

SU-GG-T-34

Xoft Axxent Electronic Brachytherapy System: A Clinical Implementation Experience

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Purpose: To clinically implement Xoft's Axxent electronic brachytherapy (EBT) system for partial breast irradiation and develop quality assurance standards. **Method and Materials:** A Xoft Axxent controller unit was tested with a single EBT source tube. The source kVp was measured using diagnostic radiology equipment: *Rad Cal 90-10* kVp Meter and *Barracuda MPD*. The dose contribution from tube warm-up and the linearity of delivered dose were measured with Standard Imaging's *HDR 1000 Plus* well chamber and *MAX 4000* electrometer. The controller's timer reproducibility and accuracy were tested. An anthropomorphic breast phantom of in-house design simulated a clinical environment during radiation exposure surveys. Exposure measurements were collected using a *Rad Cal 90-10* pancake and *Victoreen 450 B* ionization chambers for various positions and shielding conditions. System interlocks and mechanical accuracy were also tested. **Results:** Our tests demonstrated a standard deviation of 1.32% in linearity and 1.59% in constancy of measured Air Kerma Strength. The average difference between measured and expected kVp was 2.18%. The average dose resulting from source warm-up was found to be equivalent to 2.65 seconds of treatment time. Exposure levels ranged from 23 R/h (at the unshielded phantom's surface) to less than 0.3 mR/h (at 1 meter from the source with 1.5 mm Pb shielding). The timer was found to be both accurate and reproducible. Additional testing of interlocks successfully reproduced results observed during acceptance testing. **Conclusion:** Our commissioning method accurately characterizes the typical performance of a Xoft Axxent EBT system. A policy of using mobile shielding equivalent to 1.5 mm Pb was established for our clinical procedures. While the radiation source is patient specific, the performance of the controller for a given source should be characterized as a necessary part of annual quality assurance.

SU-GG-T-35

Dosimetric Comparison of Permanent Prostate Brachytherapy Plans Utilizing Cs-131, I-125 and Pd-103 Seeds

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Purpose: To compare the dosimetric differences of permanent prostate brachytherapy utilizing Cs-131, I-125 and Pd-103 seeds. **Method and Materials:** We randomly selected twenty patients with organ confined prostate cancer previously treated in our institution, and re-planned with Cs-131 (1.8u), I-125 (0.5u) and Pd-103 (1.8u) seeds to prescribed doses of 115 Gy, 145 Gy and 125 Gy respectively using Prowess Brachytherapy 3.0 treatment planning system. The prostate, urethra and rectum were contoured on trans-rectal ultrasound images with no margin applied for PTV. For each case, three optimized plans were generated by automatic loading and minor adjusting, with the goals of V100 (the percentage volume of the prostate receiving 100% of the prescribed doses) ~95%, D90 (the percentage dose received by 90% of the prostate volume) $\geq 100\%$, and prostatic urethra UD10 $\leq 150\%$. For the plan comparison, we also computed V150, rectum RV100 (the volume of contoured rectum receiving 100% of the prescribed doses), and number of seeds and needles. **Results:** The median prostate volume was 26.0cc (range 13.0cc to 66.1cc). As compared to Pd-103 and I-125, Cs-131 improved the dose homogeneity and sparing of urethra and rectum. The average V150 decreased from 45.3% (Pd-103) and 39.6% (I-125) to 35.1% (Cs-131). The average UD10 decreased from 137.6% and 123.9% to 122.5%. The average rectum RV100 decreased from 0.56cc and 0.33cc to 0.27cc. In addition, the number of seeds decreased 12.5% and 3.8%, that of needles 7.6% and 2.1%, while maintaining an average D90 of 107%, and V100 of 95.0% or so for three isotopes. **Conclusion:** Permanent prostate brachytherapy utilizing Cs-131 seeds allows for better dose homogeneity and sparing of urethra and rectum while providing comparable prostate coverage compared to I-125 or Pd-103 seeds with comparable or less seeds and needles. Further biological and clinical studies associated with Cs-131 are warranted.

