

Wrist & Hand Movement Coordination Deficits

ICD-9-CM codes:	842.01	Carpal sprains
	842.02	Radiocarpal sprains

ICF codes: Activities and Participation code: **d4300** Lifting; **d4301** Carrying in the hands; **d4401** Grasping; **d4452** Reaching; **d4453** Turning or twisting the hands or arms
Body Structure code: **s73023** Ligaments and fasciae of the hand
Body Functions code: **b7601** Control of complex voluntary movements

Common Historical Findings:

Carpal ligaments and fasciae involvement:

Effusion and pain

Trauma, e.g. fall unto outstretched hand with wrist extended

Wrist pain – worse at endrange of one motion more than others

Common Impairment Findings - Related to the Reported Activity Limitation or Participation Restriction:

Effusion if acute.

Stiffness if longstanding

End range pain with particular motion

Restricted accessory movements of distal radioulnar, ulnomeniscotriquetral, radiocarpal, or intercarpal articulations

Weak grip and/or pinch strength

Physical Examination Procedures:

Pain at end range of certain motions

If pain and motion abnormality is with pronation - primarily assess distal radioulnar joint

If pain and motion abnormality is with supination - primarily assess ulnomeniscotriquetral joints

If pain and motion abnormality is with extension - primarily assess radiocarpal joints

If pain and motion abnormality is with flexion - primarily assess intercarpal joints



Wrist Accessory Movement Test
Distal Radioulnar Joint



Wrist Accessory Movement Test
Ulnomeniscotriquetral Joints



Wrist Accessory Movement Test
Radiocarpal Joints



Wrist Accessory Movement Test
Intercarpal Joints

Performance Cues:

Normal Wrist ROM:

- Pronation - 80 degrees
- Supination - 80 degrees
- Extension - 70 degrees
- Flexion - 80 degrees
- Radial deviation - 20 degrees
- Ulnar deviation - 30 degrees

Also assess proximal radioulnar accessory movement in presence of pronation or supination ROM limitations

Distal radioulnar joint - stabilize radius, move ulna dorsally

Ulnomeniscotriquetral joints - stabilize radius and pisiform/triquetrum, move ulna volarly

Radiocarpal joints - stabilize radius, move lunate and scaphoid volarly

Intercarpal joints - stabilize one carpal bone (e.g., capitate), move adjacent bone (e.g., lunate) dorsally and volarly

Most common intercarpal sprain is a lunate sprain volarly (during fall onto outstretched hand with wrist extended)

Wrist Movement Coordination Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with wrist

Carpal Sprain the vernacular term “**Wrist Sprain**”

Description: Wrist pain – worse at end range of one motion than at end range of others. The patient with a wrist strain may also report pain, weakness, snapping, clicking or clunking of the wrist with movement or with of forcible grips.

Etiology: Wrist sprains are invariably the result of trauma. Four principal mechanisms of injury are throwing, weight-bearing, twisting, and impact injuries. Throwing injuries are often overuse injuries. Weight-bearing injuries result from repetitive, excessive, compressive, and rotational forces across the wrist. In twisting injuries, the wrist undergoes a rapid rotation, which disrupts the ligaments and stability of the wrist. Impact injuries are the most common injury resulting from either a direct impact or fall on the wrist. The fall is often on an outstretched hand, hyperextending the wrist. Wrist sprain usually occurs on the gapped side resulting from the force. It may be caused by a single incident or a result of repetitive stresses.

