

AbstractID: 8944 Title: Evaluation of 3 Tesla MR Image Distortion and Artifacts in a Titanium Applicator Presence: Toward 3T MRI Guided HDR Brachytherapy for Cervical Cancer

Purpose: Characterize 3 Tesla (T) magnetic resonance image (MRI) distortion and artifacts induced from a titanium applicator presence.

Methods and Materials: Based on the ASTM International method, a titanium tandem and ovoids (Varian) was placed in a reference phantom, and embedded in a solution (30L distilled water, 1.5g/L CuSO₄). A reference phantom was designed to be free from distortion, to suspend an applicator, and to provide a reference for distortion. MR images were scanned for transverse, sagittal, and coronal views; and also generated both with and without the applicator in place. Image artifact and artifact width were quantified for all three datasets to determine maximum width. For the purpose of this study we used three tandems to simulate an applicator. Two different gels (both water-soluble) were tested around tandems: lubricating jelly for ultrasound image and white petrolatum gel.

Results: Image artifacts were evaluated for pixels changing their intensity by $\geq 30\%$ and found at mainly three regions; the tip (its artifact width $\leq 4\text{mm}$) of tandem and the shoulder region ($\leq 5\text{mm}$) of tandem and the triangular area (its image artifacts area $\leq 0.8\text{cm}^2$) surrounded by the three tandems. A shoulder region is located inferior-outside of uterus and a triangular region also represents the gauze-packed space in the vagina. Hence, their impact on tumor delineation is minimal. At the tip of tandem, the artifacts width (4mm) potentially leads to limiting microscopic tumor delineation but is within the tolerance (5mm) of MR images registration (AAPM TG53). The distortion was determined to be no more than 1.2mm. The gels described above were found to be helpful in determining the boundary but not in improving artifacts.

Conclusion: Artifacts and distortion from a titanium applicator presence were found within the tolerance. 3T MR image is feasible to be implemented into brachytherapy planning process.