AbstractID: 5442 Title: Evaluation of the three dimensional Localization Accuracy using Cone-beam Computed Tomography of Varian On-Board Imager (OBI)

Purpose:

To evaluate 3 dimensional (3D) localization accuracy using cone-beam computed tomography of a Varian On-Board Imager (OBI) in a phantom study.

Methods and Material

An anthromorphic pelvic phantom was used to simulate an actual patient positioning scenario. The possible patient shifts were simulated by moving the treatment couch on which the phantom was placed and immobilized. While the phantom was shifted from its planning position, a CBCT scan was taken, and 3D/3D matching was performed. The CBCT 3D volumetric image was registered with the planning CT images to reveal the displacement of the real phantom position from its planning position (i.e., the positioning error of the phantom). Then, the phantom position was automatically re-positioned to compensate for the detected shift. Afterward, a second CBCT scan was taken, and 3D/3D matching was performed again to verify the re-positioning accuracy (should be zero). A range of 3D translations are simulated and the corresponding positioning accuracy using CBCT of the OBI system was examined.

Results

The results for translational shifts indicate that CBCT-based 3D/3D matching is capable of detecting displacements ranging from 1mm to 10mm, and the accuracy is within 1mm. After re-positioning of phantom, the phantom is positioned within 1mm from its planning position.

Conclusion

The current results indicate that CBCT is capable of detecting positioning errors within 1 mm in three translation directions. More characteristics is to be investigated in the future, such as rotational shifts, image quality (slice thickness), treatment site (other than pelvic), and others.

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