AbstractID: 7606 Title: Visual Sensations during Megavoltage Radiotherapy to the Orbit Attributable to Cherenkov Radiation

Purpose: To compute and to verify experimentally Cherenkov radiation production inside the eye from direct and indirect high energy x-ray irradiation of the orbit and that it exceeds detectability of Cherenkov radiation in scotopic vision. We show that the Cherenkov yield for direct and indirect irradiation exceeds the detection threshold of $6.4x10^7$ photons/m^2s.

Methods: In photon and electron beam radiotherapy of intraorbital and periorbital tissues, patients commonly report having light sensations during treatment. The explanation usually offered is that 'nerve stimulation' is occurring. The radiotherapy literature reports the effect to be the result of 'phosphenes'. Although phosphenes may play a role, we propose instead that patients are predominantly seeing Cherenkov radiation resulting from electrons inside the eye having kinetic energy exceeding the Cherenkov radiation threshold of 0.26 MeV. We consider calculations for direct irradiation of the eye from a portal image and indirect irradiation from treatment of peri-orbital tissues and show that it exceeds threshold detection.

Results: We calculate the Cherenkov yield using analytic methods and the measurements were in good agreement with our calculations. The Cherenkov radiation from a distilled water phantom, a square plastic phantom and an anthropomorphic plastic phantom were readily visible with a high quality CCD video camera. A digital camera captures the images from the console monitor. Threshold detection of Cherenkov radiation emanating from the water phantom through the video camera was determined and compared to a measurable source. The calculations for the water phantom match reasonably well with measurements and are roughly 1 lux and 3 lux respectively.

Conclusion: We show images of Cherenkov radiation emanating from routine radiotherapy treatments and demonstrate that measurements corresponding to these images match well with calculations. We show that the Cherenkov component generated inside ocular media is sufficient to be detected by the patient.