

**Purpose:** Surface matching provides quantitative shifts for patient positioning of superficial treatment sites such as breast. We investigated the reliability of 3D surface matching using AlignRT compared to positioning using skin marks followed by MV portal imaging for WBRT.

**Methods:** Five patients receiving two-field WBRT without respiratory gating were positioned daily on a breastboard (n=2) or custom alphacradle (n=3). For each treatment fraction guided by MV (n=23), the 3D surface captured using AlignRT (v4.5) was compared to the surface generated from CT simulation data. The AlignRT registration algorithm outputs 3D rotations plus translations to optimize matching between surfaces in user-defined ROIs. The correlation of AlignRT and MV shifts in 4 degree-of-freedom (3D translations and table rotation) was studied for two ROIs: the entire surface ('all') and the treated breast ('Breast'). Two surfaces were re-captured in the treatment position to compare residual registration errors. Parametric statistical tests were considered significant at  $p < 0.05$ .

**Results:** The 3D distance of the table shifts was  $3.8 \pm 5.1$  mm following MV imaging,  $5.9 \pm 4.1$  mm for 'all', and  $5.7 \pm 3.3$  mm for 'Breast' registration. While AlignRT distances were significantly different from MV, only 'all' registration correlated with MV shifts ( $r=0.76$ ). The 3D difference in initial and final positions correlated with table shifts for both ROIs ( $r > 0.9$ ) although residual 3D distances according to AlignRT remained high for 'all' ( $5.0 \pm 4.7$  mm) and 'Breast' ( $4.7 \pm 4.2$  mm). Furthermore, absolute table rotations calculated by AlignRT for consecutively acquired surfaces exhibited fluctuations that were significantly larger for registrations of 'Breast' ( $0.62 \pm 0.58$  degrees) than 'all' ( $0.27 \pm 0.18$  degrees).

**Conclusion:** Breast surface matching using AlignRT depends upon the registered ROI. A large ROI showed higher correlation with MV shifts and increased stability when calculating table rotations. Registrations exhibited a large baseline offset for all ROIs, indicating that quantitative table shifts from AlignRT overestimate those determined from MV imaging by expert physicians for WBRT.