ORIGINAL STUDY — HAND & WRIST

acta orthopaedica belgica, 2024, 90, 239-251

doi.org/10.52628/90.2.12790

# Surgical repair of posttraumatic injuries of the scapholunate ligament: A literature study

T. DE SCHEPPER[1] , J. BATSELIER[1], N. HOLLEVOET[2]

*[1]Student 3th year in Master of Medicine, University of Ghent; [2]Prof. Dr., Orthopedics and Traumatology, Universitair Ziekenhuis Gent, C. Heymanslaan 10, 9000 Gent, Belgium.*

Correspondence at: Thibault DE SCHEPPER, student 3th year in Master of Medicine, University of Ghent, Universitair Ziekenhuis Gent, C. Heymanslaan 10, 9000 Gent, Belgium. Email: Thibault.DeSchepper@UGent.be

***Background and research aims:*** **Scapholunate interosseous ligament rupture can cause wrist issues like pain, strength loss, and cartilage degeneration. While various surgical treatments exist, it's unclear which method is optimal. This study aims to determine the superior treatment approach for scapholunate dissociation. Methods: In Pubmed, Embase, Scopus and Web of Science was searched for articles reporting results of surgical repair of scapholunate dissociation. Additional inclusion criteria were English- and Dutch-language articles published between January 2000 and December 2022 with at least 8 patients and at least 1 year of follow-up. Results: Seventeen articles were included, 9 covered tenodesis repair, 2 focused on capsulodesis, 3 on direct scapholunate ligament repair using bone anchors, and 3 on a combination of tenodesis and capsulodesis. No difference could be found between the types of surgical techniques in wrist mobility and grip strength. The Disability of Arm, Shoulder, and Hand score, Visual Analogue Scale for pain and Mayo wrist scores showed no clinically relevant difference. With all methods, normal radiological values were obtained after surgery. The mean scapholunate angle was less than 60° and the scapholunate gap less than 3 mm. However, at longer follow-up an increase in this angle and gap was seen again. Discussion: This review did not allow to conclude that one technique was better than another to treat scapholunate dissociation because of poor quality of the included studies. Pre- and postoperative values were not always reported, there were insufficient comparative studies, and randomized prospective studies were missing.**

**Keywords:** Posttraumatic scapholunate dissociation, Scapholunate ligament, Surgery, Tenodesis, Capsulodesis, Bone anchor.

## INTRODUCTION

Scapholunate dissociation (SLD) is one of the most common forms of carpal malalignment, resulting from the rupture of the scapholunate (SL) ligament[1,2]. This injury typically occurs due to a fall on an outstretched hand with the wrist in extension, ulnar deviation, and intercarpal supination[1,3-5]. Rupture of the SL ligament may also occur during a fracture of the distal radius or the scaphoid bone[6]. The SL joint plays a crucial role in the mobility of the carpal bones[3]. The SL ligament, being C-shaped, with its dorsal part being the strongest and thickest, controls torsional and translational movements. Various extrinsic ligaments act as secondary stabilizers of this SL joint[1,3]. Untreated SLD eventually leads to carpal arthritis[6].

Clinically, SLD may manifest as a painful click dorsoradially in the wrist caused by subluxation of the proximal scaphoid over the dorsolateral edge of the radius[3]. Other symptoms include wrist stiffness and weakness[7]. Radiologically, standard anteroposterior wrist X-rays may reveal a cortical ring sign, a SL gap of more than 3 mm, and an SL angle of more than 60°. Not all SLD cases can be detected on standard wrist X-rays, sometimes they only become visible during stress imaging of the wrist[8].

The goal of treating SLD is to restore normal scaphoid kinematics, enhancing wrist strength and mobility while reducing pain[9,10]. Additionally, efforts aim to slow down or prevent the progression of carpal degeneration, also known as scapholunate advanced collapse (SLAC)[8]. Surgical techniques to restore SLD can be categorized into four groups: tenodesis, capsulodesis, primary SL ligament repair (e.g. with a bone anchor), and hybrid techniques. Tenodesis involves using a tendon to reconstruct

the function of the SL ligament[6,9-18]. Variations exist based on the tendon used and the methods employed: modified Brunelli[11,14-16], 3-ligament tenodesis[9], scapholunotriquetral (SLT)-tenodesis[17], and 4-bone-ligament reconstructions[18] are a few examples of numerous options. Capsulodesis involves using the dorsal intercarpal joint capsule to reinforce the dorsal part of the SL ligament. Mayo capsulodesis and Blatt capsulodesis are examples of this method[19]. While primary SL ligament repair with bone anchors is possible, it's recommended to perform primary repair within 4 weeks of the rupture due to rapid ligament degeneration[5]. Hybrid techniques mostly combine tenodesis and capsulodesis[20].

Currently, there is no consensus on the best surgical method to treat SLD[20]. The aim of this study was to review published articles on the outcomes of operative SLD treatment between 2000 and 2022, attempting to determine if a particular surgical technique was superior to others.

## MATERIALS AND METHODS

The literature search was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[21]. This was independently performed by two reviewers (T.D.S. and J.B.). The inclusion criteria were articles reporting results of surgical treatment for post-traumatic SLD, both acute and chronic, published from the year 2000 onward, with an average follow-up time of at least 1 year, surgeries performed in the absence of arthritis/SLAC, and articles in English or Dutch. The last literature screening for relevant publications was conducted on 19/12/2022. Exclusion criteria comprised salvage operations (arthrodesis, carpectomy), cadaver studies, studies with fewer than 8 patients, non-traumatic SLD, and the presence of arthritis/SLAC. Reviews were also excluded from our analysis. Additionally, articles solely describing the surgical technique without presenting results were excluded.

Searches were conducted in the databases of Pubmed, Embase, Scopus, and Web of Science using various keywords: "Treatment", "traumatic SLD surgery", "Four bone ligament reconstruction SLD", "Extensor carpi radialis longus SLD", "Three ligament tenodesis ", "acute SLD" and "Modified Brunelli SLD" . The systematic literature review by Athlani et al.[22] was also searched for articles.

