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A clinical review of elbow ligament repairs and reconstructions in the acute and chronic settings

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A R T I C L E I N F O

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Valgus instability
Suture anchor
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Allograft tendon
Medial collateral ligament
Lateral ulnar collateral ligament

Level of evidence: Level IV; Case Series; Treatment Study

Background: The ligamentous and osseous structures of the elbow joint are the major contributors to its inherent stability and damage to any of these structures can result in elbow instability. The aim of this study is to present objective and subjective outcomes following ligament repairs and/or reconstructions for acute elbow instability and chronic elbow instability.

Methods: This study included patients who underwent an elbow ligament repair and/or reconstruction for acute or chronic elbow instability. We performed a comprehensive retrospective data analysis of the patient's files, followed by a clinical examination and X-ray of these patients.

Results: We identified 12 acute stabilizations and 22 stabilizations for chronic instability. Patients who underwent stabilization for chronic instability had statistically significant improvements in their preoperative flexion and extension; 14.8 ± 6.4° and 5.9 ± 2.5°. Patients with chronic instability achieved better extension-flexion and pronation-supination arcs compared with their acute instability counterparts and this reached statistical significance. When the elbow pain and function scores were compared, we found stabilizations in the acute setting had better outcomes. There were two cases of postoperative instability, one in the acute instability group and one in the chronic instability group.

Conclusion: This study provides evidence for elbow ligament repairs and reconstructions in both acute and chronic settings. It is an effective way of stabilizing the elbow joint in chronic instability patients, and results in an improvement in their overall range of motion. These patients achieved a greater range of motions compared with their acute instability counterparts.

The ligamentous and osseous structures of the elbow joint are the major contributors to its inherent stability and damage to any of these structures can result in elbow instability.[11,17] Of these structures, the three most important are the ulno-humeral joint, the lateral collateral ligament (LCL) and the medial collateral ligament (MCL). Both the LCL and MCL have three parts to them. The most important part of the LCL is the lateral ulnar collateral ligament, which runs from the isometric point of the lateral epicondyle of the humerus to the supinator crest of the ulna. For the MCL, the anterior bundle is the most important and this runs from the anteroinferior aspect of the medical epicondyle to the sublime tubercle of the ulna.[11] The most common forms are posterolateral rotational instability (PLRI) and valgus instability. In PLRI there is insufficiency or disruption of the lateral ulnar collateral ligament, which is the most important component of the LCL.[2,10] This is typically caused by a combination of valgus stress, supination and axial loading forces on the elbow resulting in a postero-lateral subluxation or dislocation.[11] Valgus instability, on the other hand, is instability of the elbow resulting from the traumatic rupture or chronic attenuation of the anterior band of the MCL.[10]

In the acute setting, the diagnosis of elbow instability is usually straightforward, especially in patients with an irreducible dislocation, persistent instability post reduction and/or significantly associated fractures such as the terrible triad. Accurately determining the diagnosis can be more difficult in cases of chronic elbow instability as the examination findings can be subtle.[2,17] Patients can often recall a history of a previous traumatic dislocation with

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subsequent dislocation events. They describe a feeling of being 'unable to trust their elbow' because they perceived it to be weaker and prone to 'giving way'. This can also be accompanied by a painful clicking, snapping, clunking and/or locking of their elbow.[14] Patients with PLRI typically have positive chair push-up, tabletop relocation and/or pivot shift tests.[10,17] In comparison, the supporting examination findings for a patient with valgus instability are a positive valgus stress and/or moving valgus stress tests.[14] In some cases, the diagnosis needs to be confirmed with a stress X-ray, CT scan, and/or an MRI scan.[17]

Elbow dislocations are often treated nonoperatively as the risk of medium to long-term elbow stiffness is significantly greater than the risk of instability.[11] The indications for surgical intervention are variable and are continually evolving. In our practice, we would perform an acute ligament repair and/or reconstruction if there was persistent elbow instability or joint incongruity after a closed reduction, if there were significant associated fractures such as a terrible triad, or if the patient has a compound wound. Our preferred option is an acute ligament repair, but in cases where there is a significant deficiency in the ligaments, an acute ligament reconstruction may be necessary. Due to the signs and symptoms of chronic instability being more subtle, our indications for a ligament repair and/or reconstruction in the setting of chronic instability are less well defined. We would offer patients an operation if they had a history of a fall resulting in closed dislocation, currently report elbow weakness and have a sense that their elbow gives way with stress. There is often attenuation of the ligaments in these patients so a reconstruction of the ligaments invariably needs to be performed.[11]

There is currently a lack of large published studies evaluating elbow ligament repairs and reconstructions, with the largest study to date being 45 patients retrospective review by Sanchez-Sotelo et al[14] Furthermore, there are no studies comparing ligamentous repair/reconstruction in the acute and chronic settings.

