Rehabilitation Interventions Following Wrist Fracture

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Learning Outcomes

- Apply the current evidence for rehabilitation following wrist fracture and implement strategies to mitigate the effect of comorbidities and clinical signs on recovery
- Discriminate between appropriate interventions to improve the range of motion of the wrist and forearm to optimize patient recovery
- Create a home program that enhances adherence and facilitates occupational performance
- Develop patient education materials to increase client engagement

Chapter 1

Systemic and Clinical Predictors of Recovery: Early Considerations

Patient Is Depressed

1. The proportion of people with **depression** was significantly greater in the non-recovery class (24%) compared to the slow (16%, p = 0.04) and rapid recovery (8%, p = 0.03) classes.
2. Greater self-reported depression and a lower proportion of females in the non-recovery class were distinguishing factors between the classes. Patients who appear to be in slow-recovery or non-recovery classes **may need be followed more closely.**

Modarresi et al., 2019

Patient Is a Smoker or Has Renal Impairment

- **Smokers** who undergo open reduction and internal fixation of distal radius fractures had an increased risk of 30-day perioperative adverse events, even with matching and controlling for demographic characteristics and comorbidity status

- Patients **with renal impairment** had longer time to fracture healing than patients without (67.1 ± 50.4 days versus 50.4 ± 31.8 days, p = 0.044)
- Patients **≥ 65 years** also had a longer duration to fracture healing compared to patients < 65 years (mean 63.7 ± 53.0 days versus 50.2 ± 27.2 days, p = 0.033)

1. Galivanche et al., 2021
2. Lai et al., 2023

Patient Is Fearful to Use Hand: Apprehension

- Self-perceived apprehensiveness about using the injured hand was negatively correlated with activity performance during the entire follow-up period after distal radius fracture
- Early therapy intervention presents the opportunity to detect and identify patients who do not understand the edema instructions or who need more intense rehabilitation or advice in performing daily activities
- A simple question on apprehensiveness in terms of using the injured hand in daily life could be an important factor in distal radius fracture rehabilitation

Blomstrand et al., 2023

Action Observation Intervention

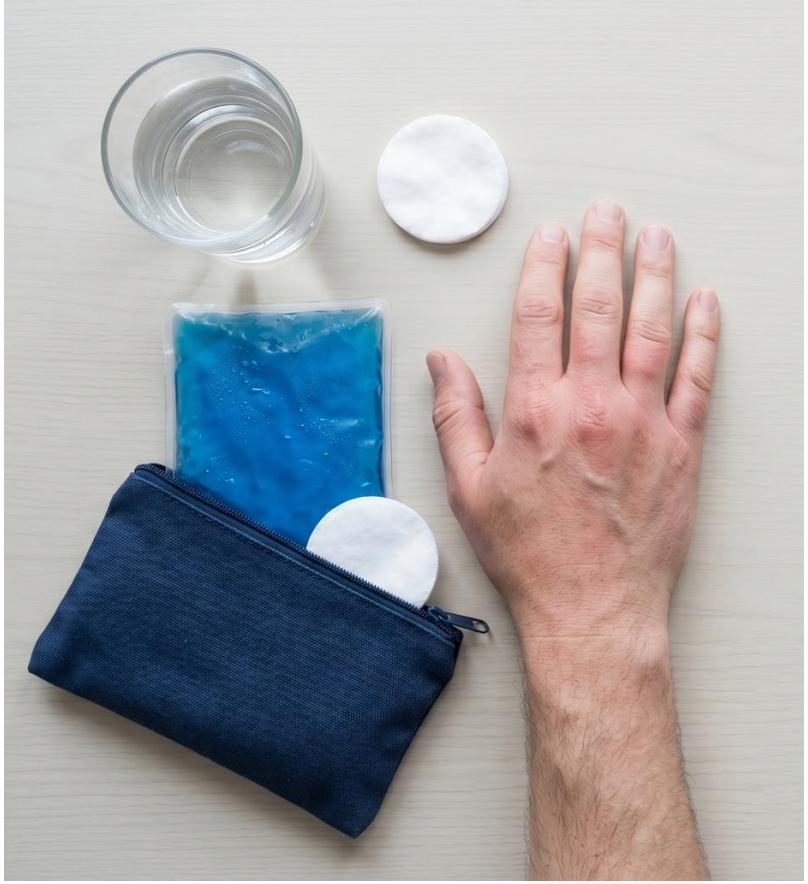
“Action Observation Intervention Using Three-Dimensional Movies Improves the Usability of Hands With Distal Radius Fractures in Daily Life”

- AOT positively affects the motor imagery of patients with DRF and can reverse the patient’s perceived difficulty in using the fractured hand during rehabilitation
- A 3D image of another person’s hand, which had been set in advance, was presented to the patient. The presented videos were finger flexion and extension (20 seconds), volar flexion and dorsiflexion (5 minutes), and pronation and supination (5 minutes). Patients were not instructed to perform active motor imagery during AOT.

