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Original Research

Outcomes of Acute Versus Subacute Scapholunate Ligament Repair

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Purpose: This study investigated the long-term outcomes of direct scapholunate ligament (SLL) repairs with or without dorsal capsulodesis performed within 6 weeks (acute repair) of a SLL tear versus 6 to 12 weeks following injury (subacute repair).
Methods: A review of medical records from April 1996 to April 2012 identified 24 patients who underwent SLL repair (12 acute, 12 subacute). Patients returned to the clinic for radiographic examinations of the injured wrist, standardized physical examinations, and validated questionnaires.
Results: The mean follow-up times for the acute and subacute groups were 7.2 and 6.2 years, respectively. At the final examination, patients with acute surgery regained more wrist extension (acute = 55°, subacute = 47°). The total wrist flexion-extension arcs, grip strengths, pinch strengths, and patient-rated outcome scores were found to be similar between groups. The final scapholunate gap, scapholunate angle, and the prevalence of arthritis were also found to be similar between the acute and subacute groups.
Conclusions: Although SLL repair is more commonly recommended for treatment of acute SLL injuries, there were no significant long-term differences between acute and subacute SLL surgeries (repair ± capsulodesis).
Type of study/level of evidence: Prognostic III.

Operative treatment for complete scapholunate ligament (SLL) disruption producing static carpal malalignment is commonly determined by injury acuity. Direct ligament repair (SLL repair), with or without dorsal capsulodesis, is recommended for patients with acute SLL tears (<6 weeks from injury).[1–3] Beyond 6 to 8 weeks after injury, hand surgeons have been reluctant to perform SLL repairs due to many reasons, including a perception, based on published studies, that there is a decreased likelihood of success.[4–11] Instead, treatment for patients with subacute SLL injuries (those treated >6 weeks after injury) typically consists of dorsal capsulodesis, SLL reconstruction, or limited wrist arthrodesis.[12–14] The issues associated with the effect of time from injury on treatment decision making is particularly important because many patients present for evaluation and treatment after the acute injury period has passed. Rohman et al[9] found that only 27 of 82 patients with SLL tears were treated within 6 weeks of the reported injury.

It is currently unknown whether the time from injury truly affects outcomes following treatment of a SLL tear with direct repair or with direct repair and capsulodesis. Theoretically, restoration of a ligamentous integrity is possible whenever sufficient ligamentous tissue is accessible, the scaphoid is reducible, and no arthritic/degenerative changes are observed.[15] Previous studies have explored direct ligament repair (with or without capsulodesis augmentation) in patients with chronic SLL injuries without comparison to acute repairs.[16–19] Short-term outcomes in these series demonstrated mixed results, with eventual progression to scapholunate advanced collapse (SLAC wrist) in some patients.[16–19] However, there are limited data that directly compare the long-term results of SLL repair or SLL repair with supplementary capsulodesis in acute versus nonacute injuries.

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Figure 1. **A** Preoperative posterioanterior and lateral radiographs of a patient with a stage 2 SLL injury. **B** Preoperative magnetic resonance image demonstrating disruption of the dorsal fibers of the SLL (blue arrows).

The purpose of this study was to compare differences in long-term outcomes when surgical restoration of SLL integrity (SLL repair with or without supplementary capsulodesis) was performed in the acute (less than 6 weeks) or subacute (6 to 12 weeks) period following injury. The null hypothesis that there would be no differences in clinical or radiographic outcomes between the 2 groups was tested.

Materials and Methods

This study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki, as reflected in a prior approval by the institutional review board of Washington University School of Medicine (HRPO #201312086), and signed informed consent was obtained from all patients presenting for research evaluations. Patients having undergone SLL repair by 1 of 4 hand surgeons (R.P.C., D.A.O.) between April 26, 1996, and April 18, 2012, were identified via an electronic billing database by Current Procedural Terminology code 25320. Patient information, including the length of time from injury to surgery, operative notes, and the postoperative treatment course, were collected and reviewed. Patients were eligible for the study if they were treated for an isolated, complete rupture of the dorsal SLL and underwent SLL repair with or without supplementary capsulodesis. The diagnosis was confirmed by review of preoperative radiographs and the operative report (Fig. 1A). If radiographs were found to be nondiagnostic, magnetic resonance imaging or a magnetic resonance arthrogram was used to confirm diagnosis (Fig. 1B). Patients were excluded from the study if they

Figure 2. Postoperative posterioanterior and lateral radiographs 4.5 years following suture repair through bone tunnels and dorsal capsulodesis.

had a concomitant carpal or radius fracture, an additional complete carpal ligamentous injury, or evidence of SLAC wrist arthrosis prior to SLL repair.

