

Rehabilitation Principles Following a Scapholunate Injury

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Intro

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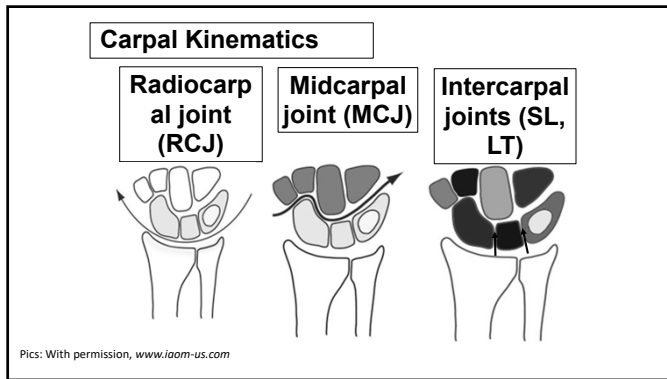
I have no disclosures

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Course Objectives:

- The presentation will provide a brief overview of scapholunate ligament injuries (SLLI) and a comprehensive summary of the rehabilitation process.
- Emphasis on the importance of evidenced-based approaches in SLLI recovery
- Encouragement for health care providers to stay up to date on the latest therapeutic treatments.
- Provide techniques for optimal outcomes.

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Carpal kinematics and stability rely on a complex interplay of bones and ligaments

- Scapholunate instability (SLI) is the most common cause of carpal instability.
- An isolated injury to the SLI may progress to abnormal joint mechanics and degenerative cartilage changes.
- Approximately 5% of all wrist sprains have an associated SL tear.
- SL injuries are often associated with distal radius fractures – on average 40% particularly radial styloid fractures
- It often take 3-12 months after trauma before dynamic instability develops and SL dissociation is noted radiologically
- SL Injury is common in young individuals. It is often the consequence of a fall forwards from a height sport injuries or a motorcycle accident
- Despite being the most common carpal instability, the SLI is often missed

Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Ortho. 2023
J.K. Anderson. Treatment of scapholunate ligament injury: Current concepts. JRCWVWUJWUJ [g] | xBQJ uJW56<WU ->W72B>8

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DISI within the proximal row

SL ligament injury:

- As the scaphoid continues to further flex, the lunate assumes an extended (or **dorsal**) position
- A radiolunate (RL) angle of > 15° in a dorsal direction is also suggestive of an SL instability

Normal

DISI

15°

Braun, N., Berger, R.A., Wolfe. Defining DISI and VISI. J Hand Surg Eur. 2021; 46(5):566-568.
Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.

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DISI within the proximal row

Scapholunate (SL) Dissociation

SL dissociation is a problem with altered kinematics in 2 planes:

- Frontal plane: widening of the SL interval
- Sagittal plane: rotatory subluxation of the scaphoid into further flexion (cortical ring sign)



PA view

Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.

Kuo, C.E. & Wolfe, S.W. (2008). Scapholunate instability: current concepts in diagnosis and management. J Hand Surg (Am), Jul-Aug;33(6):998-1013.

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Dx: Wrist pain

1

Patient A: 25 year old female CNA “jammed” wrist while transferring a pt at work 4 weeks ago

2

Patient B: 45 year old man, fell on wrist while playing hockey with his son approximately 6 weeks ago

3

Patient C: 65 year old construction worker has had pain in wrist for several years

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Clinical presentation of DISI

- Localized pain at the radial wrist
- Non-capsular pattern of limited motion
- Decreased **passive** wrist flexion
- Normal wrist extension
- Pearl : Does manually pushing up on lunate as you flex the wrist help with pain?

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Special Tests: proximal row DISI

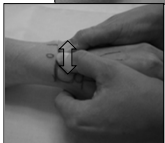
Scapholunate Ballottement Test

STEP #1:

- Stabilize the lunate with the index finger and thumb of one hand.

STEP #2:

- With the other hand, grasp the scaphoid dorsally at the proximal pole and volarly at the scaphoid tubercle. Perform anterior/posterior glides

Green DP, Pederson WC, Hotchkiss RN, Wolfe SW. Green's Operative Hand Surgery 6th ed. Elsevier Inc. Philadelphia. 2011.

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Special Tests: proximal row DISI

Scaphoid Shift Test (Watson's Test)

STEP #1:

Start with the patient's wrist passively brought in ulnar deviation, places pressure on the scaphoid tubercle



Amarasooriya, M., Jerome, T.J., Tournet, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.

Watson HK, Ashmead D, Makhoul MV. Examination of the scaphoid. J Hand Surg (Am). 1988; 13-A: 657-660.

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Special Tests: proximal row DISI

Scaphoid Shift Test

STEP #2:

Bring the patient's wrist passively into ulnar deviation, while placing pressure on the scaphoid tubercle, preventing flexion



Amarasooriya, M., Jerome, T.J., Tournet, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.

Park MJ. Radiographic observation of the scaphoid shift test. J Bone Joint Surg (Br). 2003; 85-B: 358-362.

