

Purpose: Current commercially available moving phantoms are limited in their motions and accuracy of positions. The purpose of this study is to develop a moving phantom with highly accurate position control (error less than 0.2 mm) in 3 directions so that it can reproduce most of patients' tumor motions obtained by 4D-CT. **Method and Materials:** The moving phantom consisted of two parts: thorax phantom and 3D-axial control unit. The thorax phantom was made of transparent resin, which has an electron density of 1.04. The plaster bones were structured by ink-jet printing method, and were embedded in the resin. The 3D-axial control unit was designed to achieve any motion less than 10 cm/sec in x, y and z directions in the region of 150x350x250 mm which was a cavity in the thorax phantom. Two acrylic hemispheres with a radius of 1 cm were set on the top of the 3D-axial control unit. The motion imitating respiratory tumor motion or sine curve was input, and the motion of the target was measured by a laser displacement gauge to evaluate the accuracy. The target motion was also captured by conventional CT and CBCT to evaluate the performance. **Results:** The target motion was as accurate as less than 0.1mm in the case of sine waves (1 cm, 12 bpm). In the case of patient's tumor motion (up to 7 mm, 7.5 bpm), although the motion was not modified with smoothing, the error was less than 0.2 mm. The conventional CT and CBCT images reflected the motion of the target. **Conclusions:** We developed a novel moving phantom with a high accuracy in position control. This moving phantom could be used for evaluation of 4DRT techniques.