AbstractID: 4935 Title: Uncertainties in target volume surrogates in image guided external beam partial breast irradiation

Purpose:
Two methods of image guidance for external beam partial breast irradiation (PBI) are under investigation: kilovoltage (kV) imaging and video-based three-dimensional (3D) surface imaging. Kilovoltage imaging utilizes implanted clips as surrogates for the target volume (seroma). Surface imaging uses the breast surface as a surrogate for the target volume. This study investigates the uncertainties present when utilizing such surrogates in image-guided external beam PBI.

Method and Materials:
Patients were treated on a linear accelerator with dual gantry-mounted kV imagers. Patients were initially aligned using lasers, and simultaneous orthogonal kV images were taken prior to each fraction to correct the setup. Setup corrections were calculated using software that registered the clips in the daily images with their corresponding positions in digitally reconstructed radiographs. Clip migration was examined by quantifying variations in the position of individual clips relative to the center of mass of all clips. Surface video images were also taken for each treatment. The breast surface from each treatment position was registered to the reference surface. Surface deformations were quantified by calculating the distribution of position differences for each vertex on the 3D surface.

Results:
The standard deviation in individual clip positions ranged from less than 1 mm to as much as 2 mm. For the surface deformation, the mean difference between surface vertices was 0.6 mm (range 0.4 to 1.0 mm). The standard deviation of the distribution of surface differences, used as a measure of the distribution width, ranged from 0.5 mm to 1.2 mm. The amount of deformation of the breast did correlate with breast size.

Conclusion:
The uncertainties in target volume surrogates for both clip-based kV imaging and video-based surface matching are small, typically on the order of a few mm. The precision of these surrogates indicates that they can reliably be used for image-guided treatment.