AbstractID: 6846 Title: Generating Patient Specific Motion Models using a Navigator Channel and a Liver Population FEM Motion Model

PURPOSE: To incorporate motion information from 2D images using a navigator technique and finite element modelling (FEM) to generate patient-specific 3D motion models.

METHODS AND MATERIALS: A liver population motion model was created using a FEM deformable image registration platform, MORFEUS, to simulate liver deformation during a respiratory cycle. Twenty patient's exhale livers were constructed from the population FEM, and then deformed into their inhale livers. Deformation maps were generated and used to check the accuracy of the navigator-updated patient models. NavigatorView, an in-house algorithm, places a rectangular navigator channel to define a region of interest on 2D image slices. An operator chosen navigator is placed on the exhale image while another navigator is automatically placed at the corresponding location on the inhale image. Motion was calculated as the shift required to align the intensity profiles within the channels at the superior dome and the inferior tip of the liver on coronal CT slices and simulated radiograph images. The navigator shifts were used in a weighting equation to generate patient-specific motion models from the population motion model.

RESULTS: The average accuracy ± standard deviation of the navigator channel at the superior and inferior edges is 0.12 ± 0.12cm and 0.25 ± 0.25cm respectively. The navigator-updated patient-specific models was 100% and 80% successful of the 20 patient cases for the coronal CT and simulated radiograph slices respectively, where a successful case achieved an accuracy error less than the image voxel size (0.25cm).

CONCLUSIONS: The navigator technique allows for updating patient-specific 3D motion models from a liver population model using more easily acquired 2D images. This can be a useful tool for image-guided therapeutics, such as intra-fraction image-guided tracking during radiotherapy, where 2D data may be more rapidly acquired.

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