# Introduction to Pediatric Upper Extremity & Hand Therapy

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# Development & Hand Function

## Birth-2 months

- Gross Motor:
  - Normal physiologic flexion except during startle or stretching
- Grasp:
  - Reflexive grasp on objects placed in palm
  - Avoiding response when hand is touched

## 2-3 months

•Gross Motor:
- Prone—elbows under body; weight bearing on ulnar side of hands
- Supine—moves arms overhead
- Elbows actively bend & straighten

•Play:
- Beginning to place hand to face

•Grasp:
- Fingers spontaneously open
- Thumb in palm

## 4 months

•Gross Motor:
- Prone—weight bearing on elbows

•Play:
- Swipes at toys when supine
- Hands to midline

•Grasp:
- Hand open; thumb out of palm
- Begins voluntary prehension
- Crude palmar grasp

## 5 months

•Gross Motor
- Prone—pushes up on extended arms

•Play:
- Purposeful reach for objects in supine
- Adjusts hand's relation to object using vision and touch

•Grasp:
- Automatic release
- Ulnar palmar grasp

## 6 months

- Gross Motor:
  - Prone—weight shifts on extended arms
  - Sitting—hands are now free
- Play:
  - Purposeful banging
- ADLs:
  - Independently holds bottle
- Grasp
  - Finger extension
  - Emergence of thumb opposition
  - Raking grasp

## 7 months

- Gross Motor:
  - Pivots and combat crawls
- Play:
  - Reaches in a variety of directions
  - Bangs objects together
  - Transfers from one hand to the other
  - Purposeful release
- ADLs:
  - Finger feeds with supination
- Grasp:
  - Radial palmar grasp

## 8 months

- Gross Motor:
  - Crawling
  - Bearing weight through shoulder and entire UE
- Grasp:
  - Emergence of arches in hand
  - Developmental scissors grasp

## 9 months

- Play:
  - Can manipulate objects of varying sizes
- ADLs:
  - Holding a spoon
- Grasps:
  - Wrist extended
  - Grasps with partial supination
  - Inferior pincer

## 10-12 months

- Gross Motor:
  - Stands, cruises, or walks
- Play:
  - Releases an object into an offered hand
  - Can take object out of container
  - Pokes with index finger
- ADLs:
  - Brings spoon to mouth
  - Takes off socks
- Grasps:
  - Pincer

## 12-14 months

- Gross Motor:
  - Hands no longer needed for positioning support/stability
- Play:
  - Emergence of more controlled arm movements (grasp/release, manipulation)

## 14-17 months

•Play:
- Skilled dissociation

•Grasp:
- Refined skills of release and manipulation

## 18 months

•Hand skills:
- Can differentiate the two sides of the hand
- Able to modify grasp and pressure for different sizes and weights
- Good thumb opposition

•Grasp:
- Forearm neutral palmar grasp on larger tools
- Fingertip grasp on narrower tools

## 19-24 months

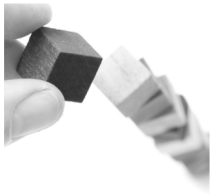
•Play:
- Both hands are actively manipulating at the same time
- Refining controlled release

## 2-3 years

- Hand skills:
  - Beginning of in-hand manipulation
- Grasp:
  - Digital pronate

## 3-4 years

- Play:
  - Refined control
    - Stacking block towers
    - Cutting simple shapes
  - Hand preference is emerging
    - Still common for children to swap hands
- ADLs:
  - Unbutton
  - Unzip
  - Feed self using utensils
- Grasp:
  - Static tripod



## 4-5 years

- Play:
  - Can throw a small ball into a basket
- ADLs:
  - Fasten buttons
  - Put on socks
- Hand skills:
  - Increased distal control/strength
- Grasp:
  - Dynamic tripod

## >5 years

- Improvements in
  - In-hand manipulation
  - Finger movements
  - Reaction times
- Increased complexity with
  - Rotation of objects
  - Bimanual skills
- Hand dominance established ~6 years

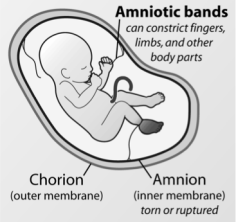
## >10 years

- Mastering use of complex tools
- Refinement of
  - Hand-eye coordination
  - Reaction times
  - Finger control and power

# Congenital Orthopedic Anomalies

## Amniotic Band Syndrome

- Varies in impact
  - Amputation of digits
  - Decreased blood flow to digit and/or extremity
  - Amputation of extremity




## Amniotic Band Syndrome

SURGICAL MANAGEMENT:

- Indicated when there is distal lymphedema, nerve or vascular compromise, progressive constriction, or syndactyly
- Release of rings via Z-plasty, W-plasty, and V-y flaps

NON-OPERATIVE TREATMENT:

- Lymphedema control
- ROM
- Scar management

## Radial Deficiency

- Type I: minimally shortened radius compared to ulna, elbow is normal, thumb hypoplasia may/may not be present
- Type II: radius is short and ulna is often bowed toward the radius; hand and wrist deviate toward the radius—usually extends into the wrist/thumb ray evident by absent scaphoid and underdeveloped thumb
- Type III: radius is hypoplastic with absence of the distal and middle thirds; wrist progressively moves into a pronated, flexed, and radially deviated posture; thumb ray and radial carpal hypoplasia are often present
- Type IV: complete absence of the radius; ulnar bowing and overall ulnar growth is usually limited to 60% of the contralateral side; elbow motion is limited; thumb is often absent and the index and long fingers often lack full ROM – may also be hypoplastic

## Radial Deficiency

- Typically associated conditions:
  - Thrombocytopenia/absent radius syndrome (TAR syndrome)
  - Holt-Oram Syndrome
  - Fanconi's anemia
  - VACTERL association

## Radial Deficiency

SURGICAL MANAGEMENT:

- Centralization or radialization procedure—stabilizes the wrist on the ulna

NON-OPERATIVE TREATMENT:

- Stretching
- Orthotics

## Thumb Deficiency

- Grade I: normal looking thumb, smaller than contralateral
- Grade II: MCP joint insufficiency with joint laxity; 1st MC is adducted, MCP joint is radially deviated due to UCL laxity; often a tight first web space
- Grade III: hypoplasia of the proximal portion of the 1st MC
- Grade IV: total aplasia of the MC with underdeveloped thumb phalanges – floating thumb
- Grade V: total absence of the thumb

## Thumb Deficiency

SURGICAL MANAGEMENT:

- Type II: stabilization of the MCP joint, centralization of the flexor and extensor mechanisms
- Type IIIA: MCP joint stabilization, tendon centralization, first web space deepening, and opponensplasty (usually involves the transfer of the superficial flexor of the ring finger *or* the transfer of the abductor digiti minimi—transferred tendons are attached to the MCP to provide additional grip/pinch strength
- Type IIIB, IV, and V:
  - Pollicization is a complex procedure involving the transfer of a finger, usually the index, to the thumb position, manual dexterity can average up to 70% of normal

POST-OPERATIVE TREATMENT:

- Casting for 4-6 weeks
- Full-time, hand-based thumb opponens orthosis for 4-6 weeks
- Progressive strengthening starts at 12 weeks
  - Avoid PROM to protect the tendon transfer
  - Soft thumb opposition orthosis may be considered to improve web space positioning

## Syndactyly

- Types:
  - Complete: fusion extending to the distal extent
  - Incomplete: fusion that fails to reach the distal extent
  - Complex: concomitant bony fusion between the two joint digits
  - Simple: absence of a bony connection
  - Pure: occur in isolation
  - Complicated: in conjunction with other congenital anomalies

## Syndactyly

SURGICAL MANAGEMENT:

- Utilize a dorsal skin flap to reconstruct the web space, and advancement flaps from the palmar and dorsal aspect of the fingers to reconstruct some of the commissure finger skin
  - Almost all require some skin grafting

POST-OPERATIVE TREATMENT:

- 2-4 weeks of casting followed by warm water soaks for cleansing of the scar areas
- Scar management
- Prevent potential web creep and skin graft loss
- Hand-based orthosis

## Camptodactyly

- Fixed flexion deformity of the PIP joint
- Most cases affect the 5th finger only

## Camptodactyly

SURGICAL MANAGEMENT:

- Only indicated if patient does not respond to non-operative strategies and/or has a >40° deformity

NON-OPERATIVE TREATMENT:

- Stretching, orthotic positioning (10-12 hours per day), and serial casting
  - Nighttime maintenance continued until skeletal maturity

## Polydactyly

- One or more extra fingers (or parts of fingers)
- Most common congenital hand anomaly

## Polydactyly

SURGICAL MANAGEMENT:

- Removal of duplicate, centralization of flexor/extensor mechanisms, and corrective osteotomies

POST-OPERATIVE TREATMENT:

- Depends on the extent of surgical correction and baseline functional status

# Acquired Orthopedic Injuries

## Brachial Plexus Injury[1]

HOW IT HAPPENS:

- Stretching of the brachial plexus during the perinatal period
  - 4 in 100 live births
  - 20-30% residual deficits
- Categorized by how badly the nerves are damaged

WHAT IT LOOKS LIKE:

- Group I and II: Shoulder adducted and internally rotated with extended elbow; function of wrist and hand is maintained
  - Group II with weakness in wrist extensors
- Groups III and IV: Weakness or paralysis of all muscles of the arm
  - Group IV distinguished by presence of ipsilateral Horner Syndrome

[1]GOVINDAN, M. & BURROWS, H. (2019). NEONATAL BRACHIAL PLEXUS INJURY. *PEDIATRICS IN REVIEW*, 40(9), 494-496.

## Brachial Plexus Injury[1]

SURGICAL MANAGEMENT:

- Nerve transfer, preferably within 6-7 months of injury

NON-OPERATIVE TREATMENT:

- Maintain full ROM
- Prevent joint stiffness/contracture
- Prevent unaffected muscles from atrophying

[1]GOVINDAN, M. & BURROWS, H. (2019). NEONATAL BRACHIAL PLEXUS INJURY. *PEDIATRICS IN REVIEW, 40*(9), 494-496.