The aim of this study is to present objective and subjective outcomes following ligament repairs and/or reconstructions for acute elbow instability and chronic elbow instability. Outcomes assessed are clinical and radiological signs of recurrent instability, elbow range of motion (ROM), and patient-rated outcome measures.

Materials and methods

Auckland Health Research Ethic Committee approval was granted for our three-phase study. The first phase consisted of a literature review using Pubmed and ScienceDirect. The second phase was retrospective data analysis involving a comprehensive review of the files of patients who underwent an elbow ligament repair and/or reconstruction for acute or chronic elbow instability. For the final phase of the study, we performed a clinical review of these patients and this included taking X-rays and completing elbow pain and function scores.

Our study included patients over 18 years of age at Middlemore, Ormiston and Mercy Ascot Hospitals who underwent an elbow ligament repair and/or reconstruction for acute or chronic elbow instability between 2010 and 2021. The patients were identified from the existing acute/elective surgical databases of Middlemore, Mercy Ascot and Ormiston Hospitals. We defined acute instability patients as those less than six months postinjury. Patients were excluded if they had failed to present for follow-up in the first 3 months after their operation or had ipsilateral fractures to the distal radius, distal ulnar and/or proximal humerus. The operations were performed by one of three fellowship-trained elbow surgeons (WHD, AD, MF) with some cases being a combined case with two of the surgeons.

All potential participants were invited to participate in the study. We reviewed the files of all patients who consented to participate in the second phase of the study and recorded their baseline demographic data including age, gender, sex, hand dominance, and type of employment. We then performed a thorough review of their clinical notes, operation notes and clinical letters to determine their mechanism of injury, the injury they sustained, the operative treatment, their ROM, and if there were any postoperative complications. The preoperative ROM was only recorded for the chronic instability patients as it was impossible to measure in the acute instability patients.

Patients participating in the third phase of the study attended an outpatient clinic appointment where they underwent a clinical examination of the elbow performed by the primary or secondary investigators. During the examination elbow ROM (flexion, extension, supination and pronation) was measured using a standard goniometer. Extension was recorded as a positive value for patients who failed to fully straighten their elbow and for patients who were able to achieve elbow hyperextension, this was recorded as a negative value. Elbow stability is assessed by performing a pivot shift test, varus/valgus stress test and a chair push-off test.[10,17] Patients were asked to detail how long it took for them to return to their occupation and if they experienced any postoperative complications. X-rays were performed to assess for radiographic signs of instability, postoperative degenerative change and heterotopic ossification (HO). Finally, participants completed the Mayo Elbow Performance Score (MEPS), Oxford Elbow Score (OES), Patient Rated Elbow Evaluation (PREE), and Quick Disability of the Arm and Shoulder and Hand (QuickDASH) score. All the scores had a maximum value of 100, except the OES which had a maximum value of 48. For both the MEPS and OES, a higher score indicates a better outcome, while the opposite is true for the PREE and QuickDASH scores.[1,6,15,18]

Statistical analyses were performed using SAS version 9.4 software (SAS Institute, Inc., Cary, NC, USA). Linear and generalized linear models for continuous response variables were calculated using the PROC generalized linear model function. The associations between acute and chronic instability patients were measured using the Wilcoxon sign-rank test, except for categorical variables where Fisher's exact test was used to assess associations. Wilcoxon scores in the one-way analysis of variance statistic produce the Kruskal-Wallis test with a continuity correction by PROC NPAR1-WAY procedure in SAS. Two-sided tests of significance were used, and P values of $\leq .05$ were considered statistically significant.

All operations were performed under a general anesthetic in the 'lazy lateral' position with an arm block and high arm tourniquet. Prior to the surgical incision, an examination under anesthesia was performed to confirm the indication for surgery.

