AbstractID: 3482 Title: Accuracy of clinical dose delivery in IOHDR brachytherapy

Purpose: To investigate the accuracy of clinical dose delivery in intra-operative high dose rate (IOHDR) brachytherapy.

Method and Materials: The IOHDR brachytherapy treatments of 10 patients recently treated at our facility were reconstructed. Treatment geometries reflecting each clinical scenario were simulated by a phantom assembly with no added buildup on top of the applicator. EDR2 radiographic film placed at the prescription depth recorded dose distributions for each clinical case. The treatment planning geometry (full scatter surrounding the applicator) was subsequently simulated for each case by adding bolus on top of the applicator and radiographic film was again exposed at the treatment depth. After careful determination of the film's H&D curve, absolute dose distributions in the plane of the prescription depth were evaluated for both scatter environments in each clinical case.

Results: For the geometries simulating the treatment planning conditions of full scatter, the average dose measured at the treatment depths was within 2% of the prescription and dose distributions were in excellent agreement with the respective treatment plan. However, for the geometry simulating treatment conditions (no added scattering material above the applicator), the dose at the prescription depth was on average 11% lower (range 8-14%) than prescribed. An analysis of the delivered dose distributions and treatment plans shows a resulting average decrease of 2 mm (range 1.2–2.4 mm) in prescription depth.

Conclusion: Dosimetry calculations for IOHDR brachytherapy are typically done with treatment planning systems with dose calculation algorithms that assume an infinite scatter environment around the applicator and target volume. We have shown that this assumption leads to dose delivery errors which result in significant foreshortening of the prescription depth. It may be clinically relevant to correct for these errors by augmenting the scatter environment or, preferably, by appropriately modifying the prescription dose entered into the treatment planning system.