

Impact of Olecranon Fracture Malunion: Study on the Importance of PUDA (Proximal Ulna Dorsal Angulation)

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Background/Purpose: Olecranon fractures are associated with permanent and significant decrease of range of motion (ROM) in 30% of the patients. The PUDA is the physiologic dorsal bow of the proximal ulna (mean 6°, range 0-140) that is symmetrical from the right and left elbow. A previous biomechanical study showed impaired elbow alignment with a PUDA malunion of 5° or more. The goal of this study is to evaluate the impact of a PUDA malunion on elbow ROM and function 1 year or more after olecranon open reduction and internal fixation (ORIF).

Methods: The radiological and surgical database of three trauma centers were reviewed and all adults who underwent ORIF for olecranon fracture were invited to join the study. Bilateral elbow radiographs, radiographic ROM measurement, PUDA malunion, demographic data, and quality of life questionnaires were recorded (PREE [Patient-Rated Elbow Evaluation, Q-DASH [an abbreviated version of the Disabilities of the Arm, Shoulder and Hand], SF [Short Form]-12, VAS [visual analog scale]). ROM and PUDA were measured using Slice-o-Matic software and following a validated method. In this case control study, patients were classified according to the difference of the PUDA between the fracture side and the normal side. Patients were categorized as "PUDA malunion" when the PUDA difference was 5° or more. Our hypothesis was that 50% of patients would present a PUDA malunion and subsequently affect their ROM and function.

Results: 49 patients entered the study; 28 of them were females. Mean age was 54 years (range, 21-76). The mean follow-up was 3 years and 9 months (range, 1-7 years). ORIF method was tension band in 23 cases and plate-screws in 26. There was no difference in terms of outcome, quality of reduction, or ROM between those two methods. The mean ROM on the fracture side was 122° compared to 135° on normal side ($P < 0.001$). The mean PUDA on the fracture side was different from the normal side (3.0 vs 4.20, $P = 0.013$). Twelve patients (25%) presented PUDA malunion. Those patients had decreased elbow flexion of 8° ($P = 0.05$) as opposed to the control group. Decrease elbow flexion was the strongest predictor of functional outcome and showed moderate correlation with Q-DASH ($r = -0.3$, $P = 0.025$), MEPS (Mayo Elbow Performance Score ($r = 0.4$, $p = 0.007$)) and PREE ($r = -0.3$, $P = 0.019$).

Conclusion: PUDA malunion was present in 25% of patients and was associated with decreased elbow flexion. Flexion loss has a greater impact than extension on functional outcome. Tension band and plate fixation can maintain good reduction in terms of PUDA and are not influencing outcome.