Acute Stage / Severe Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: **b7101.3** SEVERE impairment of mobility of several joints

- Wrist swelling, redness, warmth, and ecchymosis
- Temporary weakness of the wrist – “giving way”
- Joint noise during functional movement of the wrist
 - Grinding represents synovitis
 - Clunking and clicks signal carpal instability
 - Snapping usually represents a subluxing tendon or plica
- Significant wrist pain with activity
- Limited wrist range of motion – ROM limitation due to effusion or pain

Sub Acute Stage / Moderate Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: **b7101.2** MODERATE impairment of mobility of several joints

As above, except:

- Wrist swelling and tenderness is reduced
- Moderate wrist pain with activity
- Loss of grip strength and forearm/hand muscle strength deficits secondary to inflammation, pain, and disuse

Settled Stage / Mild Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: **b7101.1** MILD impairment of mobility of several joints

As above, except:

- Minimal wrist swelling and tenderness
- Mild pain with wrist movement, worse at end ranges
- Limited wrist range of motion due to stiffness

Intervention Approaches / Strategies

Acute Stage / Severe Condition

Goals: Limit excessive mobility to prevent further tissue damage

Alleviate wrist pain

Decrease swelling and tenderness

- Patient Education
 - Temporary restriction of activities that tend to stress the involved ligament
- Physical Agents
 - Ice
 - Contrast bath
 - Ultrasound
 - Electric stimulation
- Manual Therapy
 - Gentle cross friction massage to site of lesion to increase mobility of collagen fibers without longitudinally stressing the ligament
 - Gentle joint mobilization – especially of non-sprained carpal articulations – to help maintain mobility and relieve pain
 - Lymphatic massage if indicated by the amount of tissue edema
- External Devices (Taping/Splinting/Orthotics)
 - Compression of the swelling using an elastic bandage
 - Immobilize the wrist in a splint or light cast, when not exercising, to prevent further tissue damage
- Therapeutic Exercises
 - Gentle active range of motion in painfree ranges

Sub Acute Stage / Moderate Condition

Goals: Improve painfree range of motion

Improve motor control and strength of the weakened muscles

- Approaches / Strategies listed above
- Physical Agents
 - Hydrocollator
 - Paraffin heat
- Manual Therapy
 - Cross fiber massage with increased intensity
 - Joint mobilization to the restricted accessory movements of the distal radioulnar joint ulnomeniscotriquetral joint, radiocarpal joints, and intercarpal joints
- Therapeutic Exercises
 - Gentle mobility exercises to maintain motion gained with manual joint mobilization procedures
 - Initiate progressive resistive exercises – in painfree, mid-ranges

Settled Stage / Mild Condition

Goals: Restore normal extensibility of the wrist

Restore normal strength of the forearm and hand muscles

Improve tolerance for performing upper extremity functional tasks of the involved wrist

- Approaches / Strategies listed above
- Manual Therapy
 - Joint mobilization to the restricted accessory movements of the distal radioulnar joint ulnomeniscotriquetral joint, radiocarpal joints, and intercarpal joints
 - including mobilization with movements toward end ranges
 - Soft tissue mobilization to loosen fascial adhesions, normalize myofascial length and/or nerve mobility
- Therapeutic Exercises
 - Flexibility, progressive resistive and isokinetic exercises
 - Functional exercises and activity training
- Application of Joint Protection Principles
 - Postural and Activity of Daily Living Guidelines
 - Use of the strongest joint available for the job
 - Use of each joint in its most stable anatomical and functional plane
 - Maintenance of muscle balance and correct patterns of motion
 - Avoidance of static positioning of the joints

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goals: As above

Return to optimum level of patient function

Return to desired occupational or leisure time activities

- Approaches / Strategies listed above
- Therapeutic Exercises
 - Progress exercises focusing on job/sport specific training program based on individual needs
- External Devices
 - Protective equipments that supports the wrist when performing potentially injurious activities (e.g., proper fitting wrist guards while skating)
 - Wrist taping may be indicated during participation in athletic activities (e.g., platform divers can wear protective tape, wrist splints or wraps that limit backward bending of the wrist.)
- Re-injury Prevention / Patient Education
 - Instruct in re-injury preventive measures for specific job or sport activity
 - Job rotation strategies
 - Use of proper mechanics on the job or with a particular sport (e.g., skiers can choose ski poles that have a low-profile grips and/or be taught to grip their ski poles without using straps.)