Scapholunate ligament repairs were performed as described previously.[20,21] The SLL was repaired using bone anchors (Mini Mitek QUICKANCHOR, Depuy Synthes, or Arthrex FasTac 2.4-mm suture anchor) with attached nonabsorbable sutures, and 1.4 mm (0.045 in) Kirschner wires stabilized the scapholunate and scaphocapitate joints for 6 to 8 weeks following ligament repair. In all cases, the scapholunate (SL) interval was easily reducible and adequate ligamentous tissue was available for ligament repair. The augmentation capsulodesis was performed according to the surgeon's preference using the technique described by Blatt.[22–24] Patients were immobilized using a below-elbow fiberglass thumb spica cast until Kirschner wire removal. Following removal of the retained Kirschner wires, patients began a graduated occupational therapy protocol and maintained weight-bearing precautions through use of a removable thumb spica splint. By 10 to 12 weeks after surgery, all patients underwent progression of their occupational therapy to a strengthening protocol and gradually resumed all unrestricted functional activity.

Forty patients met the inclusion criteria. Each patient was contacted by telephone and offered study participation beginning in February 2014. Of the 40 eligible patients, 24 (12 acute repairs, 12 subacute repairs) agreed to return for a follow-up examination and to participate in the study. All 24 patients had static scapholunate dissociation and were classified as stages 2, 3, or 4 using the Garcia-Elias Staging of SLL instability scale. Patients presented for study-related clinical and radiographic evaluations from March 2014 to December 2014.

Prior to presenting for study evaluations, pertinent demographic data—including age, sex, handedness, injured extremity, time from injury to surgery, length of patient follow-up, and whether the patient underwent capsulodesis at the time of the SLL repair—were recorded from medical records. All 24 participants were found to have static scapholunate dissociation and were classified as stages 2, 3, or 4 using the Garcia-Elias Staging of SLL instability scale.[25]

Physical and radiographic evaluations were performed by 2 blinded, independent examiners (R.E.C. and D.A.O.). Posteroanterior and lateral radiographs were obtained from the patient's affected side according to previously described techniques and adhering to standard radiology protocols (Fig. 2). Preoperative and final radiographs were deidentified prior to review by a hand fellowship–trained surgeon (D.A.O.). Radiographic parameters, including the SL gap and SL angle, were measured as described by Larsen et al.[26]

Physical examinations included assessments of the wrist range of motion and strength testing. A medical goniometer (Jamar) was used to assess wrist flexion, extension, pronation, supination, radial deviation, and ulnar deviation. Grip and pinch strengths were tested using hydraulic dynamometers (Grip and Pinch Dynamometer, Jamar). Each patient completed self-administered validated patient-rated outcome measures (PROMs), including the Michigan Hand Questionnaire, Visual Analog Scores for function and pain, and the Short Form 12 Physical and Mental Health Composite Scores.

Data analysis

All data were collected and managed using Research Electronic Data Capture tools (http://project-redcap.org/). Individuals were categorized based on the time from injury to surgery and were placed into either the acute surgery group (<6 weeks from injury) or subacute surgery group (6–12 weeks from injury). Descriptive statistics were used to compare outcomes between the 2 groups. Continuous variables were analyzed using either a 2-tailed independent Student *t* test or a Mann-Whitney U test, according to data distribution. Pearson's χ^2 test was used to compare categorical variables. A *P* value of less than .05 was the threshold for rejection of the null hypothesis. The minimal clinically relevant difference in Michigan Hand Questionnaire activities of daily living and the Visual Analog Scores were adopted from previously published reports.[27,28]

Data on the surgical subgroups, in which patients underwent either SLL repair or SLL repair and capsulodesis, were compared in the acute surgery and subacute surgery groups. Because of the small number of patients within each subgroup, additional statistical analyses were not performed.

