

Wrist Mobility Deficits

ICD-9-CM codes: 813.51 Colles' fracture
 814.1 Fracture of scaphoid

ICF codes: Activities and Participation Domain codes: **d4301** Carrying in the hands; **d4401** Grasping; **d4452** Reaching; **d4453** Turning or twisting the hands or arms
 Body Structure code: **s73011** Wrist joint
 Body Functions code: **b7202** Mobility of carpal bones

Common Historical Findings:

Trauma (e.g., fall unto outstretched hand with wrist extended)
 ROM limitation due to effusion or pain if acute
 Stiffness following immobilization and healing
 Wrist pain - worse at endrange of one motion more than others

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

ROM deficits (ext/flex/sup/pron)
 Pain at end of range of limited ROM
 Hypomobile radiocarpal, ulnomeniscotriquetral, distal radioulnar, and/or intercarpal
 accessory movement tests

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

Wrist Mobility Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with wrist
Colles' Fracture the vernacular term "**Wrist Capsulitis**"

Description: A Colles' fracture refers to an extra-articular, transverse fracture of the distal radial shaft. It most commonly occurs within 1 in. of the articular surface, causing dorsal angulation of the distal fragment in the metaphyseal area, giving the appearance of an upside-down dinner fork, radial deviation of hand, swelling and ecchymosis. Severe point tenderness over the fracture site can be found with palpation.

Deforming forces in a Colles' fracture lead to:

- Ulnar positive variance: The radius is compressed (radial shortening) and the ulna is now too high. This causes a radial shift of the wrist and hand. Measurements less than 9mm in radial length in adults suggest comminuted or impacted fractures.
- Changes in radial tilt: Normal tilt is 15-25 degrees. Changes in angulation of the radial head may also suggest impaction.
- Changes in radial volar tilt: Loss of volar tilt causes difficulty with wrist flexion.

Many classification systems have been used to describe fractures involving the distal end of the radius such as the AO system and the Frykman system. However, the Frykman classification, which is a modification of AO, is more useful for the therapist and surgeon. It is based on the mechanism of injury and supports specific treatment guidelines for each classifiable injury. (Refer to *Journal of Hand Therapy* article listed in reference section for classification system table).

AO Classification of Colles' Fractures

Type	Description
A	Extra-articular
B	Partial articular
C	Complete articular
1	Simple articular and metaphyseal fracture
2	Simple articular with complex metaphyseal fracture
3	Complex articular and metaphyseal fracture

If severe enough, Colles' fractures may heal with some residual malalignment such as a shortened radius or a distal radial displacement, which disrupt the relationship of the distal radioulnar joint articular surfaces. This malalignment results in permanent loss of full wrist mobility. Other common complications of Colles' fracture include associated carpal fracture or ligamentous tear, triangular fibrocartilage complex (TFCC) tear, distal radioulnar joint (DRUJ) subluxation or dislocation, acute post reduction swelling/compartment syndrome. Late complications include extensor pollicis longus rupture, reflex sympathetic dystrophy (at times associated with distraction of an external fixator), median nerve compression/carpal tunnel syndrome, malunion, and contractures. Each of these conditions should be addressed early to avoid a more disabling result.

Frykman Classification of Colles' Fractures

Fracture Type	Radius	Ulna	Radiocarpal	Radioulnar
I	Extra-articular	Absent	Absent	Absent
II	Extra-articular	Present	Absent	Absent
III	Intra-articular	Absent	Present	Absent
IV	Intra-articular	Present	Present	Absent
V	Intra-articular	Absent	Absent	Present
VI	Intra-articular	Present	Absent	Present
VII	Intra-articular	Absent	Present	Present
VIII	Intra-articular	Present	Present	Present

Etiology: Most common mechanism of injury is a fall on an outstretched hand. The wrist usually lands in extension and the forearm in pronation. The lunate acts as a wedge to shear the radius off in a dorsal direction. The dorsal surface undergoes compression while the volar surface undergoes tension. The momentum from the fall often caused sprain of the ulnar collateral ligament and an avulsion fracture on the ulnar styloid process.

Non-operative versus Operative Management: Indications for non-operative management include patients with stable, non-displaced or minimally displaced fractures as well as patients with poor wound healing and/or medical illnesses that preclude them from surgery and those with sedentary lifestyles and low functional demands. They can be managed non-surgically by closed reduction, combination cast and splint immobilization of the wrist for about 6 to 8 weeks, and instituting early range of motion exercises when pain permits.

