ONCODAILY MEDICAL JOURNAL

abstract

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DOI: 10.69690/ODMJ-018-3101-6503

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Asia and Middle East Society of Therapeutic Radiation and Oncology
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Assessment of MOSFET Detectors in In-Vivo Dosimetry for VMAT Total Body Irradiation

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Introduction: Accurate dosimetry is essential in total body irradiation (TBI), particularly when employing advanced delivery techniques such as volumetric modulated arc therapy (VMAT), where complex modulation and large treatment fields introduce challenges in dose homogeneity and delivery. In-vivo dosimetry serves as a critical quality assurance tool to verify the accuracy of the delivered dose relative to the treatment plan. Metal–oxide–semiconductor field–effect transistor (MOSFET) detectors provide real-time, small-volume, and reproducible dose measurements for dose verification procedures. This study evaluates the performance of mobile MOSFET detectors for in-vivo dose verification during VMAT-based TBI patients, focusing on their accuracy, reproducibility, and integration into the clinical workflow.

Methodology: A total of 56 MOSFET measurements were obtained from various anatomical positions across multiple patients. Measurement points were selected according to areas of clinical interest (head, chest, abdomen, axilla, extremities, and junctions). Each patient was assessed at least twice (first treatment is mandatory), detectors were calibrated and checked before each treatment, and the measured doses were compared with the prescribed (planned) doses from the treatment planning system.

Results: The mean measured dose from the MOSFET detectors was 98.7% of the prescribed dose (range: 88.5–108%), with a standard deviation of 5.08%, and a median dose of 98.5%. On average, the delivered dose was within 2% of the prescription.

Conclusion: MOSFET detectors demonstrated strong agreement with deviations typically within ±2% in average. The detectors showed good linearity and consistent reproducibility between repeated measurements. Closely matching between mean and median dose suggests a symmetric distribution and confirms the consistency and reliability of MOSFET readings. Their compact design and real-time readout capabilty

facilitated efficient in-vivo dose verification and patient setup assessment without interrupting clinical workflow. These findings support the use of MOSFET detectors as a reliable tool for in-vivo dosimetry in VMAT-based TBI, enhancing treatment accuracy and QA robustness in advanced radiotherapy practices.

Conflict of interests: The authors declare no conflict of interests.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.