AbstractID: 13891 Title: Should the image rotation be addressed during routine CBCT QA?

Purpose: To establish whether a QA check and action level for CBCT image rotational displacement are required. **Methods and Materials**: If CBCT misregisters the angular coordinates during image acquisition, this may lead to a slightly rotated reconstructed image. If this problem goes undetected and shifts are applied to patient based on this image, an underdosage of the target volume (TV) as well as an overdosage of the normal tissues may occur. When a CBCT scan of a phantom was performed clockwise and counterclockwise, a ~2^o rotation was identified. We evaluated the clinical implications of the rotation in correlation with changes in dose distribution for 3 different clinical scenarios: (a) isocenter and TV are at the patient's center, (b) isocenter is central and TV is lateral, (c) isocenter and TV are lateral. The problem was formulated vectorially to quantify the residual shift of the TV for CBCTs acquired with the patient at or off isocenter. C++ code was written to determine the image displacements corresponding to the rotations. Patient CT image sets were rotated by 1^o,2^o,3^o,4^o, and 5^o. Treatment plans were then recalculated to quantify the changes in DVH at the target and the normal tissue levels. **Results**: When misregistered CBCT images were employed, alteration of DVH indicators becomes significant for patient alignment for rotations of >2^o for SBRT treatments. When RapidArc was employed, the change in DVH indicators was not significant, most likely due to the volume symmetry and the accompanying dose spillage. Large patient size requires CBCT acquisition and alignment to be performed off isocenter and it translates in significant changes of TV location with respect to isocenter for rotations of >2^o. **Conclusion:** We found that a CBCT QA criterion of <2^o would be a reasonable action level in order to ensure accurate dose delivery in any clinical scenario.