In-vitro evaluation of a non-invasive ultrasound prostate localization device.

The traditional solution of increasing prostate treatment volumes to account for localization and organ motion uncertainties gives the possibility of increasing normal tissue toxicity. A new ultrasound prostate localization device (BAT, NOMOS corp.) is available which may allow patient setup to be based directly on the prostate position at time of treatment.

A study is presented evaluating the localization precision and accuracy of the BAT using an ultrasound phantom with an embedded hypoechoic and radiopaque spherical target model. The phantom was purposefully misaligned by independently measured precise distances along the three principal axes. The BAT system was used to determine the couch motion required to return the target to its planning position. This was repeated over a series of days to measure reproducibility.

The mean error (accuracy) in locating the phantom varied as much as 3 mm from one session to another, with a single example of 1cm, due to relatively large systematic errors from the registration process. The optimal rigid body transformation was determined to correct for each session's systematic offset. Applying the transformation reduced the error (precision) to less than 0.5 mm in all directions.

The results indicate that the intrinsic precision of the BAT in controlled environments is sufficient to warrant further study in clinical settings, but that the BAT registration method needs to be improved.

This work supported in part by an industrial grant from NOMOS corp.