Conclusions: This is the first study to report on the biomechanical properties of the mini-plate for coracoid fixation in the Latarjet procedure. The results indicate significantly superior failure loads with the mini-plate compared to all other constructs, which may have clinical implications, particularly in the high-demand contact athlete. Across all fixation techniques and screw sizes, constructs with screws inserted at 0° performed better than constructs inserted at 15°. Overall, for graft fixation during the Latarjet procedure, this data suggests superior biomechanical properties with mini-plate versus conventional screw fixation. Clinical studies with analysing patient outcomes and failure rates are necessary to determine the clinical implications of these biomechanical findings.

Paper #6 SMART PHONE "SELFIES"âA RELIABLE AND ACCURATE TOOL FOR MEASURING ELBOW RANGE OF MOTION

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Introduction: It has been previously demonstrated that digital photography is an accurate and reliable tool for capturing elbow range of motion when patients are carefully positioned by orthopaedic surgeons. Our hypothesis was that self-taken photographs ("selfies"), performed independently after instruction by video or illustrated handout, would be an accurate and reliable tool for capturing elbow range of motion in patients with elbow contractures.

Methods: 50 patients presenting with elbow contractures participated in the study. After completion of the selfie (Fig. 1), the senior author clinically measured flexion and extension with a goniometer. The angles from the photographs were measured and analyzed.

Results: The agreement between measurements obtained by goniometer and from the "selfies" correlated closely (R^2 = 0.98, Fig. 2). Agreement was excellent in both extension and in flexion with interclass correlation coefficients (ICC) of ≥0.93. Systematic errors were also low (Fig. 3). Systemic error was 0° (95% C.I., ±11°) in extension. Systemic error in flexion was –3° (95% C.I., ±10°). Six patients demonstrated ≥10° difference between clinical and selfie measurements. Four of those six patients did not flex or extend to their limit of motion, but did so after personal instruction. Ability take a usable selfie, was inversely correlated with age (R^2=0.97).

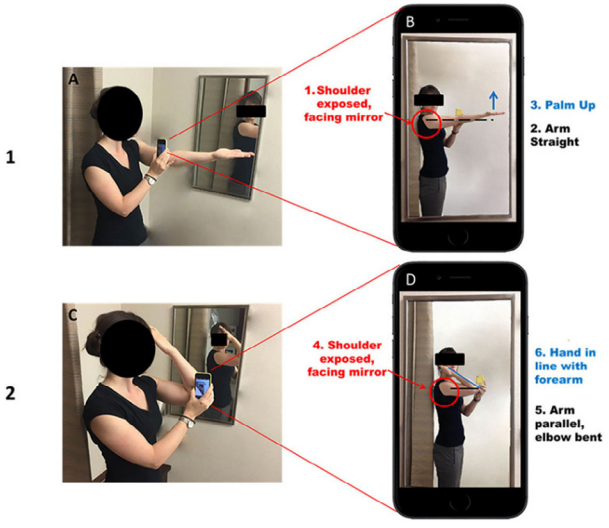

Figure 1 (A) 1.Shoulder exposed, facing mirror. (B) 2. Arm straight. 3. Palm up. (C) 4. Shoulder exposed, facing mirror. (D) 5. Arm parallel, elbow bent. 6. Hand in line with forearm.

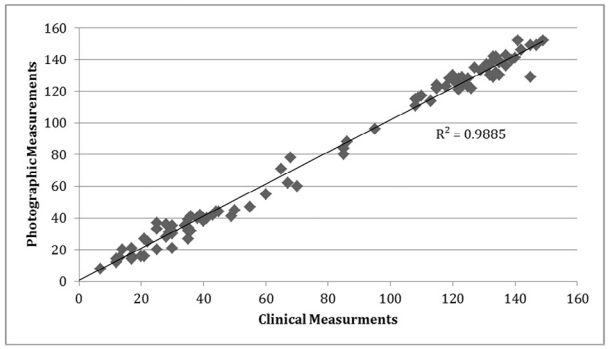

Figure 2 Correlation between clinical and photographic measurements.

