The purpose of this work was to develop and use a variable speed couch technique to deliver a uniform dose distribution in patients treated with Total Body Irradiation (TBI).

A translational bed under a 6 MV photon treatment beam is moved at variable speed with a stepping motor driven by computer. A graphical user interface uses the velocity distribution to control the delivery of the treatment. To perform the planning dosimetry, a large number of beams shifted from each other (up to 72) are generated to cover the entire body. A program was written to interact with the treatment planning (Theraplan Plus from Theratronics) to automatically generate the beams and extract their individual contribution on each CT slice. Then the program optimizes the beam weights according to a required dose distribution. The treatment planning performed the final dose calculation with the proper beam weights. The beam weights are then converted in velocity distribution.

The remote-controlled translation system can drive the couch at any velocity within the useful clinical range (0.5 to 20 cm/min) with an accuracy better than 0.5%. For a whole body Rando-like phantom, dose variation at mid-plane relative to the prescription point (navel) can be as high as 15 % (neck or legs) when calculated at constant velocity. This value is reduced to less than 2 % with variable velocity based on optimized beam weights.

Very good uniform dose distribution can be delivered for TBI treatment with a variable translational velocity couch technique.