

AbstractID: 8451 Title: Expected Clinical Impact of the Differences between Planned and Delivered Dose Distributions in Helical Tomotherapy

Purpose: To investigate the effectiveness of highly conformal radiation modalities in conjunction with a patient setup correction method, Helical Tomotherapy (HT) was employed using the Helical Megavoltage CT (MVCT) scanner of the tomotherapy unit. Any discrepancy between the planned and delivered dose distributions would likely affect the clinical outcome.

Material and Methods: The case of a head and neck cancer was used to evaluate the accuracy of dose delivery. The right parotid, left parotid and spinal cord are the primary organs at risk proximal to the target volume. MVCT images were taken before and after the patient setup correction. MVCT images of the patient were acquired daily. The three dose distributions (planned, with and without patient setup correction) were compared by using the complication-free tumor control probability (P_+) and the biologically effective uniform dose (BEUD) concepts.

Results: For the computerized treatment plan, the maximum value of P_+ is 88.3%, the total control probability, P_B is 97.3% and the total risk for complications, P_1 is 9.3%. For the delivered dose distribution without patient setup correction, the value of P_+ is 79.8% and the probabilities P_B and P_1 are 83.6% and 3.8%, respectively. Finally, for the delivered dose distribution with patient setup correction in every fraction the value of P_+ is 87.2% and the probabilities P_B and P_1 are 92.7% and 5.5%, respectively. The expected clinical effectiveness dropped by a ΔP_+ of 1.1% and 8.5% in the cases with and without patient setup correction.

Conclusions: Highly conformal treatment plans can deliver higher doses to the target allowing for increased control rates for the same or a reduced risk for complications. The results show that the effectiveness of the applied dose distribution drops between the treatment plan and the dose delivery with and without patient setup correction.