The quality of the included studies was assessed using the Modified Coleman Score (MCS)[23] and the Journal Impact Factor according to Web of Science[24], independently evaluated by both reviewers (J.B. and T.D.S.) Discrepancies in scores were resolved through consensus. The MCS ranges from 0 to 100, with higher scores reflecting higher article quality (85-100: excellent score, 70-84: good score, 55-69: fair score, <55: poor score)[23].

Initially clinical outcomes were reviewed in the included articles including wrist mobility and grip strength. The results also included functional scores such as the Disability of Arm, Shoulder, and Hand score (DASH) score, QuickDASH score, the Mayo wrist score and the Visual Analogue Scale (VAS) for pain. The DASH questionnaire is an instrument developed as a measure of upper limb impairments and symptoms. The questionnaire consists of a disability/symptom scale of 30 items, scored from 0 (no disability) to 100 (complete disability). The lower the score, the better[25]. The QuickDASH questionnaire is a shortened version and looks at only 11 items instead of 30[26]. The Mayo Wrist score is a scoring system used to evaluate the degree of disability in the wrist. The following items were assessed: pain (25 points), active flexion/extension arc as a percentage of the contralateral side (25 points), grip strength as a percentage of the contralateral side (25 points) and the ability to return to daily work and activities (25 points). For the Mayo wrist score, the higher the score, the better. An excellent result is defined as 90-100 points, good is 80-89, fair is 65-79 points and poor is less than 65 points[27].

Secondly the radiological results were analysed. The most important parameters are the SL angle and the SL distance. Normal values of SL angle ranged between 30° and 60°[28]. The SL distance was measured as the distance between the os lunatum and the os scaphoideum on anteroposterior wrist radiographs. The normal value of this parameter in adults is less than 2 mm with a value of more than 3 mm being suggestive of SLD[29]. Finally, the reported postoperative complications with the different techniques were described.

Statistical methods were the One-Way ANOVA test and the unpaired student's t-test to determine the difference in outcome between the four different techniques. In this statistical analysis, the reported, postoperative outcomes for each surgical technique were divided by the number of studies for each technique and whether these distributions were significantly different. This did not take into account the number of patients per study as individual results per patient were rarely reported. These tests could

only be performed for the variables wrist flexion, wrist extension, grip strength and VAS pain score because other parameters were insufficiently reported.

## RESULTS

The search process is detailed in the PRISMA flowchart (Fig. 1). Seventeen articles met the criteria and were included in the literature review. Table I provides an overview of these studies, detailing the surgical technique used, number of patients, and follow-up duration. The average MCS score (see Table II) of the included studies was 46 (ranging from 26 to 59), indicating moderate quality. The average follow-up period was 60 months, and the average age of patients was 40 years. Most studies had a relatively low number of patients, except for one with 117 patients[14].

The average results of clinical, radiological, functional, and pain parameters are summarized in Tables III and IV. Wrist mobility results are depicted in Figure 2, while grip strength results are in Figure 3. Among the findings, postoperative wrist mobility decreased in both tenodesis and capsulodesis techniques. There were 8 articles that mentioned the DASH and 4 that mentioned the QuickDASH score. In tenodesis, the preoperative (Quick)DASH value

