

mm Al HVL to 6 MV. Films have been irradiated at increasing dose with three different beams: 6MV beam, $TPR(10,20) = 0.684 \pm 0.01$; HVL = 2.00 ± 0.01 mm Al and HVL = 0.20 ± 0.01 mm Al, a very-low-energy beam. The dose output for each beam was determined with an appropriate calibrated ionization chamber, following IPEM and DIN6809-4 standard recommendations. Calibration curves were generated using the same dose range (0 cGy to 850 cGy) for the three energies. Using the 6MV calibration curve as reference, the film response in terms of net optical density was evaluated. The difference in the calibration curve obtained by irradiating the film with 6MV and 2mmAl HVL energy beams is less than 3%, within the calibration uncertainty, in the dose range 400–850cGy. The maximum difference is 4.1% at 150cGy. The optical density of EBT3-V3 film is significantly lower at 0.2 mmAl HVL compared to 6MV, showing differences up to 25%, with a minimum of 16% at 850 cGy. Conclusion: when the EBT3-V3 film is irradiated at doses higher than 400 cGy, the calibration curve for the 2 mmAl beam agrees with the reference beam (6MV) within 3%. A significant under-response (by up to 25%) was seen at 0.2mmAl HVL. EBT3-V3 films are suitable dose detectors when the dose response curve is measured within the range 6MV and 2 mm Al HVL. 6MV calibration curve could be used within this range, with 3% uncertainty.

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Superficial X-ray therapy beam measurements using a liquid-filled chamber array

Keith Davey^a, Margaret Moore^b, Sinéad Cleary^b

^aSchool of Physics, National University of Ireland, Galway, Ireland

^bRadiotherapy Department, University Hospital Galway, Ireland

Superficial treatment from units such as the Gulmay D3300 investigated in this study are usually measured using a single ionization chamber at the central axis. Dose falls off from the central axis towards the periphery of the field. This falloff is asymmetrical in the anode-cathode axis due to the heel effect. Current clinical practice is to prescribe dose to the central axis, which neglects the varying dose across the treatment field. Therefore, it is important to formulate a methodology to quantify this. This study investigates the viability of the PTW LA-48 Linear Chamber Array with 100 and 140 kVp beam energies with seven applicators by comparing measurements with GAFChromic EBT-3 Film measurements which is validated for use at those beam energies in previous studies. The PTW LA-48 Array has 47 iso-octane-filled chambers in series allowing investigation of off-axis dose. Measurements were taken under 5 mm of liquid water using a PTW MP3 Water Tank. Film measurements were taken under 5 mm of solid water and analysed using FilmQA Pro. Both data sets were made relative to the measured central axis dose and compared. The average percentage difference between measurements for each applicator ranged between $-2 \pm 2\%$ to $1.5 \pm 0.5\%$ for 100 kVp and $-2 \pm 1\%$ to $2 \pm 3\%$ for 140 kVp, where the uncertainty is the standard error. These results show that the PTW LA-48 measurements were comparable to the EBT-3 Film measurements and highlight the potential for liquid-filled chamber arrays to be utilised to investigate off-axis dose for superficial X-ray therapy units.

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Commissioning process for high dose rate prostate brachytherapy

Sarah Larkin, Sarah Leonard, Anysja Zuchora

National Radiation Oncology Physics Residency Programme (NROPRP), Ireland

NUI Galway – MSc Medical Physics, Ireland

University Hospital Galway, Ireland

The aim of this study was to outline and examine the commissioning process of a treatment planning system (TPS) dedicated to high dose rate brachytherapy (HDR BT) prostate treatment and the associated equipment. HDR BT treatment facilitates dose escalation to the prostate and involved seminal vesicles in conjunction with external beam treatment while minimising the dose to the rectum, bladder and urethra. In comparison to low dose rate (LDR) BT, there is an increase in precision and control in source positioning and corresponding dose distribution which results in a high tumour control and low toxicity rates. Other advantages include no patient-specific radiation precautions, as patients are not radioactive following treatment, and decreased radiation exposure to clinical staff and the general public. Commissioning and implementation of a quality assurance program of HDR delivery system guarantees optimal treatment of patients. All aspects must be thoroughly tested prior to the delivery of the treatment to patients to ensure the safe delivery of the intended dose. Based on published guidelines developed by the American Association of Physicists in Medicine (AAPM) and the European Society for Radiotherapy and Oncology (ESTRO) all aspects of the treatment planning system software including the image acquisition, dose calculations and data transfer underwent the required acceptance and commissioning testing. The quality assurance testing of the equipment and the imaging system to be used was also carried out. This study provides a framework of the steps required for the commissioning of a HDR interstitial brachytherapy prostate treatment.

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Relative response of eye dosimeters to variations in scattered X-ray energy spectra encountered in interventional radiology

Maeve Masterson^a, Seán Cournane^b, Nina McWilliams^b, Dani Maguire^b, Jackie McCavana^b, Julie Lucey^b

^aSouthend University Hospital, Ireland

^bSt Vincent's University Hospital, Ireland

The most appropriate operational dose metric for monitoring radiation dose to the eye lens has been identified as the personal and directional dose equivalent at 3 mm depth, Hp(3). Other suggested methods include evaluating Hp(3) through Hp(10) or Hp(0.07), and using conversion factors. There are many uncertainties, however, associated with these dosimetry methods. In particular, the energy response for different dosimetry techniques may vary considerably depending on the incident x-ray energy spectrum. For Thermoluminescent Detectors (TLDs), Optical Stimulated Luminescence Detectors (OSLD) and Electronic Personal Dosimeters (EPD), the deviation of the energy response from unity is reported to vary by a factor of 0.9–2.8 across Hp(0.07) and Hp(10) measurements, with overestimations occurring in the 30–60kV range. This range coincides with scattered energy spectra encountered in both interventional radiology and cardiology. Establishing how dosimeter energy dependence affects dose measurement accuracy in the clini-