SU-GG-T-36

Film Based Treatment Plan Validation for a New Vaginal Applicator Using the Xoft Axxent™ 50 kVp Miniature X-Ray Source

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Purpose: Compare delivered to planned dose for the Xoft Axxent™ vaginal applicator and 50 kVp x-ray source using radiochromic film. **Method and Materials:** A 25mm diameter vaginal applicator (FDA clearance pending) was used to deliver a simulated treatment in a water phantom. The treatment was planned with Varian BrachyVision™, using the Xoft 50 kVp source TG-43 parameters. The prescription dose was 7 Gy at 5mm from the applicator surface. The applicator and a 5" square of GAFChromic EBT film were held in a Solid Water™ frame in a water phantom. The film plane was parallel to the long axis. The exposed film was scanned and processed to create a calibrated dose profile. The BrachyVision isodose-line plot was transformed into an image with identical size and pixel density to the film then combined with the film image to create a new image with dose exposure values only along the planned isodose contours. These contours were analyzed to determine the variation in actual delivered dose along them. **Results:** Visual comparison of isodose contours and film image showed qualitatively good agreement of the delivered treatment with the plan. Further image processing quantified the agreement. An ad hoc film calibration was employed to estimate dose values along planned isodose contours, with emphasis on the prescription dose of 7 Gy. Thus absolute dose values averaged along a given contour were only approximately correct but the more germane variation of dose along each contour was found to be less than 8% (2 sigma) for dose contours from 1.75 to 8.75 Gy. **Conclusion:** Dose measured by film exposure in a plane parallel to the applicator axis was found to be constant along plan isodose contours with SD less than 8% (2 sigma). **Conflict of Interest:** Research supported by Xoft, Inc.

SU-GG-T-37

Dosimetric Comparison of Cs-131 to I-125 for Treatment of Ocular Melanoma

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Purpose: To determine the conditions where it is advantageous to use ¹³¹Cs as an alternative to ¹²⁵I in the brachytherapy treatment of ocular melanoma. **Method and Materials:** The dosimetry of nine previously treated patient plans was evaluated comparing ¹²⁵I seeds and ¹³¹Cs seeds in identical configurations of standard eye plaques. Calculations were performed following the TG43 protocol in ADAC Pinnacle Treatment planning software. The resulting doses to prescription point and other structures were compared for the same plan using the two different isotopes. In addition, comparisons using ¹³¹Cs were performed so that a prescribed dose of 85Gy was achieved, first by adjusting the source strength and second by adjusting the treatment time. ¹³¹Cs plans were also created for a dose range of 60-95 Gy to determine optimal conditions where ¹³¹Cs may provide dosimetric advantage compared to ¹²⁵I. **Results:** 12% reduction in prescribed dose to the tumor is observed for the case where the ¹²⁵I seed is replaced by a ¹³¹Cs seed with identical air kerma strengths. Other points of interest show a reduction in dose from 6 to 13 %. An average increase of 14 % for the ¹³¹Cs source strength results in a dose increase up to 10 % for other points of interest. An average increase of 15 % in treatment time results in a dose increase up to 10 % for some points of interest. Equivalent doses were found for risk structures when 70-75 Gy for ¹³¹Cs was used. Doses below 75 Gy demonstrated reduced dose to critical structures. **Conclusion:** For a given prescription dose at the tumor apex, ¹³¹Cs delivers greater doses to critical structures. Use of ¹³¹Cs as a source for ocular melanomas may provide a dosimetric advantage for at risk structures if the biological equivalent dose is found to be 75 Gy or less.

SU-GG-T-38

Tracking of Brachytherapy Source Position Using Emission Imaging

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Purpose: To construct an imaging system that uses the exit radiation from a brachytherapy source during treatment. This system uses a single flat panel detector (FPD) and is capable of tracking the source position in 3D space, with no extra imaging radiation source or extra radiation dose to the patient. **Method and Materials:** It uses one a-Si FPD and BB tray. The BB plane is parallel to detector surface and has multiple BBs embedded with mechanical