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Background

Invasive spinal treatment modalities are technically demanding. Spinal fusion surgery, spinal trauma fixation, radiofrequency ablation, radiosurgery, cancer biopsies, and spinal injections all require precise and accurate access to the spinal column in order to target pathology while avoiding critical anatomic structures.

Purpose

PRECISE Exospinal Constructive Innovative Stereotactic Evolution (PRECISE) was developed as a simple, low-cost, mobile stereotactic device.

Procedure

Computed Tomographic (CT) Images of the thoracic and lumbar spine were examined using Change Healthcare Radiology Solutions¹. The interpedicular distance (IPD), interfacet distance (IFD) and vertebral body width (VBW) were measured from the CT images of sequential scans performed at the Interior Health Authority in British Columbia from the period between December 1st, 2022 and February 1st, 2023.

PRECISE was constructed using biomedical grade, radiolucent components. PRECISE is secured onto the spinous processes of the spine positioning it in the sagittal midline of the spine. PRECISE is then referenced off the axial plane using an external wire arm. A high precision XY positioner allows a guide wire to travel in millimeter increments in an orthogonal plane. Specifically, this translates to movement in the sagittal and axial plane of the spine.

Results/Observations

Pearson's correlation, Spearman's Rho correlation and Coefficient of Variation statistics identified a strong correlation between vertebral body width and the interpedicular distance and a strong correlation between vertebral body width and interfacet distance.

The discovery of this strong correlation allowed the development of PRECISE to provide the exact location of the pedicle and facet joints in the spine solely based on the VBW. VBW is an easy and readily available measurement that can be determined on plain radiographs.

A trained spinal surgeon, an untrained volunteer and I each performed 10 localizations in a blinded fashion of the pedicle entry point and facet joint. Using PRECISE, the exact localization of the pedicle entry point and facet joint was achieved every time.

Conclusions

The ease of implementing PRECISE and its low cost will allow any surgical and medical centre to obtain this innovative technology. This will improve surgical safety, further operating room efficiency, minimize invasive surgery and simplify spinal surgical procedures.

Acknowledgements

Sean Whalen, Science Teacher, Mount Baker Secondary School, BC
Thank you for your guidance and ideas.

Andrea Hyde, B.Sc. M.Sc., Mathematics and Statistics, College of the Rockies,
Cranbrook, BC
Thank you for helping me to decide the most appropriate statistical tests.

Paul Duczek, metal and wood work Shop Teacher, Mount Baker Secondary School,
Cranbrook, BC
Thank you for machining the metal parts used in my innovation.

Mike Kostynuk, Hunter
Thank you for providing the deer spine.

Stryker Canada
Thank you for providing some of the parts used in my innovation.

Moses Bowden
Thank you for your help in designing the logo.

Discovery Foundation STEM Project Grant

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