

AbstractID: 7674 Title: Shortcomings in published brachytherapy source parameters for accurate dose calculation for an Eye Plaque Implant with I-125 or Pd-103 seeds

Introduction

Radiation therapy of uveal melanoma allows for tumor control, sparing of vision and preservation of the eye ball. Retina, optic nerve, lens, and lacrimal apparatus are the adjacent critical structures demanding special consideration for optimum results. Present treatment planning systems designed for eye plaque dose calculation utilize dosimetric parameters tabulated in TG-43U1. Dosimetric parameters tabulated in this report have successfully been utilized for various interstitial implants, but they are not optimum for eye plaque dosimetry due to unavailability of dosimetric parameters at short radial distances.

Materials and Methods

2D-anisotropy function $F(r,\theta)$ of commercially available seed type I-125 and Pd-103 sources were determined in water using Monte Carlo simulation techniques (MC) for radial distances ranging from 0.1cm to 2.0cm with 0.1cm radial increments. Accuracy of source and phantom geometry utilized in MC was validated by the comparison of $F(1,\theta)$ and, $F(2,\theta)$ with the published values for each source.

Results

Discrepancies in dose calculation for an eye plaque implant with I-125 seeds can be demonstrated by the comparison of $F(r=0.1\text{cm}, \theta=20\text{deg.})=2.070$, and $F(r=0.25\text{cm}, \theta=20\text{deg.})=1.110$ to that of $F(r=0.5\text{cm}, \theta=25\text{deg.})=0.7147$. TG-43U1 recommends use of the values of $F(0.5,\theta)$, (in this case i.e. 0.7147) in the absence of the values at close proximity (i.e. 2.070 or 1.110). It may be easier to imagine that the absence of $F(r,\theta)$ for radial distances of 0.25cm and 0.1cm may lead to discrepancies up to 35.61% and 65.48%, respectively. Similar discrepancies have been observed for Pd-103 sources.

Conclusion

Absence of $F(r,\theta)$ for radial distances at the close vicinity of the sources leads to large discrepancies and demands tabulation of $F(r,\theta)$ for smaller radial distances. Tabulation of $F(r,\theta)$ for I-125 and Pd-103 brachytherapy sources at short range will improve accuracy of eye plaque dose calculation and will minimize treatment morbidity associated with this treatment modality.