ORIGINAL STUDY — HAND AND WRIST

acta orthopaedica belgica, 2025, 91, 195-204

doi.org/10.52628/91.2.14437

# Comparing outcomes of dorsal capsulodesis techniques for chronic (pre-)dynamic scapholunate interosseus ligament tear repair: A systematic review

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***Background and study aim:*** **Scapholunate interosseous ligament (SLIL) injuries, crucial for wrist stability, can cause significant dysfunction and lead to scapholunate advanced collapse (SLAC) wrist. This review compares open and arthroscopic dorsal capsulodesis techniques for chronic (pre-)dynamic SLIL tears, aiming to identify the most effective method for optimizing outcomes and preventing SLAC wrist progression.**

***Methods:*** **A systematic search of PubMed, Embase, Web of Science, and Cochrane Library was performed. Fourteen studies met inclusion criteria. Included studies assessed long-term clinical, patient reported and radiographic outcomes (≥6 weeks post-injury). Studies combining dorsal capsulodesis with other techniques (except primary ligament repair) were excluded. Heterogeneous outcome measures precluded statistical comparison.**

***Results:*** **While older techniques (Lavernia, Blatt) resulted in significant ROM loss and failed to prevent SLAC wrist, newer open procedures (Berger, Modified Viegas) showed improved results, with the Modified Viegas technique demonstrating less ROM decrease. The all-arthroscopic Mathoulin procedure showed the most promising results regarding clinical, patient-reported outcomes, and SLAC wrist prevention. Thermal shrinkage/abrasion showed the worst outcomes.**

***Conclusion:*** **Since open procedures also require arthroscopy, all-arthroscopic techniques may be more cost efficient. The Mathoulin procedure appears the most effective even in severe tears and less favorable cases, although this review suggests some open procedures may not necessarily lead to greater ROM loss than arthroscopic ones. The Mathoulin procedure shows promise for chronic SLIL tears without arthritis and may fit into current treatment algorithms. However, larger trials with longer follow-up are needed.**

**Keywords:** Wrist, scapholunate interosseus ligament, scapholunate ligament, SLIL, surgery, arthroscopy, Berger, Modified Viegas, Mathoulin, dorsal capsulodesis.

## INTRODUCTION

The wrist comprises numerous bones and ligaments, rendering it a complex joint. Among these structures, the Scapholunate interosseus ligament (SLIL), together with its secondary stabilizers, stands out as paramount for wrist stability. This ligament links the scaphoid to the lunate and prevents diastasis and malrotation of these two bones. The ligament consists of three main components, with the dorsal component being the strongest and hence most crucial for wrist stability[1]. The most frequent cause of carpal instability therefore logically stems from injuries to the scapholunate joint, which result in significant wrist dysfunction, lost work time, and disruption to daily activities[2,3]. SLIL tears are often the consequence of a fall from a height or a motorcycle accident on an outstretched hand[4]. Untreated post-traumatic SLIL injury may, because of the dorsal intercalated segmental instability (DISI), result in the development of a distinct form of progressive wrist osteoarthritis called scapholunate advanced collapse (SLAC)[5]. Given its importance to normal wrist functionality, great emphasis has been placed on surgical intervention in scapholunate injuries. There are already a few studies comparing capsulodesis with other SLIL reconstruction techniques

like tenodesis and bone-tissue-bone graft[6-8]. While comparing these techniques can provide an overall evaluation, a superior dorsal capsulodesis technique might be overlooked amidst less favourable ones in such comparisons. Currently, there are no systematic reviews comparing the various dorsal capsulodesis techniques. This systematic review seeks to fill that gap, enabling the selection of the most effective technique when a dorsal capsulodesis is deemed preferable. Within the dorsal capsulodesis surgeries, an extra division in technique categories can be made between open and arthroscopic procedures. With the rapid evolution and improvement of the arthroscopic surgeries, it is important to see if the capsulodesis has better outcomes when done arthroscopically. To date, the majority of treatments suggested in the literature involve an open repair, which can alleviate pain and enhance grip strength but frequently results in wrist joint stiffness[9,10]. On the other hand, arthroscopic surgery is believed to allow patients to start moving their wrists sooner after surgery and create less scar tissue, which can help prevent stiffness in some cases[11].

