

The development of new technologies has led to a trend of tighter target margins and longer treatment procedures in the new era of image-guided radiotherapy. This prompts a concern of potential body motion of a patient during the treatment, especially for stereotactic body radiosurgery. The purpose of this study is to develop a technique to monitor the non-respiratory motion of a patient, separated from the relatively large respiratory motion.

The BrainLab ExacTrac system is used as the platform for the study. Multiple infrared external markers are placed on a patient's chest and abdominal surfaces. The position of each marker is monitored with two infrared cameras. The motion signal of each marker, which is the mixture of respiratory and non-respiratory motions, is recorded. The markers on the chest surface show much smaller, but correlated respiratory signals than those on the abdominal surface. The non-respiratory component can be derived from the motion signal at the chest surface subtracting the respiratory component represented by the motion signal at the abdominal surface. A computer program has been written to calculate the two motion components in real-time and was retrospectively tested in patients enrolled in a 4D-gated-CT protocol.

Total of 24 patients were tested. The duration of recorded motion signals ranged from 10 to 25 minutes for different patients. The extracted non-respiratory motion signal showed reduced respiratory ripples of less than 0.5 mm for most of the patients, with the maximal ripple of about 1.2 mm. It also showed slow-drifts as well as some sharp spikes or irregular fluctuations. The slow-drifts were <1.5mm for 8 patients, >1.5mm and <2.5mm for 6 patients, >2.5mm and <3.5mm for 5 patients, and >3.5mm for 3 patients with maximal drift of 6.5mm.

This result suggests that monitoring non-respiratory motion during treatment might be necessary.