

## **ABSTRACT**

The discrepancy in needle visualization during spinal puncture requires a high level of accuracy in needle positioning based on angle and depth. To address this, a device has been developed to replicate needle insertion into the spinal column while controlling the angle and depth.

This device operates in 3-DOF (Degrees of Freedom), encompassing axial, lateral, and elevational movements, as well as angular movements relative to the axial and lateral directions, known as linear movements. Moreover, the device is capable of motion based on specific angles, referred to as angular movements.

The motion system of this device is controlled using stepper motors, servo motors, leadscrews, and nuts. Comparative tests were conducted by measuring the input program's distance against the actual distance using a ruler, resulting in an error range of 0-5 mm, indicating highly accurate performance. Similarly, a comparison between the programmed and actual angles showed an error range of 0-5 mm, reflecting a high level of precision.

**Keywords:** Spinal needle, linear movement, angle movement, 3-DOF, needle positioning.