

AbstractID: 4814 Title: Retrospective analysis of prostate cancer patients with fiducial gold markers using a real-time tumor tracking system

Purpose: The aim of this study was to measure interfraction and intrafraction motion of the prostate during the course of radiation treatment using a real-time tumor tracking system (RTRT-system) and gold fiducial markers.

Method and Materials: Fifty-five patients underwent implantation with three 2-mm gold markers in the prostate before IMRT treatment planning CT scans. Using a RTRT-system, fluoroscopic images were taken after a) skin-based patient's positioning and b) translational repositioning by moving a couch after a calculation of actual and planned positions of three gold markers. Intrafraction as well as interfraction translation and rotations were analyzed along the three axes (right-left[RL], cranio-caudal[CC], antero-posterior[AP]). Systematic and random errors were computed for these translations and rotations in (a)conventional setup and (b)RTRT setup. To determine adequate margins for these setup, van Herks's formula of $(2.5\Sigma+0.7\sigma)$ were used.

Results: Without consideration of interfraction errors, prostate treatment would have required average margin of 9.8, 14.3 and 12.5mm (n=1466) about the right-left(RL), cranio-caudal(CC), and antero-posterior(AP) directions, respectively for skin-based patient's positioning. Interfractional random rotation error was 5.9°(systematic error, 8.6°) around RL axis, 3.1°(systematic error, 5.5°) around CC axis, and 5.1°(systematic error, 5.4°) around AP axis. Inclusion of intrafraction movement increases these margins to 11.0, 15.3, and 13.1mm, respectively (n=2905). Intrafractional and inter-beam adjustment further reduced margins to an average of 2.1, 2.5 and 2.3mm, respectively, based on a threshold of 3mm for each direction.

Conclusion: Monitoring and correction of the intrafraction movement for prostate treatment using this system, significant reduction of margins would have achieved. However, the interfraction as well as intrafraction rotations of the prostate should be taken into account for the additional margins because their magnitudes are not negligible.

Conflict of Interest (only if applicable): The authors indicated no potential conflicts of interest.