

Publication

Inertial measurement unit-assisted implantation of thoracic, lumbar, and sacral pedicle screws improves precision of a freehand technique

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OBJECTIVE:A method applying inertial measurement units (IMUs) was developed to implant pedicle screws in the thoracic and lumbosacral spine. This was compared with a freehand technique. **METHODS:**The study was done on 9 human cadavers. For each cadaver, a preoperative computed tomography (CT) scan was performed to measure the axial and sagittal tilt angles of the screw trajectories from T1 to S1. After the entry points were defined on the exposed spine, the IMU-equipped pedicle finder and screwdriver were used to reproduce these tilt angles and implant half of the screws. The other half was implanted with a freehand technique. Fluoroscopy was not used. The screw trajectories were analyzed on postoperative CTs. **RESULTS:**A hundred and sixty-two screws were placed with use of the IMUs and 162 screws were implanted by freehand. The IMU-guided technique matched the planned trajectories significantly better than the freehand technique (axial tilt $P < 0.001$, sagittal tilt $P < 0.001$). With IMU assistance, the mean offsets between the planned and postoperatively measured tilt angles of the screws were 3.3 degrees \pm 3.5 degrees for the axial plane (median 2 degrees, range 0-23 degrees) and 3.4 degrees \pm 3 degrees for the sagittal plane (median 3 degrees, range 0-13 degrees). For the freehand technique, the mean offsets between the planned and postoperatively measured tilt angles of the screws were 5.6 degrees \pm 4.5 degrees for the axial plane (median 5 degrees, range 0-31 degrees) and 6.7 degrees \pm 5.4 degrees for the sagittal plane (median 6 degrees, range 0-33 degrees). **CONCLUSIONS:**IMU-assisted implantation of pedicle screws may enhance the performance of a freehand technique in the thoracic and lumbosacral spine

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