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62 Validation of IMRT treatments in head and neck cancer through a European multicentric dosimetry study

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GORTEC IMRT Physics group contains currently some twenty physicists expert in the intensity modulated radiotherapy technique focused on head and neck cases. Due to huge common interest for such localizations using IMRT, many subcommittees exist such as for instance one working on assessment of inverse planning systems including optimization practices, on quality assurance methods and procedures, on inventory of incidents/accidents, on the development of DICOM RT platform facilitating free exchange of DICOM data, and finally the building of an IMRT head and neck dedicated phantom.

Effectively, a specific head and neck IMRT dedicated phantom, named PIGG (Physics IMRT GORTEC Group) has been designed in order to perform a dosimetry validation of such technique in some European radiotherapy institutions. This phantom is homogeneous even though fictive volumes of interest mimicking the target volumes (bilateral CTVs receiving a prophylactic dose and a unilateral CTV receiving a therapeutic dose) and the organ at risk (spinal cord, parotid glands, oral cavity, larynx). Each volume can be easily distinguished even if they are homogeneous. Treatment plans will be performed respecting a strict study protocol containing fixed parameters like positioning, CT acquisition, selection and delineation of volumes, ballistics to achieve treatment plans respecting clear dose volume objectives. In that phantom and in each center, different kind of ion chambers will be inserted together with films measurements in order to perform a complete dosimetry QA.

Hence, this multicentric IMRT dosimetry QA on PIGG is very successful and is widely appreciated as a physics quality control. Obviously, special dosimetry recommendations on IMRT will be derived from this large study. Effectively, demands are coming from clinical trials implying such complex techniques like IMRT such as for instance dose escalation studies in HNSCC using a SIB approach.

63 IMRT pretreatment verification with an EPID; data analysis and clinical results.

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Introduction: In our clinic the correct delivery of IMRT fluence profiles produced with DMLC is routinely verified before the first treatment fraction by acquiring portal dose images (PDIs) with a fluoroscopic EPID. In this study the dosimetric accuracy of this method is quantified. For a group of 200 patients, detected serious errors in realized profiles are reported.

Methods: For each patient and beam direction the measured PDI is compared to a PDI as predicted by the CadPlan TPS using the γ evaluation method and dose difference maps. For calculation of the γ values, a 3% local dose difference and a 3 mm DTA are used as reference values. The results are evaluated by visual inspection, showing rejected points (γ>1) in red. When those points are grouped in areas larger than about 1 cm², dose difference profiles are used to examine the cause of the disagreement. If necessary, additional measurements using an ionization chamber are performed. In this study the mean γ value (γmean), the maximum γ value for 95% of points (γp95) and the percentage of points with γ<1 (γacc) were derived for each image to summarize the results.

Results and conclusions: Pretreatment verification with an EPID is a fast and accurate method to verify delivery of IMRT fluence profiles. For 75 recently treated patients results of the γ evaluation are summarized in the figure below. On average γmean = 0.32, γp95 = 1.01 and γacc = 93.7%. For 77% of the images γmean was less than 0.5 and γacc exceeded 90%. A linear relation was found between γmean and γp95 showing that the latter parameter is redundant. Dose differences larger than 3% were mainly found in low dose areas, in the tongue- and-groove region between leaves and at large (>8 cm) off-axis distances in the y-direction. The latter is probably related to a less accurate cross-talk correction applied to the measured PDIs. Measurements with an ionization chamber were rarely required to explain observed dose differences. We are evaluating if an automatic analysis of the pretreatment results is possible for the majority of images using stringent, clinical relevant criteria for γmean, PDI and the clustering of rejected points. In 200 patients, the pretreatment verification successfully intercepted two severe errors before starting treatment: once a wrong IMRT plan was accidentally sent to the accelerator; in the second case, one leaf was malfunctioning.

64 Dose-response characteristics of an amorphous silicon EPID

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Introduction: The purpose of this study was to investigate the dose-response relationship of amorphous silicon EPID. A detailed understanding of the dosimetric properties of such a device is required for any dosimetric application, such as pretreatment IMRT verification or in vivo dosimetry.

Materials and Methods: The EPID response, which was defined as the ratio of the EPID signal to the number of monitor units delivered, was investigated as a function of dose and dose rate. Measurements were carried out using three photon beam qualities; 6, 10, and 25 MV. Additional build up layers (1.5 and 3.0 mm Cu, respectively) were placed on top of the detector to provide electronic equilibrium.

Results: It was observed that the response characteristics of our EPID depended on dose as well as on dose rate. Doubling the dose rate increased the EPID sensitivity by 1.5%. This behaviour was successfully attributed to a dose per frame effect, i.e. a nonlinear relationship between the EPID signal and the dose which was delivered to the panel between two successive readouts. The sensitivity was found to vary up to Monday, September 26

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