Usuki et al., 2024

Patient Has Finger Stiffness

- Whirlpool and hot pack treatments improved wrist ROM during therapy sessions in this study, making both acceptable options for clinical use when the goal is to precondition a patient for other treatments



Szekeres et al., 2018

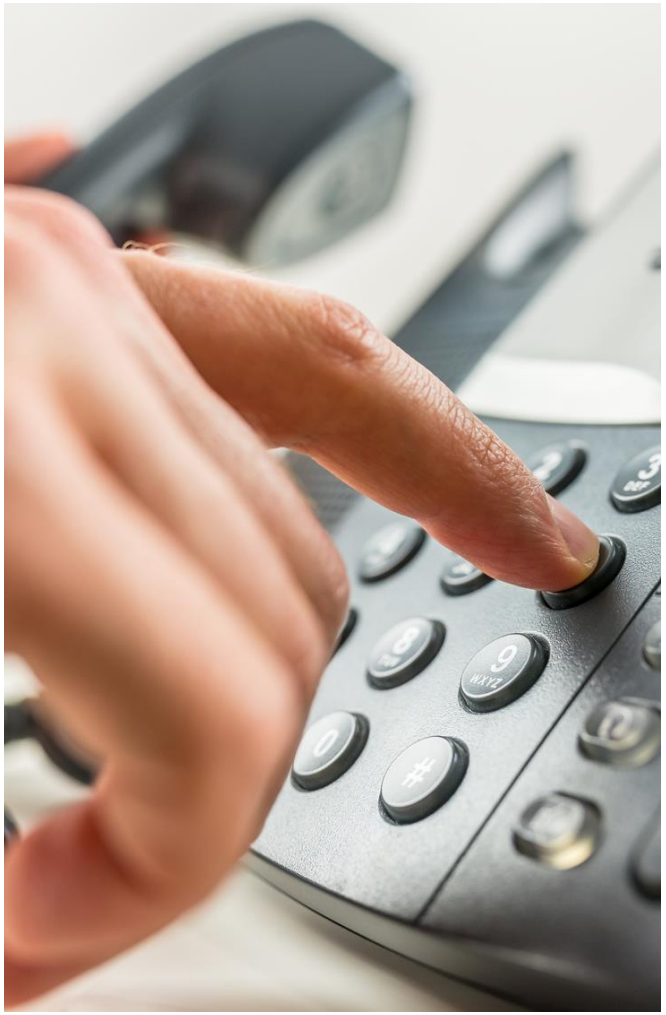
Patient Has Hand Edema

- After two weeks, participants in the intervention group experienced better outcomes compared with participants in the non-gloved comparison group.
- Intervention group participants reported reduced pain, showed less swelling, demonstrated improved ROM and hand function in specific activities, and reported improved participation in ADL. These differences were maintained until the end of the trial.

Miller-Shahabar et al., 2018

Patient in Pain After DRF

- More than one-fifth of patients who underwent ORIF of DRF experienced pain severe enough to call our institution's orthopedic hotline to ask for help at a median of seven days after fixation
- A standardized protocol for preoperative expectations, perioperative discharge instructions, and postoperative pain management may help alleviate the physician hotline phone calls



Niedermeier et al., 2021

Postoperative Instructions to Discuss With Patient

- **Pain Management**
  - Use prescribed pain medications as directed. Over-the-counter medications like acetaminophen or ibuprofen may be used unless contraindicated. Elevate the arm to reduce swelling and pain.
- **Wound Care**
  - Keep the surgical site clean and dry. Follow specific instructions for changing dressings or caring for sutures, and watch for signs of infection such as increasing redness, swelling, or discharge.
- **Swelling Management**
  - Ice the affected area to help manage swelling (apply ice for 15–20 minutes every hour as needed).
- **Activity Modification**
  - Limit activities that may strain the wrist for the first few weeks.
  - Avoid lifting or pushing heavy objects.
- **Use of Splint or Cast**
  - Wear any prescribed splint or cast as directed to support healing.
  - Do not remove or alter the splint/cast without consulting your therapist or doctor.