Results

The acute repair group and the subacute repair group were similar in age, sex, injury to dominant extremity, and time from surgery to final follow-up (Table 1). The acute repair group

Table 1
Preoperative Cohort Demographics and Clinical Characteristics*

Demographics and Characteristics	Acute SLL Repair, <6 Wk	Subacute SLL Repair, 6–12 Wk
Number of patients	12	12
Age, y	52 (35–67)	51 (18–61)
Sex, male	67%	67%
Handedness, right	92%	92%
Injured extremity, right	58%	67%
Injury to surgery, d	22 (3–38)	64 (45–90)
Follow-up time, y	7.2 (5.2–17.3)	6.2 (4.0–13.3)
SLL repair with capsulodesis, yes	75%	58%

* Values within the parentheses are ranges.

Table 2
Preoperative Demographics of Participating and Nonparticipating Patients*

Demographics	Participating	Nonparticipating	*P* Value
Number of patients	24 (100%)	16 (100%)	
Age, y	52 (38–67)	44 (23–68)	.02
Sex, male	16 (67%)	16 (100%)	.01
Handedness, right	22 (92%)	14 (88%)	.67
Injured dominant extremity	17 (71%)	16 (100%)	.02
Injury to surgery, d	43 (3–90)	37 (23–74)	.42
Follow-up time, y	6.7 (4.0–17.3)	7.0 (2.23–14.6)	.81
SLL repair with capsulodesis, yes	16 (67%)	7 (44%)	.15

* Values within the parentheses are ranges.

underwent surgery at a mean of 22 days after injury, as compared to 64 days in the subacute group. Nine of 12 patients in the acute repair group underwent concomitant capsulodesis, versus 7 of 12 patients in the subacute repair group.

Patients in the acute and subacute repair groups underwent the final follow-up at means of 7.2 years and 6.2 years, respectively. Relative to nonparticipating patients, study subjects were chronologically older, more often female, and more commonly sustained injury to the dominant extremity ($P < .05$; Table 2).

Patients who underwent surgery in the acute time period demonstrated greater wrist extension compared to those who underwent surgery in the subacute time period (55° vs 47°; $P = .02$; Table 3). All other measures of range of motion, strength, and PROMs (Table 4) were found to be similar between the 2 groups ($P > .05$). Similarly, the ranges of motion and PROMs were similar between patients who underwent SLL repair without augmentation compared to those who underwent SLL repair with capsulodesis (Tables 3 and 4).

Radiographic evidence of a scapholunate advance collapse occurred in 4 of 24 patients (1 in the acute surgery group and 3 in the subacute surgery group). The patient in the acute treatment group was asymptomatic. Of the 3 patients in the subacute surgery group with radiographic arthritis, 2 were symptomatic and underwent scaphoidectomy with intercarpal arthrodesis prior to this study at 8 months and 2.5 years following the initial surgery. These 2 patients were similar in in age, work status, smoking status, and preoperative range of motion to the other members of the cohort and were initially treated with SLL repair alone and SLL repair with supplementary capsulodesis (Table 5).

Of the 22 patients who did not undergo subsequent salvage procedures, a final radiographic examination revealed that the scapholunate angles and scapholunate gaps were similar between groups and within groups before and after surgery (Table 5).