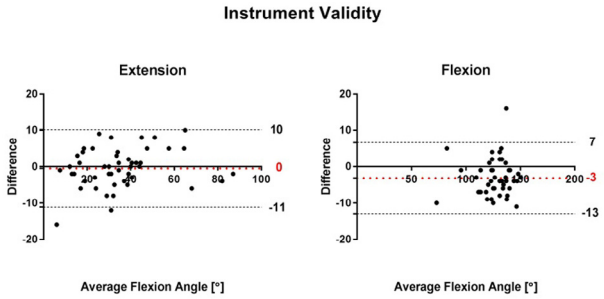

Figure 3 Instrument validity.

Conclusion: Self-taken flexion-extension photographs are a reliable and accurate tool for measuring elbow range of motion. This important parameter of elbow function can therefore be obtained outside a normal clinic visit, thereby improving frequency of follow up assessments (and minimizing loss to follow up) necessary for quality control and research.

Paper # 7 SAFETY OF POSTERIOR ENDOSCOPIC DISTAL BICEPS REPAIRS

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Background: A prerequisite to restoring preinjury supination strength following a distal biceps rupture is tendon re-attachment to its footprint.[1] An ECU / supinator muscle splitting approach reliability exposes the footprint, but iatrogenic injury to the supinator has been associated with decreased strength.[1] Repairing the distal biceps tendon using endoscopy is a unique technique that minimizes supinator injury while providing the visualization required for an anatomic repair (Fig. 1).[2] The goal of this study is to determine safe posterior endoscopy portals for distal biceps repair.

Methods: In 11 adult cadaveric specimens, the distal biceps tendons were re-attached to their footprints using endoscopy through two posterior cannulas positioned within the ECU. After repair, a flexible dilator was placed along the bicipital tunnel and through the distal cannula (Fig. 2). The dilator marked the distal extent of the endoscopic dissection.

The specimens were then dissected under loupe magnification. The PIN location was measured (LS Starrett caliper, accuracy 0.01 mm) from its dorsal location to the dilator and the olecranon—radial styloid (ORS) reference line (Fig. 3). The anatomic findings were used to

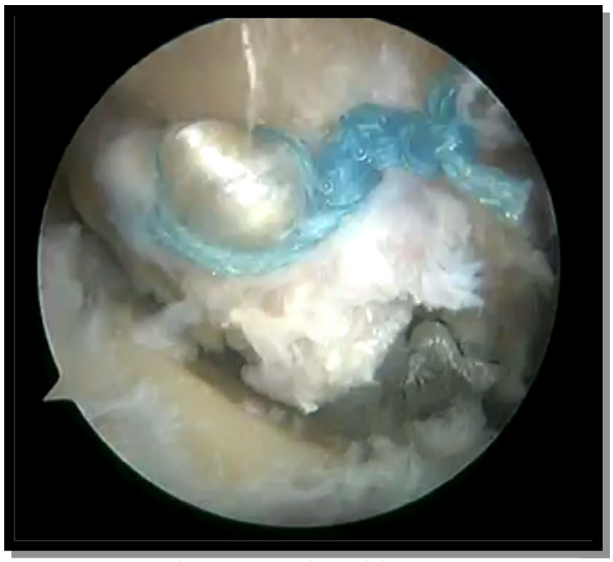

Figure 1 Endoscopic distal biceps repair.

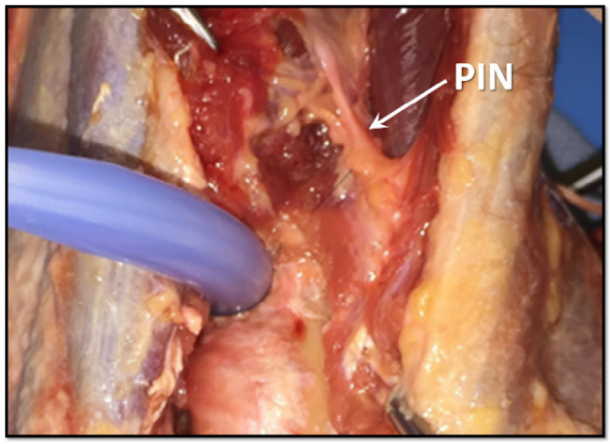

Figure 2 Dilator marking distal part of the bicipital path.