## Medial Epicondyle Fracture[1]

- How it happens:
  - Fall on outstreteched arm
  - Overuse/repetitive valgus stress
- Most likely elbow region to sustain injury
  - ~50% are associated with elbow dislocation

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Medial Epicondyle Fracture[1]

SURGICAL MANAGEMENT:

- Internal fixation when <5mm
- ORIF in traumatic/high-energy injuries or when presenting with elbow instability

POST-OPERATIVE TREATMENT:

- Casting at 90° for several weeks
- Wire/screw removal at 4-6 weeks
- Rehab per MD's protocol

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Ulnar Collateral Ligament (UCL) Injury[1]

- How it happens:
  - Overuse/repetitive valgus stress
  - Typically throwing/overhead sports
- Impacted by poor mechanics

[1]LEAHY, I., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Ulnar Collateral Ligament (UCL) Injury[1]

SURGICAL MANAGEMENT:

- Direct repair
- UCL reconstruction using palmaris longus or a hamstring autograft

POST-OPERATIVE TREATMENT:

- Rehab per MD's protocol

[1]LEAHY, I., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Osteochondritis Dessicans[1]

- How it happens:
  - Repetitive stress or axial compression
- Most often involves the lateral or central portion of the capitellum

[1]LEAHY, I., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Osteochondritis Dessicans[1]

SURGICAL MANAGEMENT:

- Typically indicated when >14 years of age
- Drill the defect, fixate and/or remove fragments, osteochondral autograft, autologous chondrocycte implantation, lateral humaral closing-wedge osteotomy

NON-OPERATIVE TREATMENT:

- Indicated when <10 years of age
- Restrict from athletic activities and ADLs that may provoke symptoms

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Panner's Disease[1]

- How it happens:
  - Overuse to the entire capitellum
  - Theorized to be caused by a compressive injury to the small posterior perforating-end arteries
- Typically seen in younger children where the capitellum is small and incompletely ossified

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Panner's Disease[1]

SURGICAL MANAGEMENT:

- Not indicated

POST-OPERATIVE TREATMENT:

- Self-limit
- Rest from the provocative activity

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Distal Radius Fractures[1]

- How it happens:
  - High-energy FOOSH or fall from height
  - MVA
  - Sports
- Most common pediatric fracture
  - Most often occurs between 13.5-14.5 years for males and 11.5-12.5 years for females
- Majority are metaphyseal (torus, greenstick, compression fractures)
- Physeal and bicortical injuries often present with significant displacement

[1]WILLIAMS, A. & LOCHNER, H. (2012). PEDIATRIC HAND AND WRIST INJURIES. *CURRENT REVIEWS IN MUSCULOSKELETAL MEDICINE, 6(1),* 18-25.

## Distal Radius Fractures[1]

SURGICAL MANAGEMENT:

- May attempt 6-8 weeks of immobilization prior to operating
- Surgical reduction +/- pinning followed by immobilization for 4-6 weeks;

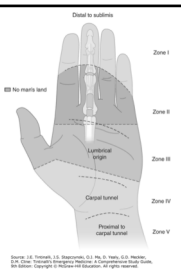
POST-OPERATIVE TREATMENT:

- Sugar tong orthosis
- Rehab per MD's protocol

[1]WILLIAMS, A. & LOCHNER, H. (2012). PEDIATRIC HAND AND WRIST INJURIES. *CURRENT REVIEWS IN MUSCULOSKELETAL MEDICINE, 6(1),* 18-25.

## Flexor Tendon Lacerations[1, 2]

- How it happens:
  - Forced extension on a flexed finger
  - Sharp laceration
  - Crush/avulsion injuries
- Classified in zones




[1]HALIM, A. & WEISS, A. (2016). RETURN TO PLAY AFTER HAND AND WRIST FRACTURES. *CLINICS IN SPORTS MEDICINE, 35(4),* 597-608.
[2]PULOS, N. & KAKAR, S. (2018). HAND AND WRIST INJURIES. *CLINICS IN SPORTS MEDICINE, 37(2),* 217-243.

## Flexor Tendon Lacerations[1, 2]

SURGICAL MANAGEMENT:

- Repair of flexor digitorum profundus and/or superficialis
- Immediate placement into dorsal blocking position (cast or orthosis)

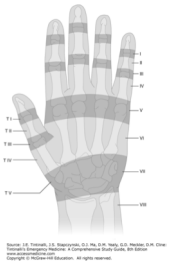
POST-OPERATIVE TREATMENT:

- Fabricate dorsal blocking orthosis if not already present
- Rehab per MD's protocol
  - Often modified Duran protocol

[1]HALIM, A. & WEISS, A. (2016). RETURN TO PLAY AFTER HAND AND WRIST FRACTURES. *CLINICS IN SPORTS MEDICINE, 35*(4), 597-608.
[2]PULOS, N. & KAKAR, S. (2018). HAND AND WRIST INJURIES. *CLINICS IN SPORTS MEDICINE, 37*(2), 217-243.

