AbstractID: 9154 Title: A comparison of doses calculated by commonly used algorithms in eyeplaque Implant

Purpose: To verify the deviation of dose calculation based on commonly used TG43U1-based algorithms from Monte Carlo simulations in eyeplaque implants, and to evaluate the dose perturbation introduced by eyeplaque.
Material and method: Monte Carlo technique was used to generate 3D dose distributions of single IsoAid^{TM} I-125 brachytherapy sources. A novel computer code EyeMC was developed to utilize the single-source 3D dose distribution to generate dose distributions of multiple-source implants for COMS eye-plaques, through rotating, superposing, displacing and interpolating methods. In addition, Monte Carlo simulations were performed for the 8-seed implant to verify the accuracy of the EyeMC and treatment planning system, and to verify the magnitude seed-eyeplaque effects. Eight seeds were placed as two isocentric squares at the same plane, with the inner square width of 0.6 cm and outside square width of 1.1 cm. The treatment planning system Brachyvision^{TM} was also used to calculate the doses at points of interest with point- and line-source approximations.
Results: The point-source approximation used in the treatment planning system agreed with line-source approximation within 10%. Compared to the Monte Carlo simulation, the treatment planning system using line-source approximation significantly underestimated the dose values at the eyeplaque axis, by 13% at 2 mm, 18% at 1.0 cm, 20% at 2.0 cm, and 24% at 3 cm. The eyeplauqe-seed effect was small but noticeable. The presence of the eyeplaque could reduce dose up to 10% at the distance of interest up to 3 cm. The data from EyeMC agreed with multiple-seed full Monte Carlo simulation within 3%.
Conclusion: Our comparison of commonly used TG43U1-based algorithm shows that neither point-source nor line-source approximations provides accurate dose calculations for multiple-seed implant eyeplaques at short distances. Our study suggests that a Monte Carlo-aided code, such as EyeMC, is needed to increase the accuracy of dose calculation.