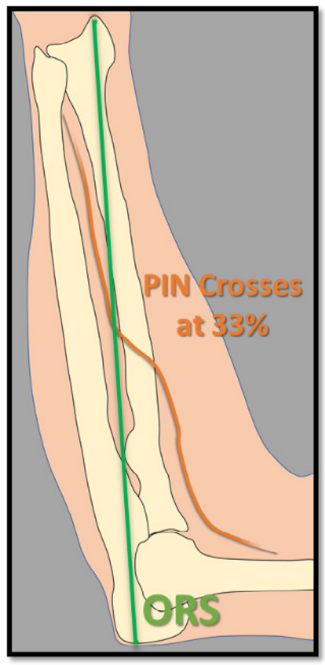

Figure 3 Schematic demonstrating where the PIN crosses the ORS.

determine safe portal placements. The distance from the dilator to the PIN and from the ORS line to the PIN were compared using a t-test with a Bonferroni correction, significance was set at P = .05.

Results: The PIN was between 2.6 ± 0.7 cm in pronation and 1.0 ± 0.3 cm in supination away from the dilator. The line drawn from the olecranon tip to the radial styloid (ORS) varied in length among specimen from 25 to 32.6 cm, but was on average 29.2 cm. The PIN reliably crossed this line between 8.9 and 12.2 cm from the olecranon tip, or on average 10.4 ± 1.0 cm with the arm in pronation, or between 8.6 and 11.5 cm, or an average of 9.7 ± 0.9 cm with the forearm in neutral which was 33.3% of the length of each specimen's line. Therefore, the danger zone for interaction with the PIN would be one-third of the length of the forearm from the olecranon tip to the radial styloid with the forearm in a neutral position. A PIN safe distal portal location is 30% of the olecranon-radial styloid (ORS) reference line.

Table 1

	Mean (SD)	Minimum	Maximum
ORS line	29.2 cm	25 cm	32.6 cm
Distance (cm) Dilator to PIN (Std Dev)			
Pronation	2.6 (0.7) [1]	1.6	4.3
Neutral	2.0 (0.6) [2]	1.2	3.3
Supination	1.0 (0.3) [1,2]	0.3	1.7
Distance (cm) (SD), (Percentage of ORS line)			
Pronation	10.4 (1.0) (35.6%)[1]	8.9 (35.6%)	12.2 (37.4%)
Neutral	9.7 (0.9) (33.2%)	8.6 (34.4%)	11.5 (35.3%)
Supination	8.8 (1.1) (30.1%)[1]	7.3 (29.2%)	10.4 (31.9%)

[1] Pronation vs. supination.
[2] Neutral vs. supination $P < .05$.

Conclusions: Endoscopic or open distal biceps re-attachments are safe procedures as long as the surgical dissection does not cross the proximal 1/3 of the olecranon-radial styloid reference line with the forearm in neutral rotation. Forearm neutral and pronated positions increase the distance between the distal portal and PIN. We recommend that the distal portal be positioned at 30% of the olecranon-radial styloid (ORS) reference line with the forearm in neutral or pronation (Table 1).

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Paper #8 INDOMETHACIN PROPHYLAXIS DOES NOT REDUCE THE RISK OF HETEROTOPIC OSSIFICATION FOLLOWING A TWO-INCISION DISTAL BICEPS REPAIR

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Background: Use of heterotopic ossification (HO) prophylaxis remains controversial following a distal biceps repair.

Hypothesis: There will be a reduction in HO in patients treated with indomethacin (INDO)

Methods and Materials: A retrospective review of all patients who underwent a two-incision distal biceps repair was performed. Inclusion criteria included: age >18, direct two-incision repair with at least 6 months follow-up. Patient demographic information as well as time from injury to surgery, tourniquet time, tobacco use, and development of HO was recorded. Patients who were prescribed any anti-inflammatory non-steroidal medications identified and the medical record was reviewed to confirm the compliance of INDO.

Results: Of 146 patients who met our inclusion criteria, 45 (30.8%) had a post-operative radiograph, 14 (31.1%) treated with INDO for a mean of 6.7 weeks (range: 2 to 12 weeks), and 31 (68.8%) without (Controls). There was a difference in age between INDO and controls (41 vs 51 years, $P < .01$), but no difference in time from injury to surgery (43 vs 21 days, $P = .62$), tourniquet time (75 vs. 72 minutes, $P = .66$), or percentage of smokers ($P = .958$). 6 Of 14 (42.9%) INDO patients developed HO/SO and 7 of 31 (22.6%) controls developed HO ($P = .16$). In an age-adjusted logistic regression model, use of INDO was associated with 8.20 (95% CI: 1.28, 52.34) times higher odds of developing HO. There was no difference in low versus high dose ($P = .63$) or length of treatment ($P = .69$).

