AbstractID: 3015 Title: An Anthropomorphic Phantom for Respiratory Motion Research in Dynamic SRS

Purpose:
The purpose of our experiment is to study the use of a respiratory anthropomorphic phantom evaluating the respiratory motion tracking capabilities in dynamic stereotactic radiosurgery (SRS).

Method and Materials:
An anthropomorphic phantom was scanned with 1.25 mm slice spacing on a 4-slice GE Lightspeed CT. A Harvard lung pump was attached to the lung bellows of the phantom and set to 15 breath/min, 40% expiration. The abdominal cavity was filled with humid sponges to resemble lung tissue density. A mini-ballcube containing a pair of orthogonal GaF-chromic films was attached to the diaphragm. The spherical target was treated to 3000cGy at 100% isodose line using both a static SRS and dynamic SRS (Synchrony) treatment. The films were analyzed using a Vidar VXR-16 scanner and the Accuray film analysis tool.

Results:
CT numbers measured in the phantom range from 42-162 for the sponges, 1111-1193 for the silicone tissue, and 1412 – 1512 for the embedded plastic skeleton. The total targeting error for the diaphragm treatment was 0.77 mm in the static and 0.91 in the dynamic case. The eccentricity for the spherical target was 1.27 mm in the axial plane for both treatments, and 1.34 mm for the static and 1.41 mm for the dynamic treatment in the coronal plane. The respiratory pattern was very similar to patterns observed in Synchrony patients. The extent of diaphragmatic motion was 8-10 mm in the superior/inferior direction.

Conclusion:
The respiratory anthropomorphic phantom is a promising tool for evaluating the respiratory motion tracking capabilities of dynamic SRS in a patient-like environment. The accessible abdominal cavity allows for different target positions. It can easily be filled with different materials (sponges, saline solution, organic material, gels) to simulate different environments in the body. The electron densities (CT numbers) of the phantom material are very close to human tissue.