Surface Imaging Accuracy for Stereotactic Radiosurgery Setup and Treatment Delivery

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PURPOSE

To determine the accuracy of using the C-RAD Catalyst HD surface imaging system for Stereotactic Radiosurgery treatment setup.

INTRODUCTION / METHOD

There is interest in whether or not the C-RAD Catalyst HD surface imaging system is precise enough to be used for Stereotactic Radiosurgery treatment setup. The Catalyst HD system is commonly used for setup in breast treatments. It is reported as being accurate enough for SRS treatments. The purpose of this project was to determine the feasibility of this system for SRS setup.

An anthropomorphic head phantom was imaged on a GE LightSpeed CT scanner in a head-first supine SRS treatment position. Plans were created with couch angles at 270, 225, 180, 135, and 90 degrees in the BrainLab treatment planning software with a simulated lesion in the right frontal lobe and the left occipital lobe. White tape was placed on the phantom's exterior in order to make it more visible to the Catalyst HD's cameras. The phantom was set up at the 180 degrees using Brainlab ExacTrac. The coordinates were captured with the C-Rad Catalyst HD system. The phantom was then set up at each of the different couch positions with ExacTrac x-ray imaging to verify internal anatomy accuracy. At each position the Brainlab shifts to isocenter were compared with the C-Rad shifts to isocenter in each dimension.