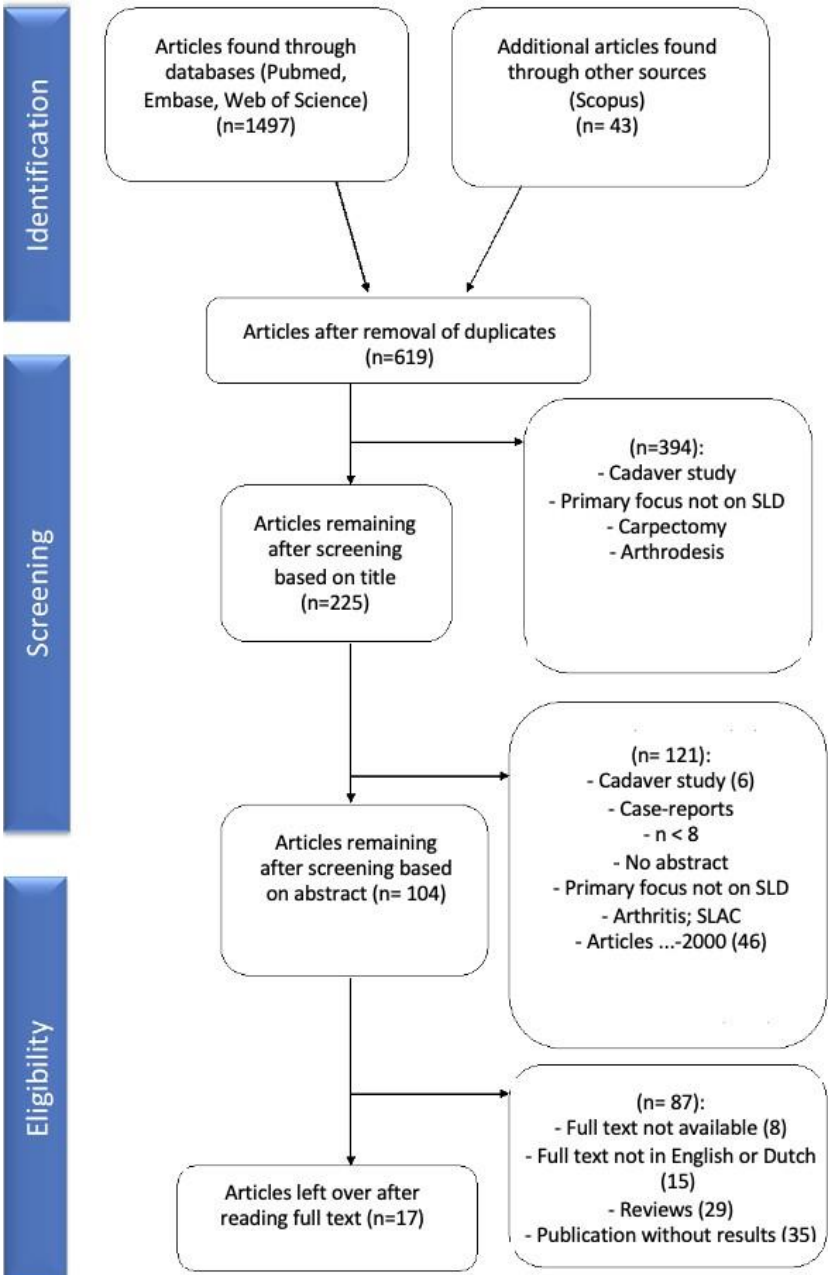


*Fig. 1 — PRISMA flowchart.*

**Table I.** — Descriptive table.

| | Technique | n | Mean follow-up (months) | Mean age (years) |
|---|---|---|---|---|
| Tenodesis | | | | |
| Bain et al. | "Quad Ligament"-Tenodesis with FCR-tendon | 8 (8 ♂) | 24 | 50 |
| Chabas et al. | Modified Brunelli-tenodesis with FCR-tendon | 19 (16 ♂ en 3 ♀) | 37 | 43 |
| Kakar et al. | Tenodesis with PL-tendon or allogeneic plantaris-tendon | 9 (8 ♂ en 1 ♀) | 34 | 44 |
| Kaltenborn et al. | Tenodesis with ECRL-tendon | 45 | 24 | 28,5 (median) |
| Links et al. | Modified Brunelli-tenodesis with FCR-tendon (n=21)<br>4-bone tendon weave (4BTW) with ECRL-tendon (n=23) | 21 (15 ♂ en 6 ♀)<br>23 (17 ♂ en 6 ♀) | 29<br>29 | 30<br>29 |
| Nienstedt et al. | Modified Brunelli-tenodesis with FCR-tendon | 8 (7 ♂ en 1 ♀) | 166 | 40 |
| Ross et al. | Scapholunotriquetral (SLT)-tenodesis with FCR-tendon | 11 (9 ♂ en 2 ♀) | 14 | 36 |
| Seradge et al. | Tenodesis with ECRL- & FCR-tendon (Dynadesis) | 20 (15 ♂ en 5 ♀) | 240 | 42 |
| Talwalkar et al. | Modified Brunelli-tenodesis with FCR-tendon | 117 (50 ♂ en 67 ♀) | 48 | 38 |
| Capsulodesis | | | | |
| Gajendran et al. | Dorsal capsulodesis | 15 (12 ♂ en 3 ♀) | 86 | 42 |
| Pomerance et al. | Dorsal capsulodesis | 17 (12 ♂ en 5 ♀) | 66 | 36 |
| Primary repair with bone anchor | | | | |
| Bickert et al. | | 12 (12 ♂) | 19 | 38 |
| Minami et al. | | 17 (17 ♂ en 0 ♀) | 49 | 33 |
| Rosati et al. | | 18 (16 ♂ en 2 ♀) | 32 | 34 |
| Hybrid | | | | |
| Carvalho et al. | Tenodesis with PL-tendon + dorsal capsulodesis | 14 (9 ♂ en 5 ♀) | 12 | 38 |
| De Carli et al. | Tenodesis with ECRL-tendon + Mayo-capsulodesis | 20 (17 ♂ en 3 ♀) | 67 | 40 |
| Papado-georgou et al. | Ligamentoplastie with ECRB-tendon + dorsal capsulodesis | 32 (23 ♂ en 9 ♀) | 50 | 39 |

n = number of patients, FCR: flexor carpi radialis, PL: palmaris longus, ECRL: extensor carpi radialis longus, SLIL: scapholunate interosseus ligament, ECRB: extensor carpi radialis brevis; SLT: scapholunotriquetral.

ranged from 54 to 78 and decreased postoperatively by a minimum of 22 to a maximum of 53 points. The Mayo wrist score was determined in only 6 out of 17 studies. Kakar et al[13] was the only study to report both pre- and postoperative results. The mean values increased from 44 to 80. For the VAS pain score, 9 studies reported both pre- and postoperative values and these decreased in each of these studies except Pomerance et al[30]. A graph showing the values of the SL angle in the different studies was shown in Figure 4 and the results of the SL distance in Figure 5.

Postoperatively, wrist mobility was reduced in both tenodesis and capsulodesis. However, the hybrid technique by Papadogeorgou et al.[31] showed increased wrist mobility. Differences were observed in average wrist extension between techniques, with tenodesis having an average of 50° and hybrid techniques showing 65° (p=0.03). There was no difference in wrist flexion among the surgical methods (p=0.9). Grip strength improved postoperatively in both tenodesis and capsulodesis. Postoperative changes in grip strength for primary repair with bone anchors and hybrid techniques could not be evaluated due to lacking preoperative values. No statistically significant difference was found between the techniques for grip strength (p=0.61). Overall, all techniques showed good postoperative results for (Quick)DASH, Mayo wrist, and VAS pain scores. No significant differences were found between the techniques for the VAS pain score (p=0.48). In the included studies, a reduction in SL angle immediately postoperatively was usually seen below 60° to then rise back to preoperative values over time. Immediately postoperatively, the SL distance usually fell below 3 mm to rise again over time, as

