

Purpose: Implanted fiducial markers are commonly used for high accuracy positioning of the prostate in radiation therapy. One source of error in fiducial-based patient positioning is the rotation and deformation of the prostate. The sensitivity of fiducial-based positioning to rotation and deformation depends upon the location of the center of mass (COM) of the fiducials relative to the COM of the prostate and on the stability of this geometric relationship throughout the treatment. This work assesses the geometric stability within the prostate of a single implanted trackable fiducial marker (Tracer, Navotek Medical Ltd.) relative to the COM of 4 gold seeds.

Methods: In a multi-site ethics committee approved clinical trial, 20 prostate radiation therapy patients were implanted with 4 gold seeds and one Tracer. CBCT imaging was performed during 5 treatment sessions to measure the locations of the implants. The locations of the Tracer and the COM of the gold seeds were compared in each treatment session, and the stability of the Tracer relative to the COM of the gold seeds from treatment to treatment was assessed.

Results: The mean change in position of the Tracer relative to the COM of the gold seeds was 2mm 1mm (mean std) and increased with the distance between the Tracer and the COM of the gold seeds and with the amount of rotation of the prostate as estimated based on the positions of the gold seeds, as expected.

Conclusions: The stability of the Tracer relative to the COM of the gold seeds was found to be similar in magnitude to the differences in positioning between any two highly accurate positioning methods. These results support the assertion that a single fiducial, placed near the COM of the prostate, can provide positioning accuracy comparable to multiple fiducials distributed around the prostate.

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