

**Purpose:** Image Guided Radiotherapy (IGRT) is a necessity for accurate radiotherapy. Ultrasound (US) imaging is a frequently used diagnostic technique for qualitative imaging of soft tissues. Recently, a quantitative 3D US system was introduced (Clarity system, Resonant Medical, Canada) which can assess the position of soft tissue in absolute space. Before introducing the device into daily practice, user variability, during both image acquisition and matching procedures must be determined. In this study we determined the inter- and intra-operator variability of 3D US matching in prostate cancer patients. Moreover, we studied the influence of the scan variability on patient setup corrections, and the influence of probe pressure on the prostate position while using a strict bladder filling protocol.

**Methods:** For 12 prostate patients multiple US scans are acquired by one or two operators during treatment. The repeated scans are matched to the reference US-scan by a single user (variability for scanning). The remaining scans are matched three times by different users, and for each patient one single scan is matched five times by the same user (variability for matching).

**Results:** In all three directions the mean intra-operator difference ranges from 1.5 to 2.4 mm, with a standard deviation of approximately 1.7 mm. The mean inter-operator difference is of the same order, 1.7 to  $2.3 \pm 1.8$  mm.

The prostate displacement due to the probe pressure varies from patient to patient and is not limited to one direction. Only the superior/inferior displacement seemed significant for high pressure, which was not needed to obtain good image quality with our bladder filling protocol. The total uncertainty is conservatively estimated to be 4 mm.

**Conclusions:** The uncertainty of the 3D US IGRT system is comparable to the uncertainty of the current standard IGRT for prostate: electronic portal imager in combination with fiducial markers.