Expectations During Recovery

- **Healing Time**
  - Bone healing generally takes 6–8 weeks, but soft tissue healing may take longer.
- **Range of Motion**
  - Expect stiffness in the wrist and fingers initially; this is normal.
  - Gradual return of range of motion should be anticipated as healing progresses, often starting with gentle movements shortly after the procedure.
- **Occupational or Physical Therapy**
  - Rehabilitation will often include therapy to restore strength, flexibility, and function.
  - Follow the recommended therapy schedule and exercises diligently. You may attend therapy for 1–6 months depending on progress.
- **Gradual Return to Activities**
  - Activities such as driving or sports may take time to resume—consult with your therapist or doctor before returning to these activities.
  - Listen to your body. Avoid pushing through pain during recovery.

Long-Term Expectations

- **Nutrition**
  - Maintain a balanced diet rich in calcium and vitamin D to support bone healing
- **Hydration**
  - Staying well-hydrated can help overall recovery
- **Smoking Cessation**
  - If applicable, cessation of smoking can improve healing outcomes
- **Important Reminders**
  - Notify healthcare providers of any unusual symptoms, such as severe pain, swelling, numbness, or changes in skin color
  - Engage in a support system, whether through family, friends, or support groups, to aid mental and emotional well-being

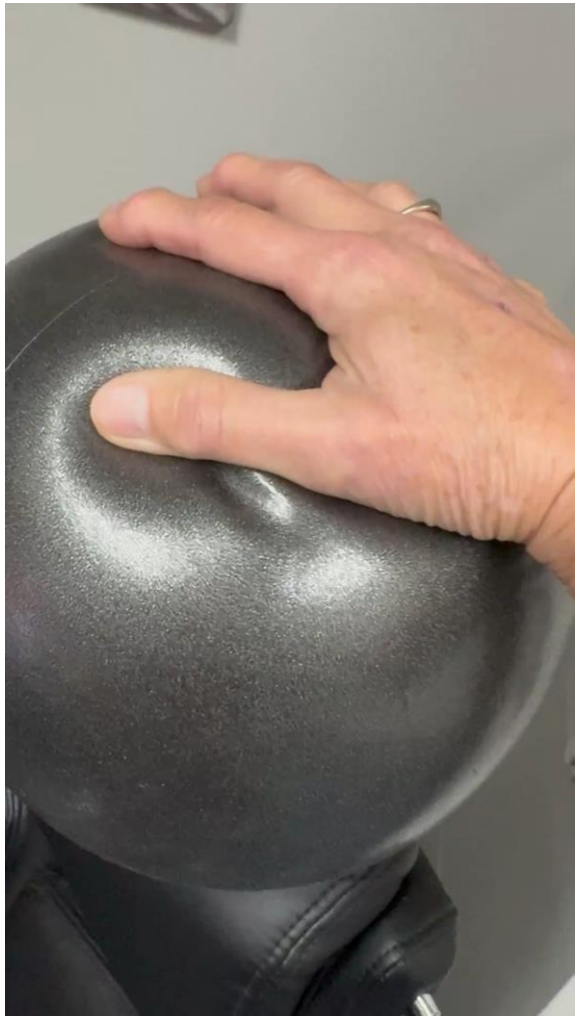
Complex Regional Pain Syndrome (CRPS) After Distal Radius Fracture

- Patients in the economically productive age group with a history of high-impact trauma and patients with a history of psychiatric disorders have greater risk of developing CRPS after DRF

Ortiz-Romero et al., 2017

Therapy for CRPS After DRF

- Fifteen minutes of active wrist and hand exercises in a whirlpool at a temperature of 34°C.
- Joint mobilization was applied to the radiocarpal joint. During the first two weeks, participants received grade II or III of Maitland techniques, at a dose of one cycle per second for one minute.
- Use gentle oscillatory movements to mobilize the joint. Focus on maintaining a neutral wrist position during mobilization.
- Manual pressure control with visual feedback. Pressure applied 5 sec, 10 reps, 10 sec rest between reps.



Gutiérrez-Espinoza et al., 2022

Therapy for CRPS After DRF (cont.)