Surgical treatment is indicated for unstable/displaced, severely comminuted, or intra-articular distal radius fractures. An unstable injury is defined as a fracture that does not reduce adequately with closed fracture manipulation or that loses reduction below acceptable reduction parameters despite appropriate immobilization techniques. The goal is to restore articular congruity and axial alignment, including radial length, volar tilt, radial inclination, as well as maintenance of reduction, achievement of bony union, and restoration of hand and wrist function.

Surgical Procedure: High-energy injuries are often associated with extensive swelling, and operative intervention should be performed after swelling has decreased, usually several days after injury. Various surgical methods include percutaneous pinning, external fixation, or open reduction and internal fixation (ORIF) with volar or dorsal plating.

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

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

- Swelling and ecchymosis around the distal radioulnar joint may be present
- Limited wrist flexion and/or extension active and passive mobility
- Limited forearm supination and/or pronation active and passive mobility
- Pain at mid range of limited motions
- Severe tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints

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:

- Pain at end range of limited motions
- Moderate tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints
- Hypomobile radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal accessory movement tests

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 at end range of with overpressure of wrist flexion and/or extension motions
- Mild pain at end range of with overpressure of forearm supination and/or pronation motions
- Mild tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints

Intervention Approaches / Strategies

Non-operative Rehabilitation

Acute Stage / Severe Condition:

Goals: Protection with short-arm cast

Control pain and edema

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Incorporate basic activities of daily living (ADLs)

- Active range of motion (AROM) and passive range of motion (PROM) to the digits
- AROM and active-assisted range of motion (AAROM) exercises to the elbow and shoulder
- Elevation, retrograde massage, and compressive wraps along the hand and digits
- Remove short-arm cast at 6-8 weeks if fracture appears radiographically and clinically healed

Sub Acute Stage / Moderate Condition:

Goals: Protection with splint as needed

Continue to control pain and edema as needed

Increase range of motion (ROM)

Incorporate activities of daily living (ADLs)

- Continue exercises as above
- AROM wrist extension and flexion
- AROM forearm supination and pronation
- PROM utilizing low load / prolonged stretch technique

Settled Stage / Mild Condition:

Goals: Full range of motion (ROM)

Begin strengthening program including grip strength

Return to all activities (exception to contact sports and heavy labor)

- Continue exercises as above
- Advance as tolerated to progressive resistive exercises (PREs) for all joints

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

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above

- External Devices
 - Protective equipment
 - Splint / Tape

Post-Operative Rehabilitation for External-Fixation Immobilization

Acute Stage / Severe Condition: Week 1-6

Goals: Control pain and edema

Protect surgical fixation from outside forces

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Prevent dystrophic changes

- Splint for pin protection
- Elevation
- AROM of uninvolved joints (AROM of wrist not possible)
- Supination / pronation ROM
- Desensitization program for irritated radial sensory nerve or chronic regional pain syndrome if necessary.

Sub Acute Stage / Moderate Condition: Week 7-10

Goals: Protect fracture healing site

Continue to control pain and edema as needed

Restore ROM and reduce stiffness of involved joints

- Active, active-assisted and passive range of motion exercises to wrist and forearm
- Emphasis on extension, radial deviation and supination range of motion
- Static progressive splinting for wrist extension, wrist flexion and supination if needed after removal of external-fixation

Settled Stage / Mild Condition: Week 10-16

Goals: Full range of motion (ROM)

Begin strengthening program

Progress tolerance to performance of activities of daily living (ADLs)

- Approaches / Strategies listed above
- Progressive passive stretching
- Wrist and forearm active range of motion (AROM) exercises, isometric exercises, progressing to resisted exercises using dumbbells or theraband
- Grip strengthening
- Functional activities and ADL training – progressing activity tolerance

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

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Post-Operative Rehabilitation for Volar-Fixed Angle Plating (ORIF)

Acute Stage / Severe Condition: Week 1-3

Goals: Protect surgical fixation from outside forces

Control pain and edema

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Maintain range of motion of wrist

Incorporate basic activities of daily living (ADLs)