LCL and/or MCL ligament repairs were almost exclusively performed in the acute setting and associated fractures of the radius and ulnar were treated on their merit with an open reduction and internal fixation and/or a radial head replacement. Isolated LCL repairs were approached through the Kaplan or Kocher interval while combined LCL and MCL repairs were approached through a curvilineal posterior incision that curved around the medial aspect of the olecranon. The repairs were carried out using Depuy Synthes Mitek GII suture anchors (DePuy Synthes, Raynham, MA, USA).

The combined LCL and MCL (360 degree) reconstruction was performed utilizing a curvilineal posterior incision that curved around the medial aspect of the olecranon. We raised full-thickness medial and lateral fascio-cutaneous flaps. On the medial side, the ulnar nerve was identified, transposed anteriorly and the MCL rupture was identified deep to the bed of the cubital tunnel. Laterally the ruptured LCL was identified via the Kocher interval. The allograft was augmented at both ends with suture tape. A bone

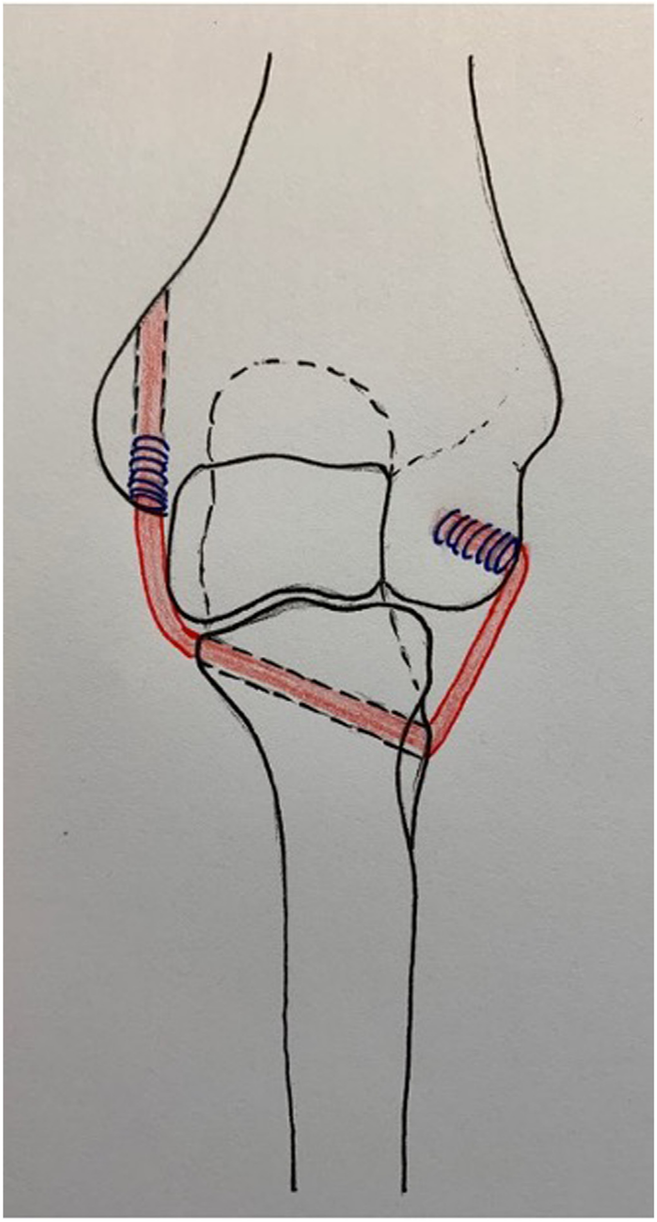

Figure 1 Diagram showing the allograft tendon secured at the isometric point of the lateral epicondyle, running through the ulnar from the supinator crest to the sublime tubercle and then secured at the anteroinferior aspect of the medial epicondyle.

