Purpose: Dynamic beam tracking has been proposed for moving targets. Since planning systems consider all structures stationary, the tracking delivery is purposely different from the plan. This study evaluated the dosimetric differences in normal tissue between the stationary beam plan and the dynamic beam delivery.

Method and Materials: IMRT plans for abdominal cancers were generated without considering organ motion. A margin of 1 cm, rather than the conventional 1.5 to 2cm, was used. The resulting MLC sequences were converted to dynamic sequences to track a hypothetical sinusoidal target motion of ±2cm in superior/inferior direction and ±1.5 cm in anterior/posterior direction. A 4-second respiration cycle and 400 MU/minute dose rate were also assumed. To assess the worst-case scenario of normal tissue dose difference, all normal structures including liver, kidneys, small bowel and spinal cord were assumed stationary. Doses recalculated using the dynamic sequences were compared with that of the original IMRT plan.

Results: As expected, dynamic beam tracking maintained target dose coverage while substantially reduced doses to surrounding normal structures. The differences in normal tissue dose between the stationary beam plan and the moving beam plan were small. The low-dose volume was increased while the high-dose volume was decreased slightly in normal tissue with dynamic beam tracking. No degradation of normal structure sparing was observed although the structures were not moving with the target.

Conclusion: Contrary to our intuitions, dynamic beam tracking does not significantly alter the normal tissue dose in the abdomen as compared with optimized plans using stationary beams. Unsynchronized motion between the target and normal structures did not cause higher doses to the normal structures when tracking is focused on the target. MLC sequences of the optimized stationary plans can be used for dynamic beam tracking using a simple conversion into dynamic sequences that follows tumor motion.