- Reverse dart-throwing exercise with pressure of the first interosseous space
- Pressure on clip for 5 sec, 10 reps, 10 sec rest between reps
- Scapular retraction exercises: 10 reps with 10 sec rest between reps
- One-year follow-up demonstrated clinically significant improvements in DASH, grip, and VAS

Gutiérrez-Espinoza et al., 2022

Graded Motor Imagery (GMI) to Reduce Pain Following DRF

- GMI protocol consisted of three stages that required three weeks of lateralization, three weeks of motor imagery, and two weeks of mirror therapy
- The GMI group showed **greater improvement in pain intensity** (during rest, 2.24; activity, 6.18 points), wrist ROM (flexion, −40.59; extension, −45.59; radial deviation, −25.59; and ulnar deviation, −26.77 points), forearm ROM (supination, −43.82 points), and functional status (Disability of the Arm, Shoulder and Hand Questionnaire, 38.00; Michigan Hand Questionnaire, −32.53 points) when compared with the control group (for all, $P < .05$)

Dilek et al., 2018

Patient Progression Algorithm: Early Stage

Patient without comorbidities or significant clinical symptoms (e.g., stiff fingers, excessive edema) who can independently follow HEP

May not need formal therapy regime

Clinical Practice Guidelines From WHO

Approach	American Academy of Orthopedic Surgeons	Danish Health Authority
Multidisciplinary management	Home exercise program	• No rehabilitation supervised by an occupational therapist or a physiotherapist on a routine basis for patients with uncomplicated cases • Offer guidance and practical instruction concerning self-rehabilitation
Therapeutic exercises	• Active finger motion exercises • No need for early wrist motion following stable fracture fixation	
Orthosis		Consider short-term cast or similar immobilizing bandage (< 2 weeks)

Gimigliano et al., 2020

Chapter Summary

- Patient apprehension, depression, smoking, and renal impairment may impact and delay recovery. Ensure that you address not only the clinical signs, like finger stiffness, but also psychological factors.

Chapter 2

New Evidence-Based Interventions to Improve Range of Motion: Mid-Stage

Frank Is 6 Weeks Post Op and DRF Is Healed According to Recent X-Ray

- Wrist total active motion measures 40 degrees
- Forearm total active motion measures 60 degrees
- Active finger flexion is to 5 cm to the palm
- Quick-DASH score is 50
- Fracture healing confirmed by physician

Patient Progression Algorithm: Mid-Stage

Work on passive range of motion of wrist/forearm/digits

Dart thrower's motion	Digit intrinsic and extrinsic stretching

↓

Sensory motor program

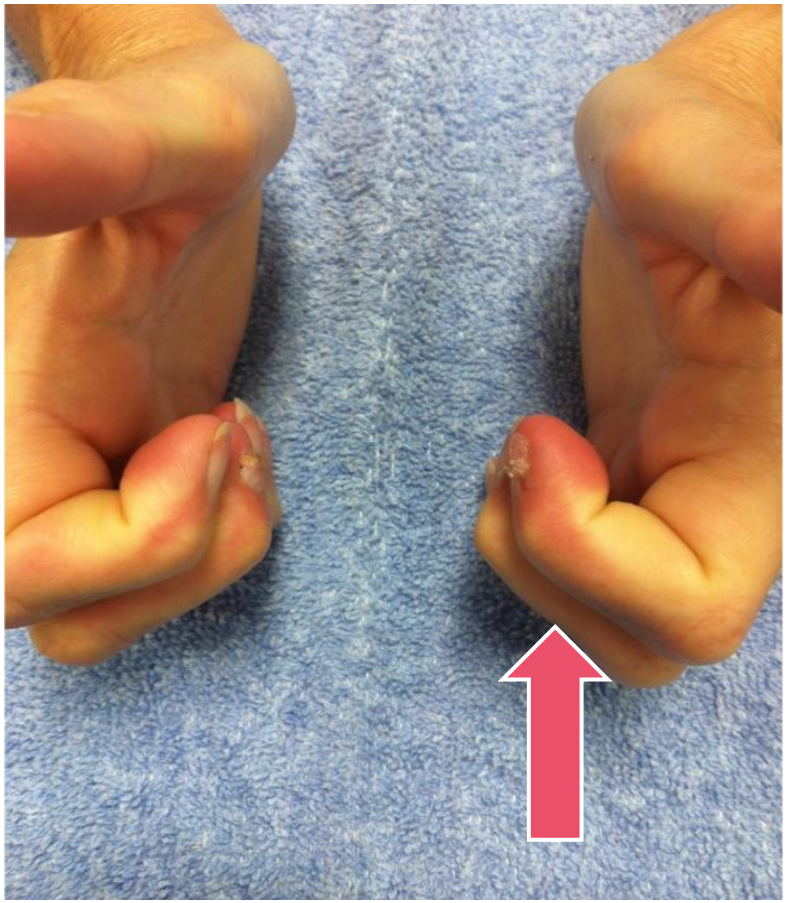
Tactile stimulation	Proprioception exercises