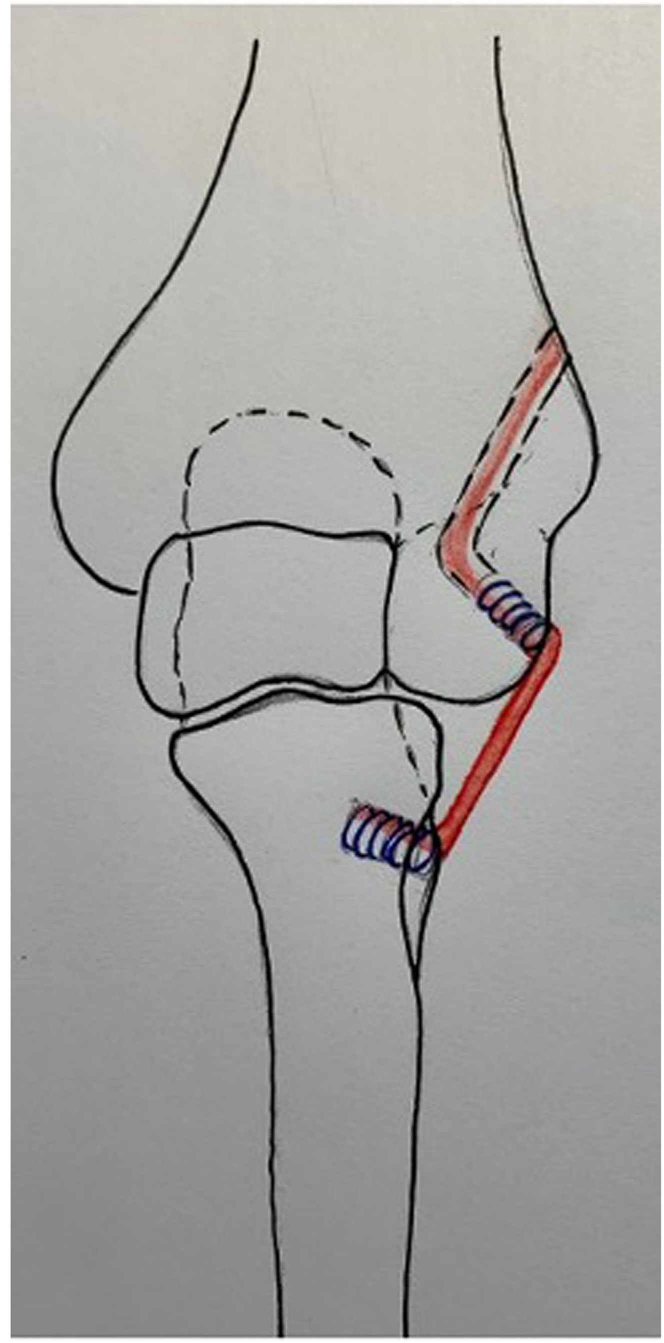

Figure 2 Diagram showing the graft tendon secured at the isometric point of the lateral epicondyle and the supinator crest.

tunnel was created but reaming over a guide wire which ran through the ulnar from the supinator crest to the sublime tubercle. Two drill holes were made, one at the isometric point of the lateral epicondyle and the other at anteroinferior aspect of the medial epicondyle. As shown in Figure 1 the graft was then secured to the lateral epicondyle with an interference screw before being threaded through the bone tunnel. The graft was tensioned by cycling the elbow through ROM and then secured to the medial epicondyle using a second interference screw.

For the LCL reconstruction, a Kocher approach was utilized to identify the ruptured LCL. In operations utilizing autograft tendon, this was then harvested from the palmaris longus, hamstrings or flexor carpi radialis. The allograft/autograft tendon was then augmented at both ends with suture tape. Two drill holes were made, one at the supinator crest and the other at the isometric point of the lateral epicondyle, exiting through the dorsum of the supracondylar ridge. As shown in Figure 2, the graft was secured distally with an interference screw, tensioned, and then secured proximally with a second interference screw. Finally, the tail of the graft was turned back onto itself and sutured in place.

The MCL reconstruction was performed similarly to the LCL reconstruction utilizing a curvilineal posterior incision that curved around the medial aspect of the olecranon. The ulnar nerve was identified and transposed anteriorly. Two drill holes were made, one through the sublime tubercle and the second through the anteroinferior aspect of the medial epicondyle and exiting out through the medial epicondylar ridge. As shown in Figure 3, the