## MATERIALS AND METHODS

This literature review was conducted and reported according to the PRISMA guidelines with ethical approval from the KU Leuven ethical committee[12].

*Data Sources and Search Strategy*

PubMed, Embase, Web of Science Core Collection, Scopus and Cochrane Library were searched using terms and synonyms for the scapholunate ligament and dorsal capsulodesis. The scope of our research strategy was tested with a few articles encompassing dorsal capsulodesis for chronic tears. Checking if these articles were identified by our search strategy assessed its comprehensiveness. The literature search was performed on the 4th of May, 2024.

*Eligibility Criteria*

Relevant articles were screened based on their title and abstract and further by reading full text. Reference lists of the selected articles were screened to detect alternative useful studies. Prospective and retrospective case series and cohort analyses were included if they investigated patients with chronic LSIL tears who underwent dorsal capsulodesis and had a minimum follow-up period of 12 months. Patients of any age or any sex with (pre-)dynamic (Grade 4 Geissler/EWAS 2-3 and 4) SLIL tears were eligible for inclusion. Studies were included if they reported on at least two of the outcome parameters listed below or provided data on radiologic evolution and had at least five cases. Studies were excluded if they were cadaveric, investigated acute SLIL injuries, combined dorsal capsulodesis with other surgical procedures (except for primary repair with additional dorsal capsulodesis), reported on fewer than five cases, or were treatment recommendations, narrative reviews, opinion pieces, columns, comparison studies, comments, non-English articles, overviews, conference proceedings, surveys, or lacked full-text availability. In some included studies, injuries were considered chronic after 4 weeks instead of 6. These were allowed in the study because, at the time of their release this was the definition of chronic SLIL injuries.

*Outcome parameters:*

1) Quantitative pain (Visual Analog Scale or a 10-point scale),
2) Clinical outcomes: grip strength, wrist flexion and extension, radial and ulnar deviations,
3) Radiographic outcomes: Scapholunate interval/gap, Scapholunate angle,
4) Disabilities of the Arm, Shoulder, and Hand (DASH) or Quick DASH score, Patient-Rated Wrist Evaluation (PRWE) score, MAYO Wrist Score (MWS) or Modified MAYO Wrist Score (MMWS) and Wrightington Wrist Function Score (WWFS).

*Screening process*

After deduplication, articles were screened in two rounds by a single reviewer (CT). The first round of screening assessed titles and abstracts. Second screening consisted of selecting articles that met the inclusion criteria, based on full texts of the articles that surpassed the first screening. In situations of doubt, senior author ID was consulted. The screening process was conducted using the Mendeley online tool.

*Statistical analysis*

Due to the heterogeneous nature of SLIL tear classifications and the unclear indication for capsulodesis repair, identifying studies that comprehensively met all inclusion and exclusion criteria proved challenging. This heterogeneity limits the comparability of study results. However, given the current state of evidence, a comparative analysis based on the available data is warranted.

## RESULTS

*Search results*

PubMed, Embase, Web of Science Core Collec

The PRISMA flow diagram in Figure I details our search strategy, study identification and selection process according to the PRISMA guidelines[12]. 7 research papers met the eligibility criteria for inclusion[13-19]. Another 7 studies found in the references of the selected articles met the right criteria[11,20-25]. All the included articles involve either an open or an arthroscopic dorsal capsulodesis technique. Two articles also included static SLIL tears and one article included static SLIL tears but also gave results of the subgroups such as (pre-)dynamic tears, which we used for our study. One article did not mention the SLIL classification.