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Three Types of Carpal Instability

○

PREDYNAMIC INSTABILITY

○

DYNAMIC INSTABILITY

○

STATIC INSTABILITY



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Pre dynamic instability

1

Anatomy : partial tear in the ligament with no malalignment

Symptoms: partial tears can cause pain – increases with gripping and weight bearing activities

Studies: no alignment changes are visible on static or dynamic studies

Diagnostic tests: Xray, MRI, MR Arthrogram, plan arthrography, multidetector CT arthrogram, arthroscopy and direct surgical intervention

Clinical exam is most important

Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.
A. Porretto-Loehrke et al. / Journal of Hand Therapy 29 (2016) 123e135

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Dynamic instability

2

Anatomy : Complete SL ligament tear with intact secondary stabilizer ligaments

Symptoms: pain – increases with gripping and weight bearing activities

Studies: no alignment changes are visible on **static**

Diagnostic tests: X-rays, **dynamic** radiographs, cineradiography, MRI, MRA, plain arthrography, multidetector CT arthrogram, arthroscopy, and direct surgical observation

Traditional

Clenched fist- reveals a dynamic SL instability and cortical ring sign present.

Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.
A. Porretto-Loehrke et al. / Journal of Hand Therapy 29 (2016) 123e135

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Importance of secondary stabilizers in a DISI with dynamic instability

G. Salva-Coll, A. Lluch, and M. Esplugas et al. / Journal of Hand Therapy

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Static Instability

3

Amarasooriya, M., Jerome, T.J., Tourret, L. Current concepts in scapholunate instability without arthritic changes. Indian J of Orthop. 2023.
A. Porretto-Loehrke et al. / Journal of Hand Therapy 29 (2016) 123e135

Anatomy: complete SL ligament tear AND tear of secondary stabilizers with mark SL dissociation, fixed flexed position of scaphoid and extension of the lunate and triquetrum.

Symptoms: Pain

Studies: Increased space noted

Diagnostic tests: Xray, MRI, MR arthrogram, plan arthrography, multidetector CT arthrogram, arthroscopy and direct surgical intervention

GAP Gilulas arc

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Chronic Scapholunate Dissociation

- The alteration in scaphoid and lunate alignment results in abnormal force distribution through the wrist
- Left untreated, a SL injury can progress into a Scapholunate advanced collapse / SLAC wrist

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What positive tests does each pt have? Which pts can be treated conservatively?

Pre dynamic Instability

1

- Dorsal radial sharp wrist pain with gripping and wt. bearing
- (+) SL Ballotement Test
- (-) Scaphoid shift test (Watson)
- Conservative management is the most successful

Dynamic Instability

2

- Dorsal radial sharp wrist pain with gripping and wt. bearing
- (+) SL Ballotement Test
- (+) Scaphoid Shift test (Watsons)
- Can NOT strengthen FCR

Static Instability

3

- (+) Scaphoid Shift test
- Likely require further surgical intervention

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Conservative Treatment Includes:

- Immobilization
 - How long
 - What type
- ROM
 - How much
- Ther ex and Manual therapy

Pt 1

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Treatment of DISI Predynamic

- 8-10 weeks-10 weeks:
- Provide support to SL joint (orthosis or tape)
- Motion: Avoid activities that pronate the distal row and neutralize the flexion-pronation tendency of the loaded scaphoid
- Selective proprioceptive training
- Protective biomechanics education

At 10 weeks +

- Continue to progress with proprioceptive wrist exercises
- Grip strength permitted at 3 months
- Strenuous activity discouraged for the first 6 months

Esplugas M, Garcia-Elias M, Lluch A, Pérez ML. Role of muscles in the stabilization of ligament deficient wrists. J Hand Ther. 2016;29:166-174.

Green DP, Pederson WC, Hotchkiss RN, Wolfe SW. Green's Operative Hand Surgery 6th ed. Elsevier Inc. Philadelphia. 2011.

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Immobilization for DISI

- Custom orthosis: static immobilization 6-8 weeks
- Custom orthosis: which allows for dart throwers motion
 - When it does come time to move- want to use the safest range.
 - Dart throwers motion allows for motion at the MID CARPAL row.
 - Research has supported this for years

Montorno H et al. IFSSH 2013 committee's report of wrist dart throwing motion. J Hand Surg. Am. 2014; 39(7): 1433-1439

Warner FW, Green JS, Short WH, Masada S. Scaphoid and lunate motion during dart throw motion. Journal of Hand Surgery AM 2004 ;29(3): 418-422

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Personally like....



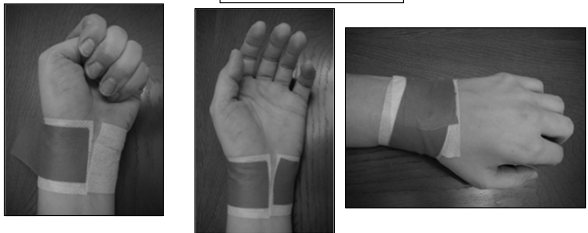
Anderson, H., Hoy, G. Orthotic intervention incorporating the dart-thrower's motion as part of conservative management guidelines for treatment of scapholunate injury. J Hand Ther. 2016 Apr-Jun;29(2):199-204. <https://doi.org/10.1016/j.jht.2016.02.007>

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Predynamic Dissociative Instability: DISI

Treatment:
Support

**Stabilization
Tape**



Porretto-Loehrke A. Taping techniques for the wrist. J Hand Ther. 2016; 29:213-216.