↓

Strengthening can be initiated, but is not the priority

Consider strengthening in dart thrower's range rather than over bolster

Finger Stiffness: Intrinsic Tightness



Extrinsic Extensor Tightness

1. Make fist with wrist in neutral
2. Make fist with wrist in full flexion
3. If motion is greater with wrist in neutral, extrinsic extensor tightness is present

Extrinsic Flexor Tightness

1. Straighten digits
2. Straighten digits and fully extend wrist
3. If finger extension is greater with wrist in neutral, extrinsic flexor tightness is present

Dart Thrower's Versus Sagittal Plane Motion

- The control group activated the wrist in the sagittal plane, whereas the research group activated the wrist in the DTM plane
- Dart thrower's motion group reported significantly higher satisfaction rates than the sagittal plane motion group on topics such as general satisfaction, motivation to exert oneself, progress in function, and self-training contribution to daily function

Kaufman-Cohen et al., 2021

Therapy Following Closed Reduction and Cast: 6 Weeks Post-Fracture

- **Participants**
  - 67 adults (76% female, mean age 60 years) treated with casting after distal radius fracture.
- **Intervention**
  - The control group received exercises and advice. The experimental group received the same exercises and advice, plus supination and wrist extension mobilization with movement (MWM) 6 times, 2 times a day
- Outcomes were better in the experimental group at 4 weeks
  - Extension (14 deg)
  - Flexion (9 deg)
  - QuickDASH (-11)
  - PRWE (-13)
- Benefits were still evident at 12 weeks for supination, extension, flexion and QuickDASH
- The experimental group were more likely to rate their global change as “improved” (risk difference 22%, 95% CI 5 to 39)

Reid et al., 2020

A. For supination, the participant glided the radius on the ulna while actively supinating the forearm.

B. For wrist extension, the participant was instructed to lightly place their relaxed fingertips onto a table. They performed a glide of the distal radius towards the little finger using the webspace of the unaffected hand.

A

B

C. Alternately, they could glide the proximal row of carpal bones towards the thumb using a thin strap.

D. While sustaining the glide in B or C, the participant then performed wrist extension by leaning forward over the hand.

C

D

Scapular Program Following DRF

- Interventions: The control group (n = 51) received a six-week physical therapy treatment; the intervention group (n = 51) received the same treatment plus a scapular exercise program
- Difference between groups for the DASH was 16.7 points ($P < 0.001$), 1.5 points ($P = 0.541$) for the PRWE, 0.2 cm ($P = 0.484$) for the VAS at rest, and 1.7 cm ($P < 0.001$) for the VAS at movement

Gutiérrez-Espinoza et al., 2019

Scapular Exercises

1. **Scapular Orientation Exercise:** This exercise has been described as an active control of scapular orientation facilitated by the therapist and then practiced by the patient. (Progressive upward rotation, decreased internal rotation, and movement from an anteriorly to a posteriorly tipped position.)
2. To correct the increase in the upward and internal rotation in the frontal plane, the **LOW ROW** exercise was performed. In the concentric phase, this exercise selectively activates the inferior trapezius, latissimus dorsi, and rhomboid major muscles.
3. Finally, to correct the increase in the upward rotation in the scapular plane, an **isometric adduction exercise with the shoulder in the scapular plane at 30°** and 60° was performed. This exercise at low load selectively activates the teres major, latissimus dorsi, and rhomboid major muscles, with low activity of the upper trapezius and middle deltoid.

The regimen was 10 times for each exercise, maintaining the task for 5–10 seconds, with 10–30 seconds of rest in between.

