Purpose: To evaluate the patient positioning accuracy and reproducibility of two commercially available immobilization systems for Stereotactic Body Radiotherapy (SBRT) treatment.

Methods: Forty one patients with lung (n=21) or liver (n=20) malignancies were assigned to one of the two immobilization devices: Elekta stereotactic body frame (SBF) with built-in stereotactic coordinate system and Civco modular indexing based frame (MIF) without stereotactic reference. All patients underwent the same simulation and planning procedure followed by cone beam CT (CBCT) guided treatment setup. A total of 151 CBCT images were analyzed. The systematic and random isocenter setup errors of the two systems were calculated and compared based on the daily setup corrections under CBCT guidance.

Results: There was not statistically significant difference between the two systems in terms of systematic setup errors in all three translational directions, for both lung and liver patients. The random errors for the lung patients under SBF setup were 1.8mm, 2.0mm and 2.9mm for the vertical, longitudinal and lateral directions, respectively compared to 3.6mm, 4.1mm, and 4.2mm for MIF. A similar trend was also observed for liver patients. The random errors of liver MIF setup reached 3.5mm, 6.1mm and 5.7mm for the vertical, longitudinal and lateral directions, respectively, with relatively smaller errors 1.7mm, 3.4mm and 2.6mm with SBF setup. Repeated CBCTs occurred for MIF system in 42.4% and 40.7% of the lung and liver treatment to verify couch corrections based on the institutional tolerance, resulting in prolonged setup time. Only 25% and 13.6% of the lung and liver treatment with SBF required with repeated CBCT.

Conclusions: Without stereotactic coordinate reference, the body frame system tended to have larger random setup errors and patient positioning accuracy inevitably relies on the volumetric imaging guidance. Patient comfort and reproducibility should be clearly considered for selecting a system.