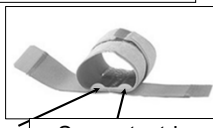
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Predynamic Dissociative Instability: DISI

Treatment:
Support

**How does the Wrist
Restore work?**

**Wrist Restore
(from OPTP)**



Supports distal pole of scaphoid and prevent excessive flexion, minimizing tension on injured SL ligaments.

Supports triquetrum via pisiform and prevent excessive extension, minimizing tension on injured SL ligaments.

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Predynamic Dissociative Instability: DISI

Treatment: Support



**Wrist Restore
(from OPTP)**

Application: Forearm neutral with wrist ulnarly deviated. Thumb is held flexed in palm. Distal edge of brace covers the carpus. Rubber bumpers cover distal scaphoid tubercle and pisiform. Straps are fastened in the order shown.

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ROM:
Dart throwers

- What we know?
- Dart throwers has research to support its use as it has least amount of strain on the S-L ligament
- Newer studies reveal that there is movement at the SL ligament with DT motion
- Functional DTM is less stressful to the SL ligament then wrist flexion and extension however, it still causes gapping to the SL ligament
- So what do we do? Throw out the DT?



GarciaElias M, Serriliah XA et al Dart throwing motion in patients with scapholunate instability: a dynamic four-dimensional computed tomography study. J hand surgery Eur Vol 2014;39 (4) 346-3532
Bergner JL, Farrar JQ, Coronado RA. Dart thrower's motion and the injured scapholunate interosseous ligament: A scoping review of studies examining motion, orthoses, and rehabilitation. J Hand Ther. 2020;33(1):45-59.

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Is there an acceptable arc of motion within the functional DTM plan that poses minimal risk?

- This would support the use of a static splint
- Requires the pt comprehension and compliance to avoid unsafe movements
- OR a dynamic orthosis to allow for functional DTM in either full or partial arc of motion while blocking orthogonal plane of motion



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Dart throwers motion and the injured scapholunate interosseous ligament: A scoping review of studies examining motion, orthoses, and rehabilitation:
J.L.Bergner, JQ, Farrar, and R.A. Coronado Journal of Hand Therapy 33 (2020)

What degree or arc of motion of radial ex and ulnar flexion stresses the injured or repaired SLIL

What is the preferred orthosis design to limit stress to the SLIL after injury or repair

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What degree of
dart throwers
motion stresses
the injured or
repaired SLIL ?

10 studies

Conservative:

- Review found the there is wide range of normal motion of DTM being somewhat unique to the pt.
- Current findings suggest that a short arc of motion is advocated over the full available DTM in patients with a torn SLIL.

Post op or repaired:

- No studies address whether there is a safe arc of DTM for repaired SLIL
- If repaired correctly the approximation of the scaphoid and lunate should be restored and the rotational deformity of scaphoid corrected.
- It should behave similarly from a biomechanical standpoint. We can then infer that early post-op follow protocols according and when able to complete DTM short arc would be better initially.

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Preferred Orthosis 5 research articles

All orthosis have similar goal to limit stress on the SLIL by allowing motion of the mid-carpal joints while limiting radiocarpal joint motion

Design: What they have in common

- Short arc should be 10-30 degrees of radial extension and 10-30 of ulnar flexion
- No research supports inclusion or exclusion of the thumb
- Two pieces – leaving a gap at volar wrist crease
- Mark the location of the scaphoid and 4th MC or ECU and FRC
- Two pieces are joined by 0.2mm wire, tubes, or rolled thermoplastic material

• **WHY?**

L. Feehan , T. Dart-throwing motion with a twist orthoses: Design, fabrication and clinical tips, / Journal of Hand Therapy 29 (2016) 205e212

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Rehabilitation for SL injury: Application of scientific and clinical evidence to practice

- Gentle DTM within a protected range is safest
- Goal is to protect healing and injured structures and promote stability while maintaining mobility to ultimately improve function

A.L. Wolff, S.W. Wolff/Rehabilitation for SL injury: Application of scientific and clinical evidence to practice/ Journal of hand therapy 29 (2016) 146-153

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Muscles to strengthen

ECRL and APL

FCU and FCR*

Mireia Esplugas MD a,b,* , Marc Garcia-Elias MD, PhD b,c , Alex Lluch MD b,c,d , Manuel Llusá Pérez MD, PhD, Role of muscles in the stabilization of ligament-deficient wrists, The Journal of hand therapy vol 29, Issue 2 2014