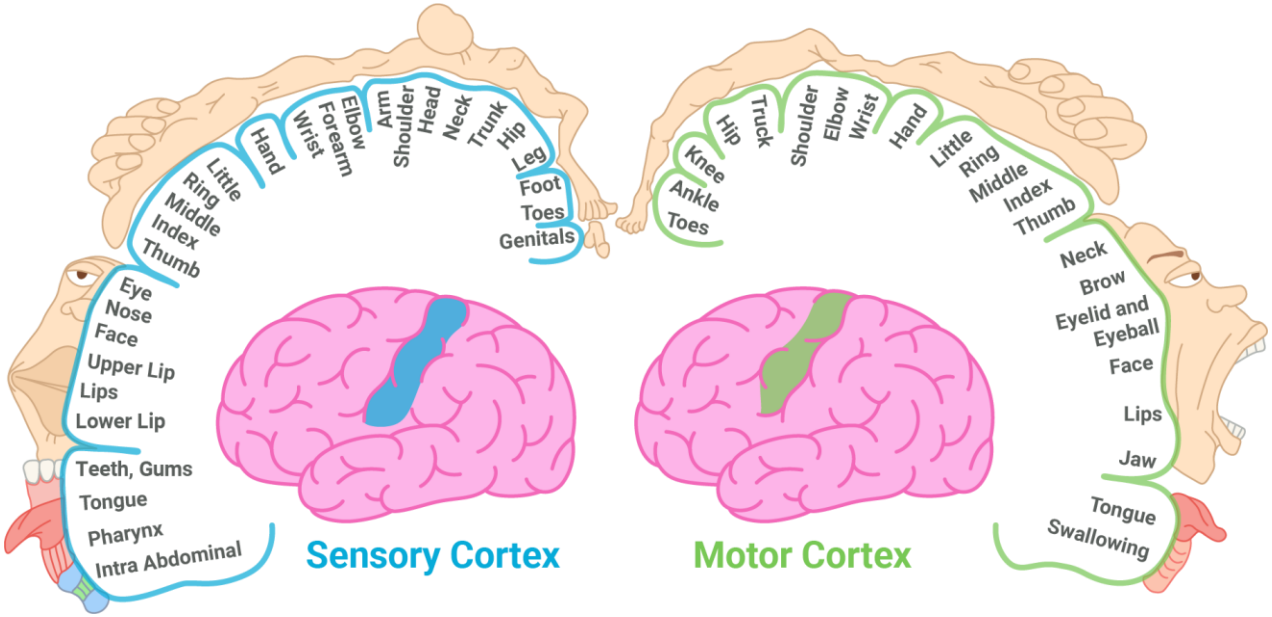
Gaming to Increase Strength

- Following DRF, strengthening was performed over two months with two weekly sessions lasting 40 min each, for a total of 17 sessions
- For the strengthening exercises, we chose four serious games of the E-Link program
    1. Monkeys for gripping
    2. Hit Walls for tip pinching
    3. Package Man for lateral pinching
    4. Skateboard for tripod pinching
- The use of serious games combined with a conventional physical therapy intervention played a fundamental role in recovery and return-to-work activities

Zago et al., 2020

Sensorimotor Program After DRF

- 60 patients following surgery were randomized into two treatment regimens
- The initial evaluation was similar for both groups, and both demonstrated significant sensorimotor deficits following surgery for DRF
- The clinical results were better in the group treated with the sensorimotor-proprioception protocol mostly in the wrist; however, not all the differences were significant



Wollstein et al., 2019

Home Program: 15 min 2× per day

Sensory stimulation: Each finger from distal to proximal with and without cream
Flexion and extension: Each finger active and passive using the uninjured hand—eyes open and eyes closed
Adduction and abduction fingers: Eyes open and closed
Mirror imaging of finger movement: 1–5 flexion/extension abduction—eyes open and eyes closed
Stimulation of each finger with different textures: Cotton, steel wool, toothbrush—eyes open and eyes closed
Imagination with eyes closed wrist flexion/extension: Radio–ulnar deviation and pro-supination
Same movement: Both wrists
Activities of daily living (ADLs): Eyes open and eyes closed
Dominant hand involved: Write, eat, dress
Nondominant hand: Eat, dress, grooming

Results

- Proprioception deficits were pronounced at initial evaluation and remained high at six weeks and at three months, though there was consistent improvement in all but the wrist parameters.
- At six weeks there was a trend toward significance in wrist proprioception between the two groups. Both groups had increased proprioception deficits when compared with the initial evaluation, but the protocol group had less of an increase. The standard group had 10 patients (55.6%) with abnormal testing, the protocol group had eight patients (28.6%) with abnormal results ($p = 0.07$).
- At three months, the differences had resolved.

