Verification of monitor units and dose distributions in IMRT treatment plans using Monte Carlo algorithms on the e-IMRT web platform

Currently, quality control (QC) for each IMRT treatment is performed by dose distribution measurements. These techniques are very time-consuming and require long accelerator downtime. QC could be only based in verification of monitor units and dose distributions, if precise control of MLC is carried out. In such a manner, the e-IMRT platform (http://eimrt.cesga.es/) is a remote distributed computing tool, which allows comparison between the dose distributions calculated by a TPS and those calculated using Monte Carlo (MC) simulations.

Previously, a 6 MV (Oncor Impression, Siemens) linear accelerator was commissioned. For this purpose, comparison of experimental and MC simulated data was carried out. Several IMRT treatments plans were calculated in superposition algorithm (TPS Xio®CMS 4.60.00) and used as input data for the e-IMRT platform. These treatment plans were previously verified employing a 2D array MapCheck™, Sun Nuclear. The gamma index (3%, 3mm) was used for validating results.

The platform displays calculated doses using MC, also gamma map (in the CT images, not only statistical data) and histogram shown in Figures 1a), b) and d). The gamma map illustrates the differences between the input and calculated doses. According to the legend in Figure 1 d), these differences correspond to less than 1%. Results show good agreement between the doses calculated by TPS and those computed by e-IMRT platform.

If a rigorous quality control is established for MLC and optimisation criteria (number of gantry angles, minimum segment size, levels of intensity for fluency map) are used. Then, QC for IMRT standard treatment plans would be only based on the verification of monitor units and dose distributions using e-IMRT II.

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