AbstractID: 2721 Title: Dosimetric Comparison of Skin, Bone, Ultrasound, and CT Alignments for Prostate Cancer

Purpose: To quantify the dosimetric impact of four alignment methods (skin marks, bone, ultrasound, and CT) on the daily treatment of prostate patients.

Method and Materials: Six prostate patients received 3 CT scans per week immediately before treatment using an integrated CT-linear accelerator (135 CT scans total). We simulated the delivery of the clinical treatment plan by re-aligning the plan on each CT scan using four techniques. The alignments used skin marks, bony registration of the CT scans, ultrasound, and prostate center-of-volume (COV). To compare the dosimetric effects of these alignments, we collected dose-volume histograms of the prostate, seminal vesicles, bladder, and rectum.

Results: These six patients could be divided into a stable group (3/6 cases) with average anterior-posterior prostate motion $\leq$ 2mm, and an unstable group (3/6 cases) with motion $\geq$ 2mm. The stable group showed minimal dosimetric changes with the four alignment techniques. For the unstable group, the average minimum prostate dose (to $1cm^3$) was 75.6Gy with prostate COV, 72.3Gy with ultrasound, 67.2Gy with bone, and 65.4Gy with skin. The variation in daily minimum prostate doses was smallest with prostate COV alignment. Ultrasound alignment also reduced the daily variation except for two patients with large gas. For one case where the prostate tended to move anteriorly, re-alignment decreased the rectal dose while increasing the bladder dose. For two cases where the prostate moved posteriorly, the reverse occurred.

Conclusions: Patients can be separated into two groups based on the average prostate motion. Patients with average anterior-posterior prostate shifts above 2mm can improve their prostate coverage by using ultrasound (better than skin and/or bone) or prostate COV (best) alignment techniques. Rectal doses will increase with posterior prostate motion. More than one CT scan is required to determine if a particular patient will significantly benefit from ultrasound and prostate COV alignment.