Patient Progression Algorithm: Late Stage

Occupation-based and return to work

ADL-relevant tasks	Work simulation

↓

Strengthening to regain function

Upgrade HEP	Progressive resistive exercises

↓

Consider orthotic intervention to regain motion if not making steady gains

Effect of Occupation-Based Intervention on Patients With Distal Radius Fracture

- The patients selected up to 10 activities using the injured hand from the illustrations on the iPad and prioritized each illustration
- At this point, the therapist suggested several activities to the patient based on the illustrations, considering the patient's needs and condition of the injured hand

Kukizaki et al., 2023

Results

- Improvements in the Pain Catastrophizing Scale magnification, Hospital Anxiety and Depression Scale, and Disabilities of the Arm, Shoulder, and Hand questionnaire scores were significantly higher in the OBI group than in the strengthening and ROM group ($p < .05$)

Occupation-Based Treatment

- Occupation is highly influential in promoting recovery of movement and function after a distal radius fracture
- Occupation improves movement by acting as a driving force, offering ready-to-hand challenge, inviting intentional use, habituating the wrist to movement, and drawing on the psychosocial resources of individuals

Collis et al., 2022

Functional Capacity Evaluation

- Job-specific functional capacity evaluation shows a better predictive validity in relation to the return to work of patients with a specific injury, such as a distal radius fracture
- A longer period from injury to FCE and compensable injury reduces the predictive ability of job-specific FCE

Collis et al., 2022

Chapter Summary

- Ensure you are preforming occupation-based interventions to increase patient engagement and satisfaction during therapy
- Scapular strengthening is also an important component of treatment following distal radius fracture

Chapter 3

Optimizing Home Exercise Programs Following a Distal Radius Fracture: A Multi-Stage Approach

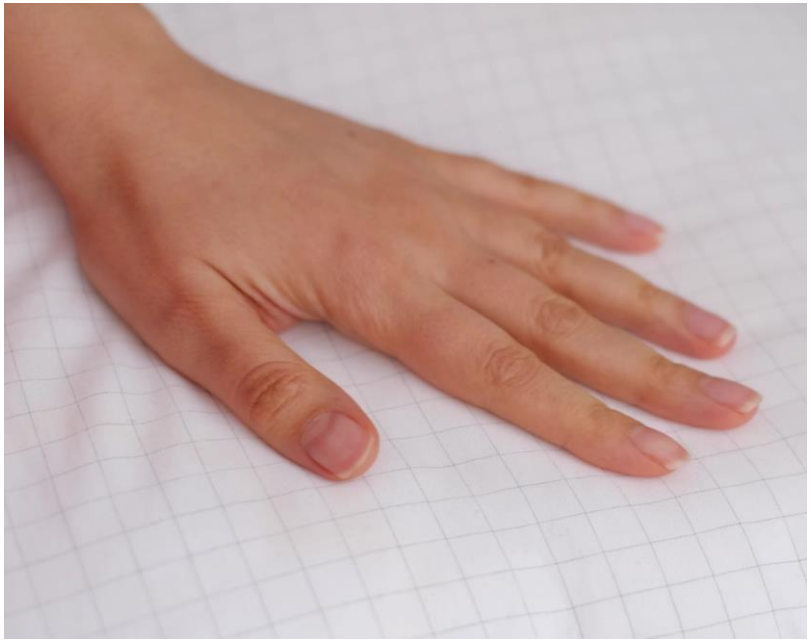
Week 1–2

- The exercises were grouped by week. During the first two weeks the priority was pain reduction and reduction of edema.
- Gentle AROM of digits, wrist, and forearm within pain tolerance.
- This program was performed once a day for six weeks and the duration of exercises was one hour daily.