- Elevation
- Begin gentle active range of motion (AROM) of the wrist and forearm
- Active range of motion of fingers, shoulder and elbow
- Resting static wrist splint in 30 degrees extension
- Protective static wrist splint
- Functional activities and sedentary work activities allowed involving less than 2lbs lifting

Sub Acute Stage / Moderate Condition: Week 4-7

Goals: Protection

Continue to control pain and edema as needed

Increase range of motion (ROM)

Incorporate activities of daily living (ADLs)

- Progress active range of motion to more progressive passive stretching
- Gradually discontinue use of protective static wrist splint
- Expand the performance of daily activities – ok to add limited resistance if indicated and tolerated

Settled Stage / Mild Condition: Week 8-12

Goals: Full range of motion (ROM)

Begin strengthening program

Return to all activities (exception to contact sports and heavy labor)

- Active range of motion (AROM) exercises, isometric exercises, progressing to resisted exercises using dumbbells or theraband
- Grip strengthening
- Advance activities and ADLs

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

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Selected References:

Donatelli R, Wooden M. *Orthopaedic Physical Therapy*. Philadelphia, USA: Churchill Livingstone, 2001.

Smith D, Brow K, Henry M. Early active rehabilitation for operatively stabilized distal radius fractures. *J Hand Ther*. 2004;17:43-49.

Wrist Mobility Deficits: Description, Etiology, Stages, and Intervention Strategies

The below description is consistent with descriptions of clinical patterns associated with wrist
Scaphoid Fracture the vernacular term “**Wrist Capsulitis**”

Description: The scaphoid is the most frequently fractured carpal bone, accounting for 71% of all carpal bone fractures, and 5% of all wrist injuries. Scaphoid fractures often occur in young and middle-aged adults, typically those aged 15-60 years. Men aged 20 to 30 years are most often affected. With particular reference to athletes, contact sports often yield higher rates of this type of injury. The importance of scaphoid fracture diagnosis is clear when one realizes that 90% of all acute scaphoid fractures heal if treated early. There are no specific risks or diseases that increase the chance of having a scaphoid fracture.

Etiology: The primary mechanism of injury to the scaphoid bone is a fall on an outstretched hand with resulting pain and swelling in the radial side of the wrist. Compression injury occurs with a longitudinal impaction or load of the wrist which leads to fracture without displacement. A displaced fracture results from a hyperextension injury where tensile stresses applied to the wrist exceed bone strength. Failure to diagnose scaphoid fractures, which can be well treated acutely, may result in delayed or non-union (with subsequent osteoarthritis) and deformity at a later date. Additional complications include avascular necrosis, and development of osteoarthritis of the radiocarpal joint.

Nonoperative versus Operative Management:

Typically, the initial course of conservative management is cast immobilization for 6-20 weeks. Surgical intervention is indicated if there are any signs that the fracture will not heal through simple immobilization.

Surgical Procedure:

Surgical procedure varies depending on the location of the fracture and whether the injury is acute or chronic. Kirschner wires, AO screws, Herbert screws, or staples may be used for fixation. Bone grafts, either vascularized or non vascularized may also be indicated. Central, acute, non-displaced or minimally displaced fractures: closed reduction and fixation with K-wires is often utilized. Acute or chronic fracture: bone grafts may be utilized with both types of fracture.

Preoperative Rehabilitation:

Preoperative rehabilitation may include temporary splinting and/or casting. Additional preoperative care includes patient education and instruction in post operative care and rehabilitation goals/expectations.

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

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

- Swelling and ecchymosis around the distal radiocarpal may be present
- Limited wrist flexion and/or extension active and passive mobility
- Limited forearm supination and/or pronation active and passive mobility
- Limited thumb active and passive mobility
- Pain at mid range of limited motions

- Severe tenderness in the anatomical snuffbox and over the scaphoid tubercle
- Severe pain on axial compression of the CMC joint

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:

- Pain at end range of limited motions
- Moderate tenderness in the anatomical snuffbox and over the scaphoid tubercle
- Moderate pain on axial compression of the CMC joint
- Hypomobile radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal accessory movement tests

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 at end range of with overpressure of wrists flexion and/or extension motions
- Mild pain at end range of with overpressure of forearm supination and/or pronation motions
- Mild tenderness in the anatomical snuffbox and over the scaphoid tubercle
- Mild pain on axial compression of the CMC joint