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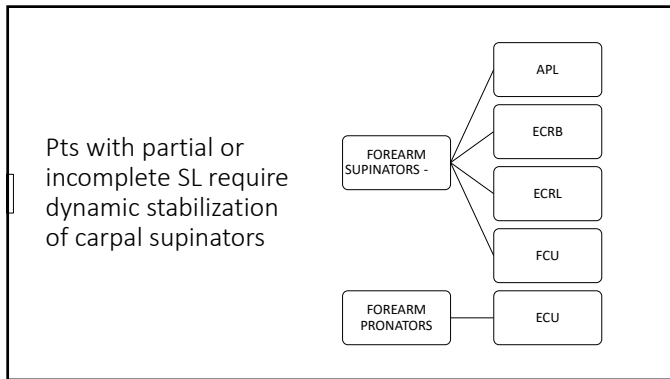
4-Stage Wrist Proprioception Rehabilitation Protocol

1. Basic rehabilitation principles for pain and edema management
2. Reconnection of the traumatized wrist through conscious proprioception awareness
3. Specific neuromuscular rehabilitation exercises to promote muscle function
4. Unconscious reflex neuromotor control of the joint.



Hagert E & Rein S. Wrist proprioception-an update on scientific insights and clinical implications in rehabilitation of the wrist. J Hand Ther. 2023

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Manual Tx:

- Manipulation of scaphoid on the radius
 - Improves extension of the scaphoid to bring it closer to the lunate
- Manipulation of Trapezoid on the scaphoid
 - Improves midcarpal motion to decrease stress on the proximal row

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Predynamic Dissociative Instability: VISI

Home Program:
DTM Radial extension ("Soda Can Maneuver")

Improve midcarpal mobility

- Gently "pull" the trapezoid in a dorsal-proximal direction, as the thumb pushes the scaphoid volarly
- Focus on more of a passive motion (versus active)
- Repeat for 10-12 times, 3+ times per day

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Home Program:

- Gently “pull” the trapezoid in a dorsal-proximal direction as the thumb pushes the scaphoid volarly
- Repeat for 10-12 reps 3 or more times per day
- Improves mid carpal mobility

A. Porretto-Loehrke et al. / Journal of Hand Therapy 29 (2016) 123e135

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Stage 1.

Concepts: Basic Hand Rehab	Principles Pain, edema scar	Therapy Modalities Compression, Massage, Paraffin, baths, Think In Nerve Length and layers , Early ROM	Senses: Brain, Skins Nerve
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E. Hagert and S. Rein / Journal of Hand Therapy

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Stage 2.

Concepts : Conscious Proprioceptive awareness	Principles Proprioception awareness, Kinesthesia, Joint Position Sense	Therapy Modalities Mirror Therapy, Kinesthetic taping, JPS training, Vibration	Senses: Brain, Skins Nerve, Muscle
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E. Hagert and S. Rein / Journal of Hand Therapy

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Therapy Modalities Stage 2
Mirror therapy- try using a laptop with a camera
Kinesio taping- both for improved proprioception awareness but also to promote skin and joint motion
Ozen et al- Application on both FCU and ECRB mm-improve DTM ranges and more functional performance more then placebo
Training of JPS through vision occluded and non-occluded (measured with goniometer)
Vibration therapy, as in tuning forks over muscle-tendon units to stimulate the sense of joint motion
Graded motor imagery – use of a laptop with camera

OzenD.O., Karakaya et al, Tension of the K-tape can be used to provide cutaneous afferent stimulation to the skin, increase blood flow, improve mm activity and improve proprioception

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Standardized steps for the AWJPS test at 30° extension angle: Passive positioning (1A), Angle memorization (1B), Active repositioning (2), and Active angle reproduction. The same volar-goniometric process was used for the wrist 0° position

C. Karagiannopoulos, Active wrist joint position sense (AWJPS) test offers variable reliability levels and scores among multiple wrist angles and tester-experience levels, Journal of Hand Therapy, <https://doi.org/10.1016/j.jht.2022.09.005>

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Vibration therapy, as in tuning forks over muscle-tendon units to stimulate the sensation joint motion using Vibration therapy

E. Hagert and S. Rein / Journal of Hand Therapy



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Stage 3 Conscious neuromuscular control

Concepts:
Conscious
Neuromus-
cular
Control

Principles
Conscious
- specific
muscle
training

Therapy
Modalities
Isometric
Eccentric
and Co-
activation

Senses:
Brain,
Skin
Muscle

E. Hagert and S. Rein / Journal of Hand Therapy

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Examples of active neuromuscular control



Isometric exercises of
ECRL and ERCB in
PRONATION
Isometric exercises of
APL in NEUTRAL
Isometric exercises of
FCR

Esplugas M, Lluch A, Salva-Coll G, et al. Influence of forearm rotation on the kinetic stabilizing efficiency of the muscles that control the scapholunate joint. Clinical application in proprioceptive and neuromuscular rehabilitation. J Hand Ther. 2023
E. Hagert and S. Rein / Journal of Hand Therapy

