AbstractID: 3634 Title: The Use of MVCT Images for Dose Calculation in the Presence of Metallic Objects

Purpose:
Metallic objects such as dental fillings and prostheses cause artifacts in kilovoltage CT (kVCT) studies. The problem with these artifacts is twofold. Firstly, they obscure soft tissue structures. Secondly, the artifacts create artificial CT numbers that compromise the accurate calculation of absorbed dose. Megavoltage CT (MVCT) imaging reduces these artifacts, and this study investigates the impact of such artifacts.

Method and Materials:

The MVCT to electron density curve for a Hi-ART II helical tomotherapy unit was extended to include high electron density materials using aluminum, titanium, and copper targets. MVCT images of a prostate patient with a hip prosthesis that is treated on a helical tomotherapy unit are then used to evaluate the impact of kVCT artifacts on the calculation of absorbed dose. At the time of treatment planning the kVCT image was used for planning. For actual patient treatment the artificial hip was generously contoured and no beam entrance though this region was allowed for treatment planning. Daily MVCT image of the patient were acquired for patient alignment. Retrospectively, a treatment plan was generated that allowed beam entrance through the hip prosthesis. This second plan was recalculated on the MVCT image to determine the dosimetric effect of the artifacts.

Results:
The recalculated dose in the MVCT image shows that the absorbed dose in the hip prostheses and immediately next to the prosthesis is lower in the MVCT image than in the kVCT image. This dose differential can be as large as 15%. Soft tissue areas that are affected by the kVCT image artifacts have higher absorbed dose in the MVCT based recalculation.

Conclusion:
In the presence of metallic artifacts, significant differences in the absorbed dose computation exist between dose calculations based KVCT images and that calculated in megavoltage images.

Conflict of Interest:

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