Discussion

Prognostic data based on natural history and therapeutic data regarding the effect of treatment continue to be lacking for SLL injuries. A 2004 study based on a survey of the memberships of the American and Canadian Societies for Surgery of the Hand revealed that enthusiasm for repair of an SLL, with or without capsulodesis, after 6 weeks from injury decreases among those physicians most likely to treat these injuries.[3] In that survey, SLL repair alone or SLL repair plus capsulodesis were the favored treatment options for treatment of acute SLL tear by 33% and 44%, respectively, of 468 hand surgeon respondents. In contrast, far fewer hand surgeons indicated that they would treat a chronic SLL tear with an SLL repair (2%) or an SLL repair plus capsulodesis (17%). The observed findings in this survey likely reflect conclusions drawn from a number of landmark studies on carpal instability that suggested impaired healing potential of the SLL after 4 to 6 weeks and poor outcomes following attempted reconstruction of chronic injuries.[4–8] Due to these previous findings, Larsen et al[6] created a classification system by which injury chronicity was given prognostic significance for SLL injuries; in their study, 6 weeks was established as the time frame after which an injury was deemed to be “chronic.” To date, these recommendations have not been validated; nonetheless, this classification system continues to play an important role in treatment decision making.[29]

Despite concerns about the ability to restore the SLL in a chronic injury, prior studies have indicated some success with ligament repair.[16–18] Lavernia et al[16] studied 21 patients at 3 years of follow-up who had an SLL repair and capsulodesis at an average of 17 months after injury and found satisfactory results in terms of pain reduction, wrist motion (except palmar flexion), and radiographic findings. A similar study by Pomerance[17] (repairs occurred at a mean of 16 weeks from injury to surgery) concluded that scapholunate repair and capsulodesis had a role in chronic repair of patients who did not place a high demand on their wrists. This study corroborates these previous findings and may add further validity to the assertion that treatment of SLL tears with repair with or without capsulodesis beyond 6 weeks from the time of injury is a viable treatment option.

Similar to previous studies on outcomes following SLL repair (Table 6), patients who underwent an isolated SLL repair, as well as those who underwent an SLL repair with concomitant dorsal capsulodesis, were included in this study. Compared to previous studies, the final postoperative wrist flexion value among this cohort appears to be lower than what has been previously observed in some prior studies. Although 12° to 20° of loss of wrist flexion after capsulodesis has been reported in the literature after capsulodesis,[14,22,23,30] we are unable to determine whether there are specific reasons that wrist flexion was relatively low in our cohort.

The ability to fully evaluate the relative effects of the cointerventions (SLL repair and dorsal capsulodesis) is limited. The aim of this study was to investigate the effect of surgical timing (rather than surgical treatment) on outcomes following treatment of SLL tears. Although subgroup outcomes (SLL repair and SLL repair + capsulodesis) are presented, the ability to detect potential differences is restricted by the small number of patients within each subgroup (Tables 3–5).

An acute SLL injury was defined as an injury that occurred less than 6 weeks from injury. The authors agree with the assertion of Larsen et al[6] that 6 weeks is an arbitrary cutoff; it is not associated with a biological event that leads to a qualitative change within the ligament. Previous studies have found differences indicative of healing potential, including gene expression of cellular component organization, cellular localization, and extracellular matrix organization, between patients with chronic (>12 months) anterior cruciate ligament injuries and those with acute injuries (<3 months).[31,32] However, extrapolating these findings to SLL injuries

Table 3
Postoperative Physical Examination Findings of Injured Wrists*

Wrist Positions	Acute† SLL Repair, <6 Wk	Subacute† SLL Repair, 6–12 Wk	*P* Value
Wrist flexion, °	35 (10–43; 83%)	32 (5–52; 80%)‡	.55
SLL + Capsulodesis	35 (10–43; 83%)	30 (20–38; 79%)	.15
Wrist extension, °	55 (35–66; 87%)	47 (40–60; 77%)‡	.02
SLL + Capsulodesis	53 (35–65; 87%)	48 (40–60; 77%)	.15
Supination, °	81 (70–85; 99%)	82 (65–90; 95%)‡	.76
SLL + Capsulodesis	79 (70–85; 98%)	80 (65–90; 95%)	.91
Pronation, °	74 (70–90; 98%)	73 (70–90; 95%)‡	.67
SLL + Capsulodesis	75 (70–85; 96%)	74 (66–90; 94%)	.85
Radial deviation, °	15 (6–24; 101%)	17 (5–30; 103%)‡	.55
SLL + Capsulodesis	16 (6–24; 101%)	15 (7–19; 100%)	.82
Ulnar deviation, °	27 (16–40; 86%)	28 (22–37; 101%)‡	.71
SLL + Capsulodesis	26 (16–40; 86%)	29 (25–37; 102%)	.34
Grip strength, kg	38 (4–53; 98%)	39 (13–59; 90%)‡	.87
SLL + Capsulodesis	37 (4–53; 98%)	35 (13–50; 88%)	.86
Pinch strength, kg	9 (4–12; 101%)	10 (5–13; 90%)‡	.48
SLL + Capsulodesis	9 (4–11; 100%)	9 (5–12; 90%)	.94