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Avoid Activation of ECU

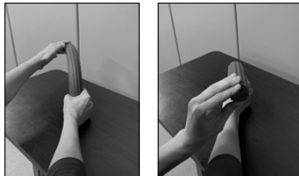
- ECU loading provokes extension and pronation of the distal carpal row, transmitted to the proximal carpal row through the ligaments.
- This enhances the natural tendency of the scaphoid to pronate, and thus, it could be potentially harmful to the scapholunate ligament
- Increased ECU activation and decreased ECR activation may serve to extend the scapholunate gap

Esplugas M, García-Ellas M, Lluch A, et al. Role of muscles in the stabilization of ligament deficient wrists. J Hand Ther. 2016. Apr-Jun;29(2):166-74. doi: 10.1016/j.jht.2016.03.009.
I. Eraklas et al. Alterations in forearm muscle activation patterns after scapholunate interosseous ligament injury: a dynamic electromyography study/ Journal of Hand Therapy 34 (2021) 384-395

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Predynamic Dissociative Instability: DISI

Treatment: Strengthening



Example: Using a flex bar to perform isometrics in the dart-thrower's plane

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Influence of forearm rotation on the kinetic stabilizing efficiency of the muscles that control the scapholunate joint. Clinical application in proprioceptive and neuromuscular rehabilitation

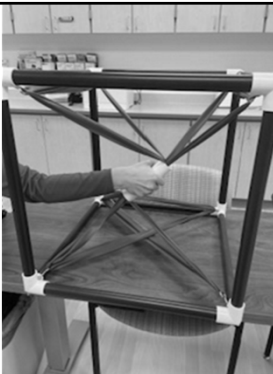
- FA mm categorized as carpal pronators or carpal supinator based on their effect during traction in neutral rotation.
- Carpal Pronators are ECU and FCR
- Carpal Supinators are APL and ECRL and FCU
- Scaphoid Lunate dysfunction may benefit from strengthening and prop training of the supinator mm and FCR ?
- Role of prop in dynamic carpal stability and their role in managing SL dynamic instability
- ECU and FCR identified as primary pronators of the mid carpal

Esplugas M, Lluch A, Salva-Coll G, et al. J Hand Ther. 2023

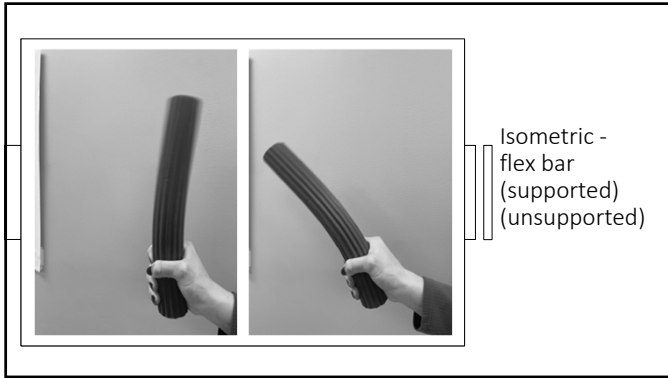
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Stage 3
Conscience:

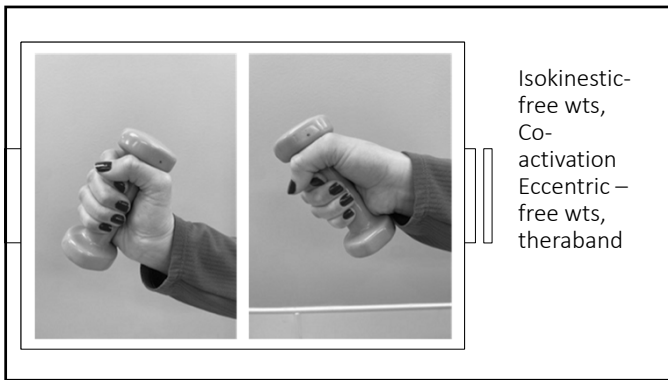
- Isokinetic- free wt.
- Co-activation
- Eccentric – free wt., TheraBand



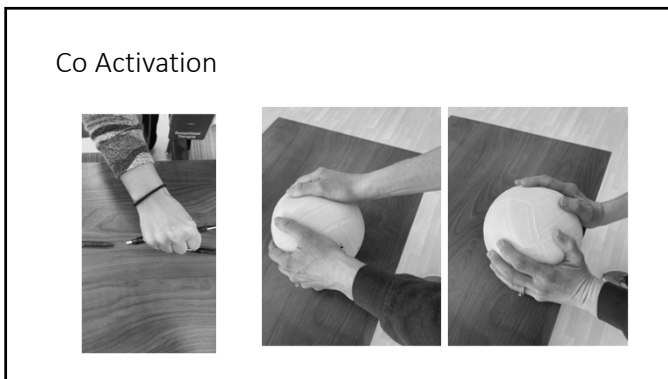
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Pearls

- Pearls –
- When can you progress
 - When pain is <2/10 with exercises
 - When pt is able to complete isometric x 10 reps
 - When can the brace be discharged?
 - When grip is same with brace and without.
 - Can start these ex with the brace, transition to tape and then no support.