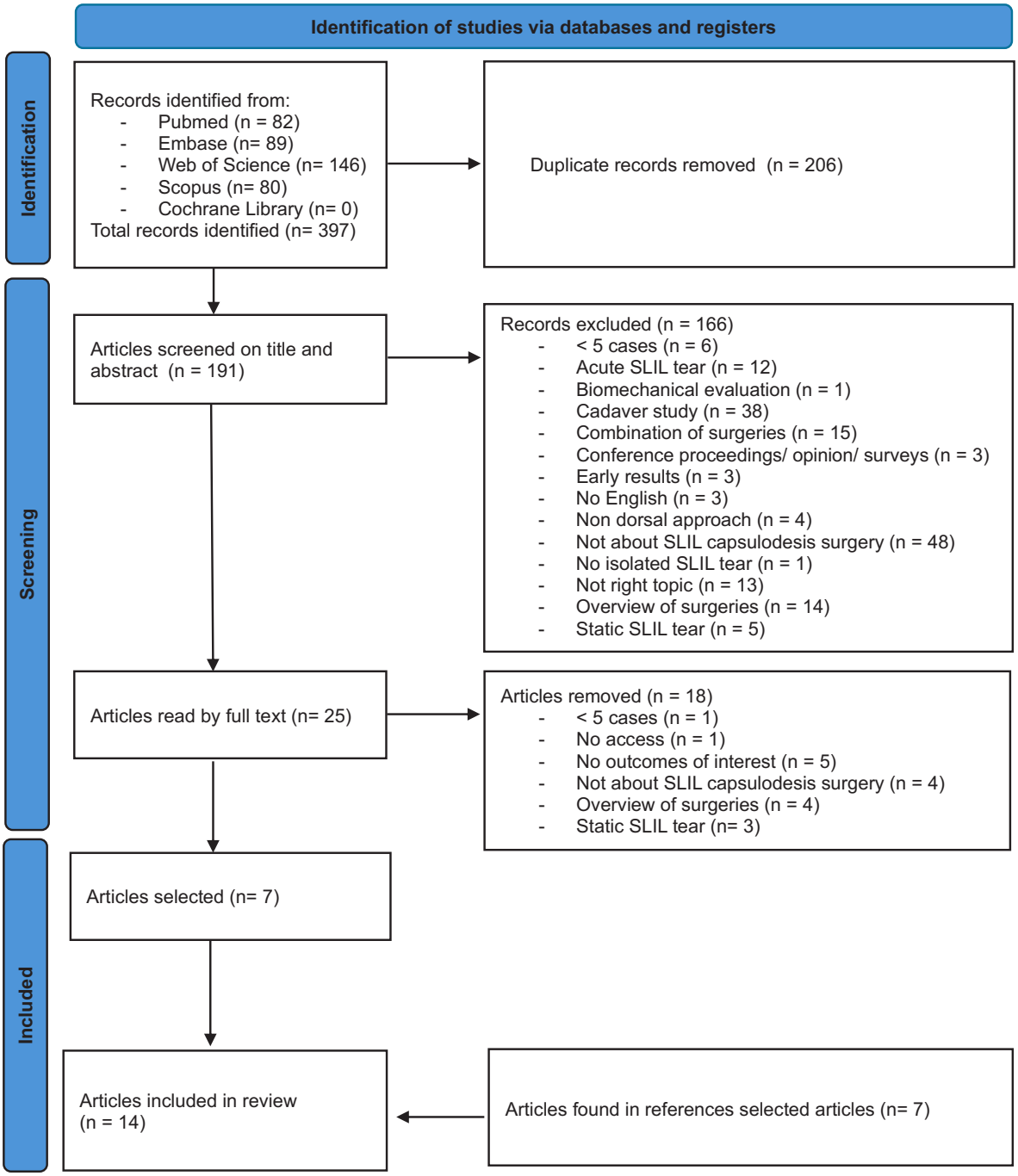


*Fig. 1 — FPRISMA flow diagram[12].*
*n= sample size.*

*Characteristics of the selected studies*

All included studies were either retrospective or prospective case-series studies, except for one comparative study. They were performed over a large time span between 1992 and 2023. This time span is needed to include the older techniques like Blatt capsulodesis. The studies and their characteristics can be seen in Table I. The SLIL classification changed over time, causing the literature to be scattered with multiple classifications. This makes it harder to compare the techniques to one another. The level of evidence was not often given, and when given, varied between level III and level IV.

*Patient-Reported Outcome Measures (PROMs)*

All PROMs analysed in this study were postoperative results. To allow for comparison across different questionnaires, overall PROM scores were categorized into "excellent", "good", "fair", and "poor", as seen in Table II. The DASH[26] questionnaire assesses subjective pain, function, and satisfaction in upper extremity musculoskeletal conditions. The PRWE[27] form evaluates wrist pain and function. In 2004, the PRWE was changed into the PRWHE with only minor changes[28]. The WWFS[29] assesses subjective pain, function, and satisfaction. The MWS[30], a modified version of the Green and O'Brien questionnaire by Cooney et al., assesses pain, grip strength, range of motion, and return to employment status.