* Values in parentheses are ranges and percentages of contralateral (uninjured) side findings.
† Outcomes are reported for all patients and then separately for the SLL + capsulodesis subgroups.
‡ Patients who underwent a salvage procedure are excluded from the comparison (n = 2).

Table 4
Postoperative Patient-Rated Outcomes*

Outcomes	Acute SLL Repair, <6 Wk	Subacute SLL Repair, 6–12 Wk	*P* Value
VAS function†	8 (6–10)	8 (7–10)‡	.82
SLL + Capsulodesis	8 (6–10)	9 (7–10)	.45
VAS pain§	1 (0–4)	2 (0–8)‡	.44
SLL + Capsulodesis	2 (0–4)	2 (0–4)	.55
SF12 PCS	50 (36–59)	45 (26–59)‡	.27
SLL + Capsulodesis	49 (36–59)	45 (31–55)	.50
SF12 MCS	55 (44–60)	52 (31–64)‡	.42
SLL + Capsulodesis	54 (44–60)	52 (31–55)	.08
MHQ ADL	90 (64–100)	87 (55–100)‡	.66
SLL + Capsulodesis	94 (76–100)	92 (71–100)	.65
MHQ total	89 (64–100)	79 (44–100)‡	.19
SLL + Capsulodesis	87 (64–100)	83 (56–100)	.62

ADL, activities of daily living; MCS, Mental Health Composite Score; MHQ, Michigan Hand Questionnaire; PCS, Pain Catastrophizing Scale; SF12, Short Form 12; VAS, Visual Analog Scores.
* Outcomes are reported for all patients and then separately for the SLL + capsulodesis subgroups.
† For VAS function scoring, 0 indicated no function and 10 indicated complete function.
‡ Patients who underwent a salvage procedure are excluded from the comparison (n = 10).
§ For VAS pain scoring, 0 indicated no pain and 10 indicated the worst imaginable pain.

Table 5
Radiographic Outcomes*

Outcomes	Acute SLL Repair, <6 Wk	Subacute SLL Repair, 6–12 Wk	*P* Value
Preoperative SLA, °	70 (62–87)	70 (62–87)	.98
SLL + Capsulodesis	69 (62–87)	71 (67–74)	
Preoperative SLG, mm	3.5 (2.1–6.5)	3.5 (2.0–5.0)	.89
SLL + Capsulodesis	3.6 (2.1–6.5)	4.0 (2.5–5.0)	
Final SLA, °	68 (45–80)	65 (51–74)†	.60
SLL + Capsulodesis	67 (45–80)	71 (62–74)	
Final SLG, mm	2.9 (1.5–4.0)	2.9 (1.8–5.1)	.97
SLL + Capsulodesis	2.9 (1.5–4.0)	3.0 (2.2–5.1)	
Progression to SLAC wrist, n	1 (Grade I)	3 (Grade I, II, III)	.27
SLL + Capsulodesis	1 (Grade I)	2 (Grade I, III)	
Salvage procedures, n	0	2 (Grade II, III)	.14
SLL + Capsulodesis	0	1 (Grade III)	

SLA, scapholunate angle; SLG, scapholunate gap.
* Outcomes are reported for all patients and then separately for the SLL + capsulodesis subgroups. Values within the parentheses are ranges.
† Patients who underwent salvage procedures are excluded from the comparison.

may be inappropriate due to differences in vascularization of the knee compared to the wrist and differences in definitions of acute and chronic injuries. Other issues that likely influence restoration of ligamentous integrity may include a generalized scar response resultant from the pinning during the SLL repair.

