AbstractID: 10924 Title: Biological Gamma Plus Index Concept Experimental Verification

Purpose: A new biological gamma evaluation index, gamma plus, was proposed to more effectively describe the quality assurance of IMRT treatment by considering biological effective dose (BED) information. Although gamma index has been used to evaluate the physical dose delivery and spatial discrepancies between the treatment planning system (TPS) and practical treatment, it does not consider important biological information of organs.

Method and Materials: An experiment was designed to verify this new bio-gamma concept. Lung IMRT plan for the RANDO® Phantom was created using Pinnacle^3 TPS, and then was delivered to the GAFCHROMIC® EBT film located in a specific plane of RANDO® Phantom by a Varian Clinac 23EX linear accelerator. Lung IMRT plan was to prescribe 200 cGy per fraction to 100% of point dose at "iso" for 20 fractions. Four 6 MV photon beams were assigned to this prescription at gantry angle of 20, 150, 180, and 220 degrees, respectively. MATLAB codes were developed to compare the delivered planar dose distribution to the planned dose distribution of Lung IMRT plan based on the bio-gamma concept.

Results: Under the standard tolerances of 3% dose difference and 3 mm distance difference, the gamma plus calculations of the lung IMRT case not only give similar results as the gamma index does, but also show difference from the gamma index by considering biological dose information and various dose fractions. With different treatment parameters in clinical cases, such as dose per fraction, the gamma plus index will change its value, which implies the treatment outcome information has been included.

Conclusion: Combined with BED concept, gamma plus index shows its advantages on quantitative evaluations of the dose distributions over the gamma index. Better quality control of IMRT treatment could be obtained because bio-gamma incorporates the information of treatment outcome and biological dose of organs.