

Using image-based immobilization devices for prostate patients receiving radiation therapy with treatment plans derived from MR-simulation

L Voros, V Yu, S Hellman, P Booth, M Hunt, M Lovelock, M Zelefsky, J Deasy
Memorial Sloan Kettering Cancer Center, New York, NY

INTRODUCTION

Our standard **immobilization** for prostate patients undergoing MRCAT only simulation is a thermoplastic anterior mold.

We evaluate a new workflow, where the patient is MR-simmed without immobilization.

The immobilization mold used for treatment is **machined** from polystyrene foam based on the outer contour obtained from MR-simulation.

AIM

This study is innovative because using new **automated** way to provide **immobilization custom molds** for our MR only prostate cancer patients.

Aquaplast is our standard immobilization device, however this technique is covering the anterior patient's skin surface. The reason why Aquaplast was chosen for our prostate patients' MR only simulation is to reduce the distance between the posterior coil to the patient.

We proposed a **new workflow**, which can provide an immobilization free MR simulation and deliver the posterior custom mold for treatment delivery.

METHOD

- 6 patients went through MR-sim positioned on a pad without immobilization and received their custom machine-milled posterior mold for treatment delivery.
- Prescription for the 6 prostate bed and regional nodes patients were 72 Gy total of 40 fractions.
- Prescription for daily setup verification was bony registration using orthogonal kv images and weekly CBCT.
- Initial patient setup was performed using laser alignment to the tattoos, marked during simulation.
- A pair of orthogonal kilo-voltage x-ray images were acquired, and automated bony registration used to shift the patient to the treatment position.

RESULTS

12 patient's data (6 image-based immobilization, 6 Aquaplast immobilization) were compared.

The difference of final online matched position and initial couch position were extracted from Aria Offline Review.

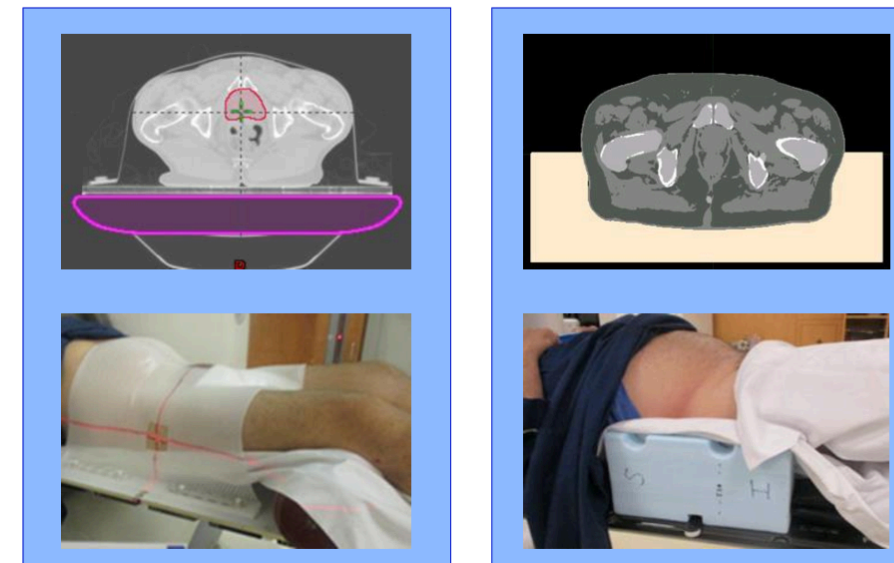
The mean of couch shift vector lengths for the 6 **image-based immobilization** (N=212) setups was **0.94 ±0.52** cm [range, 0 to 2.3 cm].

The mean of couch shift vector lengths for the 6 **Aquaplast immobilization** (N=230) setups was **0.94 ±0.45** cm [range, 0 to 3 cm].

The observed average shifts and ranges were similar in the superior-inferior, anterior-posterior and left-right directions.

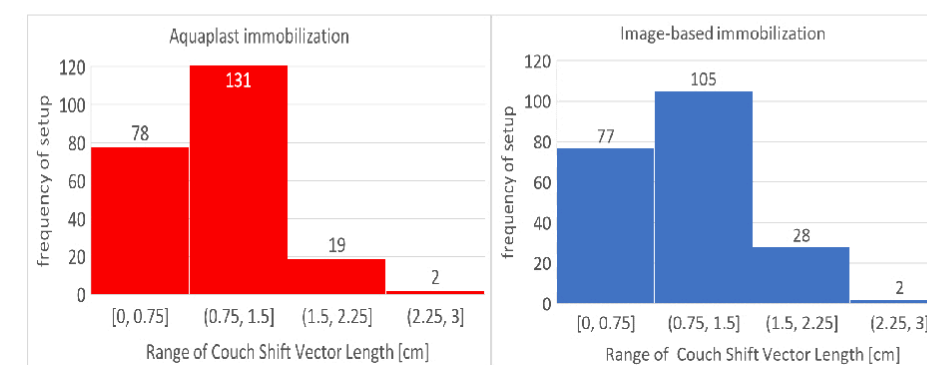
	Mean (cm)	Stdev (cm)	Min (cm)	Max (cm)
Couch shift vector length (CSVL)				
Image-based	0.94	0.52	0	2.3
Aquaplast	0.94	0.45	0	3
Anterior-posterior				
Image-based	-0.36	0.47	-2.00	0.77
Aquaplast	-0.27	0.41	-1.94	0.84
Superior- inferior				
Image-based	0.15	0.74	-2.12	1.98
Aquaplast	-0.47	0.57	-2.74	1.39
Left-right				
Image-based	0.11	0.47	-1.30	1.90
Aquaplast	0.11	0.54	-2.49	1.44

Table 1. Observed couch shift vector length and translational shifts as the difference of final online matched position and initial couch position in each direction for both immobilization technique



Patient setup with anterior Aquaplast

Patient setup with posterior image-based custom mold



Histograms of couch shift vector length (CSVL) for a total of 12 patients (442 treatment fractions data available). CSVL for Aquaplast immobilization (left), image-based immobilization (right).

CONCLUSIONS

The **image-based immobilization workflow** provides similar setup positioning for our MR-sim prostate patients without the need for covering the patient's anterior skin surface.

Switching from our anterior mold to the posterior mold showed no influence on patient setup errors.

Provides a more comfortable treatment setups for the patients.

Opens the possibility to use surface image guidance and might offer a tattoo free option for these patients in our clinic.

FUTURE GOALS AND POTENTIAL CLINICAL IMPACT:

- Consider combining surface imaging with image-based immobilization & **no tattoos**
- Potential to eliminate or **shorten simulation**
- Streamline simulation** process for multi-modality patients (example CT, MRI)
- Recycling polystyrene molds

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Michael Zelefsky, M.D., Department of Radiation Oncology

CONTACT INFORMATION

vorosl@mskcc.org