Conclusion: Although not statistically significant, there was an 8 times higher odds of developing HO when patients were treated with INDO after a two-incision distal biceps repair. No difference was noted in dosage, nor duration of treatment. We feel that prophylaxis is not warranted and can actually increase risk of HO following a two-incision repair.

Keywords: distal biceps, two incision, prophylaxis, indomethacin, heterotopic ossification, synostosis

Paper #9 DELAYED MANAGEMENT OF DISTAL BICEPS RUPTURE: RECONSTRUCTION WITH SEMITENDINOSIS AUTOGRAFT VERSUS PRIMARY REPAIR

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Background: Delayed presentation of distal biceps ruptures can make primary repair impossible, in which case reconstruction using a graft is an option. The current literature includes a variety of techniques with reconstruction studies reporting small patient numbers but no comparison to delayed direct repair has been made. The aim of this study was to compare functional outcomes, patient satisfaction and complications between delayed direct repair (>21 days) and reconstruction with a semitendinosis autograft.

Methods: Nineteen delayed distal biceps rupture cases treated with a tendon reconstruction were compared to sixteen delayed primary repair cases (>21 days). The reconstructions were performed using a semitendinosis autograft through a bone tunnel in the radius and a pulvertaft weave into the remnant distal biceps tendon and muscle. The patient cohorts were reviewed and completed functional outcomes testing including range-of-motion, supination and isometric elbow flexion strength, Disabilities of the Arm, Shoulder and Hand questionnaire; Patient-Reported Elbow Evaluation, Single Assessment Numeric Evaluation, and Mayo Elbow Performance Score.

Results: Mean patient age was 46 ± 8 years in the reconstruction cohort versus 49 ± 9 years in the delayed repair cohort. Mean duration of follow-up was 45 ± 27 months in the reconstruction cohort versus 47 ± 25 months in the delayed cohort. The time from injury to surgery averaged 266 ± 248 days in the reconstruction cohort versus 37 ± 12 days in the delayed repair cohort. Range of motion, supination strength and elbow flexion strength were similar between cohorts ($P = .62$, $P = .26$, $P = .93$ respectively). The average maximum elbow extension achieved in the operating room after delayed primary repair was 48 ± 22° vs. 57 ± 18° for the reconstruction cohort ($P = .12$). The mean postoperative Disabilities of the Arm, Shoulder and Hand questionnaire, and the Single Assessment Numeric Evaluation were similar between the cohorts ($P = .08$, $P = .22$ respectively). The Patient-Rated Elbow Evaluation, and the Mayo Elbow Performance Index were better in the delayed repair cohort compared to the reconstruction cohort (3.6 ± 4.5 versus 13.8 ± 19.1, $P = .02$, and 95.3 ± 7.2 versus 85.8 ± 13.7, $P = .04$ respectively). Complications were similar between cohorts ($P = .87$). The most common complication was transient lateral antebrachial cutaneous nerve palsy in four patients (21%) in the reconstruction cohort and six patients (38%) in the delayed repair cohort lasting beyond 6 months. One patient (5%) in the reconstruction group had an early graft failure at the muscle-tendon graft interface.

Conclusion: Delayed reconstruction of irreparable distal biceps ruptures with semitendinosis autograft produces similar strength, range of motion and complication rates but slightly worse functional outcome scores compared with delayed primary repair. Despite placing the elbow into high degrees of flexion at the end of primary repair and reconstruction, this did not impede final range of motion, strength or functional outcome scores.

Paper #10 ASYMPTOMATIC MRI FINDINGS OF THE ELBOW PREDICT INJURY AND SURGERY IN MAJOR LEAGUE BASEBALL PITCHERS

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Background: Repetitive pitching produces significant stresses onto the elbow that produce structural abnormalities discernable on Magnetic Resonance Imaging (MRI) without causing symptoms. It is unknown whether these structural abnormalities pose any long term clinical significance. The purpose of this study is to determine whether there exists an association between subclinical MRI findings in asymptomatic elbows in major league baseball pitchers, and future placement on the disabled list or future surgery.

Methods: All major league pitchers undergoing routine pre-signing imaging at a single organization were retrospectively reviewed