## Extensor Tendon Lacerations[1]

- How it happens:
  - Forced flexion or axial load against a hyperextended finger
    - DIP flexed with inability to extend




Source: J.E. Tintinalli, J.S. Stapczynski, O.J. Ma, D.M. Yealy, G.D. Meckler, D.M. Cline: Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 8th Edition
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[1]LEAHY, L, SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*. 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Extensor Tendon Lacerations[1]

SURGICAL MANAGEMENT:

- Not typically indicated

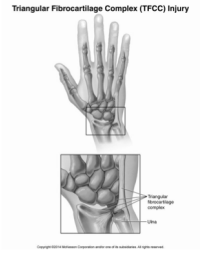
NON-OPERATIVE TREATMENT:

- Immobilization orthosis for ~6 weeks
- Compliance with orthosis wear is crucial to success

[1]LEAHY, L, SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*. 201-211. DOI: 10.1016/J.JHT.2015.01.003

## Triangular Fibrocartilage Complex (TFCC) Injuries

- How it happens:
  - Fall on extended wrist with forearm pronated→traction injury to ulnar side of wrist
  - Degenerative injury
- Typically diagnosed with wrist arthroscopy




## Triangular Fibrocartilage Complex (TFCC) Injuries

SURGICAL MANAGEMENT:

- Arthroscopic debridement
- Possible ulnar shortening osteotomy

POST-OPERATIVE TREATMENT:

- Immobilization orthosis for 4-6 weeks
- ROM and strengthening

## Phalangeal Fractures[1]

- How it happens:
  - Most often high-velocity ball sports
- Second most common fracture type in children


[1]STARNES, T., & CHHABRA, A. B. (2010). PHALANGEAL FRACTURES. IN *ESSENTIAL ORTHOPAEDICS* (VOL. 1, PP. 416–423).

## Phalangeal Fractures[1]

SURGICAL MANAGEMENT:

- Stable: Closed reduction with buddy taping for 3-4 weeks
- Unstable: Open reduction +/- pinning, wires, or other internal fixation

POST-OPERATIVE TREATMENT:

- Fabricate orthosis for the affected joint only; typically in an intrinsic plus position

[1]STARNES, T., & CHHABRA, A. B. (2010). PHALANGEAL FRACTURES. IN ESSENTIAL ORTHOPAEDICS (VOL. 1, PP. 416–423).

## Metacarpal Fractures

- How it happens:
  - Direct blow to hand
  - Rotational injury with axial load


## Metacarpal Fractures

SURGICAL MANAGEMENT:

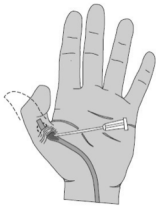
- Reduction and fixation
- Placement into an immobilization orthosis
  - Intrinsic plus position

NON-OPERATIVE TREATMENT:

- Majority of cases treated non-operatively
- Immobilization orthosis

## Trigger Finger[1]

- How it happens:
  - Local trauma from power grip or recent surgery
  - Systemic complication (diabetes, arthritis, etc.)
- Trigger **thumb** is one of the most common pediatric hand conditions
  - Trigger finger occurs 10x less frequently



Source: John Murtagh: *John Murtagh's Practice Tips*, 7e:
www.murtagh.mhmedical.com


[1]BAUER, A. & BAE, D. (2015). PEDIATRIC TRIGGER DIGITS. *JOURNAL OF HAND SURGERY, 40(11)*, 2304-2309.

## Trigger Finger[1]

SURGICAL MANAGEMENT:

- A1 pulley release

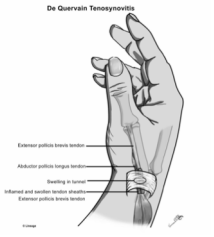
NON-OPERATIVE TREATMENT:

- Benign neglect
- Stretching
- Casting and/or orthosis fabrication
- Steroid injections

[1]BAUER, A. & BAE, D. (2015). PEDIATRIC TRIGGER DIGITS. *JOURNAL OF HAND SURGERY, 40(11)*, 2304-2309.

## De Quervain's Tenosynovitis[1]

- How it happens:
  - Overuse




[1]LEAHY, I., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY*. 28. 301-311. DOI: 10.1016/J.JHT.2015.01.003.

## De Quervain's Tenosynovitis[1]

SURGICAL MANAGEMENT:

- Release of first dorsal compartment
- Indicated when conservative management fails

NON-OPERATIVE TREATMENT:

- Corticosteroid injection
- Orthosis fabrication and/or casting

[1]LEAHY, L., SCHORPION, M., & GANLEY, T. (2015). COMMON MEDIAL ELBOW INJURIES IN THE ADOLESCENT ATHLETE. *JOURNAL OF HAND THERAPY, 28*, 201-211. DOI: 10.1016/J.JHT.2015.01.003