*Results and Comparison of techniques*

The results of the studies can be seen in Table III. The PROMs are grouped into categories. If the result of a PROM was given in categorical groups in the study for every subgroup, a mean was calculated based on the mean value of every category subgroup. This mean was then put in categories like we did for the other studies. The clinical outcomes, namely the grip strength and the range of motion, were either given in % of the unaffected side or in degrees lost or gained between pre-operative and post-operative. Finally, there are 2 radiological outcome measures. The difference in SL interval and SL angle preoperative versus postoperative were measured respectively with static anteroposterior radiographs and lateral radiographs.

*Blatt and Lavernia procedures*

Deshmukh et al.[14] showed that Blatt's capsulodesis significantly decreased the wrist ROM and the grip strength. The Lavernia repair and dorsal capsulodesis had better results in terms of grip strength. Lavernia[13] also showed an average of 17° palmar flexion loss. Pomerance[22] confirmed prior observations of declining results over time, particularly in patients with demanding daily wrist activities. Almost 20% of the patients already showed a static carpal instability at final follow-up. Early techniques suffered from significant ROM reduction for fairly poor results, and a rapid degeneration. Moran et al.[21] showed approximately 20° loss of palmar flexion and 4 out of 31 patients progressing to SLAC arthritis. They looked at results of Blatt's capsulodesis and results of MAYO capsulodesis. It is important to note that 14 out of the 31 patients had a static SL-tear.

*Berger and (Modified) Viegas procedures*

Luchetti[17] and Micicoi[24] reported significant pain and grip strength reduction (near 90% of contralateral in Micicoi[24]) with Berger capsulodesis. They also showed a loss of flexion/extension of almost 20% compared to the contralateral side. The PROMs showed post-operative improvement and fair results. Luchetti[17] showed 4 clear cases and 6 doubtful cases of carpal instability in clenched fist X-rays at a mean follow-up of 45 months. Micicoi[24] also showed, at a mean follow-up of 54 months, 7 out of 96 (pre-)dynamic SLIL-tears to progress to SLAC wrists after the surgery. The VAS and grip strength values are only given postoperatively and are respectively 4 and 31 kg. Camus et Van Overstraeten[23] showed comparable results for the Viegas capsulodesis at 25 months of follow-up, with clear improvement of VAS and grip strength. They showed a slightly improved ROM compared to pre-operative, but they did not compare this to the contralateral side. However, they noted that the Viegas technique does not lead to wrist stiffness. The study did include 5 static wrists. They had 12% postoperative complications and 8% progression to arthritis. This progression to arthritis was seen without radiographic instability. Della Rosa et al.[15] studied Geisler III SLIL injuries in 25 young athletes. It showed only 11% ROM loss compared to the contralateral side. Important to note here is that the postoperative gain of flexion is expressed as a median loss. Conversely, the postoperative increase of extension is given as an average, being 87% of the contralateral side. This makes it harder to compare. Also, there were no complications and no degenerative progress to SLAC wrist. All the athletes got back to their previous sports within an average of 6 months.

Rosa et al.[16] compared Berger capsulodesis with Modified Viegas capsulodesis. The results were in line with previous studies, showing a good improvement on all fields for both techniques. The SLA angles were postoperatively inside the normal range, being on