Intervention Approaches / Strategies

Non-operative Rehabilitation

Acute Stage / Severe Condition: Immediately following injury to Week 2

Goals: Protection with short-arm cast

Control pain and edema

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Incorporate basic activities of daily living (ADLs)

- Active range of motion (AROM) and passive range of motion (PROM) to the digits, except the thumb, which is immobilized
- AROM and active-assisted range of motion (AAROM) exercises to the elbow and shoulder
- At week 2, MD may repeat x-ray or choose a bone scan in the event of continued pain and tenderness over the snuffbox with negative x-rays

Sub Acute Stage / Moderate Condition: Week 3-6

Goals: Protection

Continue to control pain and edema as needed

Increase range of motion (ROM)

Incorporate activities of daily living (ADLs)

- Continue exercises as above
- Limit supination and pronation ROM exercises based on pain

Settled Stage / Mild Condition: Week 7-12

Goals: Full range of motion (ROM)

Begin strengthening program

Return to all activities (exception to contact sports and heavy labor)

- Remove short-arm cast at 6-8 weeks if fracture appears radiographically and clinically healed.
- May use wrist splint for protection
- Gentle AROM of the wrist and thumb
- Advance as tolerated to progressive resistive exercises (PREs) for all joints

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

Goal: As above
Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Postoperative Rehabilitation for ORIF

Acute Stage / Severe Condition: Immediately following surgery to Week 3

Goals: Protection with cast or splint
Control pain and edema
Maintain range in uninvolved joints (fingers, elbow, shoulder)
Incorporate basic activities of daily living (ADLs)

- Elevation and application of compressive dressing of the arm to assist in edema control
- AROM and PROM of digits consisting of blocking and composite exercises, except the thumb
- AROM and AAROM exercises to the elbow and shoulder

Sub Acute Stage / Moderate Condition: Week 4-7

Goals: Protection with cast or splint
Continue to control pain and edema as needed
Increase range of motion (ROM)
Incorporate activities of daily living (ADLs)

- Continue fingers, elbow, and shoulder exercises as above
- At 6 weeks if fracture appears radiographically healed, cast or splint is removed for gentle AROM exercises of the wrist and thumb

Settled Stage / Mild Condition: Week 8-12

Goals: Full range of motion (ROM)
Begin strengthening program
Return to all activities (exception to contact sports and heavy labor)

- Advance therapeutic exercises with gentle AROM of the wrist and thumb exercises
- Begin grip strengthening with use of silicone putty at 10 weeks
- Advance as tolerated to progressive resistive exercises (PREs) for all joints
- May use wrist splint for protection for all activities

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

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Selected References:

Berger RA. The anatomy of the scaphoid. *Hand Clinics*. 2001;17:525-532.

Cooney WP III, Linscheid RL, Dobyns JH: *Fractures and dislocations of the wrist in adults*. Philadelphia, USA: JB Lippincott Co, 1991.

Gutierrez, G. Management of scaphoid fractures. *The Physician and Sports Medicine*. 1996; 24(8).

Powell JM, Lloyd GJ, Rintoul RF. New clinical test for fracture of the scaphoid. *Can J Surg*. 1988;31(4):237-238.

Rettig AC, Weidenbener EJ, Gloyeske R. Alternative management of midthird scaphoid fractures in the athlete. *Am J Sports Med*. 1994;22:711-4.

Wozasek GE, Moser KD. Percutaneous screw fixation for fractures of the scaphoid. *J.Bone Joint Surg*. 1991;73:138-42.

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

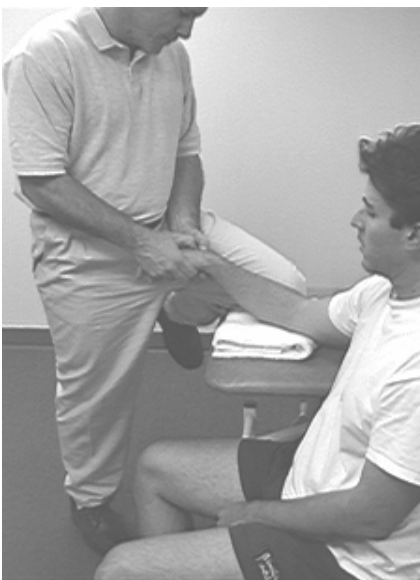


Proximal Carpal Row Ulnar Glide

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