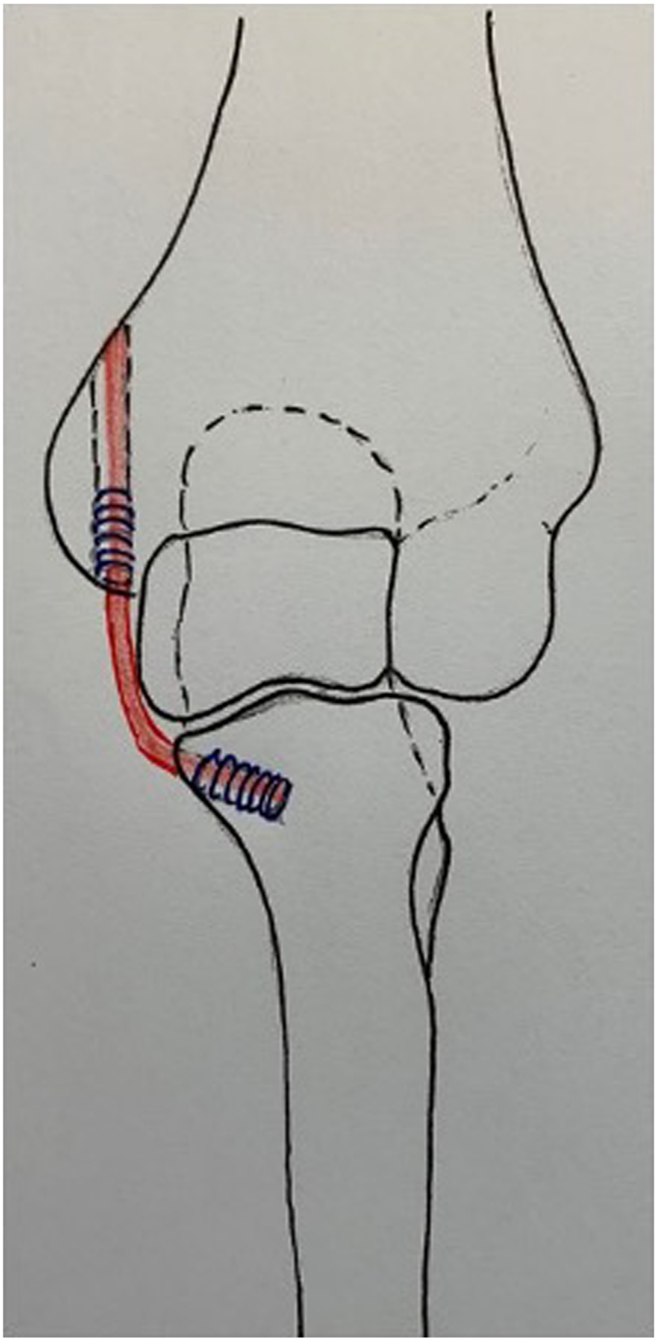

Figure 3 Diagram showing the graft tendon secured at the sublime tubercle and then secured at the anteroinferior aspect of the medial epicondyle.

allograft/autograft tendon was secured proximally, tensioned and then secured distally.

Postoperatively patients were placed into a back-slab cast at 90 degrees of flexion for two weeks before being transitioned into a ROM brace to commence ROM exercises. Patients remained in the ROM brace for four weeks and commenced strengthening exercises three months after the operation.

Results

For the retrospective analysis, we identified 34 patients who met the inclusion criteria with 12 stabilizations in the acute setting and 22 stabilizations for chronic instability. In the acute setting, there were 10 fracture-dislocations and two dislocations. There were a total of eight LCL repairs and four combined LCL and MCL repairs. Four patients also underwent a radial head fixation and five patients required a radial head replacement. For the chronic instability patients, there were three fracture-dislocations, 12 dislocations, five cases of post-traumatic instability with no clear dislocation event, one LCL rupture postextensor carpi radialis brevis débridement and one traumatic LCL rerupture post historic LCL repair. In total there were three LCL repairs, 12 LCL reconstructions, one LCL repair and MCL reconstruction, five combined LCL and MCL reconstructions and one MCL reconstruction. The reconstructions were performed using palmaris longus, hamstring or flexor carpi radialis autografts or allografts.

There were no significant differences between the acute and chronic instability groups in terms baseline demographics as shown in Table I. The average age of the participants was 42 years with no significant differences ($P = .90$) between the acute (41.7 years) and chronic (41.6 years) instability groups. 71% of the patients were male. There were no statistically significant differences in the distribution of arm dominance ($P = 1.0$) or the distribution of left and right arms operated on in each group. Although there were slightly more manual laborers in the chronic instability group; 45% vs. 33% in the acute instability group and this was not statistically significant. 58.3% of patients in the acute stabilization group had a high energy mechanism of injury as opposed to 18.1% in the chronic instability group. The mean time to surgery from the date of injury was 12 days in the acute group and 542 days in the chronic instability group.