Long-term radiographic measures following SLL repair with or without capsulodesis were predicted by and similar to presurgery radiographic measures in this study. In 17 patients, at an average of 66 months after SLL repair and capsulodesis, Pomerance[17] reported comparable radiographic findings before and after surgery (2 mm

Table 6
Prior Studies Investigating Outcomes Following Treatment of Isolated SLL Repair (With or Without Capsulodesis)

Reference	Design	Sample Size	Age, Y (Range)	Procedure Type	Injury Type	Time From Injury (Range)	Follow-Up Time (Range)	Outcomes
Pomerance, 2006[17]	Retrospective	17	36 (18–54)	SLL Repair and Capsulodesis (17/17)	Dynamic (17/17)	22 wk (18–40 wk)	66 mo (19–120 mo)	Final Wrist Flexion/Extension: 50°/44° Preop/Final SLA: 49°/55° Preop/Final SLG: 3 mm/3 mm Final VAS Pain: 3/10 Final Grip Strength: 38 kg Final DASH: 31 (19–44) Degenerative Changes: 3/17 Secondary Salvage Procedures: 0/17
Lavernia et al, 1992[16]	Retrospective	21	Not reported (14–52)	SLL Repair (4/21) SLL Repair and Capsulodesis (14/21) Capsulodesis (13/21)	Unknown (Scaphoid Shift Positive in 12/21)	17 mo (1–84 mo)	33 mo (1–84 mo)	Final Wrist Flexion/Extension: 52°/NR Preop/Final SLA: 62°/57° Preop/Final SLG: 3.2 mm/ 1.9 mm Final Pain: minimal or absent: 19/21 Final Grip Strength: 35 kg Degenerative Changes: 3/21 Secondary Salvage Procedures: 0/21
Wyrick et al, 1998[19]	Retrospective	17	35 (19–51)	SLL Repair (4/17) SLL Repair and Capsulodesis (14/17)	Dynamic (17/17)	3 mo (3 d–16 mo)	30 mo (12–84 mo)	Final Wrist Flexion/Extension: 47°/44° Preop/Final SLA: 78°/72° Preop/Final SLG: 4 mm/ 3 mm Final Pain: pain at rest 7/17 Final Grip Strength: 71% opposite wrist Degenerative Changes: NR Secondary Salvage Procedures: 4/17
Bickert et al, 2000[20]	Retrospective	12	38 (24–55)	Arthroscopy/Open SLL Repair (12/12)	Dynamic (12/12)	6 wk (4 d–22 wk)	19 mo (8–27 mo)	Final Wrist Flexion/Extension: Total arc 78% opposite wrist Preop/Final SLA: NR/55° Preop/Final SLG: NR/3.2 mm Final VAS Pain 2.8 Final Grip Strength: 81% opposite wrist Final DASH: 21 Degenerative Changes: 1/12 Secondary Salvage Procedures: 1/12
Schweizer and Steiger, 2002[18]	Retrospective	22	46 (29–68)	SLL Repair and Capsulodesis (22/22)	Dynamic (7/22) Static (15/22)	6 mo (1–35 mo)	63 mo (12–134 mo)	Final Wrist Flexion/Extension: 58°/48° Preop/Final SLA: 65°/53° Preop/Final SLG: 2 mm/2.5 mm Final Pain minimal or absent: 19/21 Final Grip Strength: 49 kg Degenerative Changes: 6/22 Secondary Salvage Procedures: 0/22
Current Study	Retrospective	24	52 (35–67)	SLL Repair (8/24) SLL Repair and Capsulodesis (16/24)	Dynamic (24/24)	43 d (3–90 d)	80 mo (38–208 mo)	Final Wrist Flexion/Extension: 50°/48° Preop/Final SLA: 70°/67° Preop/Final SLG: 3.2 mm/3.5 mm Final VAS Pain: 1.5 Final Grip Strength: 39 kg Degenerative Changes: 4/24 Secondary Salvage Procedures: 2/24

DASH, Disabilities of the Arm, Shoulder, and Hand; NR, not recorded; SLA, scapholunate angle; SLG, scapholunate gap; VAS, Visual Analog Scores.

