Evaluation of Initial Setup Accuracy and Intra-fraction Motion for Spine SBRT Using Stereotactic Body Frames.

We have quantified initial setup accuracy and intra-fraction motion when using stereotactic body frames (SBF) for spine SBRT. Either the commercial Elekta SBF or an in-house SBF (BHS-SBF) were used. The BHS-SBF is shown in figure 1. Patients were treated using VMAT arcs. The Brainlab ExacTrac system was used for patient positioning. Lasers calibrated to the frame coordinate system were used to position the patient in the frame. The ExacTrac system would then drive the frame into position using IR markers identified on the planning CT. kV x-rays were acquired with the ExacTrac system and an automatic 6-D bony anatomy fusion performed (Figure 2). The calculated translations & rotations give the initial setup accuracy of the frame.

Figure 3 shows the initial setup error results for the 31 fractions treated. No significant systematic error was observed and there was no difference between the Elekta and BHS-SBF. The patient was shifted based on the fusion and verification imaging was acquired confirming positioning within 1 mm / 1 deg. The imaging/fusion process was repeated between treatment arcs and at the end of the fraction. Intra-fraction motion was determined from shifts between image sets. Figure 4 shows a histogram of the 3-D intra-fraction shift magnitude observed. The mean 3-D intra-fraction magnitude was 0.6 mm with a 95% certainty of 1.4 mm which compares favorably with our previously published results for mask based cranial radiosurgery.\(^1\)

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