**Table I.** — Characteristics of included studies.

| First author, publication year | Journal | Surgery Type | Study Type, Lev. of Evidence | Quality (NHLBI) | N | SLIL Classification | Mean Time To Surgery, mo | Mean ollow-Up Time, mo |
|---|---|---|---|---|---|---|---|---|
| C. J. Lavernia; 1992 | J Hand Surg [Am] | Lavernia | R, NA | 4.5/7 | 21 | (Pre-)Dynamic | 17 | 33 |
| S. C. Deshmukh; 1999 | J Hand Surg | Blatt | P, NA | 5.5/9 | 44 | Not specified | 48 | 22 |
| S.L. Moran; 2005 | J Hand Surg | Blatt or Berger | R, IV | 6/9 | 31 | Dynamic Static | 20 | 54 |
| J. Pomerance; 2006 | J Hand Surg [Am] | Lavernia | R, IV | 6/9 | 17 | Dynamic | 5.25 | 66 |
| R. Luchetti; 2010 | J Hand Surg | Berger | P, NA | 6/9 | 18 | (Pre-)Dynamic | 10 | 45 |
| C.L. Mathoulin; 2011 | Hand Clin | Mathoulin | P, NA | 6/9 | 36 | Garcia-Elias stages 2, 3 and 4 | 9.8 | 11.4 |
| A. Wahegaonkar; 2013 | J Wrist Surg | Mathoulin | P, NA | 6.5/9 | 57 | Garcia-Elias stages 2, 3 and 4 | 9.42 | 30.74 |
| E.J. Camus; 2013 | Chir Main | Viegas | P, NA | 6/9 | 25 | 18 Pre-Dynamic 2 Dynamic 5 Static | 12 | 26 |
| G. Micicoi; 2020 | J Hand Surg [Eu] | Berger | R, IV | 6/9 | 120 | 48 Pre Dynamic 48 Dynamic (24 Static) | 18 | 54 |
| N. Della Rosa; 2020 | Eur J Plastic Surg | Modified Viegas; Berger | C, III | 6/9 | 40 | Pre-dynamic | NA | Modified Viegas: 23.5 Berger: 47.5 |
| N. Della Rosa; 2020 | J Hand Surg | Modified Viegas | R, IV | 6/9 | 25 | 24 Geissler type III 1 Geissler type IV | 22 | 35 |
| C.L. Mathoulin; 2021 | J Hand Surg | Mathoulin | P, NA | 6/9 | 602 | EWAS 2-4 | NA | 48 |
| F. Borrel; 2022 | J Wrist Surg | Mathoulin | P, IV | 6/9 | 146 | 69 EWAS stage 4 77 EWAS stage 2-3 | ~subgroup | 12 |
| M. W. T. Curran; 2023 | J Wrist Surg | Thermal Shrinkage; Capsular Abrasion | P, NA | 7/9 | 23 | Pre-dynamic | 18 | 12* |

N, number of participants; P, Prospective case series; R, Retrospective case-series; C, Comparative study; NA, not available; EWAS, European Wrist Arthroscopy Society. *Median follow-up instead of mean follow-up.

average 47.5° for the Modified Viegas capsulodesis and 55.6° for the Berger capsulodesis. However, when compared the Modified Viegas technique performed significantly better on 4 outcome values (PRWHE score, grip strength, SL angle and ROM) and showed a higher return to work and resumption of physical activities.

*Mathoulin arthroscopic procedure*

Mathoulin et al.[25] and Wahegaonkar et al.[11] both show good clinical results. Table III also illustrates good gain of ROM for both studies. The fairly low gain in DASH score and VAS is likely due to the low pre-operative scores in both studies. Regarding the correction of malalignment, the two studies give different outcomes. In Mathoulin et al.[25], the DISI is often incorrected after surgery, whereas in Wahegaonkar et al.[11], every case was successfully corrected post-surgery. Both studies showed a return to work after 9 weeks.

The second study of Mathoulin et al.[20] shows the clinical outcomes of the Mathoulin arthroscopic capsuloligamentous repair for the EWAS stages 2 to

**Table II.** — Categorization of scores for each patient-reported outcome measure.

| | MWS, MMWS (0-100) | PRWE, PRWHE (0-100) | DASH, QuickDASH (0-100) | WWFS (0-100) |
|---|---|---|---|---|
| Overall Score | Excellent 90–100<br>Good 80–89<br>Fair 65–79<br>Poor < 65 | Excellent 0–20<br>Good 21–40<br>Fair 41–60<br>Poor 61–100 | Excellent 0–5<br>Good 6–15<br>Fair 16–35<br>Poor 36–100 | Excellent 81–100<br>Good 61–80<br>Fair 41–60<br>Poor 20–40 |
| MWS, MAYO Wrist Score; MMWS, Modified MAYO Wrist Score; PRWE, Patient-Rated Wrist Evaluation; PRWHE, Patient-Rated Wrist and Hand Evaluation; DASH, Disabilities of the Arm, Shoulder, and Hand; WWFS, Wrightington Wrist Functional Score. | | | | |