**Table II.** — Quality control of articles according to modified Coleman Score/ Journal impact factor 2020.

| | Colemanscore | Web of science Journal | Type of article |
|---|---|---|---|
| Bain et al. | 42 | / | Prospective |
| Bickert et al. | 47 | 0.844 | Retrospective |
| Carvalho et al. | 59 | / | Prospective |
| Chabas et al. | 48 | 2.23 | Retrospective |
| De Carli et al. | 48 | / | Retrospective |
| Gajendran et al. | 50 | 2.23 | Retrospective |
| Kakar et al. | 42 | 5.082 | Retrospective |
| Kaltenborn et al. | 54 | 2.355 | Prospective |
| Links et al. | 43 | 2.230 | Retrospective |
| Minami et al. | 45 | / | Retrospective |
| Nienstedt et al. | 43 | 2.230 | Retrospective |
| Papadogeorgou et al. | 49 | 1.140 | Retrospective |
| Pomerance et al. | 43 | 2.230 | Retrospective |
| Rosati et al. | 26 | / | Retrospective |
| Ross et al. | 52 | / | Prospective |
| Seradge et al. | 38 | / | Retrospective |
| Talwalkar et al. | 55 | 0.844 | Retrospective |

did the SL angle. Figure 4 shows how the SL angle for the tenodesis and hybrid techniques were each well reduced immediately after surgery but increased again at later follow-up. Figure 5 shows the same for the SL distance for tenodesis and capsulodesis (see Fig. 5).

Complications included radial nerve neuropraxia, infection/inflammation (1.9%), persistent sensitivity at the incision site (1.9%), complex regional pain syndrome (CRPS) (2.7%), and eventual progression to osteoarthritis in 5.4% requiring additional surgery (salvage operations such as arthrodesis, proximal carpal row resection)[32].

## DISCUSSION

The average MCS of the included articles in this literature study was only 46, indicating low quality. Reported wrist mobility varied across studies. The average wrist extension of 65° with hybrid techniques[20,31,35] was better than the 50° with tenodesis (p=0.03). However, caution is warranted in interpreting these findings as only 2 out of 3 included studies on hybrid techniques reported wrist extension results. It's also uncertain if the difference between 50° and 65° is clinically significant. Some studies showed improved wrist mobility after tenodesis[10,13], while others reported a decrease postoperatively[15,17]. Most studies lacked preoperative values, hindering determination of the surgery's effect on wrist mobility. The two capsulodesis studies found a decline in wrist mobility[19,30]. Insufficient data were available for primary SL ligament suture to draw conclusions about mobility. Ligamentoplasty using the the extensor carpi radialis brevis tendon combined with dorsal capsulodesis yielded positive results regarding wrist mobility[31]. In an earlier literature study on surgical repair of SLD by Naqui et al.[33], better grip strength was found in the capsulodesis patient group compared to tenodesis. However, in our study, no statistically significant difference was observed in grip strength between the different surgical techniques. Postoperatively, grip strength improved in tenodesis studies, while one capsulodesis study[19] reported a decrease, and another[30] reported an increase. Insufficient results were available for primary suture and hybrid techniques to draw conclusions about grip strength. Radiological evaluation demonstrated that operative SLD repair initially reduced the SL angle and SL gap to less than 60° and 3 mm, respectively, but these corrections were not sustained long-term (see fig. 4 and 5). One capsulodesis study showed an average postoperative increase in the scapholunate angle from 49° to 55°[33]. Similarly, most studies reported good SL gap results, except for Bickert et al.[2], which reported a significant SL gap. Other studies by Rosati et al. and Minami et al.[5,34] simply mentioned "no gap" without further explanation.

This literature study addresses a known problem in the orthopedic field without a standard treatment protocol. There's debate about whether surgery is worthwhile and which technique to use[20,33]. The statistical analysis in this study remained relatively limited due to the small number of included articles per technique, low study populations, and frequent lack of reporting certain parameters. Additionally, no randomized controlled trials were found. It would be beneficial for results to be reported more uniformly across studies. Furthermore, all included studies had limitations in terms of study population size. Multicenter collaboration could offer a solution in this regard.

## CONCLUSION

This literature review compared the outcomes of four different surgical techniques (tenodesis, capsulodesis, primary suture, and a combination of capsulodesis and tenodesis) for restoring SLD. No significant differences were found between the techniques concerning clinical and radiological parameters, except for better postoperative wrist extension with hybrid techniques compared to tenodesis (65° versus 50°). The lack of evidence is attributed to the low quality of the studies and the absence of comparative studies or a control group.

