AbstractID: 11543 Title: Treatment of retinoblastoma using different proton delivery methods: scattering, rectangular scanning, and circular scanning

Purpose: The high risk of radiation induced malignancy in retinoblastoma with conventional radiotherapy makes treatment with proton beams advantageous since it minimizes exposure of normal tissue in brain and orbit. Until recently, only scattered proton beams were used. In this study we compare contaminating neutron dose from three different beam delivery methods: passive scattering, uniform scanning with a rectangular scan pattern, and uniform scanning with a circular scan pattern adjusted to the target size. In all three scenarios the same brass aperture was used.
Methods: CT scans of three patients with retinoblastoma were selected for treatment planning. Patients were treated under anesthesia using an ocular suction cup. Two patients had bilateral, one had unilateral treatment. The plans were reproduced in a phantom using the three delivery methods described above. Dose distributions were measured with MAGIC gel placed inside the phantom with readout performed using MRI. Neutron doses to the phantom were measured using Bubble detectors (Bubble Technology Industries™) and a SWENDI-II (Thermo Electron Corporation™) detector.
Results: In all three patients dose to the ethmoid bone and the frontal lobe was minimized by protons. When the optimized circular beam scanning pattern was used, secondary neutron dose was lower compared to both the rectangular scanning pattern and the passively scattered beam. For a 3 cm circular aperture, the secondary neutron component was 0.23 mSv/Gy for a 12x12 cm rectangular pattern. It was 80% lower for a 4cm optimized circular scan pattern and 15% higher for a 12cm diameter double scattered field.
Conclusions: Delivery of proton beams using a scan pattern adjusted to the shape of the treatment field yields comparable dose distributions to conventional proton beam delivery but has the advantage of delivering less contaminating neutron dose to the patient.