AbstractID: 6761 Title: Reducing dose calculation time for accurate iterative IMRT planning

The time required to complete iterative IMRT inverse planning is limited by the speed of the dose calculation algorithm. Accurate superposition/convolution (SC) and Monte Carlo (MC) dose calculations are currently considered too time consuming for iterative IMRT dose calculation, thus, fast, less accurate measurement based algorithms such as pencil beam (PB) algorithms are typically used. A method has been developed to reduce the dose computation time for iterative IMRT dose calculation by creating a hybrid dose calculation method that is based upon a correction matrix. In the proposed method, an infrequently computed voxel-by-voxel dose correction ratio matrix ($R=D_{SC}/D_{PB}$) is applied to the PB dose results during the optimization, that is $D_{PB}\times R$ is used for the dose during the optimization. The optimization proceeds until both the IMRT beam intensities and the dose correction matrix converge. We have compared IMRT plans developed with this ratio matrix method with those obtained when the SC algorithm is used for all optimization iterations. We find that no clinically significant differences exist between the ratio matrix results and the pure SC results. However, we do find that the number of time consuming SC iterations is reduced from ~20 for pure SC optimization to less than 4 for the ratio matrix method. Since the PB algorithm is ~100 times faster at computing dose for a single beam, this reduces the inverse planning optimization time by a factor of 4 or more compared to pure SC optimization, without compromising the quality or accuracy of the final treatment plan.