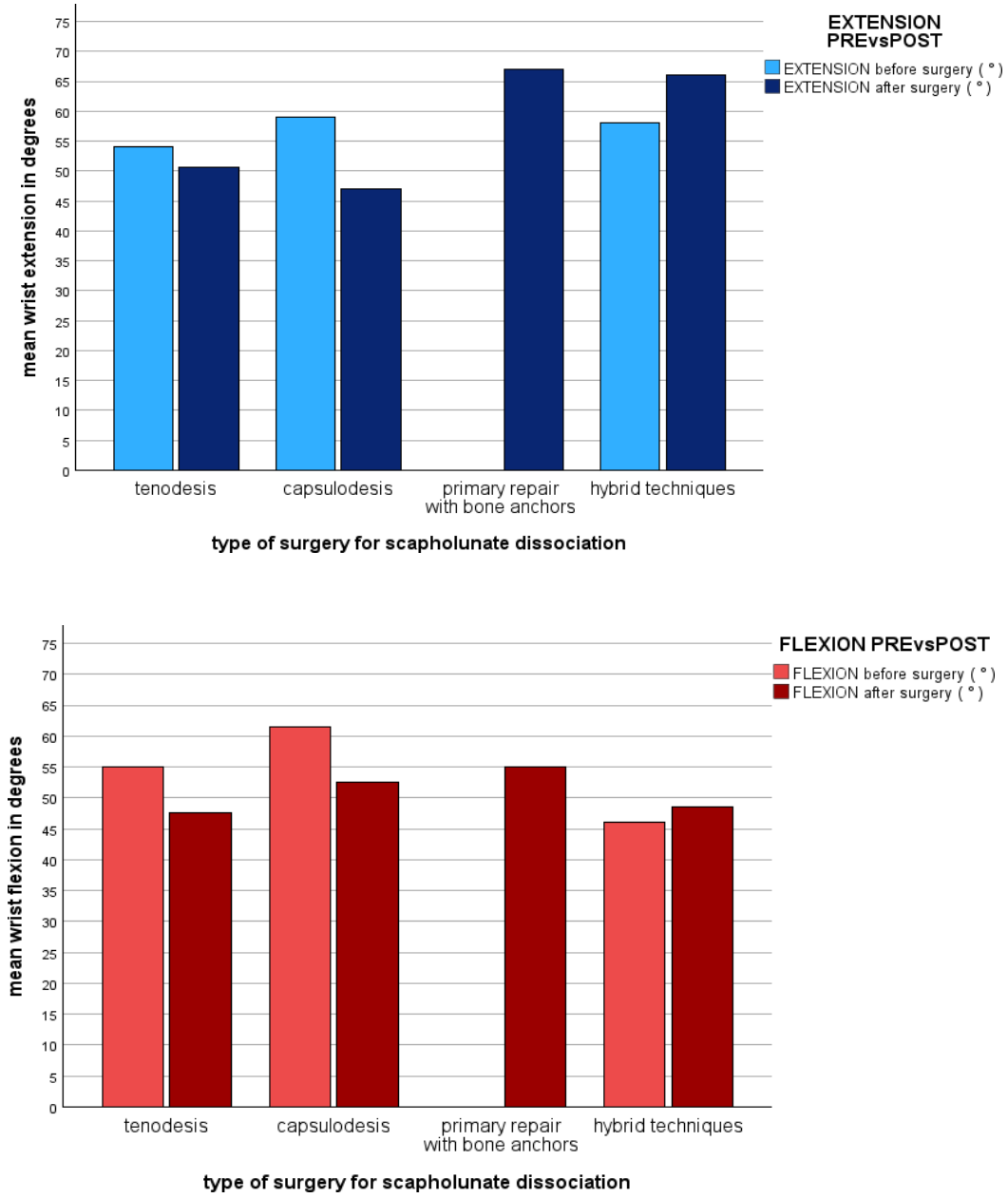


*Fig. 2 — Average pre- and postoperative wrist mobility by surgical technique to restore scapholunate dissociation.*

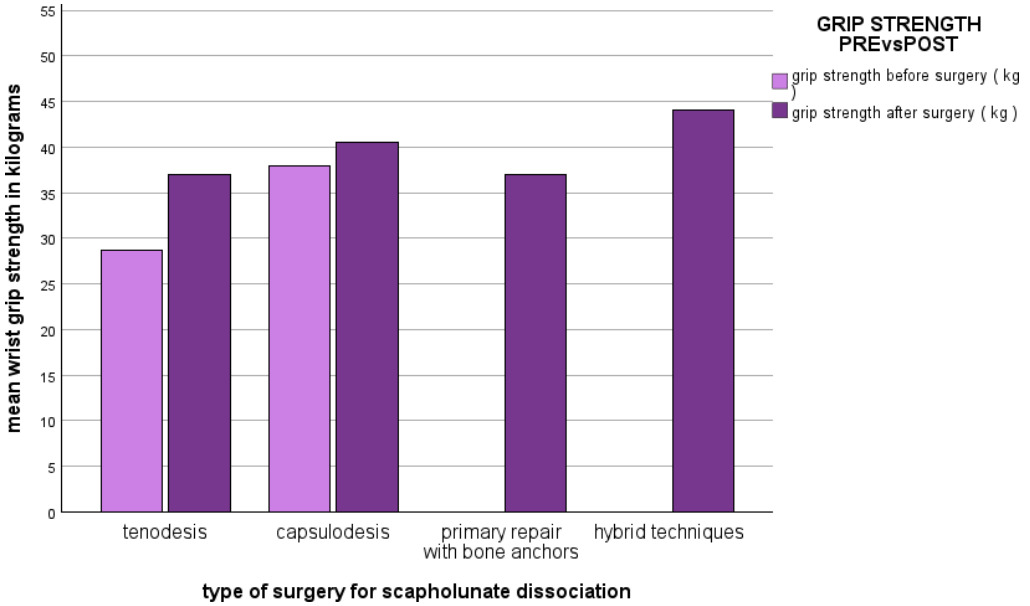


*Fig. 3 — Average pre- and postoperative grip force by surgical technique to restore scapholunate dissociation.*

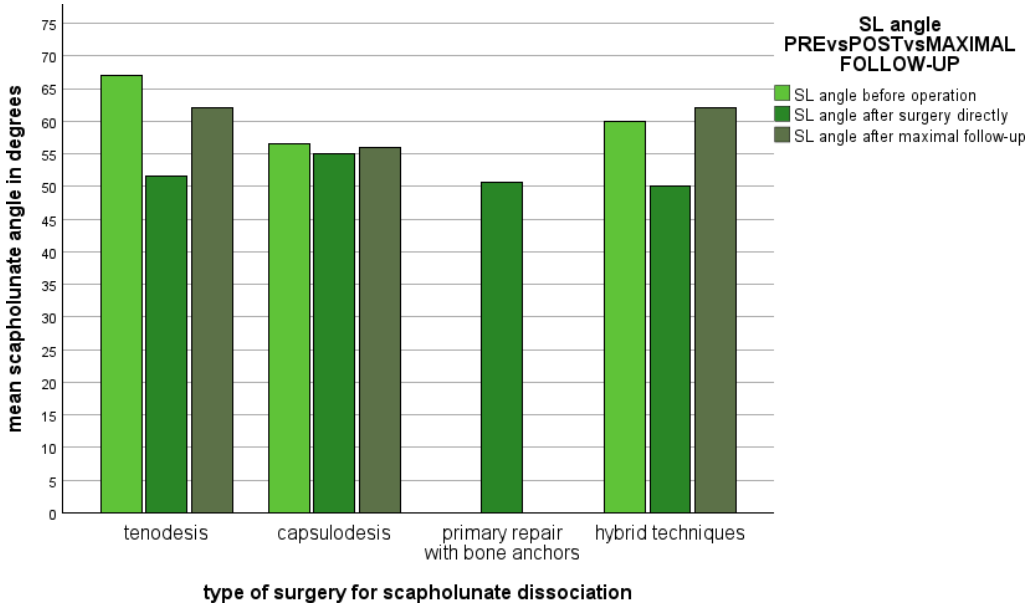


*Fig. 4 — Average scapholunate angle preoperatively, immediately postoperatively and at final follow-up by surgical technique to restore scapholunate dissociation.*

