



Contribution ID: 5

Type: Oral

A Comparison of Two Approaches for Checking the Source Positioning Accuracy in Brachytherapy

Thursday, 27 October 2022 10:15 (10 minutes)

Purpose:

In brachytherapy remote afterloaders are used to transfer a radioactive source via transfer tubes to applicators or interstitial needles with submillimetre accuracy. Predefined dwell positions and dwell times of the source define the dose distribution to aim for interior/superficial target volumes. A high dose is delivered over a small amount of fractions and a large offset of the source position can have an impact on dose delivery. It is recommended to verify the position of the source before treatment. The Varian BRAVOS afterloader has an automated position verification device called BRAVOS CamScale device (BCSD) available to verify the position of the source. Over one year conventional position verifications with a ruler have been performed in parallel to the BCSD approach and compared.

Methods:

The BCSD is used to position the tip of the source or dummy cable (DC) at one of three predefined positions (90.0cm/120.0cm/150.0cm). Three cameras in the device are detecting the end position of the tip on a calibrated ruler with 0.05cm accuracy. Conventional position verification devices for the BRAVOS are not available anymore. Nevertheless, on a transparent transfer tube, a landmark at 90.0cm was tagged and the predefined source position visually via CCTV cameras checked. Close to the landmark, a ruler with a 1mm scale was placed. If the tip of the source was within ≤ 1 mm the daily spot check passed.

Results:

The median offset determined by the BCSD of the source and DC was 0.1mm with a maximum standard deviation of 0.4mm/0.2mm for the source/DC. The BRAVOS corrects the source position based on the actual DC position before treatment. Two times the DC position exceeded our threshold of 0.8mm during the daily check followed by a calibration of the source position. Hence, a maximum deviation of the source position was determined to 0.6mm. The conventional approach passed the visual check always with an accuracy of ≤ 1 mm.

Conclusion:

The BCSD was compared to a conventional approach for one year with reliable results and even higher accuracy.

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Session Classification: Session I: QA, Dosimetry, Treatment Planning

Track Classification: Radiation Therapy