**Table III.** — Outcome parameters of included studies.

| Study | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 |
|---|---|---|---|---|---|---|---|---|---|
| C. J. Lavernia; 1992 | "sign. reduction" | (+7 kg) * | NA | (-1.3) * | NA | NA | NA | NA | NA |
| S. C. Deshmukh; 1999 | -3.8 | 65% | 48% | NA | (+3) * | NA | NA | NA | Good |
| S.L. Moran; 2005 | NA | (83%) * | 70% | +1.2 | +7 | NA | NA | Fair | Good |
| J. Pomerance; 2006 | 0 | +7 kg | 84% | -1 | +6 | Fair | NA | Fair | NA |
| R. Luchetti; 2010 | -3 | (+3 kg) *<br>(87%) * | 80%<br>(-4°) * | NA | NA | Fair | NA | Good | NA |
| C.L. Mathoulin; 2011 | -2.8 | 92% | +15° | NA | -7.7 | Good | NA | NA | NA |
| A. Wahegaonkar; 2013 | -5.46 | 93.4% | +25° | NA | -8.9 | Good | NA | NA | NA |
| E.J. Camus; 2013 | -2.96 | +8.9 kg | +2.6° | -0.7 | -3.7 | NA | Fair | NA | NA |
| G. Micicoi; 2020 | NA | NA | 74% | -0.5 | -5 | Fair | Good | Fair | NA |
| N. D. Rosa; 2020 | NA | MV: +14.03 kg<br>B: +8.9 kg | MV: +31.2°<br>B: +22.4° | NA | NA | NA | MV: Good<br>B: Fair | NA | NA |
| N. D. Rosa; 2020 | -4 | +15.5 kg | NA | -0.8 | -23 | Fair | Good | NA | NA |
| C.L. Mathoulin; 2021 | -6.9 | +22 kg | +32° | NA | NA | Good | NA | Excellent | NA |
| F. Borrel; 2022 | NA | NA | NA | NA | -19.6 | NA | NA | NA | NA |
| M. W. T. Curran; 2023 | -1.8 | +2 kg | (+22°) * | -0 | NA | Poor | Good | NA | NA |
| Note: Non-significant parameters ($\alpha < 0.05$) are marked with a *<br>Q, question; NA, not available; MV, Modified Viegas capsulodesis; B, Berger capsulodesis. | | | | | | | | | |

4 separately. This technique reduced the pain almost equally well for all the stages. The lower the wrist extension and flexion were before surgery, the lower they will be after surgery even though the gain of ROM gets higher according to the severity of the injury. The same goes for the grip strength, although these results give the biggest average gain of grip strength across all the studies. The mean reduction of DASH score is also the biggest of all the studies. Out of the 602 cases not a single one was labelled as "poor" with the MAYO Wrist Score and 95% scored "excellent" or "good". For the outcome parameters we can conclude that this arthroscopic surgery technique scores particularly good at a mean follow-up of 4 years.

Additionally Borrel et al.18 did a follow-up of 12 months of 146 operated SLIL tears and showed that the DISI and the SL angle lowered over time and approach the healthy side at the final 12 months follow-up.

*Thermal Shrinkage or Dorsal Capsule Abrasion*

Curran et al.[19] threating 23 pre-dynamic tears with thermal shrinkage or capsule abrasion only show a 1.8 point VAS reduction, 2 kg gain in grip strength and no reduction of SL interval postoperatively. Their PROMs are also fairly poor except for the PRWE score which is classified as 'good'.

## DISCUSSION

The primary goals of surgical intervention for a chronic scapholunate interosseous ligament (SLIL) tear are to alleviate pain, improve range of motion, and restore strength, thereby enhancing patients' daily activities. Additionally, and arguably even more important, surgery seeks to prevent the progression of SLAC wrist arthritis. It is now well-established that dynamic changes in scapholunate gap measurements during wrist movement are more critical indicators of

instability than static gap measurements[31,32]. Greater variation in the scapholunate gap correlates with decreased joint stability and an increased risk of progression to scapholunate instability. Conversely, radiographic scapholunate diastasis that remains stable or exhibits minimal variation during wrist motion is typically not associated with significant instability or a substantial risk of developing arthritis[33]. Therefore, it may be possible to identify earlier stages of potential instability and implement conservative treatment, reducing the need for unnecessary surgical repairs in stable lesions with a minimal risk of progression to arthritis. When needed, there is a relatively established treatment approach for acute SLIL tears.