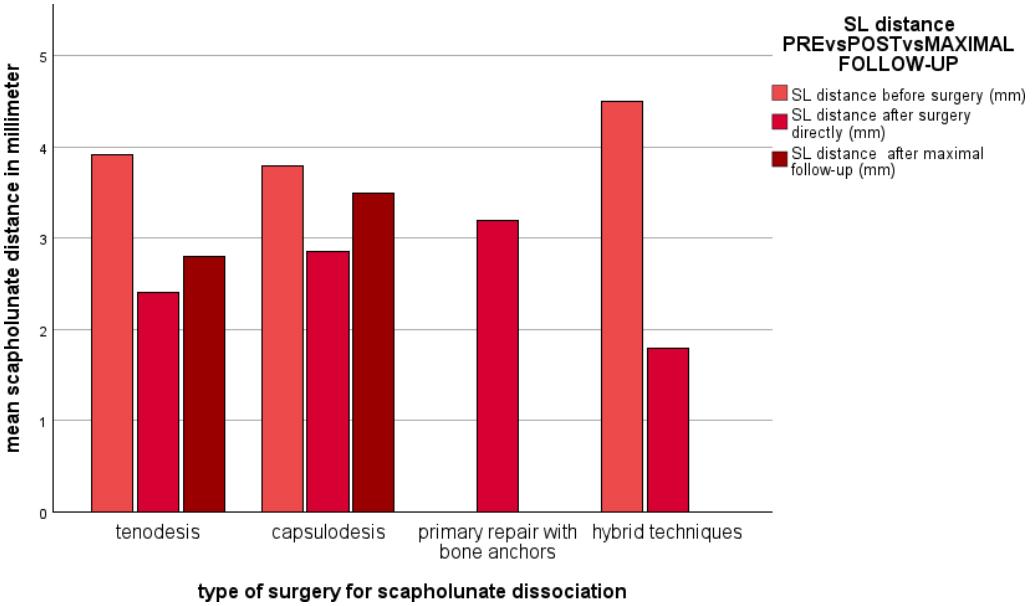


*Fig. 5 — Average scapholunate distance preoperatively, immediately postoperatively and at final follow-up by surgical technique to restore scapholunate dissociation..*

**Table III.** — Results (part 1).

| | | Average wrist mobility | | | Average grip strength | | | Average SL angle | | Average SL gap | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Pre-op** | **Post-op** | **Difference** | **Pre-op** | **Post-op** | **Difference** | **Pre-op** | **Post-op** | **Pre-op** | **Post-op** |
| **Tenodesis** | | | | | | | | | | | |
| Bain et al. | | Extension: 51°<br>Flexion: 48° | Extension: 56° (91% CL)<br>Flexion: 44° (70% CL) | +10%<br>-8% | / | 41 kg<br>(95% CL) | / | 71° (post-op) and after 6 months >71° in 7 of 8 patients | | 3 mm (post-op) and after 6 months >3 mm in 3 of 8 patients | |
| Chabas et al. | | / | Extension: 50° (73% CL)<br>Flexion: 41° (75% CL) | / | / | 78% CL | / | 61° | 53° and after 37 months 62° | 3 mm | 2 mm after 37 months |
| Kakar et al. | | Extension: 46°<br>Flexion: 46° | Extension: 47°<br>Flexion: 56° | +2%<br>+22% | 24 kg | 39 kg | +63% | 71° | 54° and after 34 months 57° | 5 mm | 2 mm and after 34 months 3 mm |
| Kaltenborn et al. | | / | Extension: 55,5°(81% CL)<br>Flexion: 65,5° (90% CL) | / | / | 30 kg<br>(68% CL) | / | / | / | / | / |
| Links et al. | Modified Brunelli | Extension: 61°<br>Flexion: 59° | Extension: 55° (85% CL)<br>Flexion: 45° (72% CL) | -10%<br>-24% | 30 kg | 41 kg<br>(98% CL) | +37% | 61° | 46° | 4 mm | 2 mm |
| | 4BTW | Extension: 61°<br>Flexion: 60° | Extension: 36° (57% CL)<br>Flexion: 27° (43% CL) | -41%<br>-55% | 30 kg | 34 kg<br>(84% CL) | +13% | 61° | 53° | 4 mm | 3 mm |
| Nienstedt et al. | | / | Extension: 63° (81% CL)<br>Flexion: 37° (52% CL) | / | / | 44 kg<br>(85% CL) | / | 72° | 46° and after 166 months 63° | 5 mm | 2 mm and after 166 months 3 mm |
| Ross et al. | | Flexion-extension arc: 130° | Flexion-extension arc: 102° | -21% | 37,4 kg | 44 kg | +18% | 81° | 57° after 14 months | 4 mm | 2 mm after 14 months |
| Seradge et al. | | Extension: 51°<br>Flexion: 62° | Extension: 55°<br>Flexion: 55° | +8%<br>-11% | 22 kg | 30 kg | +36% | 58° | 49° after 20 years | 4 mm | 2 mm after 20 years |
| Talwalkar et al. | | / | Flexion-extension arc: 74% CL | / | / | 80% CL | / | / | / | / | / |

