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The Peak to Peak Method: A Novel Technique of Acquiring Humeral Alignment During Intramedullary Nailing

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Purpose: Rotational malalignment during intramedullary nail insertion for humeral shaft fractures is a serious concern. To date, there is no consensus on accurate anatomic landmarks to guide surgeons during implant placement to correct for rotational deformity. We describe a new method that may be used as a supplement to evaluate humeral alignment during intramedullary nail insertion using the profile of the greater tuberosity and its relation to the transepicondylar axis called the greater tuberosity version angle (GTVA).

Methods: This study analyzed 506 cadaveric humeri of adult patients. All humeri were CT scanned using $0.625 \times 0.625 \times 0.625$ -mm cubic voxels. The images acquired were used to generate 3D surface models of the humerus. Next, 3D landmarks were automatically calculated on each 3D bone using custom-written software (C++). The anatomical landmarks analyzed were the transepicondylar axis, the humerus anatomical axis, and the perpendicular axis of the greater tuberosity. Lastly, the angle between the transepicondylar axis and the greater tuberosity axis was calculated and defined as the greater tuberosity version angle.

Results: The value of GTVA was $20.9^\circ \pm 4.7^\circ$ with a 95% confidence interval between (21.3° and 20.5°). Results of analysis of variance revealed that females had a statistically significant larger angle of $21.95^\circ \pm 4.49^\circ$ compared to males, which were found to be $20.49^\circ \pm 4.8^\circ$ ($P = 0.001$).

Conclusion: The GTVA is a simple and reliable method for recreating the anatomic alignment of the humerus. It may be used as a secondary intraoperative reference to help mitigate the complications associated with malrotation of the humerus following intramedullary nailing.

