

AbstractID: 11145 Title:

Comparison of prostate rotation and Calypso Beam rotation for prostate margin evaluation

Purpose:

The Beacon rotation angles reported by the Calypso system have not been utilized clinically due to the difficulties in rotating the patient. The actual prostate rotation angle is affected by Beacons' migration, prostate's shrinkage and deformation due to rectal/bladder filling. This work investigates the actual prostate rotation angles between the planning CT and the treatment CBCT and to compare those reported by the Calypso system.

Method and Materials:

The Calypso system reports centroid shifts and rotation angles of the 3 implanted Beacons, relative to their locations on the planning CT. CBCT scans were obtained for 9 treatment fractions of 5 patients. The same sets of the Beacons in the planning CT and post-treatment CBCT were segmented according to their high intensities and aligned according to their centroid positions. An iterative closest point (ICP) method was developed to find the best matching iteratively between two sets of Beacons after rotation and translation.

Results:

The maximum inter-Beacon distance varied from 1.1 to 4.7 mm with inter-Beacon distances from 14.4 to 40.4 mm. The mean Beacon rotation angle reported by the Calypso system in each plane was $4.7 \pm 3.8^\circ$, which were likely caused by the inter-Beacon distance change. After the best 3D matching of the Beacons, our method reported a mean rotation angle of $1.5 \pm 1.7^\circ$ for all the fractions. If the projected inter-Beacon distance was $>9\text{mm}$ there was good agreement between our method and the Calypso system. As the inter-Beacon distance decreased, the uncertainty in the reported rotation angle increased.

Conclusion:

The actual rotation angles for the prostate were smaller than those for the Beacons reported by the Calypso system. It is recommend to avoid small ($<9\text{mm}$) projected inter-Beacon distances to reduce the uncertainty in the reported rotation angle.