**Table III.** — Results (part 1 bis).

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Capsulodesis** | | | | | | | | | | |
| Gajendran et al. (n pre-op = 22) (n post-op = 16) | Extension: 62° Flexion: 66° | Extension: 50° Flexion: 55° | -19% -17% | 45 kg | 43 kg after 86 months | -4,4% | 64° | 56° after 25 month (n=22) and 62° after 86 months (n=16) | 4,6 mm | 2,7 mm after 25 months (n=22) and 3,5 mm after 86 months (n=16) |
| Pomerance et al. | Extension: 56° Flexion: 57° | Extension: 44° Flexion: 50° | -21% -12% | 31 kg | 38 kg (82% CL) | +22,5% | 49° | 55° | 3 mm | 3 mm |
| **Primary repair with bone anchor** | | | | | | | | | | |
| Bickert et al. | / | 78% CL | / | / | 81% CL | / | / | 55° | 3,2 mm (post-op) (5 patients: <3 mm; 4 patients: 3-4 mm; 1 patient: >5 mm; 2 patients: /) | |
| Minami et al. | / | Extension: 67° (87% CL) Flexion: 55° (70% CL) | / | / | 37 kg (88% CL) | / | / | 49° | / | "no gap" |
| Rosati et al. | / | / | / | / | / | / | / | 48° | / | 1 patient with "no gap"; 2 patients with 3 mm |
| **Hybrid** | | | | | | | | | | |
| Carvalho et al. | 331° | 321° (96,9% CL) | -3% | / | / | / | / | / | 4,3 mm | 1,8 mm |
| De Carli et al. | / | Extension: 62° (90% CL) Flexion: 55° (73% CL) | / | / | 44 kg (92% CL) | / | 60° | 50° and after 67 months 62° | 5 mm | 2 mm and after 67 months 2 mm |
| Papadogeorgou et al. | Extension: 58° Flexion: 46° | Extension: 70° Flexion: 42° | +216% -9% | 48% CL | 86% CL | / | / | / | / | / |

CL = compared to the contralateral side; ~ = mean; / = not mentioned; 4BTW = Four Bone Tendon Wave, pre-op: preoperative, post-op: postoperative

**Table IV.** — Results (part 2).

| | | Mean (Quick)DASH-score (at 100) | | Mean Mayo-score (at 100) | | Mean VAS pain score (at 100) | |
|---|---|---|---|---|---|---|---|
| | | **Pre-op** | **Post-op** | **Pre-op** | **Post-op** | **Pre-op** | **Post-op** |
| **Tenodesis** | | | | | | | |
| Bain et al. | | / | / | / | / | 58 | 21 |
| Chabas et al. | | / | 30 (DASH) | / | / | 75 | 30 |
| Kakar et al. | | 54 (QuickDASH) | 12 (QuickDASH) | 44 | 80 | 70 | 10 |
| Kaltenborn et al. | | 55 (median) (QuickDASH) | 28 (median) (QuickDASH) | / | / | / | / |
| Links et al. | Mod. Brunelli | 78 (DASH) | 25 (DASH) | / | / | 69 | 20 |
| | 4BTW | 67 (DASH) | 45 (DASH) | / | / | 67 | 34 |
| Nienstedt et al. | | / | 9 (DASH) | / | 83 | / | / |
| Ross et al. | | 50 (QuickDASH) | 21 (QuickDASH) | / | / | 18 | 14 |
| Seradge et al. | | / | / | / | 89 | 78 | 8 |
| Talwalkar et al. | | / | / | / | / | / | 37 |

**Table IV.** — Results (part 2 bis).

| | | | | | | |
|---|---|---|---|---|---|---|
| **Capsulodesis** | | | | | | |
| Gajendran et al. | / | 19 (DASH) | / | 78 | / | / |
| Pomerance et al. | / | 31 (DASH) | / | 67 | 30 | 30 |
| **Primary repair with bone anchor** | | | | | | |
| Bickert et al. | / | 21 (DASH) | / | / | / | 28 |
| Minami et al. | / | / | / | / | / | / |
| Rosati et al. | / | / | / | 88,4 | / | / |
| **Hybrid** | | | | | | |
| Carvalho et al. | 1 (DASH) | 6,5 (DASH) | / | / | / | 18 |
| De Carli et al. | 38 (QuickDASH) | 8 (QuickDASH) | / | / | Rust: 34<br>Actief: 70 | Rust: 5<br>Actief: 17 |
| Papadogeorgou et al. | / | 22 (DASH) | / | / | / | / |

DASH = Disabilities of the Arm, Shoulder and Hand; VAS = Visual Analogue Scale; / = not mentioned; 4BTW = Four Bone Tendon Wave.

