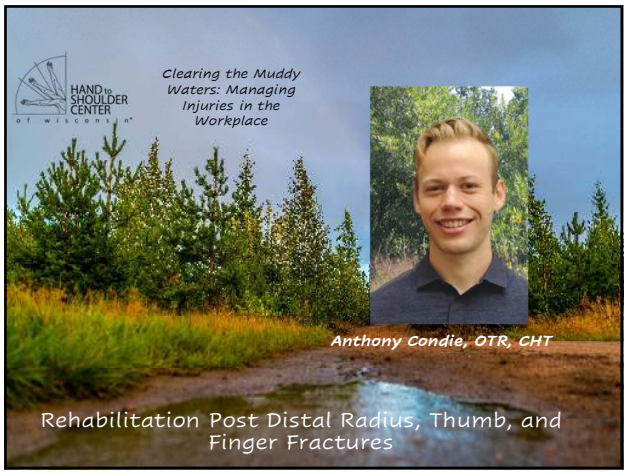


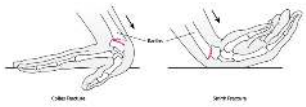
1

Goals of This Presentation

- Understand what the phases of rehabilitation look like
- Learn about factors that may influence recovery
- Understand how work simulated strengthening is used to bridge the gap to return to work

2

A Bone to Pick with Fractures



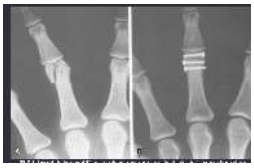
(Osterman et al., 2017)

(Osterman et al., 2017)

3

A Bone to Pick with Fractures

(Osterman et al., 2017)



(Osterman et al., 2017)

4

General Principles of Rehabilitation with Fractures

- Stable vs unstable fracture
  - Length of immobilization
- Open vs closed fractures
  - Open fractures lead to increased infection risk (Balaram and Bednar, 2010)
- Single fracture vs complex fractures
- Primary healing vs secondary healing
  - Primary healing (ORIF) allows for early ROM due to sufficient internal support (Hardy, 2004)
  - Secondary healing relying on callus formation – longer time (Hardy, 2004)

5

General Principles of Rehabilitation with Fractures Cont.

- Most common complication of digit fractures is stiffness (Balaram and Bednar, 2010)
  - Associated with crush injuries, multiple finger involvement, open fractures, and immobilization greater than 4 weeks

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Phases of Recovery

- Early Phase: Post surgical date to orthosis (first 1-2 weeks)
- ROM Phase: Primary focus on AROM/AAROM (2-6 weeks)
- Light strengthening/PROM phase (6-10 weeks)
- Late Phase: Work simulated strengthening (10+ weeks)

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Phases of Rehab Cross Referenced with Case Study

- Compare rehab stages with progressive exercises
- Different obstacles at each stage
- Described phases are fluid vs concrete stages in relationship to rehabilitation
  - Treatment session may have components of all the stages

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Early Phase – Evaluation Day

- Obtaining history, work status, job requirements, etc.
- Removing post op bandaging (can vary)
  - Patient seeing injury for the first time
- Taking measurements
- Education on precautions, wound care, and home exercises
- Orthosis fabrication

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Orthoses Types

- WHFO Thumb Spica

- HFO Thumb Spica

10

Orthoses Types Cont.

- WHO

- FO Tip protector

- W/HFO Intrinsic Plus

11

Goals of Orthosis Fabrication

- Protect surgical site
- Prevent positions of deformity
  - Most common deformity after crush injuries include intrinsic-minus positioning and thumb adduction (Goodman et al., 2017)

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Treatment Focus in Early Phase

- Education (precautions, explanation of what they are feeling and why, wound care, etc.)
- Initiating ROM and proper performance
- Edema management
- Orthosis management
- Addressing physical and psychosocial factors

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Case Study Introduction

- 32-Year-Old Male
- Hand caught in machine and pulled towards machine leading to multiple fractures/tendon lacerations
- Surgery Date 3/5/25 – Distal radius ORIF, Ulna metaphysis ORIF, and internal fixation/pinning of 3rd MCP and metacarpal base fracture, ORIF proximal phalanx of index finger
  - Partial laceration of EPL, collateral ligament repairs of IF/MF and sagittal band repair, RF zone VI 6 EDC repair
- First post-operative therapy visit on 4/14/25 (pins removed on this date)

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Case Study – Early phase

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Case Study – Early phase

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Case Study – Evaluation Date (4/14/25)

- Cleared for full ROM of wrist, thumb, ring, and small fingers
- Limiting MP flexion of IF to 45 degrees, MF MP/PIP to 45 degrees flexion
- Placed in radial gutter intrinsic plus (WHFO-static) with MPs in slight flexion (15 degrees)
- Work restrictions: Left hand work only

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ROM Phase

- Continue progressing with ROM, edema management, scar mobility
  - Monitoring for development of secondary conditions such as flexion contractures, scar adhesions, etc.
- Continued education on symptoms, healing process, and management of symptoms at home
- Avoiding the "roller coaster" of good days/bad days

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ROM Phase Cont.