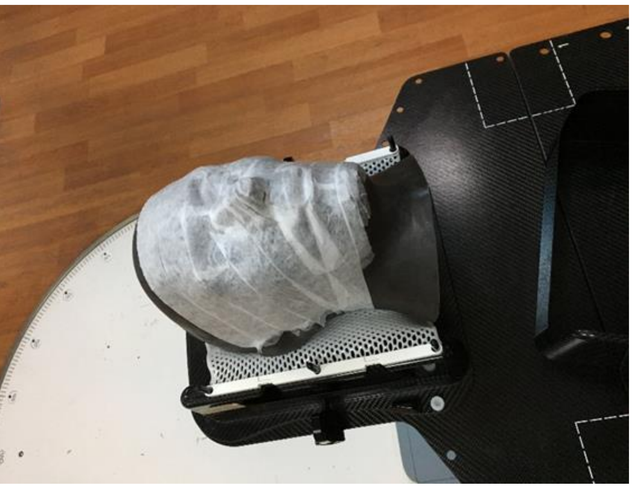


Figure 1 Anthropomorphic head phantom

Figure 2 Head phantom with Brainlab Exactrac's frame in place

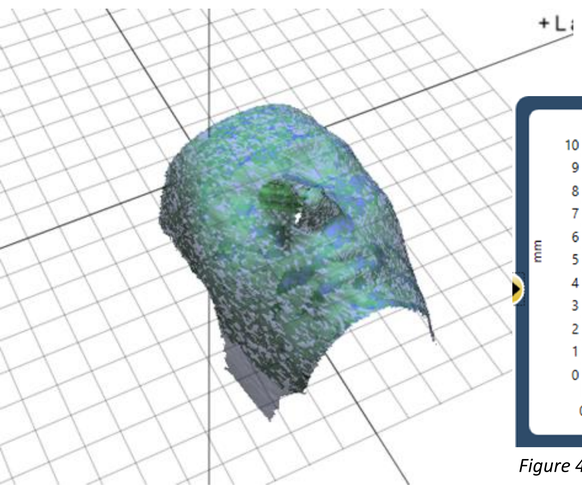


Figure 3 C-RAD Catalyst HD's view of the head phantom

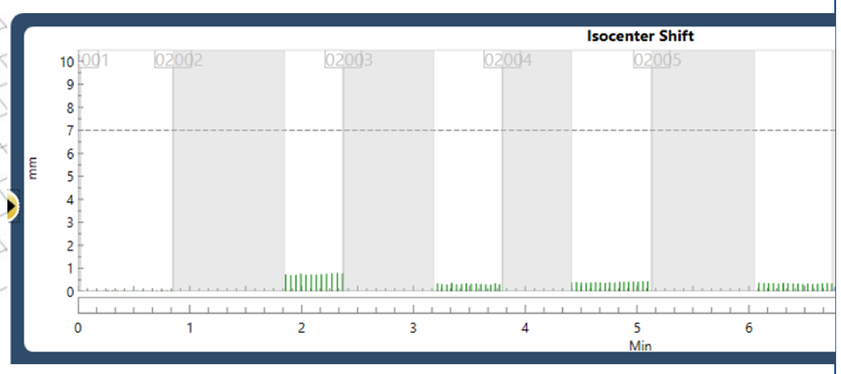
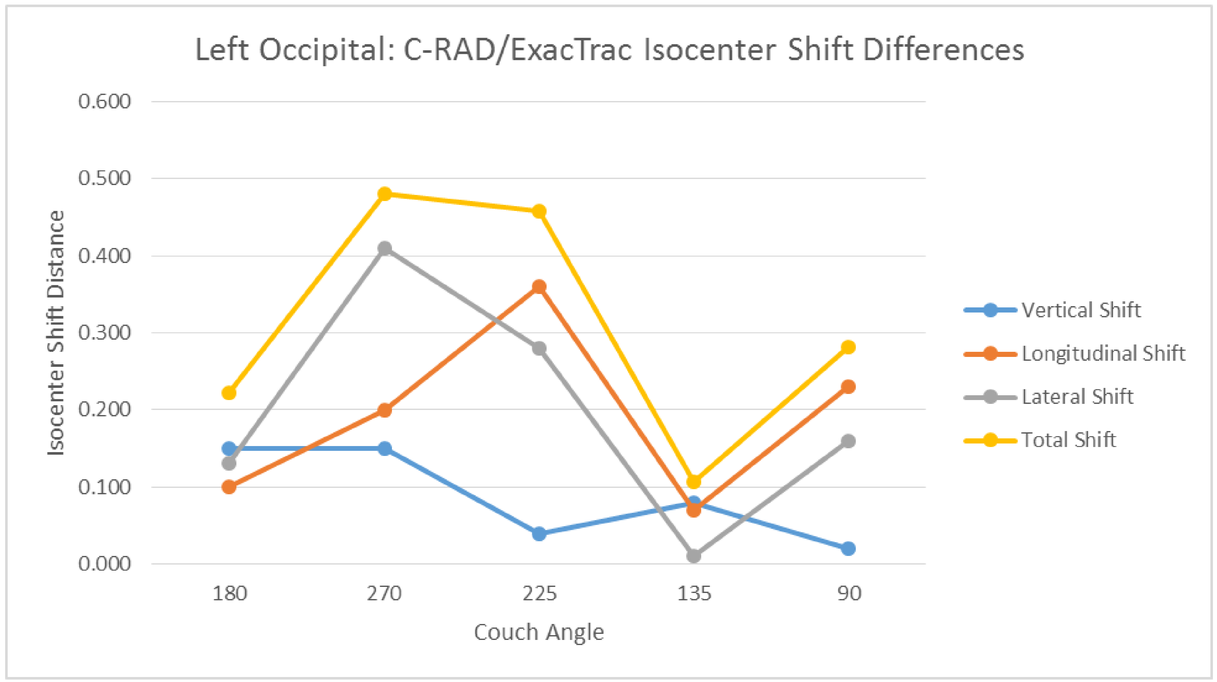
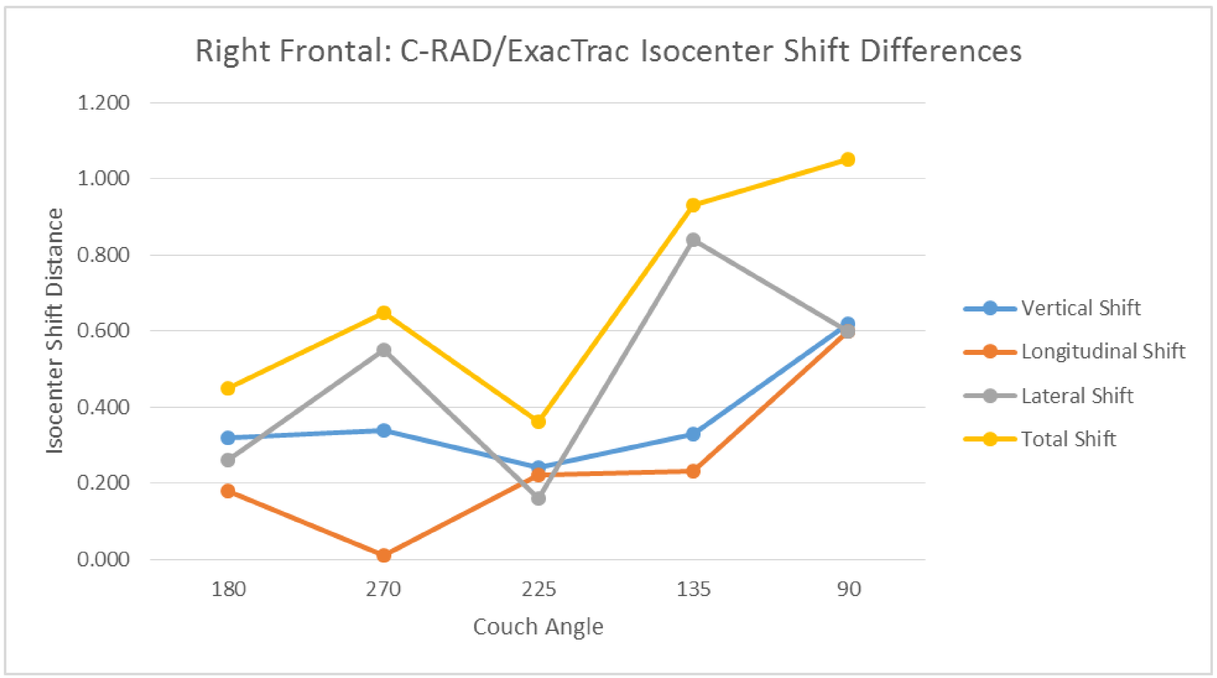


Figure 4 C-RAD Cataylst HD's Isocenter Shift live graph

RESULTS



Plot 1: Plot showing C-RAD and Brainlab Isocenter shift differences for the left occipital lobe lesion.



Plot 2: Plot showing C-RAD and Brainlab Isocenter shift differences for the right frontal lesion.

External surface imaging and internal x-ray imaging had agreement within 0.62 mm, 0.84 mm, and 0.60 mm in the vertical, lateral, and longitudinal dimensions respectively across all couch angles. Total range of values for each were 0.02 mm – 0.62 mm, 0.01 mm – 0.84 mm, and 0.01 mm – 0.60 mm respectively. The maximal vector shifts were calculated to be ranging from 0.11 mm – 1.05 mm. Rotation deviation was negligible for all angles (<0.2˚).

DISCUSSION / CONCLUSIONS

Per TG 42, SRS treatments should deliver the dose to within 1 mm for all angles. Any system used for SRS treatment setup would be expected to help the user meet this goal. For the phantom analyzed, C-RAD Catalyst HD has a discrepancy of less than 1 mm from internal x-ray imaging in each cardinal direction for the full range of couch angles. This project assumes that the BrainLab ExacTrac system has no error associated with it. Realizing that this isn't the case means that the total shifts have the potential to be even smaller than what they are reported as. These results are promising for its application for SRS treatment and verification.

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