

AbstractID: 10826 Title: Imaging study to determine appropriate implanted fiducial markers for proton or photon image guided radiation therapy

Purpose: Fiducial markers are used to verify and correct prostate position during x-ray intensity modulated radiation therapy or proton therapy. However, each commercially available marker has some advantages and disadvantages associated with their use. We have conducted an imaging study to determine the appropriate type of marker to be used for prostate patients undergoing x-ray or proton imaged guided radiation therapy (IGRT).

Method and Materials: Four types of markers were evaluated: a) gold (0.8 mm x 3.0 mm); b) gold (1.2 mm x 3.0 mm); c) carbon (1.0 mm x 3.0 mm); d) plastic (1.0 mm x 5.0 mm). The markers were inserted into the pelvis of a Rando phantom and a computed tomography (CT) was obtained. The radiographic visibility of the markers, were assessed by visual inspection of radiographs using a linac kilovoltage (kV) and megavoltage (MV) x-ray imaging system.

Results:

Under CT imaging, the large gold marker produced the greatest artifact followed by the small gold marker. The carbon and plastic markers produced minimal CT artifact. Under kV imaging, all four fiducials were clearly visible. Under MV imaging, both the gold fiducials were visible, however, both carbon or plastic fiducials were not-visible.

Conclusion:

Due to CT artifacts, gold markers are inaccurate to contour on the CT dataset resulting in approximate marker locations on the digitally reconstructed radiographs (DRR's). This limitation adds to patient setup uncertainty during daily IGRT. Gold markers, especially the smaller marker, would be a suitable choice when imaging with MV beams. Carbon or plastic markers provide high resolution kV localization with minimal CT artifacts. Fewer artifacts leads to more accurate DRR's. Gold markers cause dose perturbation in patients receiving proton radiotherapy. Low density carbon markers could be used instead. Carbon markers would also be a great choice for patients receiving x-ray kV IGRT.