For the third phase of our study, we were able to clinically review 10/12 (83.3%) of the acute stabilizations, with the remaining two patients having passed away of unrelated causes. In comparison, we were only able to clinically review 12/22 (54.5%) of the stabilizations for chronic instability as two patients declined to participate in this phase of the study, six patients had moved out of town and were unable to return for a clinical review, and one patient had passed away of unrelated causes. This gave us a final follow-up percentage of 65%.

From our retrospective review (phase two of the study), we found that at the completion of follow-up patients who underwent an acute stabilization achieved an average postoperative extension-flexion arc of 24.2-123.6° and an average pronation/supination arc of 69.7/63.4°. Six of these 12 patients achieved a functional extension-flexion arc of at least 30-130°, while 10 of the 12 achieved a functional pronation/supination arc of at least 50/50°. In contrast, patients who underwent stabilization for chronic instability achieved an average postoperative extension-flexion arc of 2.7–143.1° and a pronation/supination arc of 75/80°. All of these patients achieved functional extension-flexion and pronation/supination arcs. As shown in Table II the chronic instability patients had a greater ROM compared with their acute instability counterparts and this reached statistical significance. For the chronic instability patients, there were statistically significant improvements in their preoperative flexion and extension; $14.8 \pm 6.4°$ ($P = .03$) and $5.9 \pm 2.5°$ ($P = .03$) respectively. The mean follow-up times were similar for the two groups; 9.2 ± 4.7 months for acute stabilization patients and 9.5 ± 6.4 months for the chronic instability patients.

Our clinical review (phase three of the study) showed that there were further improvements in the flexion and extension of both groups of patients compared to their previous follow-up clinic appointments. Patients who underwent an acute stabilization improved their mean flexion by $14.2 \pm 3.9°$ from 125.8° to 140.0° and statistical significance was reached ($P = .002$). Although there was also a $1.5 \pm 4.5°$ improvement in their mean extension from

Table I
Table showing the baseline demographic data of the patients.

	Categories	Chronic instability	Acute instability	P value*
Age avg (SD)		41.55 (16.8)	41.67 (16.8)	.90
Sex (column %)	Male	16 (62.5)	8 (66.6)	.71†
	Female	6 (37.5)	4 (33.3)	
Operations on dominant arm N (column %)	Left-arm	2 (11.8)	1 (9.1)	1.00†
	Right-arm	17 (88.2)	11 (90.9)	
Occupation (column %)	Manual labourer	10 (45.4)	4 (33.3)	.72†
	Non Manual labourer	12 (54.6)	8 (66.6)	
Mechanism of injury (column %)	High	4 (18.1)	7 (58.3)	.03‡
	Low	18 (81.9)	5 (41.7)	
Time (months) to return to light duties at work mean (SE); 95% CI		3 (3.30); 0.79, 5.21	3.72 (4.09); 1.17, 6.27	.94
Length in months of follow-up time mean (SD); 95% CI		9.54 (2.31); 4.82, 14.25	9.17 (3.13); 2.78, 15.55	.26

SD, standard deviation.
* P value from Kruskal-Wallis test.
† P value from Fisher Exact test.
‡ Statistically significant.

Table II
Table comparing elbow range of motion in chronic and acute instability patients at the time of the retrospective review.

	Chronic instability	Acute instability	Chronic vs. acute
	Mean (SE); 95% CI	Mean (SE); 95% CI	Mean difference (SE); P value*
Flexion	143.2 (2.3); 138.5, 147.9	123.6 (3.1); 117.2, 130.0	19.6 (3.9); <.0001†
Extension	2.7 (2.8); 3.0, 8.4	24.2 (3.8); 10.9, 37.4	−21.4 (4.7); <.0001†
Pronation	75.0 (0); 72.3, 77.7	69.7 (1.8); 66.0, 73.3	5.3 (2.2); .02†
Supination	80.0 (2.5); 74.9, 85.1	63.4 (3.4); 56.5, 70.3	−16.6 (4.2); .0004†

SE, standard error; *CI*, confidence interval.
* P value from Kruskal-Wallis test.
† Statistically significant.