- More hands-on stage of their recovery
- Desensitization
- Start introducing proprioceptive exercises
- Normalize movement!
- Use of modalities

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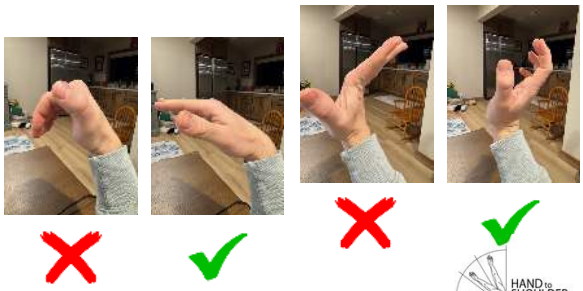
ROM Phase – Education on Proper Form with HEP



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Case Study – ROM Phase (MD visit on 5/7/25)

- Working within ROM precautions until next MD visit on 5/7/25
  - MD update included progressing with full ROM
- Patient noting recurrent nightmares of work incident that has impacted his sleep
  - Important to screen for changes in sleep pattern, behavior, and mood (Goodman et al., 2017)
- Continued global stiffness present through digits and wrist specifically
  - Monitoring extension lag for IF/MF
- Work restrictions: Right hand assist of 1-2 lbs
  - No high force gripping or extreme wrist positions

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Evaluation Date to MD Follow-Up

IF to SF ROM:

Range of Motion (degrees)		Right AROM	AROM 4/28
Index	MP	15-25	10-45
	PIP	10-25	0-45
	DIP	0-16	0-35
Middle	MP	16-30	15-40
	PIP	10-30	10-35
	DIP	0-17	0-20

Wrist, Forearm & Elbow ROM:

Range of Motion (degrees)		Right AROM 4/23	AROM 4/28
Wrist	Flexion	17	25
	Extension	15	24
	Uln. Dev.	5	16
	Rad. Dev.	15	18
Forearm	Supination	30	45
	Pronation	60	85
Elbow			
Comments			

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Case Study – ROM Phase

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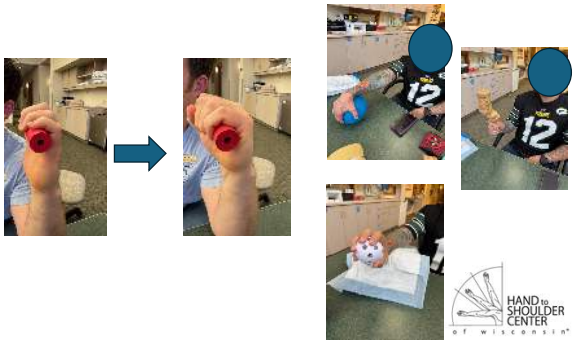
Case Study – ROM Phase



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Case Study – ROM Phase

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PROM/Light Strengthening Phase

- Phase is characterized by introduction of passive stretching and clearing for more "aggressive" ROM
  - May be cleared for use of static progressive orthoses if struggling to gain motion
- Introduction to gentle strengthening activities. May start as light as a foam block, progressing to foam football, putty, and spring-loaded gripper
- Can start some gentle weight bearing activities in later stages
- Building blocks for strengthening that will lead to more advanced stages of work-simulated strengthening

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PROM/Light Strengthening Phase – Case Study (MD visit 6/4/25)

- Global stiffness present through wrist and digits. Continued work with ROM, with introduction of more aggressive PROM
- MP flexion limiting ability to grasp
  - Issued static progressive orthosis to help achieve MP flexion with wearing schedule 2-3x day for 20-30 minutes
- Flex bar strengthening
- Putty exercises
- Work restrictions: Light assist of right hand up to 2 lbs
  - No high force gripping and no frequent extreme positions of wrist

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Case Study – PROM/Light Strengthening (MD visit on 6/4/25)

IF to SF ROM: IF to SF ROM:

Range of Motion (degrees)		Right AROM Eval	Right AROM 5/30
Index	MP	15-25	5-58 61 (passively)
	PIP	10-25	0-91
	DIP	0-16	0-70
Middle	MP	16-30	14-52 62 (passively)
	PIP	10-30	5-84
	DIP	0-17	0-64

Wrist, Forearm & Elbow ROM:

Range of Motion (degrees)		Right AROM Eval	Right AROM 5/30
Wrist	Flexion	10	46 was 50
	Extension	5	44 was 35
	Uln. Dev.	5	25
	Rad. Dev.	15	20
Forearm	Supination	-30	75
	Pronation	65	85
Elbow		45-130	0-138
Comments			