Gutiérrez-Espinoza et al., 2024

Pitfalls to Watch For

- Loss of finger extension
  - Patient is holding fingers in flexion and never executing full motion
- Pitting edema
  - Pressure with fingertip to dorsum of patient's hand leaves an impression
- Signs of avoidance of the hand
  - Covering with washcloth, carrying it on a pillow, etc.
- Loss of shoulder motion

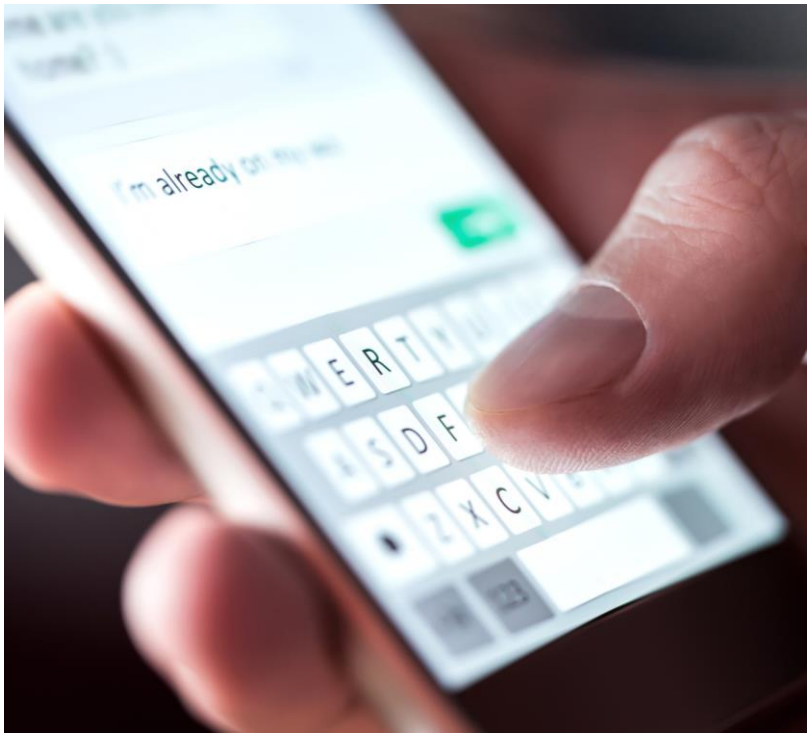


Home Exercise Program Tips to Promote Adherence

- Use visual aids and demonstrations during initial sessions
- Provide clear written instructions with anatomical references of top three exercises
- Explain the “why” behind each exercise
- Connect exercises to functional goal
- Create personalized instruction sheets
- Record demonstration videos for complex movements
- Use analogies patients can relate to
- Schedule follow-up education sessions

Leverage Technology for Reminders

- **Text Message Reminders**: Simple, scheduled prompts
- **App Notifications**: Interactive exercise tracking
- **Email Follow-Ups**: Weekly progress check-ins
- **Video Demonstrations**: Accessible technique references



Meijer et al., 2023

Current Practice Patterns of Therapists Regarding HEP Following DRF

Interventions	
Active range of motion exercises	91.3%
(Grip) Strength exercises	79.3%
Passive mobilization exercises/stretches	67.4%
Other exercises	27.2%
Support Tools Used	
Leaflets	40.2%
Online webpages	10.8%
Mobile applications	25.0%
Pictures / visual support (videos)	17.4%

Meijer et al., 2023

Week 3–4

- Passive ROM exercises to the digits, wrist, forearm, elbow, performed (early active motions without resistance, including finger stretching and spreading exercises, forearm stretching, bending and stretching elbow exercises, as well as abduction/adduction and external/internal rotation of the shoulder)

Importance of Static Stretch for Gaining Motion

- Static stretch exercises (30 min or more) result in a marked enhancement in flexibility with larger effects of passive, as compared with active, static stretch exercises
- Systematic review

Arntz et al., 2023

Two Theories Regarding the Effectiveness of Static Stretch

- Sensory theory proposes that chronic exposure to stretching results in an increased stretch tolerance. The patient can tolerate more passive tension after training owing to a modification of the subjective perception of discomfort probably caused by adaptions at the level of nociceptive endings.
- Mechanical theory assumes that stretching protocols decrease joint resistance to a stretch probably because of a change in in tissue stiffness or geometry (e.g., the addition of sarcomeres in series and increase in fascicle length).

Artnz et al., 2023

Week 5 and Beyond

- Grip strengthening exercises and dynamic muscle exercises with light resistance initially
- Upgrade to heavier resistance as tolerated
- Use free weights, hammer, tennis ball for gripping

Chapter Summary

- Low-cost exercises like tennis ball squeezes, hammer alternating supination and pronation, and free weights can be incorporated after fracture healing has been confirmed
- Providing visual aids or texting patients may help them with home program adherence

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