AbstractID: 6908 Title: Gel dosimetry for measuring a complex 3D dose distribution in stereotactic radiosurgery

Purpose:
To explore the feasibility and the accuracy of using polymer gel dosimeters in measuring a complex 3D dose distribution irradiated using dynamic arc for stereotactic radiotherapy.

Method and Materials:
MAGIC-2 polymer gel was produced and poured into a 500mL vessel. The treatment plan has four dynamic arcs and was generated from the BrainLab planning system using CT images with 6 MV photon beam. The treatment plan with a complex 3D dose distribution was delivered to gel with the micro-multileaf collimator, m3, adapted to a Varian Trilogy treatment machine. The irradiated gel was imaged by MRI on a Philips Achieva scanner at 3T. Before imaging, the gel was placed in the imaging suite overnight to reach room temperature. The gel phantom was scanned using a multi-echo spin-echo sequence. T2 (transverse relaxation time) images were calculated by performing a least-square fit to a single exponential for each pixel of the echo images. R2 (transverse relaxation rate) images were calculated as the inverse of the T2 images. A 2-mm transverse slice through the gel at maximum dose was chosen for analysis.

Results:
The calculated and measured relative dose distributions were quantitatively compared using gamma index calculations. With criteria of 5% dose and 3mm distance-to-agreement, approximately 97% of all pixels within the 50% isodose curves in the R2 image of the plan had gamma values of less than unity, indicating that they were in acceptable agreement with the dose distribution. For criteria of 5% dose and 1 mm distance-to-agreement, approximately 58% of the pixels had a gamma value of less than unity.

Conclusion: Polymer gel dosimetry is potentially a very useful dosimeter in measuring a complex 3D dose distribution for stereotactic radiotherapy treatment. It is able to provide a high resolution 3D dose distribution to verify a complex treatment plan.