Comparison between multi-criteria optimization (MCO) (Raystation®) and Progressive Resolution Optimizer (PRO) (Eclipse®) for the dosimetry of breast cancer with prophylactic nodal irradiation treated with volumetric modulated arc therapy (VMAT)

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Introduction:

Since 2012 in our centers, VMAT with ECLIPSE® Treatment Planning System (TPS) v10 (Varian®) is routinely used to treat patients with breast cancer requiring prophylactic nodal irradiation.

In 2015, we acquired the RayStation® TPS v4.7.2 (RAYSEARCH®), with the new dosimetric approach based on MCO concept.

The aim of the study is to demonstrate that the use of the MCO reduces learning time by obtaining faster treatment plans respecting the clinical dosimetric constraints commonly published in the literature.

Methods:

This retrospective study included 10 patients, randomly Selected, treated for breast cancer (5 left breasts and 5 right breasts) with nodal irradiation (internal mammary chain, supraclavicular area and axillar third area of Berg when clinically relevant) using VMAT. For each patient, the initial dosimetry was performed using the Eclipse TPS with PRO optimization algorithm V3 and the calculation of the dose with the algorithm "Analytic Anisotropic Algorithm" V10 and 2mm grid. The prescribed doses were 50Gy on the mammary gland and from 44 to 50Gy to the nodes, within 25 fractions.

For each patient, a new plan was performed using the RayStation® TPS, maintaining ballistic parameters and the computing grid (2mm), but with the MCO optimization and the algorithm for dose calculation "Collapsed Cone Convolution".

PTV coverage was evaluated in terms of the homogeneity index (HI), conformity index (CI), DMEAN (Gy), V95% and doses to organs at risks were compared to each other.

Results:

The Homogeneity index was significantly better in the MCO algorithm arm with V95% = 95.39 ± 1.96% versus 85.15± 8.48% (p = 0.005) in the PRO arm. Even finding for the HI index = 0.15 ± 0.03 vs 0.21 ± 0.03 (p = 0.007)) and HI index = 0.18 ± 0.06 vs 0.24 ± 0.05, respectively for the PTVBreast and PTVNodes.

The analysis of doses to organs at risk for the 10 patients shows that there was no significant difference between the two algorithms (p> 0.05).

Conclusions:

The MCO algorithm can be used to generate efficiently treatment plans for complex breast cancer.

The TPS RayStation with the MCO optimization can quickly and easily obtain comparable or even higher treatment plans than the PRO algorithm.

This new TPS was easily and quickly adopted by our team for this location.

Keywords: Breast cancer, MCO, VMAT, PRO