, cone-beam CTs (CBCT) can be acquired during VMAT delivery to monitor intrafraction motion during treatment. Stereotactic spine treatments can be lengthy, increasing patient motion likelihood during treatment. We evaluated during-treatment CBCT (DT-CBCT) feasibility to assess patient motion for stereotactic spine treatments in place of a mid-treatment CBCT. **Methods:** CBCTs from seven spine treatments were analyzed retrospectively. Various fractionation schemes were used (16-25Gy delivered in 1-5 fractions). All plans contained two VMAT arcs of 2209.5-13,332.4 MUs with treatment times of 7-58 minutes. Projections from pre-correction CBCTs were combined with post-correction CBCT to simulate patient motion (1cm, 2 deg) occurring after 50% to 90% of the first beam being delivered. Images were reconstructed and registered (bony alignment) in Elekta XVI 5.0 by an imaging specialist. For reconstructions, image quality and the difference from true CBCT shifts were assessed. Ground truth shifts ranged from translations of 0.60-1.12cm and rotations of 0.0-1.9 degrees. **Results:** Simulated motion impacted DT-CBCT image quality, displaying double anatomy and decreased delineation of vertebral bodies when patient movement occurred after 50%-80% of the first beam delivery. For all treatments, when motion occurred in this range it was obvious to the imaging specialist that the CBCT should not be used. However, image quality was not impacted for 6/7 treatments when simulated motion occurred after 90% of first beam delivery. Registration of these images resulted in erroneous patient translations and rotations from the ground truth up to 1.02cm and 1.9 degrees. **Conclusion:** Even large patient motion that occurs near the end (at 90%) of the beam 1 delivery is not detectable with DT-CBCT resulting in erroneous patient setup for the 2nd beam delivery. Use of a mid-treatment CBCT for stereotactic spine treatments is recommended.

PO-GePV-M-155, Imaging Performance of the Onboard Kilo-Voltage Fan-Beam Computed Tomography for Ring Gantry Therapy Unit: G Gibbard, J Tan, Y Park, M Lin, K Wang, W Lu, R Reynolds, A Godley, A Pompos, S Jiang, B Cai, T Zhuang*, University of Texas Southwestern Medical Center, Dallas, TX

Purpose: This study aims to evaluate the performance of the kV Fan-Beam Computed Tomography (kV-FBCT) system on the RefleXion® X1 by use of standard image quality metrics. The RefleXion X1 is a novel ring-gantry radiotherapy platform that incorporates kV-FBCT and on-board PET for image guided radiotherapy (IGRT) and Biology-guided Radiotherapy. **Methods:** Images of a physical phantom (Catphan 604, The Phantom Laboratory, New York, NY) were acquired using two different imaging protocols of 120 kV/1.25 mm with 0.5 pitch/150 mA (medium dose medium couch noted as MM) or 0.2222 pitch/133 mA (high dose slow couch noted as HS), respectively. Images were reconstructed in a 512x512 grid with 50 cm field-of-view. Image quality metrics, including slice thickness accuracy, spatial resolution, low-contrast resolution, geometric accuracy, CT Hounsfield unit (HU) number accuracy, and image uniformity, were evaluated**. Results:** For both medium dose and high dose protocols, the spatial resolution is 6 lp/cm; the slice thickness is within 0.1 mm of expected; the geometric accuracy tests passed within 0.5 mm at a 50 mm distance; the image uniformity is within 2.8 HU; the CT numbers are within expected range for most inserts, except for “air”,”teflon”, and “bone 50%”. The CT number for “bone 50%” is outside the expected range by less than 15 HU. The low contrast visibility is higher with high dose mode. The diameter of the smallest visible target in the 1% contrast group is about 3 mm and 4mm in the HS and MM protocols respectively**. Conclusion:** All major image quality metrics were within vendor-recommended tolerances for both MM and HS protocols. The onboard kV-FBCT system on the RefleXion X1 meets specifications for clinical implementation of IGRT.

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PO-GePV-M-156, Evaluation of An Auto-Segmentation Tool On Full Field-Of-View and Limited Field-Of-View Cone Beam Computed Tomography: J Marasco*, S Hendley, J Wong, A Granatowicz, A Besemer, S Zhou, S Wang, University of Nebraska Medical Center, Omaha, NE

Purpose: Auto-segmentation tools are rapidly changing the practice of treatment planning in radiation oncology. They have immense potential to become an essential component in accelerating target/OAR delineation for adaptive radiotherapy. The purpose of this study is to evaluate the performance of a commercial auto-segmentation tool on Cone Beam Computed Tomography (CBCT) with different scanning protocols. **Methods:** Forty-two prostate cancer patients who had undergone radiotherapy treatments have been retrospectively selected for this study. Twenty-two patients received SpaceOAR hydrogel (Boston Scientific) implant prior to radiotherapy. All patients were treated on