22.5° to 21.0°, this was not statistically significant (P = .7). There was a statistically significant improvement of 5.4 ± 3.5° in the flexion of chronic instability patients from 142.5° to 147.9° (P = .1). The mean extension also improved from 3.8° to 2.1°, but this 1.7 ± 4.1° improvement was not statistically significant (P = .7). There were also improvements in pronation and supination in the acute stabilization group from 68.6° to 71.1° and from 65.1° to 70.1° respectively. Only the improvement in supination reached statistical significance (P = .04). There were no further improvements for the chronic instability group as maximal pronation and supination were already achieved at the time of their previous follow-up clinic appointment. As shown in Table III patients with chronic instability achieved better extension-flexion and pronation-supination arcs compared with their acute instability counterparts and this reached statistical significance. The chronic instability group achieved an extension-flexion arc of 2.1 ± 8.2° to 147.9 ± 4.0° whereas the acute group only achieved an arc of 21.0 ± 9.0° to 140.0 ± 4.4°. In terms of supination/pronation, it was 80.0 ± 5.6/75.0 ± 2.3° for the chronic group and 70.1 ± 6.3/71.1 ± 2.5° for the acute group. The mean follow-up time was slightly higher for the acute stabilization group at 75 ± 24 months, as opposed to 62 ± 22 months in the chronic instability group, but this did not reach statistical significance.

When the elbow pain and function scores were compared we found that patients who underwent a stabilization in the acute setting had better outcomes. This is shown in Table IV. Both the MEPS (98.0 vs. 89.2) and OES (45.6 vs. 39.3) were higher in the acute stabilization group which indicated a better outcome. The values of the PREE (9.6 vs. 16.3) and QuickDASH scores (6.8 vs. 16.1) were lower in the acute stabilization group and this also indicated a better outcome for them. For all the scores except the QuickDASH, statistical significance was reached.

All patients were able to return to their previous occupations. The time to return to light duties at work was not significantly different between the two groups (P = .94). Patients with chronic instability returned in 3 ± 2.1 months, while the patients with acute instability returned approximately in 4 ± 2.6 months.

There were two cases of postoperative instability, one in the acute stabilization group and one in the chronic instability group. The patient in the acute stabilization group was a middle-aged female who sustained a compound elbow dislocation with a Mason IV radial head fracture. She underwent a LCL repair with FiberWire (Arthrex, Naples, FL, USA) suture and radial head replacement. However, X-rays at the follow-up clinic showed a radial head subluxation and she underwent a revision LCL repair, MCL repair and application of a hinged external fixator. Thirty-six months after the elbow external fixator was removed, X-rays showed she had developed HO which limited her extension and she required a surgical excision and anterior capsule release. The patient in the chronic instability group was a gentleman in his 60s who was reviewed again seven years after his LCL and MCL reconstruction. He reported ongoing instability at the end ROM. To examine he had good ROM from 0-140°, but had positive varus/valgus stress tests and a positive chair push-off test. As his X-rays showed that he was developing elbow osteoarthritis, he decided against a further stabilization procedure. One patient in the chronic instability group sustained a fall eight years after her MCL reconstruction and required LCL and MCL reconstructions. We did not consider this an instability complication and the overall rate of postoperative instability was 9.1%.

Other complications included one case of asymptomatic HO, one case of a postoperative hematoma that required a washout, and two cases of complex regional pain syndrome which subsequently resolved.

Discussion

Our study has shown that patients who underwent surgery in the acute setting tended to have a lower elbow extension-flexion arc compared to patients with chronic instability. A smaller percentage of these patients achieved a functional arc of motion. This may be due to the fact that instability in the acute setting is frequently the result of high-energy trauma. As a result, there is

Table III
Table comparing elbow range of motion in chronic and acute instability patients at the time of the clinical review.

	Chronic instability	Acute instability	Chronic vs. acute
	Mean (SE); 95% CI	Mean (SE); 95% CI	Mean difference (SE); *P* value*
Flexion	147.9 (1.9); 143.9, 151.9	140.0 (2.1); 135.64, 144.36	7.9 (2.8); .02†
Extension	2.1 (3.9); −6.1, 10.3	21.0 (4.3); 12.0, 30.0	−18.9 (5.8); .007†
Pronation	75.0 (1.1); 72.8, 77.3	71.1 (1.2); 68.64, 73.56	3.9 (1.6); .02†
Supination	80.0 (2.7); 74.4, 85.6	70.1 (3.0); 64.0, 76.3	9.9 (4.0); .02†

SE, standard error; *CI*, confidence interval.
**P* value from Kruskal-Wallis test.
†Statistically significant.

Table IV
Table comparing the elbow pain and function scores in chronic and acute instability patients at the time of the clinical review.

