AbstractID: 10756 Title: Motion Adaptation for Registering Daily Online CBCT Images to Planning CT Images

**Purpose:** Perform online image guidance (IGRT) and motion assessment using deformable registration by adapting patient liver motion models

**Materials and Methods:** 4DCT and daily 4DCBCT images were obtained for 15 patients treated under a stereotactic-body radiotherapy protocol. Finite element models of patient liver respiratory motion were generated using a biomechanical-model based platform, MORFEUS from 4DCT images. Motion was assessed using a Navigator channels (NC) technique. Five NCs, rectangular regions of interest, were placed on two images at corresponding spatial locations to define left (LR), anterior-posterior (AP), and superior-inferior (SI) liver edges. To determine interfraction liver/tumour positioning, the 4DCT exhale and daily 4DCBCT exhale images were used, while intrafraction liver/ tumour motion used exhale and inhale 4DCBCT images. The NC determines the 1D displacement between both images. This 1D motion adapts the MORFEUS-based liver motion model. NC adaptation accuracy was evaluated by comparing the results with MORFEUS registration.

**Results:** NC refinement has been performed on 8 patients to date in less than 2 mins each. Inter-fraction motion of the liver exceeded 1 cm. Inter-fraction NC technique accuracy (absolute mean (SD)) was 0.15 (0.11), 0.16 (0.10), and 0.15 (0.09) cm, in the LR, AP, and SI directions, respectively. Intra-fraction motion exceeded 1.5cm. NC technique accuracy was 0.14 (0.10), 0.15 (0.08), and 0.18 (0.09) cm, in the LR, AP, and SI directions, respectively. The accuracy of the NC technique to identify the center of mass shift of the tumour for intra-fraction motion was 0.16 (0.15), 0.14 (0.12), and 0.15 (0.10) cm, in the LR, AP, and SI directions, respectively.

**Conclusion:** NC adaptation technique can accurately and efficiently integrate deformable registration into the IGRT process to account for inter and intra-fraction motion.

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