AbstractID: 3893 Title: Heterogeneity Effects in Small-Field Macular Irradiation

Purpose: To evaluate the effects of bone heterogeneities on the dose distribution to the macula in small-field macular irradiation.

Method and Materials: An elliptical aperture measuring 8 mm x 10 mm on the major axes was constructed to project a circular field onto the macula through each of six fields focused on the macula and angled 28 degrees relative to the central axis of the eye. Using a stereotactic diode, the Tissue-Maximum-Ratio was measured for this aperture to a depth beyond the macula. These measurements were repeated using bone-density material in order to approximate the attenuation through the cartilage of the nose and the supra-orbital ridge. The beam profile at the depth of the macula was determined by film densitometry and the profiles for strictly soft tissue overlay were compared with the profiles for given thicknesses of bone density phantom added to the soft tissue. Lastly, the profile was determined for bone-density phantom covering only half the field to simulate a treatment situation where the supra-orbital ridge might intersect only half the incident field.

Results: The excess attenuation of the bone material representing cartilage or supra-orbital ridge is easily described by a simple exponential. The beam profile at the depth of the macula appears unchanged from the beam profile for soft tissue overlay, while the beam profile as modified by bone density material covering half the field shows a measurable attenuation through the bone. However, there is no widening of the profile in any of these situations.

Conclusion: These results suggest that a small-field pencil beam photon algorithm should be sufficient to calculate the radiation dose distribution for macular irradiation. Pencil beam and Monte Carlo dose calculation algorithms will be compared against these measurements.

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