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Impairment: Limited Forearm Pronation
Limited Ulnar Dorsal glide (at the distal radioulnar joint)



Ulnar Dorsal Glide

Cues: Stabilize radius on a wedge
Mobilize ulna dorsally
If the patient has normal shoulder range of motion, it may be most efficacious to perform this mobilization with the arm overhead while the patient is supine

Impairment: Limited Forearm Supination
Limited Ulnar Volar Glide (at the distal radioulnar and ulno-meniscal-triquetral joints)



Ulnar Volar Glide

Cues: Stabilize the radius and lateral carpal bones with one hand
Use your thumb and index finger of the other hand to contact the posterior aspect of the ulna and the volar aspect of the triquetrum (and pisiform)
Glide the ulna anteriorly (volarly) on the fixed radius and lateral carpal bones

The following reference provides additional information regarding this procedure:
Carolyn Wadsworth MS, PT: Manual Examination and Treatment of the Spine and Extremities,
p. 155, 1988

Impairment: Limited and Painful Wrist Extension



Wrist Extension MWM

Cues: Stabilize the distal radius and ulna
Radially glide the proximal carpal row
Sustain the radial glide while the patient actively extends his/her wrist
Alter amplitude and direction of the glide to achieve painfree active movement
Apply overpressures if indicated

The following reference provides additional information regarding this procedure:
Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 82-84, 1995

Impairment: Limited Wrist Extension
Limited Scaphoid and/or Lunate Volar Glide (at the radiocarpal joint)



Scaphoid/Lunate Volar Glide

Cues: Position the patient seated near the end of the treatment table with the forearm supported on the table
Stabilize (and pad) the radius with one hand
Mobilize the proximal carpal row volarly- utilize either a web space (more comfortable) or a index finger metacarpal (more specific) contact
Use a weight shift from the edge of the table
Modify the amount of distraction as indicated by the patient's feedback on level of comfort

The following references provides additional information regarding this procedure:

Carolyn Wadsworth MS, PT: Manual Examination and Treatment of the Spine and Extremities, p. 154, 1988

Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 82, 1989

Impairment: Limited and Painful Wrist Flexion



Wrist Flexion MWM

Cues: Stabilize the distal radius and ulna
Radially glide the proximal carpal row
Sustain the radial glide while the patient actively flexes his/her wrist
Alter amplitude and direction of the glide to achieve painfree active flexion
Apply overpressure if indicated

The following reference provides additional information regarding this procedure:
Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 82-84, 1995

Impairment: Limited Wrist Flexion
Limited Dorsal Glide of the Capitate or Lunate (at the intercarpal articulations)



Hamate or Capitate Volar Glide

Cues: Thumbs on dorsal surface of wrist - index fingers on volar surface
Stabilize lunate with your finger and mobilize capitate dorsally with your thumb - or –
stabilize capitate with thumb and mobilize lunate volarly with your finger
Same concept with hamate and triquetrum
Slightly alter wrist flexion/extension and radial/ulnar deviation to determine the
intercarpal treatment plane

The following reference provides additional information regarding these procedures:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p.73, 77, 1989

Impairment: Limited Wrist Radial Deviation
Limited Proximal Carpal Row Ulnar Glide



Proximal Carpal Row Ulnar Glide

Cues: Position the patient seated near the end of the treatment table with the forearm supported on the table
Stabilize (and pad) the ulna and radius
Use a web space contact on the scaphoid and mobilize the proximal row ulnarly
Again, use a weight shift and distraction

The following references provides additional information regarding this procedure:

Carolyn Wadsworth MS, PT: Manual Examination and Treatment of the Spine and Extremities, p. 154, 1988

Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 76, 1989

Impairment: Limited and Painful Wrist Motions
Limited Intercarpal Dorsal or Volar Glides of Hamate, Capitate, Trapezoid, Trapezium, Scaphoid, Lunate, or Triquetrum



Intercarpal Dorsal/Volar Glides

Cues: Ensure that patient is relaxed: comfortable chair with back rest; pad under elbow; correct table height; supported forearm, wrist and hand
Maintain good body mechanics to ensure therapist comfort (and thus optimal coordination and proprioception)
Keep hands relaxed

