Quality assurance program implementation for computerized treatment planning systems

F. Ribeiro\textsuperscript{1}, M. C. Oliveira\textsuperscript{1}, S. Macedo\textsuperscript{1}, A. Oliveira\textsuperscript{1}, O. Santos\textsuperscript{1}, C. Simão\textsuperscript{1}, J. Faria\textsuperscript{1}, M. Roldão\textsuperscript{1}

\textsuperscript{1}Department of Physics, Service of Radiotherapy, Portuguese Institute of Oncology, Francisco Gentil, Lisbon, Portugal

**Introduction**

In radiotherapy, patient treatment procedures involve different steps, one is the dose calculation distributions, performed by a Treatment Planning System (TPS). The Quality Control (QC) application procedures are essential to avoid the risk of overdosage of normal tissue and underdosage of tumor. In practice, TPS commissioning involves numerous tasks such as the generation of a reliable set of dosimetric reference data and the effective methodology application. This work represents our experience in Quality Assurance (QA) implementation program for Precise Plan (vs R 2.15) Treatment Planning System which was submitted to an upgrade. The necessary tests to implement the QA program were established and performed, in accordance with the IAEA publication TRS430 and with AAPM Task Group 53.

**Methods**

Data were obtained from five Linear Accelerators (4 GE Saturne and 1 Elekta Precise), which were commissioned for external beam photons for different energies (4, 6, 8 and 15 MV). Monitor Unit accuracy calculations were performed under the following conditions, with a water phantom (40x40x40 cm) in the TPS clinical workspace. Reference points were entered, along the central axis on the central slice, for different depths (5, 10 and 20 cm). For each field size, energy and SSD (100 cm) were normalized separately to the reference depth (5, 10 and 20 cm) using individual prescriptions and 100 cGy for each delivering. Table 1 summarizes the Monitor Unit (MU) calculations performed for each field and energy. The results obtained were compared with experimental data. In the TPS, profiles were computed in a phantom to a field 30x30 cm and SSD=90 cm, and depth dose curves also obtained in the same phantom but for a field 10x10 cm in size and SSD = 100 cm. The obtained curves were compared with the experimental data acquired under the same condition (Fig. 3 and 4).

In a second stage were verified the hardware, network systems integration, data transfer, and software parameters such as printer, digitizer, CT, block cutting system and the Mosaic R\&V system. It was implemented a sheet of quality control for Precise Plan where are summarized the tests to execute for each machine. This procedure is performed with a fixed periodicity, about 2 months, Fig. 2.

**Results**

In the non-dosimetric tests were verified hardware, network systems integration, data transfer, and software parameters. The results obtained are consistent with the specifications of the manufacturer. For dosimetric tests, the absolute dose was measured for simple geometries, such as square and rectangular fields. Results were analysed by the use of confidence limit as proposed by Venselaar et al. Acceptability criteria had been applied also for the comparison between the values of MU calculated manually and MU generated by TPS. The results of the dosimetric tests show that they are inside of the considered tolerance interval which ensure that they are in operational standards for TPS.

**Conclusions**

The non-dosimetric tests that we performed were done to ensure accurate format and transfer of TPS input and output information for an accurate treatment delivery. It was tested the functionality of hardware, software and the functionality of calculation algorithm. Quality control results indicated good reproducibility of all parameters, which ensure that they are acceptable at time of purchase and continue to be maintained as closely as possible.

**Bibliography**

