Iodised hydrogel for prostate cancer radiotherapy

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Introduction

- SpaceOAR Vue™ is an iodised hydrogel spacer used in prostate radiotherapy[1] and is easily visualised on a number of different medical imaging modalities.[2]
- The aim of this study was to characterise SpaceOAR Vue™ for clinical use and assess its utility for online IGRT.

Methods

- Megavoltage (MV) transmission through SpaceOAR Vue™ was measured and compared to water using an ionisation chamber and slab phantom geometry.
- This setup was recreated in the treatment planning system (TPS), with the SpaceOAR Vue™ overridden to water and subsequent calculations compared to measurement.
- SpaceOAR Vue™ was delineated on the planning magnetic resonance images (MRI), planning computed tomography (CT), and cone beam CT (CBCT) of five patients to assess changes to SpaceOAR Vue™:
    - Volume (cc),
    - Position (Dice similarity coefficient and clinical observation), and
    - Hounsfield Units (HU).

Results

- MV dosimetric variation of SpaceOAR Vue™ and water was measured to be <0.5%.
- TPS calculations agreed with measurement to within 0.5% with the SpaceOAR Vue™ overridden to water.
- SpaceOAR Vue™ delineated on the planning CT compared to CBCT demonstrated:
    - Volume variation of approximately 1cc (figure 1).
    - Median Dice Similarity Coefficient ranged between 0.60-0.78 (figure 2) and shape changes were observed (figure 3).
    - Median HU remained consistent over the treatment course (figure 4).
- SpaceOAR Vue™ delineated on the planning CT compared to MRI demonstrated:
    - Volume variation of approximately 1cc (figure 1).
    - Median Dice Similarity Coefficient ranged between 0.73-0.89 (figure 2) and shape changes were observed (figure 3).

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SpaceOAR Vue™ improves delineation of rectum and prostate but may be inappropriate for matching or tracking.

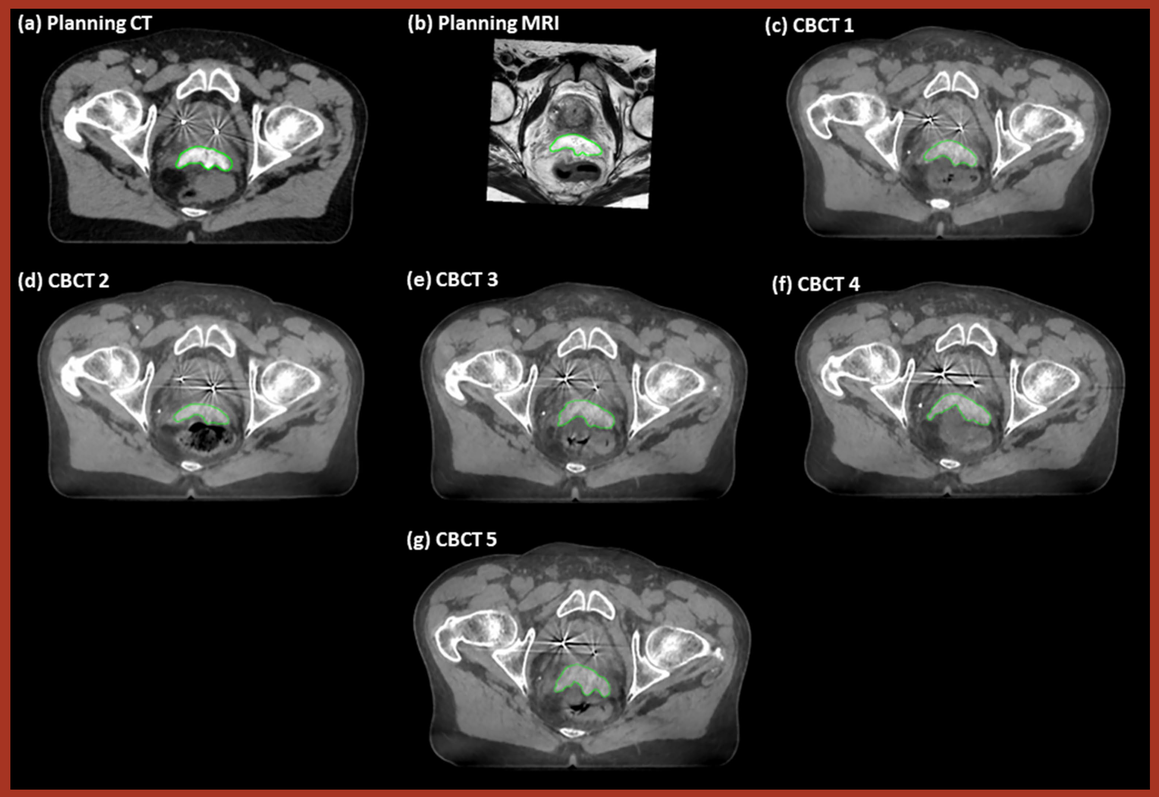

Figure 3: SpaceOAR Vue™ (green) shape change during a treatment course

SpaceOAR Vue™ visualised at the same level of the prostate on the (a) planning CT, (b) planning MRI, and on (c – g) CBCT scans during treatment. SpaceOAR Vue™ improves the delineation of rectum and prostate but may not be appropriate for matching or tracking due to the interfraction shape change.

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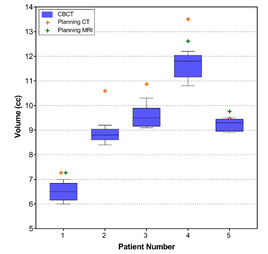

Figure 1: SpaceOAR Vue™ volume change. Orange and green crosses indicate volume on planning CT and MRI, respectively. Blue box and whiskers indicates the volume across five CBCT images.

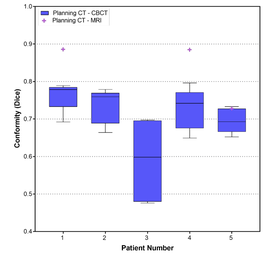

Figure 2: Dice similarity coefficient. Purple cross indicates Dice Similarity score of Planning CT and MRI. Blue box and whiskers indicate Dice Similarity scores of Planning CT and five CBCT images.

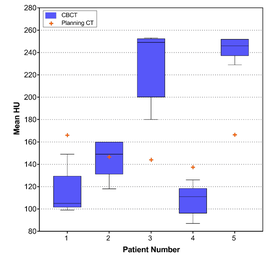

Figure 4: Mean HU of SpaceOAR Vue™. Orange cross indicates mean HU measured on planning CT. Blue box and whiskers indicates the mean HU measured on five CBCT scans.

Conclusion

- SpaceOAR Vue™ transmission demonstrated <0.5% dosimetric difference to water transmission in a MV beam.
- By overriding SpaceOAR Vue™ to water in TPS, dose calculations agreed to measurement to <0.5%.
- The volume and HU of the material remained stable during the treatment course.
- SpaceOAR Vue™ may not be appropriate for matching or tracking due to differences between planning CT/MRI and subsequent CBCTs (figure 2&3).

Acknowledgements

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