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 77, 1989

Wrist & Hand Movement Coordination Deficits

ICD-9-CM codes:	842.12	Metacarpophalangeal sprain
	842.13	Interphalangeal sprain

ICF codes:

Activities and Participation code:	d4300 Lifting; d4301 Carrying in the hands; d4401 Grasping
Body Structure code:	s73023 Ligaments and fasciae of the hand
Body Functions code:	b7601 Control of complex voluntary movements

Common Historical Findings:

Thumb ligaments and fasciae involvement:

- Forceful abduction and/or repetitive micro trauma; effusion
- Pain at end range of valgus stress test at 15 degrees of MP joint flexion
- Pain reproduced with palpatory provocation of ulnar collateral ligament

Finger ligaments and fasciae involvement:

- Trauma which causes a hyperextension or lateral stress to the fingers; effusion
- Pain at end range of varus/valgus stress test
- Pain reproduced with palpatory provocation of ulnar collateral ligament

Common Impairment Findings - Related to the Reported Activity Limitation or Participation Restriction:

- Effusion
- Symptoms reproduced with: 1st MP or 1st to 5th PIP varus / valgus stress test
- Provocation of MP or PIP collateral ligaments
- Weak grip and/or pinch strength

Physical Examination Procedures:



1st MP Valgus Stress Test

Cues: Flex MP joint 15 degrees - then apply valgus stress
If radial deviation is greater than 35 degrees (under local anesthesia) - suspect a complete rupture

Wrist Movement Coordination Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with thumb

Metacarpophalangeal sprain the vernacular term **“Thumb Sprain”**

Description: When a valgus stress on the UCL of the MCP joint exceeds the amount of what the tissue can bear, you get a partial or complete rupture of that ligament, with or without bony avulsion. This commonly occurs in skiers during a fall when the handle of the pole applies a valgus force to the thumb. With a complete rupture of the UCL the adductor aponeurosis can come to lie between the UCL and its distal attachment resulting in a “Stener lesion”. This type of lesion may prevent healing and lead to chronic instability of the thumb MCP joint.

Etiology: Forceful abduction of thumb (often during a sport activity – e.g., “Skier’s Thumb”). Repetitive micro trauma which gradually stretches and weakens the ligaments and capsule (e.g., “Gamekeeper’s Thumb”)

Nonoperative versus Operative Management: Most authors recommend surgical repair, especially with a complete tear of the UCL. It is estimated that 80% of complete UCL ruptures are identified as Stener lesions. With surgery there is more consistency with outcomes in relation to instability. The complications with surgical management include any risks associated with surgery, especially infection, and re-rupture. For some complete and non-complete tears, nonoperative management includes functional bracing for 4-12 weeks with daily active range of motion (ROM) exercises. Problems with nonoperative management include chronic instability of the joint.

Surgical procedure: Surgical repairs vary greatly between physicians. Most procedures can be divided into two general categories. The first are dynamic procedures in which stability is restored by tendon transfer or adductor tendon advancement. The second are static procedures in which the ligament is reconstructed using a tendon graft fixed to the thumb metacarpal neck and proximal phalangeal base. When ROM exercises can be initiated depends on the type of procedure.

Preoperative Rehabilitation

- Functional bracing to prevent further injury
- Control pain and edema
- Patient education of surgical procedure and post-operative rehabilitation

Acute Stage / Severe Condition: Physical Examination Findings (Key Impairments)

ICF Body Functions code: **b7101.3** SEVERE impairment of mobility of several joints

- Effusion, swelling and redness in the injured thumb
- If there is a complete rupture of the ligament, the joint will test as unstable and there will be a corresponding loss of function
- Pain with all thumb active movements
- Laxity in excess of 35° and/or 15° greater than the contra lateral thumb on valgus stress testing
- Pain reproduced with palpation/provocation of ulnar collateral ligament