vs 3 mm SL gap, respectively; 49° vs 54° SL angle, respectively). Wyrick et al[19] performed a similar study with a 3-year follow-up and found that final radiographs were not significantly different than preoperative radiographic measures. Similar to findings described by previous authors, most patients in this cohort were doing well with regard to pain, general health, and upper extremity function at the final follow-up, regardless of the radiographic appearance. A comparison of outcomes between the subacute repair group and acute repair group, as well as the inclusion of only isolated, complete injuries to the SLL, may decrease the confounding effect of evaluating a heterogenous group of SLL tears containing both partial and complete injuries.[9,14] Although these findings may not be generalized to predynamic SLL instability and partial tears of the SLL, it is reasonable to assume that outcomes following treatment of lesser-severity SLL instability cases are likely to be equivalent to or better than those demonstrated in this investigation.

Of the 12 patients in the subacute repair group, 2 underwent intercarpal arthrodesis because of symptomatic SLAC wrist. While this did not represent a statistically significant result, concerns regarding statistical power limit the ability to determine whether a difference truly exists in the risk of radiographic SLAC wrist following acute or subacute surgery. Regardless, at a mean of 6.2 years, 83% of patients who underwent an SLL repair with or without capsulodesis beyond 6 weeks after injury had minimal pain, demonstrated a minimal difference in function compared to patients who underwent acute repair, and did not require salvage surgery. This may suggest that subacute SLL repair with or without capsulodesis is a viable treatment option and serves to reinforce the previously reported observation of a lack of correlation between clinical and radiographic outcomes following surgery for SLL tears.

There are several limitations in this study. Although the use of a standard protocol for obtaining radiographs decreases random variation in repeated measures, flaws in test reliability may have influenced the observed results and prevented the detection of between-group differences. The retrospective nature of the study suggests that there may be unmeasured patient factors in each group that influenced the observed results. Patients in this study were older on average than those in previous studies (Table 6); it is unclear whether the same conclusions would have been reached if the study population were younger. In addition, data on work exposure, a known predictor of surgical outcomes, were unavailble.[17] Only 60% of eligible subjects in this call-back study were enrolled; because 16 of the 40 eligible patients lack final follow-up data, the possibility exists for selection bias. In addition, the low enrollment rate inhibited the ability to detect minimal clinically important differences for the PROM variables. Four patients in this study (1 acute surgery group, 3 subacute surgery group) developed posttraumatic arthritis (SLAC wrist). It is possible that some of the patients who were eligible for study participation but who did not elect to participate in the study sought subsequent treatment elsewhere. However, concerns regarding selection bias are mitigated by the fact that outcomes reported in this study, including the proportion of patients who went on to develop degenerative changes following treatment of an SLL tear, were similar to outcomes reported previously (Table 6). The strict inclusion criteria increase homogeneity between group comparisons; as a result, this study's groups were relatively small. In this limited data set, the chance of a type 2 statistical error exists. In the face of a limited study population, data were examined for differences that could be considered clinically relevant; however, even with this perspective, the data demonstrate limited evidence of meaningful differences between groups. Although wrist extension among the acute surgery group was statistically greater than that among the subacute group (55° vs 47°, respectively; $P = .02$), the magnitude of the between-group difference in wrist motion is unlikely to be clinically significant. Preoperative patient-rated outcome scores and patient work exposure information were unavailable for all patients in this study. Future studies should consider the effects these may have on surgical outcomes. As is true in any clinical or research-related assessment of SLL tears, the possibility exists that a patient presents with an acute exacerbation of a chronic injury, leading to recall bias and mischaracterization of the time since injury.

Despite these limitations, it is notable that the radiographic findings and clinical results were similar in the acute and subacute groups at over 5 years after surgery. Although 2 patients in the subacute repair group eventually elected to have intercarpal arthrodesis for SLAC wrist, the data indicate a relatively low (17%) incidence of subacute SLL repair failure. A multicenter, prospective study would best enroll a larger number of patients, better test the implication of time to repair of the SLL, and is necessary to validate the findings of this investigation.

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