

Purpose: To compare low lung doses in treatment plans for left side locoregional breast cancer with TomoTherapy and Volumetric Modulated Arc Therapy (VMAT) where VMAT is planned by Monaco® (Elekta-CMS) treatment planning system which incorporates a Monte-Carlo (MC) dose calculation engine.

Methods: Four patients previously treated on TomoTherapy were replanned with the VMAT technique for treatment on Elekta Synergy. Plans were optimized and calculated using Pencil Beam (PB) and MC algorithms available in Monaco. As a benchmark, plans were also recomputed using a previously validated and published in-house Monte Carlo model of TomoTherapy and VMAT. Particular attention was given to the low lung doses (V5Gy and V20Gy), which are considered as important clinical parameters in evaluating the acceptability of this type of treatment plan, but where accuracy is usually lacking with current planning system dose calculation algorithms.

Results: Similar dose distribution and time of delivery could be achieved between TomoTherapy plans ($V_{95\%}=99.1\pm 0.9\%$) and VMAT plans ($V_{95\%}=98.5\pm 0.6\%$). The average percentage ($\pm 1SD$) difference between our in-house MC model lung doses and Monaco MC lung doses was ($2\pm 2\%$) for V5Gy and ($4\pm 1\%$) for V20Gy. Slightly larger average percentage differences were observed between our in-house MC model for the V5Gy ($-11\pm 4\%$) and V20Gy ($3\pm 1\%$) for plans calculated using Collapsed Cone Convolution (CCC) algorithm in TomoTherapy. As expected, the largest average percentage differences for V5Gy ($-28\pm 1\%$) and V20Gy ($-10\pm 2\%$) were found between the in-house MC model and the PB model in Monaco.

Conclusions: We have demonstrated the feasibility of adapting our technique developed on TomoTherapy for treating left sided locoregional breast cancer to VMAT and compared the accuracy of the low isodoses calculated with the Monaco MC algorithm to the TomoTherapy CCC algorithm.