Department of Surgery, Queen's University
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Title: The Comparison of Triceps Insertion Violation During Olecranon Plate Osteosynthesis with Different Olecranon Plating Systems

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Background: The triceps brachii muscle is the primary elbow extensor muscle. During fracture fixation, surgeons generally avoid injuring and compromising tendon insertions, however, it is common practice to violate the triceps tendon insertion during olecranon fracture fixation. The degree of triceps tendon insertion compromise has not been studied. The triceps insertion violation varies based on the plate design and method of application. This violation might have a clinical negative impact on the triceps function. By gaining knowledge about the triceps insertion footprint and quantifying the amount of triceps insertion violation by some of the commonly used olecranon plates, surgeons can be more aware of this violation and choose fixation methods which will have less impact on triceps insertion. This can lead to better plate designs to avoid injuring the triceps insertion while maintaining secure fixation.

Objective: The purpose of this study was to quantify the degree of triceps footprint violation by comparing the surface areas of the section of the olecranon plates which would disrupt the triceps insertion footprint to the total triceps footprint. This study also validates the triceps insertion surface area and measurements in relation to the olecranon surface area.

Methods: A total of seven types of olecranon plates and six cadaveric upper extremity specimens were used in the study. The elbow plates were laser scanned using the SG100 ShapeGrabber to obtain their digitized 3D model. With a 3D modelling software, MeshLab, their respective surface areas on the olecranon were calculated. For the anatomical dissection, the deep (muscular) and the superficial (tendinous) insertions of the triceps were marked on the specimens. A digital caliper was also used to make the triceps insertion and olecranon surface area measurements. The surface area of the triceps violated for each olecranon plate construct was calculated and compared to two studies in the literature.

Results: In our study, the largest olecranon plate surface area was reported in Smith-Nephew Peri-LOC plate followed by Synthes – wide Variable Angle (VA) plate whereas the smallest was shown in Acumed – short plate if applied under the triceps. Synthes – wide VA and Smith-Nephew Peri-LOC plate demonstrated the largest amount of triceps violation (100% of the insertion) while Acumed – short plate had the least violation if applied under the triceps (57.4% of the insertion). The plate violation in our study was compared to the triceps footprint measurements in Keener et. al and Barco et. al studies.

Conclusions: Olecranon plating systems violate the triceps footprint. This study demonstrates the amount of triceps footprint violated by common plate designs. Future studies should assess the clinical implications of triceps footprint disruption. Better understanding of the triceps footprint and olecranon anatomy may lead to improvement in plate design.

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