# Mixed Injuries

TRAUMA

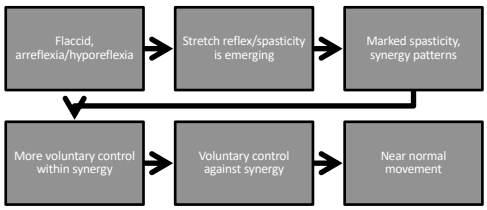
## Motor Vehicle Accident

- May be a mix of orthopedic and neurological injuries
  - Plan of care will vary widely
- Can be challenging to maintain precautions while promoting early mobilization/activity

## Brain Injury

- Early recovery within first 3-6 months
- Functional recovery may continue until 3 years post-injury but may start to level off after a year

## Brunnstrom's Levels of Motor Recovery




## Brain Injury

GOALS OF THERAPY

- Maintain connective tissue length and/or increase extensibility
- Maintain/restore proper biomechanics
- Increase contractile activity and/or active use

TARGETED INTERVENTIONS

- Electrical stimulation
- Dynamic stretching +/- orthosis
- Vibration of antagonistic muscles

## Burns

SUPERFICIAL (1ST DEGREE)

- Involves the epidermis
  - Often a sunburn
- Red and painful
  - No blisters
- No functional impairment

PARTIAL THICKNESS (2ND DEGREE)

- Does not extend entirely through the dermis
  - Sweat glands, hair follicles and sebaceous glands remain intact
- Low incidence of hypertrophic scarring; may have permanent pigment changes
- Heals in 2-3 weeks
- Minimal or no functional impairment

## Burns

DEEP PARTIAL THICKNESS (DEEP 2ND DEGREE)

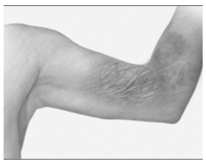
- Extends into the lower dermis
- May impact joint function; hypertrophic scarring is common
- May require excision and grafting
- Heals in 3-9 weeks

FULL THICKNESS (3RD DEGREE)

- Involves all layers of dermis
  - May include tendons, muscle, or bone
- Presence of eschar
- Wound coverage via grafting, biologic dressings, or skin substitutes

## Burns

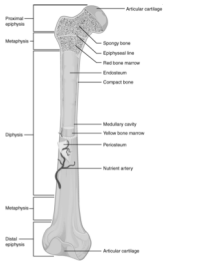
- Priority #1 is wound and scar management
  - Wound contraction→ loss of ROM; shortening of muscles/skin/nerves
- Successful grafting may require revision down the road



# Assessment

## Differences in Working with Children

- Bones are not completely formed
  - Larger percentage of collagen and cartilage
  - Periosteum is more metabolically active
- Skeletal maturity
  - ~15 years for females
  - ~17 years for males

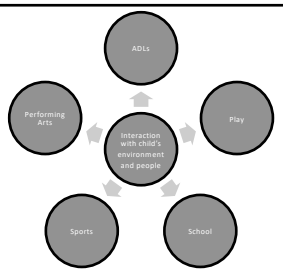



## Differences in Working with Children

- More likely to injure themselves in general
  - Most children are very active with a high power-to-weight ratio
  - Control of movement is still developing
- Injury to the upper extremity is common in children[1]
  - 71% fractures
  - 29% soft tissue/tendons/nerves

[1]HO, E., PONNURTHURAI, J., & CLARKE, H. (2014). THE INCIDENCE OF IDIOPATHIC MUSCULOSKELETAL PAIN IN CHILDREN WITH UPPER EXTREMITY INJURIES. *JOURNAL OF HAND THERAPY*, *27*(1), 38-43.

## Impact on Occupational Performance




## Subjective vs. Objective Assessment

- Self-report relies on patients/parents to self-identify impairments
- "It seems that hand therapists are administering outcome measures that consider patients' occupations without using the results of these to create client-centered occupational goals and interventions"[1]

[1]BURLEY, S., DI TOMMASO, A., COX, R., & MOLINEUX, M. (2018). AN OCCUPATIONAL PERSPECTIVE IN HAND THERAPY: A SCOPING REVIEW. *BRITISH JOURNAL OF OCCUPATIONAL THERAPY*, *81*(6), 299-318. DOI: 10.1177/0308022617752110

## Objective Assessment Tools: JAMAR Hand Function Test

- Formerly Jebsen-Taylor Hand Function Test
- Simulates everyday activities
- Norms exist for 6+ years old

## Objective Assessment Tools: 9-Hole Peg Test

- Using one hand, place all the pegs on the board and then remove them (one at a time)
- Norms exist for 4+ years old

## Objective Assessment Tools: Functional Dexterity Test

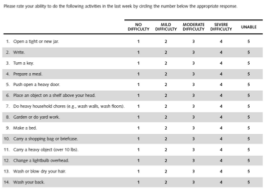
- Using one hand, keeping hand pronated, flip over all the pegs in a zigzag pattern
  - Time penalties added for supination, touching the board, and dropping pegs
- Norms exist for 3+ years old

## Objective Assessment Tools: Box and Block Test

- Using one hand, move as many blocks as possible into the other box within 60 seconds
- Norms exist for 3+ years old

## Subjective Assessment Tools: Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)

- 30-item self-report questionnaire
  - Optional Sports/Performing Arts & Work modules
- 11-item QuickDASH is also an option
- Developed for use with adults



Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

| | NO DIFFICULTY | MILD DIFFICULTY | MODERATE DIFFICULTY | SEVERE DIFFICULTY | UNABLE |
|---|---|---|---|---|---|
| 1. Open a tight or new jar. | 1 | 2 | 3 | 4 | 5 |
| 2. Write. | 1 | 2 | 3 | 4 | 5 |
| 3. Turn a key. | 1 | 2 | 3 | 4 | 5 |
| 4. Prepare a meal. | 1 | 2 | 3 | 4 | 5 |
| 5. Push open a heavy door. | 1 | 2 | 3 | 4 | 5 |
| 6. Place an object on a shelf above your head. | 1 | 2 | 3 | 4 | 5 |
| 7. Do heavy household chores (e.g., wash walls, wash floors). | 1 | 2 | 3 | 4 | 5 |
| 8. Garden or do yard work. | 1 | 2 | 3 | 4 | 5 |
| 9. Make a bed. | 1 | 2 | 3 | 4 | 5 |
| 10. Carry a shopping bag or briefcase. | 1 | 2 | 3 | 4 | 5 |
| 11. Carry a heavy object (over 10 lbs). | 1 | 2 | 3 | 4 | 5 |
| 12. Change a lightbulb overhead. | 1 | 2 | 3 | 4 | 5 |
| 13. Wash or blow dry your hair. | 1 | 2 | 3 | 4 | 5 |
| 14. Wash your back. | 1 | 2 | 3 | 4 | 5 |

## Subjective Assessment Tools: Upper Extremity Functional Index (UEFI)

- 20-item self-report questionnaire focused on difficulty performing ADLs
- Developed for use with adults

UPPER EXTREMITY FUNCTIONAL INDEX

We are interested in knowing whether you are having any difficulty at all with the activities listed below because of your upper limb problem for which you are currently seeking attention.
Please provide an answer for **each** activity.
**Today, do you or would you have any difficulty at all with:**

| ACTIVITIES | Extreme Difficulty | Quite a Bit of Difficulty | Moderate Difficulty | A Little Bit of Difficulty | No Difficulty |
|---|---|---|---|---|---|
| a. Any of your usual work, housework or school activities | 0 | 1 | 2 | 3 | 4 |
| b. Your usual hobbies, recreational or sporting activities | 0 | 1 | 2 | 3 | 4 |
| c. Lifting a bag of groceries to waist level | 0 | 1 | 2 | 3 | 4 |
| d. Placing an object onto, or removing it from an overhead shelf | 0 | 1 | 2 | 3 | 4 |
| e. Washing your hair or scalp | 0 | 1 | 2 | 3 | 4 |
| f. Pushing up on your hands (e.g., from bathtub or chair) | 0 | 1 | 2 | 3 | 4 |
| g. Preparing food (e.g., peeling, cutting) | 0 | 1 | 2 | 3 | 4 |
| h. Driving | 0 | 1 | 2 | 3 | 4 |
| i. Vacuuming, sweeping, or raking | 0 | 1 | 2 | 3 | 4 |
| j. Dressing | 0 | 1 | 2 | 3 | 4 |
| k. Doing up buttons | 0 | 1 | 2 | 3 | 4 |
| l. Using tools or appliances | 0 | 1 | 2 | 3 | 4 |
| m. Opening doors | 0 | 1 | 2 | 3 | 4 |
| n. Cleaning | 0 | 1 | 2 | 3 | 4 |
| o. Tying or lacing shoes | 0 | 1 | 2 | 3 | 4 |
| p. Sleeping | 0 | 1 | 2 | 3 | 4 |
| q. Laundering clothes. (e.g., washing, ironing, folding) | 0 | 1 | 2 | 3 | 4 |
| r. Opening a jar | 0 | 1 | 2 | 3 | 4 |
| s. Throwing a ball | 0 | 1 | 2 | 3 | 4 |
| t. Carrying a small suitcase with your affected limb | 0 | 1 | 2 | 3 | 4 |
| **Column Totals:** | | | | | |

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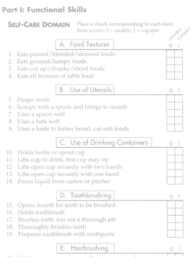
Score: _____ /80

## Subjective Assessment Tools: Pediatric Evaluation of Disability Inventory (PEDI)

- Functional skills, need for caregiver assistance, need for modifications related to:
  - Self-care
  - Mobility
  - Social function
- Child is "capable" or "unable"
- 6 months-7 years



Part I: Functional Skills

SELF-CARE DOMAIN

A. Food Textures

B. Use of Utensils

C. Use of Drinking Containers

D. Toothbrushing

E. Hairbrushing

## Subjective Assessment Tools: Roll Evaluation of Activities of Life (REAL)

- 6 skill areas each for BADLs and IADLs
- 4-point scale for how often a child is able to complete a task
- 2-18 years old