	Chronic instability	Acute instability	*P* value*
	Mean (SE); 95% CI	Mean (SE); 95% CI	
Oxford Elbow Score	39.25 (2.42); 34.19, 44.31	45.6 (2.66); 40.06, 51.14	.02†
Mayo Elbow Performance Index	89.17 (2.78); 83.37, 94.96	98.0 (3.04); 91.65, 104.35	.03†
Quick-DASH functional score	16.05 (5.76); 4.03, 28.07	6.81 (6.31); 0, 19.97	.32
Patient-reported elbow evaluation	16.33 (5.78); 4.29, 28.37	9.6 (6.32); 0, 22.79	.05†

SE, standard error; *CI*, confidence interval.
**P* value from Kruskal-Wallis test.
†Statistically significant.

more extensive ligament/soft tissue damage and a higher incidence of bony injuries. These patients also reported better OES, MEPS and PREE scores compared with their chronic instability counterparts. We postulated that these patients understood the serious nature of their injury, and therefore had lower postoperative expectations in terms of pain and function levels. However, it is worth noting that the differences in the OES and Mayo Elbow Performance Index failed to meet the minimal clinically important difference. The 6.3 point difference in the OES was less than the 10 point minimal clinically important difference estimated by Dawson et al[3] For the MEPS the MICD was calculated to be 12.2 by Ziyang et al and this is higher than the 8.8 point difference in our study.[16] There were no published studies that evaluated the MICD for the PREE Score so we are unable to comment on this.

Counterintuitively, patients with chronic elbow instability have an improved elbow extension-flexion arc after their reconstructive surgery. We feel that this can be explained by patients subconsciously learning to limit their ROM to a known stable arc of motion, in order to avoid a feeling of elbow instability. The ligament reconstruction/s improved the size of this stable arc of motion, thus allowing patients to achieve a greater arc of motion postoperatively. There could also be some contribution from the fact that not all fractures needed to be addressed operatively and none of the patients had significant preoperative flexion or extension contractures. Our study has also demonstrated that there are further improvements in elbow ROM in the medium-to-long term with both the acute and chronic instability patients demonstrating improvements in elbow ROM between the retrospective and clinical reviews.

Our study showed promising results when compared to the studies from our literature review. We identified five studies that investigated the outcomes of acute ligament repairs. Two looked at patients with purely ligamentous injuries, while the other three looked at patients with fracture-dislocations who underwent an acute ligamentous repair in addition to an open reduction and internal fixation and/or radial head replacement. MCL repairs were performed in all studies except Forthman et al's retrospective study of fracture-dislocation patients. [4,7-9,19] When compared to these studies our patients achieved higher degrees of flexion at 140.0°, but lower degrees of extension at 21.0°. Overall our 9.1% rate of instability complications was similar to a combined rate of 6.7% in these studies.[4,7-9,19] Upon review of our single instability complication, we believe that it was the result of us not repairing the MCL during the initial operation. We felt the elbow joint was stable after both a LCL repair and a radial head replacement. This highlighted to us the importance of considering a MCL repair in highly unstable elbows, especially in fracture dislocation cases.

Our literature review also identified four studies that looked at patients with chronic elbow instability as a results of a purely ligamentous elbow injury.[5,12-14] Our patients achieved a greater extension-flexion arc of 2.1 − 147.9° compared with these studies, with only exception being Oslen et al's study where the reported extension was 0.1° higher.[12] Our overall 8.3% rate of instability complications was again similar to what combined rate in the literature of 9.8%.

There are limitations of this study that need to be acknowledged. The second phase of the study was a retrospective review of the clinical data which makes the ROM data open to measurement and recording bias. There was no blinding of assessors who performed the patient clinical examinations in the third phase of the study. The elbow pain and function scores were all self-reported which makes them open to reporting bias. We had a relatively small sample size of 34 patients with an almost 2:1 ratio of chronic to acute instability patients. Although we were able to follow-up 65% of our patients in the third phase of our study, the follow-up percentage was only 55% in the chronic instability patients as opposed to 83% in the acute instability group. This means there is potential for the result to be affected by response bias.

Conclusion

This study provides evidence for elbow ligament repairs and reconstructions in both the acute and chronic settings. It is an effective way of stabilizing the elbow joint in chronic instability patients, and results in an improvement in their overall ROM. These patients achieved a greater ROMs compared with their acute instability counterparts and although they had lower self-reported elbow pain and function scores, this was not deemed to be clinically significant.

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Drawings used with permission from the senior author WHD.

Disclaimers:

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