the immobilization mask, the software tool revealed progressive geometric miss of the PTV over a one-week time frame; based on the delivered PTV DVHs, which indicated the dose covering 95% of the PTV had decreased by 5 cGy from the original planned dose of 175 cGy per fraction, an adaptive replan was advised for this patient.

**Conclusion:** Our initial clinical use of the automated dose-tracking tool for tomotherapy delivery indicates that the tool can effectively verify the delivery of planned target coverage and organ-at-risk sparing, and can identify and confirm sufficient degradation of plan quality to trigger adaptive replanning.

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### Real-Time Ultrasound and Electromagnetic Transmitter Based Tracking Systems for Adaptive Radiotherapy in Prostate Cancer Patients

M.C. Biston,[1,2] L. Delcoudert,[1] C. Gorsse,[1] A. Munoz,[1] and P. Pommier[1]; [1]*Centre Leon Berard, Lyon, France,* [2]*Université de Lyon, CREATIS; CNRS UMR5220; Inserm U1044; INSA-Lyon Université 1, Lyon Cedex 08, France*

**Purpose/Objective(s):** Hypofractionated radiotherapy protocols in prostate cancer treatment require a better accuracy in dose delivery because of an increased risk of toxicity in the surrounding tissues. To achieve this goal, a robust pre-treatment imaging device combined with a real-time prostate monitoring system for correcting inter and intrafraction motion is required. Two monitoring modalities are available in our department: intra-prostatic electromagnetic transmitters (EM-T) (RayPilot, Micropos Medical, Sweden) and ultrasound imaging using transperineal probe (TP-US) (Clarity, Elekta, Sweden). The objective is to report the monitoring results obtained with the two devices used concomitantly.

**Materials/Methods:** The accuracy of the two systems was first investigated in a phantom study. Then intra-fraction motions measured with the two devices used simultaneously were analyzed for 3 intermediate risk prostate adenocarcinoma patients (60 sessions). Patients were implanted with the EM-T and two fiducial markers 8 days before the simulation CT. Pre-treatment positioning was first performed with the TP-US. The shifts obtained were then controlled by a Cone Beam CT (CBCT) imaging (+ fiducial markers)/CT registration. During CBCT imaging the 2 devices monitoring mode were started. Irradiation was stopped and patient positioning adjusted for shifts above a threshold of 3 mm for at least 15 seconds for both devices. Each time threshold was exceeded a CBCT was performed to confirm the obtained shifts.

**Results:** On phantom, differences between TP-US and EM-T were below 1.5 mm in all directions if only translational shifts were applied on the target volume. When large rotations were applied (pitch 4°, yaw 9°), the correlation between EM-T vs CBCT was superior than between TP-US vs CBCT (i.e. 1.6 mm difference vs 5.3 mm in supero-inferior direction for EM-T vs TP-US, respectively). Mean differences between displacements observed on patients with EM-T and TP-US were less than 0.5 mm in all directions (Table 1). A larger variability was found in the antero-posterior direction where more important shifts were observed. However, the maximum differences over all the sessions were found less than 1.5 mm.

**Conclusion:** EM-T is a reliable technique for monitoring prostate during radiotherapy treatment. It can be implemented rapidly and *in situ* dosimetry will be soon operational. TP-US is a promising option because it is non-invasive and enables visualization of the target and organs at risk. However the accuracy of the TP-US system needs further investigations in case of prostate rotations.

**Abstract 1119; Table 1 Mean differences between displacements observed with EM-T and TP-US during all the treatment sessions**

| | Left-Right (mm) | Supero-inferior (mm) | Antero-Posterior (mm) |
|---|---|---|---|
| Patient 1 | 0 ± 0,28 | -0,13 ± 0,21 | 0,12 ± 0,29 |
| Patient 2 | 0,1 ± 0,26 | -0,4 ± 0,37 | 0,22 ± 0,30 |
| Patient 3 | 0,02 ± 0,16 | -0,10 ± 0,14 | -0,11 ± 0,45 |

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