

A Monte Carlo Simulation Method for Treatment Planning :Title 14037 :AbstractID C Code4Optimization of Eye Plaques Using MCNP

Purpose:

Ophthalmic plaque radiotherapy using I-125 radioactive seeds in removable episcleral plaques is often used in management of ophthalmic tumors. The goal of this study was to develop a Monte Carlo simulation method for treatment planning optimization of eye plaques.

Method and Materials:

MCNP4C Monte Carlo Code was used to calculate the percent depth dose curves, dose profiles and isodose curves created by three different plaques. The plaques used were Collaborative Ocular Melanoma Study-12mm (COMS-12mm) with eight model 6702 seeds, COMS-20mm with three model 6711 seeds, and University of Southern California (USC) #9 with nine model 6711 seeds. Dosimetric characteristics of I-125 model 6702 and 671 seeds, were calculated according to recommendations of AAPM Task Group 43 protocol. Then, the geometry of each plaque was simulated and dose calculations were performed using F6 tally card in a 12mm radius spherical water phantom.

Results:

The comparison of calculated central axis depth doses to reported measured values, showed the deviation up to %10 for COMS-12mm, %3 for COMS-20mm and %1 for USC#9. For off-axis dose profiles the deviation was up to %9 for COMS-12mm, at 7mm depth, %6 for COMS-20mm at 10mm depth and %1 for USC#9 at 17 mm depth.

The results of this study show that COMS-12mm and COMS-20mm plaques are suitable for treatment of symmetrical tumors with thickness-diameter (base) of 8mm-14mm and 4mm-12mm, respectively. However, a USC#9 plaque is suitable for treatment of non-symmetrical tumors with 8mm thickness and 16mm base diameter.

Conclusion:

The user code developed in this study can be used as an optimization tool within a few millimeters of the plaque surface. It can also be used to design custom made plaques for treatment of ocular tumors with various sizes, shapes and locations.