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Wrist Circumduction

- Performing elliptical movement that combines the position of the wrist in all directions
- The circumduction envelope is the 3D space that is generated by this motion



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Stage 4: Unconscious Neuromuscular Training

Concepts: Conscious Neuromuscular Control	Principles Reflect Neuromuscular training	Therapy Modalities See below	Senses: Brain, Muscle, ligament
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Slosh Pipe

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Hand Therapy Academy

How to build your own slosh pipe

- Parts List: 1x 2-inch PVC pipe cut from 24" to 18" long. (can be done in the store with handsaw in trim dept)
- 2x 2-inch PVC pipe caps 1x Small container of PVC 2-in-1 glue (can use primer and adhesive but unnecessary)
- 1x Krylon Fusion Spray paint in fun color
- 1x 16oz water bottle to fill pipe about half-way Instructions:
- Step 1: Lay out a junk towel you don't mind getting the glue or primer all over.
- Step 2: Swab glue (or primer, then glue if using 2-part) on one end and 1 cap Then, QUICKLY!
- Step 3: Press the glued cap onto the glued and rotate 90 degrees while holding in place for 30 sec. ** Wait for 2-3 minutes **
- Step 4: Pour the water into pipe
- Step 5: Repeat steps 2 & 3 for the other end of the pipe.
- Step 6: After waiting 10+ minutes, spray paint the pipe in a well-ventilated area. Paint one side lightly, let it dry, flip over and paint other side, repeat if needed on first side

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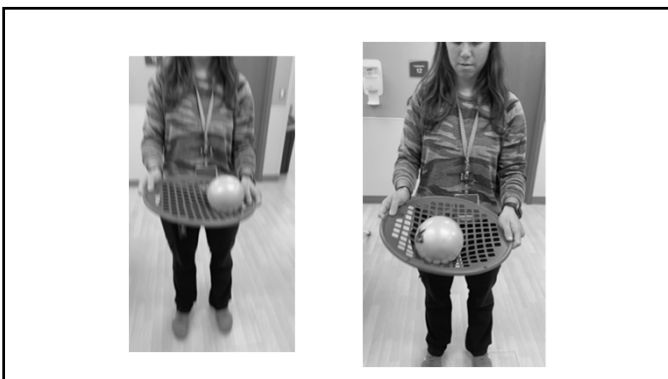
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Later intervention:
 Proprioception: An evidence-based review K. Valdes, K. C. Manalang C. Leach/ Journal of Hand Therapy sept 2023

- Perception of force and effort can be trained by using dynameter or pinch meter and asking pt to exert a pre-determined amount of force or maintain the same amount of force for a defined period of time – 10 sec
- Also upgrade the program having them alter when standing on a flat surface, foam pad or seated therapy ball.
- Therapy add visual or verbal feedback to improve pt accuracy of performance

Hincapie OL, et al. Proprioception retraining for a patient with chronic wrist pain secondary to ligament injury with no structural instability. J Hand Ther. 2016;29(2):183-190

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- Slosh pipe
- Power ball rebounder
- Drop and catch PNF patterns tennis ball – bilateral
- Drop and catch ball wted
- Drop and catch PVC pipe
- PVP pipe archery
- Tennis racket bounce ball
- Therabar with band at top and bottom of a PVC pipe or thera bar
- PVC bar bands on top and bottom- pull away and therapist taps top and bottom
- Then try push
- What about shoulder fav- therabnd alphabets
- Roll theraball (large cross over stops)

Ideas

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Ideas

- Flex bar
- Wt. bearing through a foot ball deflated with a squeeze
- Stick on a Thera ball – fast and slow Thera bar into deflated ball
- Spiral dynamic figure 8 with pencil
- Timing and rhythm sock and ball – twirl up twirl down / circles
- SL dart throwers baton
- Balls in container/ lid roll
- Wooden dowel rod – moves with band
- Mini wobble board- dycem ball lid circles



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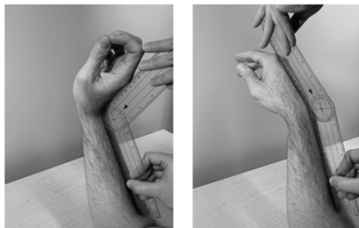
Assessment of F-DTM – Bergner, Jamie et al

- Limited data on clinical measurement of F-DTM
- Prior studies report on F-DTM measurement method are challenging to perform in clinic setting .
- Cross sectional study and descriptive study
- Provides a detailed description of how to implement
- WHY?
- Provides a clinical feasible method to quantify coupled joint motion in pts w wrist injuries to compare functional ROM loss compared to opposite side
- May provide use with information on the limitations at the midcarpal joint

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F-DTM measures Bergner, Jamie Et al

Seated forward leaning position
Elbow place in the center of the table
Therapist standing behind the patient's shoulder
FA positioned half-way between full pronation and neutral
Therapist provides verbal instruction and demonstration
Patient performs until they properly demonstrate ability to move in F-DTM



J.L. Bergner, J.Q. Farrar, H. Master et al Clinical measurement of functional darts throwers motion in patients with unilateral wrist conditions undergoing nonoperative or postoperative hand therapy, Journal of hand therapy 36 (2023) 923-932

