

AbstractID: 1833 Title: Extra-Cranial Stereotactic IMRT For Deformable Targets Using a Piecewise Image Fusion Technique

Extra-cranial stereotactic intensity-modulation radiotherapy (ESIMRT) demands high precision and accuracy (2-mm) in target refixation during the course of treatment. However, it is extremely difficult to deal with tumor volume changes, tissue inflammation, head-arm-shoulder displacements, and patient-organ motion during the course of treatment. Recently, we have introduced an image-guided ESIMRT for Head & Neck, spine, breast, chest wall, and other superficial tumors. By using a 3D camera mounted on the ceiling of the treatment vault, we can quickly capture the 3D surface of interest following patient setup for daily treatment. The real-time surface image of the patient can be automatically transformed to the machine coordinate system and then overlapped onto the surface image at the desired treatment position. By giving different colors (or gray levels) to individual surface images, we can visualize any systematic difference caused by the target displacement or deformation. For a large extra-cranial target, a piecewise image fusion approach is required to quantify the position changes. These changes include the local shifts and rotations as well as piecewise deformation (parameterized by the root-mean-square of the piecewise alignment). Phantom experiments demonstrated that the proposed approach could determine sub-millimeter position changes. Results from our clinical trial done in patients with brain and head and neck cancers have shown that any large shape and position change could be corrected. A small patient shift (1-mm) caused by a table rotation or patient moment could be unfolded. Such accuracy, precision, and ease of use are superior to currently available treatment systems.

