AbstractID: 13385 Title: Evaluation of inter-fraction setup uncertainty of the cervical spine using a novel relocatable head frame intended for intra-cranial stereotactic radiotherapy

Purpose:
To quantify inter-fraction variation in upper-spine (C1–C3) positioning when using a novel vacuum bite-block relocatable head-frame (RHF), that was originally designed for use in intra-cranial stereotactic radiotherapy (SRT).

Methods and Materials:
The RHF (Extend™) was designed for multi-session treatments on Perfexion™. As part of an ethics-approved study, the RHF was used to set up and immobilize patients undergoing linac-based intra-cranial SRT. For each fraction, cone-beam CT (CBCT) was used to guide the skull to the treatment room isocentre based on anatomical 3D image-matching. In this study, the same CBCT data were analyzed to quantify the relative displacement of the upper-spine to an ideally well-aligned skull as follows. For each patient, each daily CBCT image set was first co-registered to the planning CT images based on bony anatomy in the skull. From this reference position, the mean difference and standard deviation between planning and daily treatment was determined for each of the geometrical centroid of the C2 process, as well as the spinal canal at level of C3.

Results:
Data from three patients were analyzed (total of 80 fractions). The mean relative displacement of the C2 process after skull alignment was 0.9±0.78 (range: -1.84-2.7) and 1.2±0.57 (range: -1.15-3.2) mm in the lateral and anterior-posterior directions, respectively. The mean displacement at the level of C3 was 0.35±2.04 (range: -4.1-6.5) and 1.59±1.2 (range: -4.2-4.6) mm in the lateral and anterior-posterior directions, respectively.

Conclusion:
Relative to an ideal skull-based alignment as determined with 3D-CBCT, systematic differences in upper-spine position were observed, as indicated by the non-zero mean deviations. Furthermore, a larger variability in daily positioning of C3 compared to C1/C2 was observed, as indicated by the larger standard deviations. These results indicate that applying translational corrections intended for skull localization may be insufficient for localization of the upper-spine when using the RHF.