

Applications of MOSkin as a real-time detector for *in vivo* dosimetry during high-dose rate Cobalt-60 brachytherapy

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Abstract:

Dose measurement in high dose rate (HDR) brachytherapy treatment is challenging due to the nature of steep dose gradient characteristic of brachytherapy source. MOSkin is a MOSFETbased detector which possesses the main advantages of having small active volume and water equivalent packaging as well as providing real-time measurement. It therefore has a high potential to be the detector of choice for implementation of in vivo dosimetry (IVD) programme in clinical brachytherapy. In this work, the aim is to evaluate the feasibility and applicability of MOSkin as an in vivo detector for Cobalt-60 (Co-60) brachytherapy dose measurement during brachytherapy of skin and cervical cancers. The MOSkin was first explored for a dosimetric study at lead-tissue interface to measure the dose to the targeted and normal skin regions during skin brachytherapy. Dose quantification with MOSkin performed in three different source-lead-bolus phantom setup arrangements and during treatment delivery, providing dosimetric information of tumour and normal tissue doses evaluation. There was 20% dose enhancement at the target area from source-lead-bolus (SLB) setup while > 25% dose reduction to normal skin was achieved with source-bolus-lead (SBL) setup arrangement. The suitability of the MOSkin detector for rectal dose measurement during cervical intracavitary brachytherapy (ICBT) was then investigated. Verification of classical cervical pear-shaped isodose distribution from ICBT applicator was performed in a custommade gynaecological phantom which resulted in < 3% dose difference between the TPS planned and MOSkin measured dose. This is followed by clinical in vivo rectal dose measurements in 18 brachytherapy insertions with placement of single MOSkin detector, which resulted in percentage dose difference with planned doses ranging from -16.3% to 14.9%. In conclusion, the MOSkin detector has been used for IVD and the results have verified the suitability and applicability of the MOSkin as detector of choice for IVD in HDR brachytherapy using Co-60.