Purpose: To quantify magnitude of the prostate rotation during daily treatment and evaluate strategies to effectively compensate the rotation if a six-degree table is not available.

Methods: Six patients, with forty-four kilo-voltage cone beam CT (KV-CBCT), were selected for this study. On these KV-CBCTs, the prostate was contoured by a physician. These patients had three transponders implanted for non-imaging daily prostate localization using the Calypso system. To determine the prostate movement, we registered each KV-CBCT with the planning CT in four different ways: (a) manually align to the bones with translation only (Bone_T); (b) automatically align to the markers with both translation and rotation (Marker_TR); (c) manually align to the markers with translation only (Marker_T); (d) manually align to the prostate contour with translation only (Contour_T). The prostate rotations from the second method were recorded. Using the contour registration as a benchmark, two center of mass distances (CMD) between the Contour_T and Marker_TR/Marker_T registrations were calculated. Only translations were used for the CMD calculation.

Results: Detected from the Marker_TR method, the mean and standard deviation of the prostate rotations about the transverse, anterior-posterior, and longitudinal axes were 3.21±6.26°, -1.39±2.91°, and -0.94±2.75°, respectively. The mean CMD between the Contour_T and the Marker_TR/Marker_T shifted prostate were 6.6 and 4.0 mm, respectively. When the rotation is greater than 10°, the differences in CMD were greater than 5 mm in 7 out of 8 (87.5%) of such fractions. When the rotation is greater than 6°, the differences were greater than 4 mm in 13 out of 19 (68.4%) cases.

Conclusions: Without a six-degree table, prostate rotations were often not corrected. Compensating for the rotations with translational shifts is effective, and superior to ignoring rotations. Simply ignoring large rotations may lead to increased planning margins or inaccurate prostate localization.