

Effects of TRUS and Fluoroscopy Registration Error on Dosimetric Quality in Prostate Brachtherapy

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Background: It has been shown that intraoperative planning can enhance the quality of prostate brachytherapy procedures. Because seeds are visible in fluoroscopy while anatomy is visible in ultrasound, registration of transrectal ultrasound (TRUS) to fluoroscopy can provide the 3D seed localization needed in intraoperative planning. **Purpose:** It is expected that each degree of freedom (DOF) in registration will not have the same influence on final dose quality. Hence the objective of this work is to analyze the effects of each translational and rotational DOF in registration error on dose quality in the prostate, urethra, and rectum. **Method:** An ideal plan was created in MATLAB and all the seeds were perturbed to simulate misregistration. The perturbed plans were then analyzed for changes in dosimetric quality with respect to the ideal plan. In all simulations, a right-handed coordinate system was placed at the center of the prostate with the positive z axis parallel to the needle tracks and pointing towards the perineum. **Results:** Dose quality in all three organs was much more sensitive to translational than rotational error. Individually, the urethra displayed high sensitivity to translation and rotation in the x and y axes, the rectum showed high sensitivity to translation in the y axis, and finally the prostate showed uniform sensitivity in all three axes. **Conclusion:** The results confirm that registration error in the six DOFs has different effects on dose quality in all three organs of interest. The more sensitive parameters should be given further consideration in TRUS-fluoroscopy registration.