Activities of Daily Living (ADL) Sc

| Item | FEEDING Skills | | | | |
|---|---|---|---|---|---|
| | My child... | | | | |
| 1 | Eats all textures of table food (pureed, soft, chewy, crunchy) | 0 | 1 | 2 | 3 |
| 2 | Eats mixed textured foods (casseroles, fruit and yogurt) | 0 | 1 | 2 | 3 |
| 3 | Eats foods from all food groups | 0 | 1 | 2 | 3 |
| 4 | Finger feeds self | 0 | 1 | 2 | 3 |
| 5 | Scoops with a spoon or fork and brings to mouth | 0 | 1 | 2 | 3 |
| 6 | Uses a spoon well | 0 | 1 | 2 | 3 |
| 7 | Uses a fork well | 0 | 1 | 2 | 3 |
| 8 | Uses a knife to spread foods (butter) | 0 | 1 | 2 | 3 |
| 9 | Uses a knife to cut foods | 0 | 1 | 2 | 3 |
| 10 | Drinks from a regular cup well | 0 | 1 | 2 | 3 |
| 11 | Can use a straw for drinking well | 0 | 1 | 2 | 3 |
| 12 | Pours liquids from a pitcher into a cup well | 0 | 1 | 2 | 3 |
| 13 | Gets onto and off of kitchen chairs safely | 0 | 1 | 2 | 3 |
| | Feeding Skills Total | | | | |

# Intervention

## Step #1: Build Rapport

- Patients have gone through multiple tests and provider visits before they get to you
  - What is OT anyway? AKA Why am I here?
  - What are you going to do to me?
  - Is this going to hurt?

## Occupational Approach vs. Rote Exercise

- Patients value engagement in an occupation as a more important outcome vs. improvements in objective measures[1, 2]
- "…seems to be an assumption that interventions using a biomechanical approach indirectly result in improved occupational performance and engagement" [1]

[1] BURLEY, S., DI TOMMASO, A., COX, R., & MOLINEUX, M. (2018). AN OCCUPATIONAL PERSPECTIVE IN HAND THERAPY: A SCOPING REVIEW. *BRITISH JOURNAL OF OCCUPATIONAL THERAPY*, *81*(6), 299-318. DOI: 10.1177/0308022617753110
[2] CHEUNG, T.W.-C., CLEMSON, L. O'LOUGHLIN, K., ET AL. (2016). UNDERSTANDING DECISION-MAKING TOWARDS HOUSEWORK AMONG WOMEN WITH UPPER LIMB REPETITIVE

## Occupational Approach vs. Rote Exercise

- 4-week CIMT study for adults with median and ulnar nerve injuries[1]
  - Control group
  - Exercise-based constraint group
  - Occupation-based constraint group
- Occupation-based constraint had increased generalization/learning transfer, increased patient motivation/satisfaction vs. exercise-based constraint

[1] ROSTAMI, H.R., AKBARFAHIMI, M., MEHRABAN, A.H., AKBARINIA, A.R., & SAMANI, S. (2017). OCCUPATION-BASED INTERVENTION VERSUS ROTE EXERCISE IN MODIFIED CONSTRAINT-INDUCED MOVEMENT THERAPY FOR PATIENTS WITH MEDIAN AND ULNAR NERVE INJURIES: A RANDOMIZED CONTROLLED TRIAL. *CLINICAL REHABILITATION*, *31*(8), 1087-1097. DOI: 10.1177/0269215516672276

## Developmental Hierarchy of Play

| Age | Type of Play | Examples |
|---|---|---|
| 0-2 years | Exploratory | • Finger feeding<br>• Dropping objects into a container to make noise<br>• Knocking down a block tower |
| 2-4 years | Symbolic | • Simple construction<br>• Sorting into a container<br>• Manipulating objects with moving parts to see how they work |
| 4-7 years | Creative | • Complex construction<br>• Building or creating a pattern<br>• Carrying objects with a spoon to place in a container<br>• Molding clay into shapes |
| 7-12 years | Competitive | • Games<br>• Race/relay/timed placement of objects into a container<br>• Throwing at a target (ball/darts)<br>• Card games<br>• Timed completion of a puzzle |

[1] MODIFIED FROM MORRISON, C.D., METZGER, P. PLAY. IN: CASE-SMITH, J., ED. (2001). OCCUPATIONAL THERAPY FOR CHILDREN, 4TH ED. ST. LOUIS: MOSBY. 528-564

## HEP

- What does the family already have at home?
- How can you involve the child in established occupational routines?

# Physical Agent Modalities

## Physical Agent Modalities[1]

- PAMs use different forms of energy to:
  - Modulate pain
  - Modify tissue healing
  - Increase tissue extensibility
  - Modify skin and scar tissue
  - Decrease edema or inflammation

[1]AOTA COMMISSION ON PRACTICE. (2012). PHYSICAL AGENT MODALITIES. *AMERICAN JOURNAL OF OCCUPATIONAL THERAPY*, *66*(6_SUPPLEMENT), S78–S80. https://doi.org/10.5014/ajot.2012.66s78.

