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Quality control procedure for linear accelerator multileaf collimators in radiotherapy

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Introduction:

The introduction of Multileaf collimator (MLC) systems into clinical Linear Accelerators (Linacs) facilitated computer-control and verification of complex treatment, and resulted in an increase in patient set up speed. A MLC system thus requires a re-evaluation of the quality assurance requirements for beam collimation. To this end a combined procedure was developed and executed based on several Linear Accelerator Multileaf Collimator Quality Control Methodologies in Radiotherapy.

Materials and Methods:

The performance of MLCs for an Elekta Linac at the Livingstone Hospital (LH) in Port Elizabeth and a Siemens Linac at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) were examined. The standard quality control procedures executed are leaf matching, leaf position accuracy, inter-leaf leakage and transmission through abutting leaves. A single exposure procedure was developed to execute all procedures on one image as shown below.

Radiographic film was used at CMJAH and radiographic film and an Electronic Portal Imaging Device (EPID) were used at LH. Record and verify data management systems were used to set up and execute the procedure. The calibration of all the imaging devices was also performed.

Results:

The individual and combined procedures were successfully carried out and analysed using the two different detectors on the two Linac systems over a period of 6 months. The data allowed for the characterisation of MLC performance over a period of time including MLC re-calibration. The analysis of the data obtained showed consistency across procedures, devices and reproducibility in the results with time.

Conclusion: Monitoring the performance of an MLC over time improves understanding of how the MLC varies with clinical usage and predicts when recalibration is necessary. The combined procedure facilitates early detection of system failure and is a resource-sparing methodology.

Keywords: Multileaf Collimator, Quality Control, Assurance

Country

South Africa

Institution

Livingstone Hospital

Primary author: RULE, Ayron (SAAPMB: Department of Health: Eastern Cape)

Co-author: VAN DER MERWE, Debbie (Charlotte Maxeke Johannesburg Academic Hospital /University of Witwatersrand)

Presenter: RULE, Ayron (SAAPMB: Department of Health: Eastern Cape)

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