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Case Study Continued (PROM and Strengthening)

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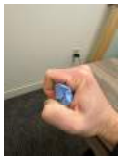
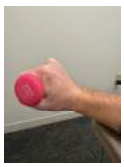
Case Study Continued (PROM and Strengthening)





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Case Study Continued (PROM and Strengthening)




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Case Study Continued (PROM and Strengthening)



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Treatment Focus in Late Phase – Work Simulated Strengthening

- Less emphasis placed on ROM with shift towards gearing up for full duty work
- Breaking down work duties and tasks that can be replicated in clinic
- Exploring different supportive braces to help aide with work task as needed
- Allows patients a chance to clarify concerns with their job duties and practice those tasks in a safe environment

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Late Phase Strengthening



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Late Phase Strengthening



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Late Phase Strengthening – Case Study




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Late Phase Strengthening – Case Study




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Road to Recovery


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Rehabilitation Obstacles

- Continued pain throughout index finger/middle finger MCPs and ulnar side of wrist
- Trialed bullseye brace and education on lifting mechanics, but pain continued
  - This in turn limited patient's ability to progress with increasing resistance, repetitions, and work simulated tasks
- Led to 2nd surgery on 9/12/25 to remove ulna plate, MCP capsulectomy, and tenolysis

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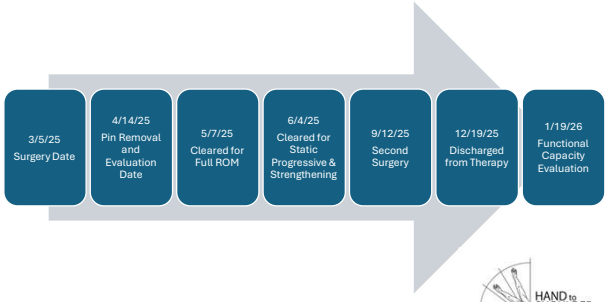
Length of Rehabilitation



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Final Measurements

IF to SF ROM:

Range of Motion (degrees)		Right AROM	Right PROM
Index	MP	5-61 was 0-68	70 was 72
	PIP	+5-92 was 0-105	80
	DIP	+5-80 +6-80	50
Middle	MP	15-59 was 5-64	65 was 70
	PIP	0-95 was 0-99	82
	DIP	0-65 was +5-78	63

Wrist, Forearm & Elbow ROM:

Range of Motion (degrees)		Right AROM	Right PROM
Wrist	Flexion	53 was 58	
	Extension	62 was 62	
	Uln. Dev.	22	
	Rad. Dev.	15	
Forearm	Supination	72 was 69	
	Pronation	71 was 75	
Elbow			

Strength (lb.) Tool #1	Right	Left
Grip at 90 deg elbow flexion	57 was 44, 44, 45 lb (44.6 lb average)	95
Grip in elbow extension		
Pad Pinch	14 was 16	19
Lateral Pinch		
Tip Pinch		
Comments		

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Case Study – Complications with Rehab

- Combatting stiffness
- Psychological factors such as recurrent nightmares from work injury
- Ongoing pain with progression of strengthening/work simulated task
  - Led to second surgery to remove ulnar styloid plate
- Patient went on to achieve functional ROM, but ultimately struggled with his return-to-work secondary to pain/weakness in his hand

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Take-Home Messages

- Recovery is not linear
  - Set-backs can happen when return to work tasks are initiated
- More traumatic injuries, such as crush injuries, can lead to a longer recovery
  - Multiple joint involvement leads to increased stiffness!
- The early stages of therapy help lead to the building blocks of work simulated strengthening
- Work simulated strengthening is catered to the patient and demands of their job duties

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Thank you!

- References

  - Balaram, A. K., & Bednar, M. S. (2010). Complications after the fractures of metacarpal and phalanges. *Hand Clinics*, *26*(2), 169–177. https://doi.org/10.1016/j.hcl.2010.01.005
  - Goodman, A. D., Got, C. J., & Weiss, A.-P. C. (2017). Crush injuries of the hand. *The Journal of Hand Surgery*, *42*(6), 456–463. https://doi.org/10.1016/j.jhsa.2017.03.028
  - Hardy, M. A. (2004). Principles of metacarpal and Phalangeal Fracture Management: A review of rehabilitation concepts. *Journal of Orthopaedic & Sports Physical Therapy*, *34*(12), 781–799. https://doi.org/10.2519/jospt.2004.34.12.781
  - Osterman, A. L., Skirven, T. M., Fedorczyk, J. M., Amadio, P. C., Feldscher, S. B., & Shin, E. K. (2021). *Rehabilitation of the hand and upper extremity*. Elsevier Mosby.

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