## REFERENCES


1. Ward PJ, Fowler JR. Scapholunate Ligament Tears: Acute Reconstructive Options. Orthop Clin North Am. 2015;46(4):551-9.
2. Bickert B, Sauerbier M, Germann G. Scapholunate ligament repair using the Mitek(TM) bone anchor. Technique and preliminary results. Journal of Hand Surgery. 2000;25 B (2):188- 92.
3. Chennagiri RJ, Lindau TR. Assessment of scapholunate instability and review of evidence for management in the absence of arthritis. J Hand Surg Eur Vol. 2013;38(7):727-38.
4. Andersson JK, Garcia-Elias M. Dorsal scapholunate ligament injury: a classification of clinical forms. Journal of Hand Surgery-European Volume. 2013;38E(2):165-9.
5. Rosati M, Parchi P, Cacianti M, Poggetti A, Lisanti M. Treatment of acute scapholunate ligament injuries with bone anchor. Musculoskelet Surg. 2010;94(1):25-32.
6. Kaltenborn A, Hoffmann S, Settje A, Vogt PM, Gutcke A, Rüttermann M. Modified minimally invasive extensor carpi radialis longus tenodesis for scapholunate dissociation: a prospective observational study. BMC Musculoskelet Disord. 2017;18(1):54.
7. Laulan J, Marteau E, Bacle G. Wrist osteoarthritis. Orthop Traumatol Surg Res. 2015;101(1 Suppl):S1-9.
8. Baxamusa TH, Williams CS. Capsulodesis of the wrist for scapholunate dissociation. Tech Hand Up Extrem Surg. 2005;9(1):35-41.
9. Garcia-Elias M, Lluch AL, Stanley JK. Three-ligament tenodesis for the treatment of scapholunate dissociation: indications and surgical technique. J Hand Surg Am. 2006;31(1):125
10. Seradge H, Parker W, Seradge C, Steppe C, McKenzie A. Dynadesis for Treatment of Dynamic Scaphoid Instability with 20-Year Results. J Wrist Surg.
11. Nienstedt F. Treatment of Static Scapholunate Instability With Modified Brunelli Tenodesis: Results Over 10 Years. Journal of Hand Surgery-American Volume. 2013;38A(5):887-92.
12. Bleuler P, hafighi M, Donati OF, Gurunluoglu R, Constantinescu MA. Dynamic repair of scapholunate dissociation with dorsal extensor carpi radialis longus tenodesis. J Hand Surg Am. 2008;33(2):281-4.
13. Kakar S, Logli AL, Ramazanian T, Gaston RG, Fowler JI. Scapholunate ligament 360 degrees procedure A PRELIMINARY OUTCOME REPORT. Bone & Joint Journal. 2021;103B(5):939-45.
14. Talwalkar SC, Edwards ATJ, Hayton MJ, Stilwell JH, Trail IA, Stanley JK. Results of tri-ligament tenodesis: A modified brunelli procedure in the management of scapholunate instability. Journal of Hand Surgery. 2006;31(1):110-7.
15. Links AC, Chin SH, Waitayawinyu T, Trumble TE. Scapholunate interosseous ligament reconstruction: results with a modified Brunelli technique versus four-bone weave. J Hand Surg Am. 2008;33(6):850-6
16. Chabas JF, Gay A, Valenti D, Guinard D, Legre R. Results of the Modified Brunelli Tenodesis for Treatment of Scapholunate Instability: A Retrospective Study of 19 Patients. Journal of Hand Surgery-American Volume. 2008;33A(9):1469-77.
17. Ross M, Loveridge J, Cutbush K, Couzens G. Scapholunate ligament reconstruction. J Wrist Surg. 2013;2(2):110-5.
18. Bain GI, Watts AC, McLean J, Lee YC, Eng K. Cable-Augmented, Quad Ligament Tenodesis Scapholunate Reconstruction. J Wrist Surg. 2015;4(4):246-51.
19. Gajendran VK, Peterson B, Slater Jr RR, Szabo RM. Long-Term Outcomes of Dorsal Intercarpal Ligament Capsulodesis for Chronic Scapholunate Dissociation. Journal of Hand Surgery. 2007;32(9):1323-33.
20. De Carli P, Donndorff AG, Torres MT, Boretto JG, Gallucci GL. Combined Tenodesis- Capsulodesis for Scapholunate Instability: Minimum 2-Year Follow-Up. J Wrist Surg. 2017;6(1):11-21.
21. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021
22. Athlani L, Pauchard N, Detammaecker R, Huguet S, Lombard J, Dap F, et al. Treatment of chronic scapholunate dissociation with tenodesis: A systematic review. Hand Surg Rehabil. 2018;37(2):65-76.
23. Coleman BD, Khan KM, Maffulli N, Cook JL, Wark JD. Studies of surgical outcome after patellar tendinopathy: clinical significance of methodological deficiencies and guidelines for future studies. Victorian Institute of Sport Tendon Study Group. Scand J Med Sci Sports. 2000;10(1):2-11
24. Web of Science. Journal Impact Factor 2020 [Internet]. Available from: https://jcr.clarivate.com/jcr/home?app=jcr&Init=Yes&authCode=null&SrcApp=IC2LS.
25. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. BMC Musculoskelet Disord. 2003;4:11.
26. Gummesson C, Ward MM, Atroshi I. The shortened disabilities of the arm, shoulder and hand questionnaire (QuickDASH): validity and reliability based on responses within the full-length DASH. BMC Musculoskelet Disord. 2006;7:44.
27. Slutsky DJ. Outcomes assessment in wrist surgery. J Wrist Surg. 2013;2(1):1-4.
28. Tischler BT, Diaz LE, Murakami AM, Roemer FW, Goud AR, Arndt WF 3rd, Guermazi

A. Scapholunate advanced collapse: a pictorial review. Insights Imaging. 2014 Aug;5(4):407- 17.

29. Knipe H, Botz B, Kusel K, et al. Scapholunate interval. Reference article, Radiopaedia.org (Accessed on 04 Nov 2023)
30 Pomerance J. Outcome after repair of the scapholunate interosseous ligament and dorsal capsulodesis for dynamic scapholunate instability due to trauma. Journal of Hand Surgery- American Volume. 2006;31A(8):1380-6.
31. Papadogeorgou E, Mathoulin C. Extensor carpi radialis brevis ligamentoplasty and dorsal capsulodesis for the treatment of chronic post-traumatic scapholunate instability. Chir Main. 2010;29(3):172-9.
32. Montgomery SJ, Rollick NJ, Kubik JF, Meldrum AR, White NJ. Surgical outcomes of chronic isolated scapholunate interosseous ligament injuries: a systematic review of 805 wrists. Canadian Journal of Surgery. 2019;62(3):199-210.
33. Naqui Z, Khor WS, Mishra A, Lees V, Muir L. The management of chronic non-arthritic scapholunate dissociation: a systematic review. J Hand Surg Eur Vol. 2018;43(4):394-401.
34. Minami A, Kato H, Iwasaki N. Treatment of scapholunate dissociation: ligamentous repair associated with modified dorsal capsulodesis. Hand Surg. 2003;8(1):1-6.35.
35. Carvalho VB, Ferreira CHV, Hoshino AR, Bernardo VA, Ruggiero GM, Aita MA. Dorsal capsulodesis associated with arthoscopy-assisted scapholunate ligament reconstruction using a palmaris longus tendon graft. Rev Bras Ortop