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TABLE 1. Mean Values and Absolute Ranges (Minimum to Maximum) of DTM for Male and Female Subjects in Dominant and Nondominant Wrists

Measurement (°)	Male	Female
Dominant RE	71 (44 to 89)	73 (45 to 89)
Dominant UF	55 (23 to 78)	57 (25 to 87)
Dominant arc of motion	126 (83 to 166)	129 (79 to 170)
Nondominant RE	65 (24 to 87)	70 (29 to 87)
Nondominant UF	49 (30 to 66)	56 (38 to 85)
Nondominant arc of motion	114 (62 to 148)	126 (70 to 167)
Difference in RE	-6 (-51 to 11)	-4 (-41 to 21)
Difference in UF	-6 (-40 to 14)	-1 (-31 to 25)
Difference in arc of motion	-12 (-65 to 13)	-4 (-80 to 33)

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Axial loading – life-long limitations



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Surgical interventions-

- Acute scapholunate repairs
- Scapholunate reconstructions
- Salvage procedures

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Surgical interventions-

- Arthroscopic debridement
- Percutaneous pinning

PT 1
Pre
Dynamic

K. Wahed et al. Management of chronic scapholunate ligament injury/ Journal of Clinical Orthopaedics and Trauma 11 (2020) 529-536

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Surgical interventions-

- Dorsal SLIL repair/ capsulodesis
- Ligament reconstruction using dorsal intercarpal ligament
- Open reduction internal fixation

PT 2
Dynamic

K. Wahed et al. Management of chronic scapholunate ligament injury/ Journal of Clinical Orthopaedics and Trauma 11 (2020) 529-536

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Surgical interventions-

- Three ligament tenodesis
- Dorsal and volar capsulodesis
- SLAM scaphoid lunate axis method
- Intercarpal fusions
- Salvage procedures
- Wrist arthrodesis

PT 3
Static

K. Wahed et al. Management of chronic scapholunate ligament injury/ Journal of Clinical Orthopaedics and Trauma 11 (2020) 529-536

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Goal of Scapholunate repair or reconstruction

- To recreate the normal kinetics and kinematics of the carpus and to prevent degenerative changes
- Goal of post op therapy is to protect the injured or healing structures while promoting mobility for better functional outcomes

A.L. Wolff, S.W. Wolff/Rehabilitation for SL injury: Application of scientific and clinical evidence to practice/ Journal of Hand therapy 29 (2016) 146-153

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Post op management

- Look to MD for specific protocols
- **All have in common :**
 - Protected limited ROM in the DTM and wrist circumduction (circumduction envelope)
- Avoid PROM
- Focus on strengthening of the ECRL, APL and FCU
- AVOID ECU and FCR
- Follow Hagert rehab protocol for proprioceptive training – conscious progress to unconscious.

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Direct ligament repair / Percutaneous Pinning

Post op recovery at 6 weeks

- Short arm cast

12 weeks post op

- K-wires are removed and pt begins short arc of motion dart thrower

4-4.5 months

- Strengthening begins

6 months

- Pt released to unrestricted with life-long avoidance of extended wrist loading

Swanson MM, Lee SK (2015) Open treatment of acute scapholunate instability. Hand Clin 31(3):425-435

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Direct Ligament Repair / Percutaneous Pinning Outcomes

- Wrist stiffness 10-11 degrees into flexion
- Outcomes improve when repairs are performed acutely and in conjunction with a capsulotomies
- Grip strength 70-75% of that of uninvolved side

Swanson MM, Lee SK (2015) Open treatment of acute scapholunate instability. Hand Clin 31(3):425-435

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Modified Brunelli Tenodesis

- Strengthens connection between scaphoid and the distal carpal row
- Reconstructs the dorsal portion of the SL ligament
- Applied tension to the radiotriquetral ligament to pull the lunate and the triquetrum to the radial aspect of the wrist (to avoid ulnar translocation)

Outcomes:

- 51 degrees of flexion
- 52 degrees of extension
- Grip strength 61% of opposite side

Crawford K, Owusu-Sarpong N, Day C, Iorio M. Scapholunate ligament reconstruction: a critical analysis review. J Bone Joint Surg Am. 2016; 4: 41-8.

