AbstractID: 6562 Title: A Method to achieve uniform dose distributions in small animal subcutaneous tumors

Purpose: In the current radiotherapy paradigm, a major treatment planning goal is target dose uniformity. However, a boost dose to as large a fraction as possible of the target volume (partial target boosting) may improve local control without increasing the risk of normal tissue injury. We are investigating the feasibility of using 6 MV photon beam from Varian 2100 Linac to deliver controlled, non-uniform dose distributions to subcutaneous small animal tumors. The focus here is to achieve dose uniformity as the first step.

Methods: A superficial structure was created near the thigh of a healthy mouse to simulate a subcutaneous tumor. It had a maximum dimension of 9mm and density equal to water. The fast Monte Carlo code, Dose Planning Method, (DPM) was coupled to our research treatment planning system, CERR (Computational Environment for Radiotherapy Research), to conduct the planning study. The mouse was placed on the in-house microRT system. Different boluses and beam arrangements were tested.

Results: By computing and evaluating the different plans using 2, 4, and 7mm boluses, it was found that 4mm bolus was enough to provide buildup. Two slightly-angled (35º and 240º) or parallel-opposed (60º and 240º) beams can achieve a tumor dose with 3% RMS, the minimum and maximum dose as 0.89Gy and 1.05Gy respectively, for the mean dose 1Gy. This suggested that the uniform dose distributions can be delivered.

Conclusions: 6MV photon beam is capable of delivering uniform dose on a superficial tumor of 9mm. Thus it is achievable to deliver a non-uniform dose on the tumor, provided accurate positioning and beam collimation, to facilitate the investigation of tumor response to heterogeneous dose. The microRT hardware and CERR planning system are a useful platform for this study.

Conflict of Interests: This research was partially supported by a grant from Varian Medical Systems, Inc.