## Superficial Thermal Agents

- Cryotherapy (cold packs, ice, etc.)
- Hot packs
- Hydrotherapy (whirlpool, contrast baths, etc.)
- Infrared light
- Paraffin
- Fluidotherapy®

[1]AOTA COMMISSION ON PRACTICE. (2012). PHYSICAL AGENT MODALITIES. *AMERICAN JOURNAL OF OCCUPATIONAL THERAPY*, 66(6_SUPPLEMENT), S78–S80. HTTPS://DOI.ORG/10.5014/AJOT.2012.666S24.

## Deep Thermal Agents

- Ultrasound
- Phonophoresis
- Short-wave diathermy

## Electrotherapeutic Agents

- Biofeedback
- Neuromuscular electrical stimulation (NMES)
- Functional electrical stimulation (FES)
- Transcutaneous electrical nerve stimulation (TENS)
- High-voltage galvanic stimulation for tissue and wound repair (ESTR)
- High-voltage pulsed current (HVPC)
- Direct current (DC)
- Iontophoresis

## Mechanical Devices

- Vasopneumatic devices
- Continuous passive motion (CPM)

## Use of PAMs: AOTA[1]

- "… may be applied only by occupational therapists and occupational therapy assistants who have documented evidence of possessing the theoretical background and technical skills for safe and competent integration of the modality into an occupational therapy intervention plan."
- "The exclusive use of PAMs as a therapeutic intervention without direct application to occupational performance is *not* considered occupational therapy."

[1]AOTA COMMISSION ON PRACTICE. (2012). PHYSICAL AGENT MODALITIES. *AMERICAN JOURNAL OF OCCUPATIONAL THERAPY*, 66(6_SUPPLEMENT), S78–S80. HTTPS://DOI.ORG/10.5014/AJOT.2012.E6S78.

## Use of PAMs: State of Florida[1]

- For each modality:
  - 4 hours of in-person didactic training
  - Performance of 5 supervised treatments

[1]USE OF PRESCRIPTION DEVICES, FLORIDA BOARD OF OCCUPATIONAL THERAPY STANDARDS OF PRACTICE RULE 64B11-4.001 (2013).

# Orthotics

## Classification Criteria

- "…rigid or semi-rigid device which is used for the purpose of supporting a weak or deformed body member or restricting or eliminating motion in a diseased or injured part of the body."

[1]CENTER FOR MEDICARE/MEDICAID SERVICES. (2008). *MEDICARE BENEFIT POLICY MANUAL*. (HTTP://WWW.CMS.GOV/REGULATIONS-AND-GUIDANCE/GUIDANCE/MANUALS/DOWNLOADS/BP102C15.PDF.

## Immobilization Orthosis

- Provide symptom relief
- Protect and position edematous structures
- Aid in maximizing function use of the hand
- Maintain tissue length to prevent contracture
- Protect healing structures and surgical procedures
- Maintain and protect reduction of a fracture
- Protect and improve joint alignment
- Block or transfer power of movement to enhance exercise
- Reduce tone and contracture of a spastic muscle

## Mobilization Orthosis

- Remodel long-standing, dense, mature scar tissue
- Elongate soft tissue contractures, adhesions, and musculotendious tightness
- Increased PROM
- Realign and/or maintain joint and ligament profile
- Substitute for weak or absent motion
- Maintain reduction of an intra-articular fracture with preservation of joint mobility
- Provide resistance for exercise

## Restriction Orthosis

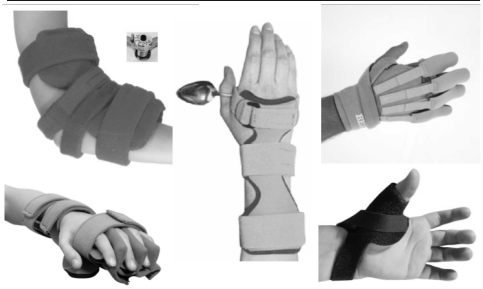
- Limit motion after nerve injury or repair
- Limit motion after tendon injury or repair
- Limit motion after bone-ligament injury or repairs
- Provide and improve joint stability and alignment
- Assist in functional use of the hand

## Rx

- If custom orthosis fabrication is not included in the plan of care, you will need a separate prescription that specifies orthosis fabrication.
- Patients will need a prescription to pursue orthosis fabrication on their own (through a vendor)
  - You may need to help them with measurements for an order form

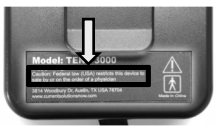
# Hand Therapy without "Hand Therapy Stuff"

## OTC Orthotics



## OTC E-stim Units

- Not all units are created equal
  - What programs does it have?
  - How many channels?
  - How much output power?
- Make sure it's really OTC



## DIY Hot Packs

- Fabric exterior
  - Sock (tie shut)
  - Pillowcase (sew closed)
- Dry filling
  - Beans
  - Rice

## DIY Cryotherapy

- Freeze water in small cups; peel away the paper as you go
- Cold packs:
  - Alcohol-based: 1 cup alcohol + 2 cups water
  - Salt-water based: 2 tablespoons salt + 2 cups water
  - Corn syrup