PRecision Exospinal Constructive Innovative Stereotactic Evolution (PRECISE)

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Spinal treatment modalities such as spinal fusion and trauma surgery, radiofrequency ablation, and cancer biopsies require the utmost precision to avoid damaging critical structures such as the spinal cord. Current methods used for spine surgery require substantial amounts of equipment, several technicians, and are cost prohibitive at most hospitals ($900,000 CAD). The purpose of this project was to develop a simple, accurate, and low-cost stereotactic device for spinal treatment modalities. The pedicle entry points and facet joints are commonly targeted during spine surgery. The interpedicular distance (IPD), interfacet distance (IFD), and vertebral body width (VBW) were digitally measured from every lower thoracic and lumbar spine level on Computed Tomographic (CT) imaging, totalling 990 measurements. Coefficient of variation, Pearson's Correlation, and Spearman Rho's statistics all showed a significant correlation amongst these measurements. Importantly, this relationship provided the ability to accurately predict the IPD and IFD from the VBW alone. A prototype was developed and tested by guiding a needle in a three-dimensional axis to target the pedicle entry points and facet joints in an anatomically correct spine model and deer spine sample using the calculated IPD and IFD. All 180 trials were successful in targeting anatomic structures, regardless of age, sex, or vertebral level. The simple and low-cost stereotactic device developed in this study, estimated at $500 CAD, demonstrated a high level of accuracy targeting structures used commonly in spine surgery. PRECISE has the potential to improve surgical safety, minimize invasive surgery, further operating room efficiency, and simplify surgical procedures.

Awards Won:

Third Award of $1,000