Sub Acute Stage / Moderate Condition: Physical Examination Findings (Key Impairments)
*ICF Body Functions code: **b7101.2** MODERATE impairment of mobility of several joints*

As above, except:

- Less effusion, swelling and redness in the injured thumb
- Minimal pain at end range of valgus stress test
- Thenar muscle weakness

Settled Stage / Mild Condition: Physical Examinations Findings (Key Impairments)
*ICF Body Functions code: **b7101.1** MILD impairment of mobility of several joints*

As above, except:

- Mild pain with overpressure during valgus stress test

Intervention Approaches / Strategies

Non-Operative Management

Acute Stage / Severe Condition

Goals: Alleviate pain of the thumb
Decrease joint effusion

- Physical Agents
Ice
- External Devices (Taping/Splinting/Orthotics)
Compress the effusion and swelling with an elastic bandage
Immobilize the thumb in a splint or light cast
- Therapeutic Exercises
Active flexion/extension exercises in the painfree ranges

Sub Acute Stage / Moderate Condition

Goals: Improve thumb strength
Increase function of the involved hand

- Approaches / Strategies listed above
- External Devices (Taping/Splinting/Orthotics)
Taping or Splinting to assist re-injury prevention
- Therapeutic Exercise
Progressive strengthening exercises for the thenar muscles – including flexor pollicis longus

Settled Stage / Mild Condition

Goals: Maintain or return to functional activities of involved thumb

- Approaches / Strategies listed above
- External Devices (Taping/Splinting/Orthotics) – Re-injury Prevention Instruction
Tape joint before practice or competition to prevent reinjury
Consider utilizing a fabricated hand orthotic that can protect the thumb during potentially injurious occupational or leisure time activities
- Therapeutic Exercise
Add functional strengthening exercises

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goals: As above

Return to optimum level of patient function

- Approaches / Strategies listed above
- Re-injury Prevention Instruction
 - Wear a thumb or wrist brace or tape the thumb before activities
 - Use ski poles that do not have straps

Postoperative Rehabilitation

Acute Stage / Severe Condition: 0-6 weeks following repair

Goals: Protect repair

- Wear short-arm thumb spica splint continually

Sub Acute Stage / Moderate Condition: 6-8 weeks following repair

Goals: Continue to protect the repair

Control pain and edema

Minimize deconditioning

- Begin gentle AROM and PROM exercises three times a day
- Avoid any lateral stress to the thumb
- Begin dynamic splinting to increase ROM prn
- Use of modalities if needed for pain control

Settled Stage / Mild Condition: 8-12 weeks following repair

Goals: Full ROM

Limit scar formation

Strengthen hand and wrist muscles

- Wear splint only during sports related activities and heavy lifting
- Progress strengthening exercises

Intervention for High Performance / High Demand Functioning in Workers or Athletes: 12+ wks

Goals: Return to unrestricted activity

Decision of when to allow patients to return to sports are dependent on estimated healing of the repair, pain, swelling, strength, and the ability to perform the specific requirements of their sports.

Selected References:

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Wrist Movement Coordination Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with finger **Interphalangeal Sprain** the vernacular term “**Finger Sprain**”

Description: Violent overstretching of one or more ligaments that hold the finger joints together. These sprains may occur at the CMC, MCP, PIP and DIP joints.

Etiology: A twisting and jamming force on the end of the finger, or, a hyperextension or overstretching by radial or ulnar forces.

Acute Stage / Severe Condition: Physical Examination Findings (Key Impairments)

ICF Body Functions code: b7101.3 SEVERE impairment of mobility of several joints

- Effusion around the involved joint
- If complete rupture of the capsule/ligament, instability may be present with varus-valgus forces, surgery is usually recommended - followed by physical therapy
- Crepitus in an acutely injured joint may indicate a fracture
- Pain at end range of varus/valgus stress test – stressing collateral ligaments and capsule
- Pain with mid-range active and passive movements
- Tenderness/pain reproduced with palpation/provocation of involved collateral ligament