Over the past years a lot of different techniques have been described for the repair of a chronic SLIL tear. Despite the ever-growing scientific research and development, the surgical management of chronic scapholunate injuries is still a challenge and a subject of debate[34,35]. There are a few major categories for chronic SLIL tear repair: tenodesis, bone-tissue-bone repair and capsulodesis. Previous studies could not find a significant difference between those 3 categories[3,6,36]. These studies also included a major part the older capsulodesis techniques, which, shown in this review, show inferior results than the current techniques. Thus, these studies comparing capsulodesis to the other major categories of surgery hide the better, newer techniques which get overshadowed by the worse results of the older capsulodesis studies. A crucial difference between the major categories is that for both the tenodesis technique as well as the bone-tissue-bone technique a ligament or bone needs to be harvested or rerouted. This suggest that these techniques are more invasive than a capsulodesis and may be the reason a lot of surgeons prefer to perform a dorsal capsulodesis.

The recent shift in understanding the role of the SLIL in carpal stability, with greater emphasis on secondary stabilizers and the DCSS, is evident in contemporary surgical practices. This evolving understanding has led to innovative treatment approaches for scapholunate instability, such as the Mathoulin arthroscopic technique which aim to repair the DCSS.

*Major Findings*

The Mathoulin all-arthroscopic technique seems to be the overall best procedure for chronic dynamic SLIL tears, based on the studies implemented in this review. This all-arthroscopic procedure, which Mathoulin terms a dorsal capsuloligamentous repair rather than a capsulodesis, has shown the most promising results. The technique focuses on repairing the DCSS. The results show that the technique can have satisfied patients, good clinical results and seems to prevent deterioration towards SLAC wrist. While long-term efficacy in preventing SLAC wrist remains to be proven, the promising results at the 4-year follow-up, along with the steady improvement in SL and RL angles over the course of a year, suggest sustained correction over extended periods. The procedure proves itself for both the pre-dynamic as the dynamic tears without major complications. Also, the costs seem to be in favour of the Mathoulin all-arthroscopic procedure because the other recent procedures also include an arthroscopic part, which is necessary for indication of surgery. However not all the arthroscopic techniques are better and more suitable for these types of tears. The capsule abrasion or thermal shrinkage seems to not give enough stabilisation for the chronic dynamic tears. Surprisingly, the more recent open procedures like the Modified Viegas capsulodesis showed more or less the same loss of ROM postoperatively compared to the healthy side as the all arthroscopic techniques. However, it must be stated that this was tested only in pre-dynamic cases and predominantly involved a young, athletic population. Nevertheless, the Modified Viegas technique seems to provide the best results for the open procedures. This is believed to be because the Modified Viegas technique makes use of a thicker part of the DIC ligament and preserves the so called 'V construct' of the dorsal ligaments. Older techniques, such as the Blatt and Lavernia capsulodesis, served as stepping stones for today's methods. However, their results, when compared to newer techniques, show that they are now outdated.

Based on our research all-arthroscopic Mathoulin procedure gives the best short term results (at least 48 months) and seems to give the best protection to SLAC wrist development.

*Unique contributions*

We found that contrary to popular belief, open surgical procedures do not necessarily lead to significantly more loss of ROM. While some ROM loss is inevitable, the Modified Viegas Capsulodesis has shown comparable outcomes to arthroscopic procedures in terms of ROM preservation. Nevertheless, the Modified Viegas Capsulodesis has yet to prove its efficacy for dynamic SLIL tears, as the included studies focused on pre-dynamic tears.

By comparing the all-arthroscopic Mathoulin procedure to traditional open techniques like

the Berger Capsulodesis and Modified Viegas Capsulodesis, this review demonstrates the superior efficacy of minimally invasive approaches.