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Scapholunate Axis Method

- Newer procedure / shows promising results
- Chan et al ROM was 45 wrist flexion 56 degrees of wrist extension
- Mean grip strength was 62%
- In a 2019 study by Dolderer et al 22 patients
- Significant improvement in pain and functional outcomes pre and post
- Potential increase in pre op grip strengths by 33%

Chan, K, Engasser, W & Jebson, PJ (2019) Avascular necrosis of the lunate following the reconstruction of the SL ligament using a SLAM, the journal of hand Surgery 44 (10) 904
Dolderer JH, Zimny K, Klein SM, Koller M, Prantl L, Geis S. Reconstruction of chronic scapholunate dissociation with the modified scapholunate axis method (SLAM). Arch Orthop Trauma Surg. 2019 Nov;139(11):1641-1647. doi: 10.1007/s00402-019-03248-x. Epub 2019 Aug 12. PMID: 31407035

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Salvage procedures SLAC wrist

- Proximal row carpectomy
- Four corner fusion
- Partial / total wrist denervation
- Arthroplasty

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Post op Pearls/Proximal Row Carpectomy

- Usually, immobilized for 3 weeks
- Recovery is 3-6 months with max benefit at 12 months
- Imperative that pts do grip strengthening for many months
- Why? To promote shortening of the finger and wrist flexors and extensors

Green DP, Pederson WC, Hotchkiss RN, Wolfe SW. Green's Operative Hand Surgery 6th ed Elsevier Inc. Philadelphia 2014

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Post op Pearls/ Four Corner Fusion

- Usually, immobilized for 3 weeks
- Recovery is 3-6 months with max benefit at 12 months

Green DP, Pederson WC, Hotchkiss RN, Wolfe SW. Green's Operative Hand Surgery 6th ed Elsevier Inc. Philadelphia. 2011

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PRC verses the Four Corner Fusion

- Systematic review by Saltzman et al 2015
 - ROM measured in flexion/ extension arc
 - PCR: 75 degrees
 - 4 corner fusion: 62 degrees
 - Grip strength
 - PCR: 67% of uninjured side
 - 4 corner fusion: 75%
- Systematic review of 7 article by Chammas et al, 2022
 - PRC produced significantly better ROM in flexion and ulnar deviation with significantly lower complication rates
 - No significant difference in grip, extension, radial deviation and DASH scores

Saltzman BM, Frank JM, Slikker W, Fernandez JJ, Cohen MS, Wysocki RW. Clinical outcomes of proximal row carpectomy versus four-corner arthrodesis for post-traumatic wrist arthropathy: a systematic review. J Hand Surg Eur Vol. 2015 Jun;40(2):450-7. Chammas P, E, et al (2022) Proximal row carpectomy generates better mid to long term outcomes than four corner fusion arthrodesis for post traumatic wrist arthritis Orthopedics and Traumatology surgery and research 108 (7)

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Denervation

- Posterior interosseous neurectomy (PIN) for patients with chronic wrist pain secondary to SLAC wrist
- While it may be effective surgical technique for wrist reconstruction what is the impact on proprioception?
- We know that wrist proprioception in the carpals is dependent on an intact PIN nerve
- Hagert E and Persson state that routine excision of the PIN during wrist procedures should be avoided

Hagert E, Persson JK. Desensitizing the posterior interosseous nerve alters wrist proprioceptive reflexes. J Hand Surg Am. 2010. 35: 1059-66

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Post op therapy management

Expectations

- Nothing truly restores the kinematics and loading ability of the wrist
- Most will have some flexion limitations
- Salvage procedures essentially have about 50% reduction in ROM and 50-70% strength compared to opposite side.

Considerations

- Avoid joint mobilizations and passive stretches
- With PRCs focus on grip strengthening to promote shortening of the finger and wrist flexors and extensors
- Educate your patient on post op expectations

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In Summary

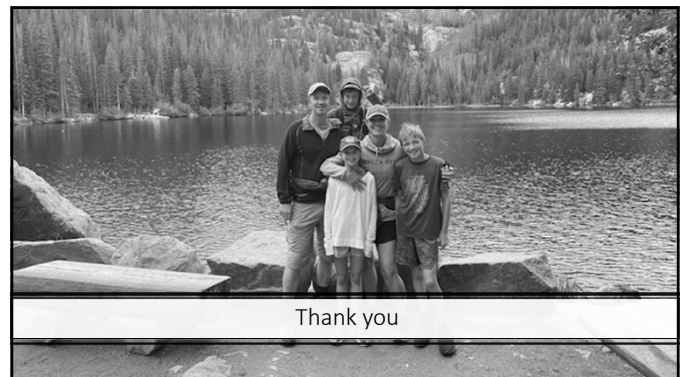
- Do not stress with the dreaded "wrist pain " dx
- Listen to the pts history
- Look to your images- be aware the plain view images may not tell the full story
- Complete your clinical exam
- Test and re test – do your pt's sx change with extension of the scaphoid ie: push splint
- Following a period of immobilization slowly with Hagert et el proprioceptive protocol
- Remember to look to "Pearls" before moving to the next level.
- If surgery is next step go slow, following immobilization progress with therapy as you would with a healing SL ligament

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Evidence Based Practice Supports

- Conservative treatment for a predynamic SILI
- Immobilization for a period with transition to less support as sx improve
- Orthosis that allow dart throwers motion
- Short arc of motion dart throwers motion is the safest
- Use of taping tech for biofeedback or to support healing tissue
- Proprioception is vital to wrist rehab
- Including conscious and unconscious phases
- The FA mm can impact the carpals as pronators and supinators.
- Avoid supinators ECU in predynamic and ECU and FCR in later phases.
- Post op pts follow similarly rehab once their immobilization phase has progressed

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Thank you

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