Sub Acute Stage / Moderate Condition: Physical Examination Findings (Key Impairments)

ICF Body Functions code: b7101.2 MODERATE impairment of mobility of several joints

As above with the following differences:

- Moderate swelling and stiffness around the involved joint
- Pain with active and passive movements at end ranges

Settled Stage / Mild Condition: Physical Examination Findings (Key Impairments)

ICF Body Functions code: b7101.1 MILD impairment of mobility of several joints

As above with the following differences:

- Mild swelling and stiffness around the involved joint
- Pain with active and passive overpressure movements at end ranges
- Potential limitations and pain with joint accessory motion examination

Intervention Approaches / Strategies

Acute Stage / Severe Condition

Goals: Prevent further tissue damage
Decrease swelling and stiffness
Alleviate pain of the involved joint

- Physical Agents
 - Ice pack or ice massage
 - Electrical stimulation
 - Ultrasound
- External Devices (Taping/Splinting/Orthotics)
 - A “buddy” taping (taping one finger to its neighbor) to provide stabilization
 - Thermoplastic splinting for 6 weeks continually (remove for therapeutic exercises) and then just at night for 4 more weeks
 - Compressive bandage (or kinesiotape) for swelling control, cohesive crepe bandage (light weight and easy to apply), or neoprene sleeve
- Therapeutic Exercises
 - Gentle active range of motion in painfree ranges
 - Note: Joint motion should be encouraged as soon as possible to prevent contractures
 - Improving movement at the distal (uninvolved) joint to assist with motion at the involved joint while avoiding further injury and pain.

Sub Acute Stage / Moderate Condition

Goals: Achieve normal ROM
Return to normal, non-strenuous daily functions

- Approaches/ Strategies listed above
- Therapeutic Exercises
 - Progress joint active range of motion
 - Strengthening exercises and exercises that stimulate functional activities
 - Slow firm, isolated passive and active range of motion to stretch joints with limited mobility
- Manual Therapy
 - Joint mobilization where required to restore normal accessory joint mobility (more commonly indicated following a period of joint immobilization)

Settled Stage / Mild Condition

Goals: Restore normal strength and extensibility of the involved finger
Maintain or return to functional activities of involved joints

- Approaches / Strategies listed above
- Therapeutic Exercises
Progress strengthening exercises and exercises that stimulate functional activities
- Re-injury Prevention Instruction
Tape and/or splint vulnerable joints before potentially injurious activities, such as athletic participation

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goal: Return to optimum level of patient function

- Approaches / Strategies listed above
- Therapeutic Exercises
Ensure that strengthening exercises will enhance performance and stimulate high performance/high demand functioning

Selected References

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Impairment: Limited and Painful Interphalangeal Flexion



Interphalangeal MWM

Cues: Stabilize proximal phalanx medially and laterally
Laterally glide or medially glide the distal phalanx (which ever is painfree)
Sustain the glide while the patient actively flexes his/her finger
As always - slightly alter the amplitude and direction of the glide if it is not painfree
At the end of available active range - gentle overpressure may be applied, if indicated, by the therapist or patient

The following reference provides additional information regarding this procedure:
Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 79-81, 1995

Impairment: Limited Interphalangeal Flexion
Limited Intermediate or Distal Phalanx Volar Glide



Phalanx Volar Glide

Cues: Stabilize proximal phalanx of involved PIP or DIP on a wedge - “pad” the stabilized bone with your finger or another soft object
Mobilize the distal phalanx volarly
If indicated, perform volar glides of the medial condyle or volar glides of the lateral condyle
Take care not to put excessive stress on healing post-surgical or post-traumatic tissue

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 55, 1989

Impairment: Limited Interphalangeal Extension
Limited Intermediate or Distal Phalanx Dorsal Glide



Phalanx Dorsal Glide

Cues: Stabilize proximal phalanx of involved PIP or DIP
Mobilize the distal phalanx dorsally
If indicated, perform dorsal glides of the medial condyle or dorsal glides of the lateral condyle