*Comparison to current literature*

When looking at the existing treatment algorithms we find that Andersson[37] stated in 2017 that the SLIL tears would not be directly repairable after 6 weeks because of degeneration of the ligament. Mathoulin et al.[20] did not specify their time from tear to surgery but stated it being a chronic tear, thus being more than 6 weeks. Andersson[37] proposes arthroscopic debridement or thermal shrinkage, capsulodesis or physiotherapy with re-education of the flexor carpi radialis for pre-dynamic tears. Based on our review we would not recommend thermal shrinkage or arthroscopic debridement, given that it provides (almost) no protection for deterioration towards SLAC wrists. The open capsulodesis procedures such as the Berger and Modified Viegas techniques proved themselves for pre-dynamic tears but also in these cases the Mathoulin procedure seems favourable. The same goes for dynamic SLIL tears. Andersson[37] proposes an open direct SL repair and capsulodesis as an augmentation. Our study suggests that the direct repair is not the primary factor for achieving satisfactory results but we do suggest that the Mathoulin procedure should be used in the cases with dynamic tears.

Our findings can also be fit in the treatment algorithm proposed by Mullikin et al. in 2020[38]. The (pre-)dynamic tears suitable for the Mathoulin (and potentially Modified Viegas) procedures are those without arthritis and with sufficient remaining tissue (a usable remnant) on either the scaphoid or lunate bone. The Mathoulin 2017[39] study also states these as being the only two direct contra-indications for their repair. New all-arthroscopic direct ligament repair with capsulodesis augmentation techniques, similar to the Mathoulin procedure, are on the horizon. This review seems to be in favour of their results with proper indication.

*Limitations*

The studies identified through the search strategy predominantly comprised Level IV studies, with scores ranging from fair to good in quality. Additionally, 5 out of the 14 included studies were retrospective in nature, which contributes to potential bias. It is believed that higher-level studies, such as randomized controlled trials (RCTs), are currently unavailable. Moreover, only 5 of the 14 studies had a sample size greater than 50, which may limit the generalizability of the findings. Also the search strategy and risk of bias assessment was carried out by only one reviewer, CT. Senior author, ID, was consulted when in doubt.

Of particular note, the heterogeneity in outcome measures, SLIL tear classifications, patient characteristics, and post-operative care significantly complicates the comparison of the various techniques. As a result, statistical analysis was not feasible in this study. The evolving nature of SLIL tear classifications further complicates comparisons between older and more recent techniques.

Furthermore, there is a lack of independent studies evaluating the Mathoulin all-arthroscopic procedure, as all included studies listed Mathoulin as an author. This limitation restricts the ability to draw definitive conclusions regarding the superiority of the procedure. Therefore, the results should be interpreted with caution.

*Limitations*

To definitively establish the superiority of the Mathoulin all-arthroscopic capsulodesis technique and to establish the use of all-arthroscopic capsuloligamentous techniques in the treatment of chronic SLIL tears, prospective comparison studies are necessary. These studies should be performed with more homogeneity, allowing for a direct comparison with the Modified Viegas capsulodesis. Furthermore, independent surgeons should replicate Mathoulin's results using the same arthroscopic technique to validate the findings and look at long term protection to SLAC wrist. Additionally, further research is needed to evaluate the Modified Viegas technique on dynamic tears, ensuring that it does not compromise range of motion.

## CONCLUSION

Scapholunate joint injuries are a common cause of carpal instability. Tears to the SLIL can significantly impair wrist function, leading to work loss and difficulties with daily activities. Untreated, these tears often progress to osteoarthritis. While acute scapholunate ligament tears have well-established treatment protocols, the optimal management of chronic tears remains controversial. This review demonstrates that, against common belief, open procedures do not necessarily inflict more loss of ROM. However the promising results of the Modified Viegas capsulodesis still need to be confirmed in cases of dynamic scapholunate interosseous ligament tears for non-athletes. The Mathoulin all-arthroscopic procedure appears to yield the most promising results, with good PROMs, favourable clinical outcomes, and

potential protection against progression to SLAC wrist. If confirmed by independent researchers and surgeons and after longer-term follow-up, this technique may be a suitable option in the treatment algorithm, particularly in cases without arthritic changes and a usable ligament remnant on either the lunate or scaphoid bone. The field of wrist surgery is increasingly moving towards all-arthroscopic procedures and so it seems for SLIL tear repairs as well. This review emphasizes the need for larger, multicentre trials with longer follow-up periods and with standardized outcome measures and classification system to improve our understanding and management of this common wrist injury.

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