

Evaluation of the localization accuracy and precision of the RayPilot® system compared to Cone-Beam CT

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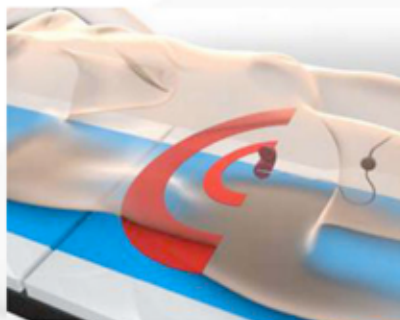
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Purpose

The Micropos Medical AB has developed the four-dimensional localization system RayPilot®. The system is designed to provide real-time prostate tumour localization before treatment and tracking during radiotherapy, without use of ionizing radiation. The aim of this investigation is to evaluate the localization accuracy of the Ray Pilot® system compared with Cone-Beam CT, Elekta's Synergy XVI.

Methods and materials

To investigate the accuracy of the RayPilot® and kV Cone-Beam CT a prostate phantom was made of tissue equivalent material with three gold markers placed similarly to the clinical practice. The RayPilot® transmitter was inserted between the gold markers. The phantom was mounted on a jig which could be moved in the x, y and z direction with the precision of 0,1 mm. This equipment was placed on the RayPilot® receiving sensor plate on the treatment table. Numerous controlled movements were executed on the phantom and the readout of the RayPilot® system and Cone Beam CT was detected simultaneously.



Results

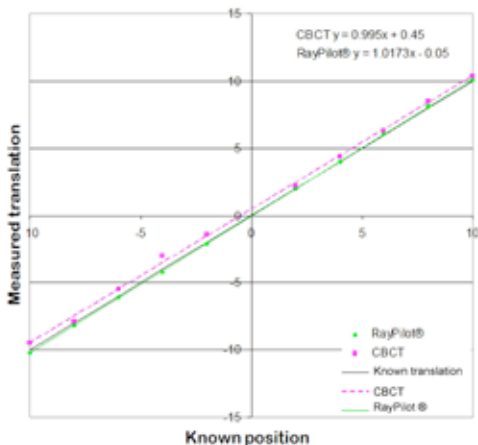
Both systems show sub millimetres accuracy but the Cone-Beam CT seems to overestimate the translation in the positive direction and underestimate it in the negative direction. The RayPilot® system had a higher precision than the Cone Beam CT with the lowest SD in all directions, 0.20 and 0.34 respectively.



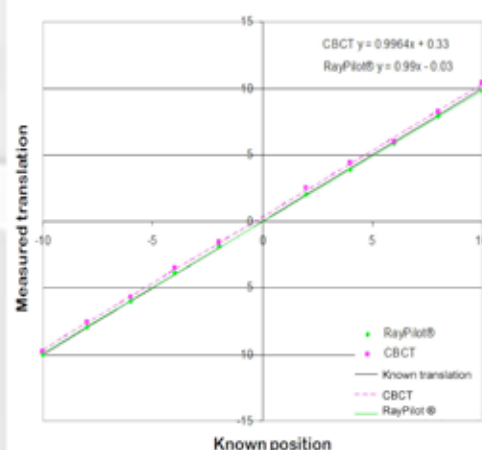
Extract from vertical translation: 10.0mm movement

Translation	Movement	CBCT	RayPilot®
Vertical	10.0mm	10.1mm	9.6mm
Vertical	10.0mm	9.8mm	10.0mm
Vertical	10.0mm	10.4mm	10.1mm
Vertical	10.0mm	10.6mm	9.8mm
Vertical	10.0mm	9.9mm	10.0mm
Mean		10.16mm	9.9mm
SD		0.34	0.2
Median		10.1mm	10.0mm

Longitudinal translation



Lateral translation



Conclusion

The results indicate that the RayPilot® system is an accurate and precise tool to detect the prostate position during the course of radiotherapy and can be a beneficial tool to detect the prostate position during external beam delivering in real time.