Real-time dosimetry for HDR brachytherapy

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Conclusion: Measured source position and dwell time accuracy comply with the vendor’s specifications. Small deviations were found for the dwell time accuracy at the most proximal source position. Similar tests should be performed regularly to warrant the mechanical accuracy of the afterloader and the quality of the applicators and transfer tubes.

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Real-time dosimetry in HDR-BT, e.g., prostate and breast.

Purpose or Objective: Dose verification and quality assurance in radiotherapy (RT) should be assessed in order to provide the best treatment possible and minimize risks for patient. In certain treatments there are no tools capable of performing real-time dose measurement. In addition, in-situ real-time dosimetry would enhance brachytherapy (BT) by providing technical conditions to perform treatment readjustment and real-time dose correction. Considering the current challenges, we developed a dosimeter intended for in-situ and real-time dosimetry in High Dose Rate brachytherapy (HDR-BT), e.g., prostate and breast.

Material and Methods: The dosimeter developed has a sensitive 3 m long optical fiber probe of 1mm or 0.5 mm diameter comprehending a 5 mm length scintillating optical fiber. To read the signal produced at the probe, 1x1 mm2 Silicon Photomultipliers (SiPM) from Hamamatsu were used. A custom made readout system with SiPM temperature compensation was used. The main concerns when performing dosimetry at high dose rates with high energy isotopes is the actual position of the dose are represented in Figure 1. The small difference from the reference IC is due to the different detector volumes of the fiber dosimeter and the ionization chamber. The dosimeter shows a linear response with dose rate being capable of detecting μGy dose variations.

Results: The studies carried out allowed assessing the amount of stem effect produced in the optical fiber cable. In the conditions described above, the stem effect contribution is lower than 1% for both 0.5 and 1 mm probes. The dosimeter was placed in a PMMA phantom and the reference ionization chamber (IC) read by an electrometer for stem effect quantification and second using an electrometer for stem effect quantification.

Figure 1: Fiber optic dosimeter stem-effect and response for 0.5 and 1 mm diameter versions compared to ionization chamber response.

Conclusion: The first round of in-vitro tests in clinical setting demonstrated that the fiber optical based dosimeters developed are suitable for dosimetry in regimes such as HDR prostate BT. The versatility of this kind of device and easiness of use allows application in other radiotherapy modalities. Besides fulfilling all the requirements for a dosimeter in HDR-BT, the high sensitivity of this device makes it a suitable candidate for application in LDR-BT.

Electronic Poster: Brachytherapy track: Prostate

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Comparison of intraoperatively linked and loose seed in prostate brachytherapy using sector analysis

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Purpose or Objective: An intraoperatively built custom-linked (IBCL) seeds system is a push-button seed delivery system that allows the user to create intraoperatively customized linked seeds, using a combination of seeds, connectors, and spacers. To date, only three studies have compared the implant quality of IBCL seeds to loose seeds for use in permanent prostate brachytherapy (PPB). However, they did not use sector analysis. Therefore, we compared the implant quality of IBCL seeds to loose seeds in PPB using sector analysis.

Material and Methods: Between June 2012 and January 2015, 64 consecutive prostate cancer patients underwent brachytherapy with IBCL seeds (n = 32) or loose seeds (n = 32). All the patients were treated with 144 Gy of brachytherapy alone. IBCL and loose seeds were alternately used basically. All patients were treated by the same radiation oncologist and urologist. We used the same dose-