Evaluation and Treatment of the Upper Extremity in Children with Cerebral Palsy: Therapy Considerations

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4 – 6 pm

Session # 17
AACPDM

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Disclosure Information
AACPDM 69th Annual Meeting | October 21-24, 2015

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I have no financial relationships to disclose

Therapy Outline

Assessments

- Muscle tone
- Stereognosis
- A/PROM
- Grip and pinch strength
- Box and blocks test
- Assisting hand assessment
- Shriner's hospital upper extremity evaluation

Treatment

- Stretching
- Strengthening
- Fine motor activities
- Hand splinting
- ADLs - handwriting, shoe tying

Initial Assessment

- Physician referral
- Interview the parent while you are observing the child play
- Observe the child's arm and hand positions at rest and during active use
- Understand strengths and concerns:

  arm/hand use and ADLs
- Learn their therapy and orthotic history
- Ask the parent/child specific goals for therapy

Muscular Dysfunction (Tone)

- May be described as spastic, dyskinetic, ataxic, hypotonic, or mixed
- The children in our study had spastic hemiplegic cerebral palsy may be the most amenable to surgical treatment
- Because of the abnormal tone patterns, the arm and hand is positioned such that it reflects the imbalance of muscle forces

Muscle Tone Assessment

- Spasticity of the muscle can be detected by performing the passive opposite movement and feeling the abnormal contraction of the muscle

Ashworth Scale of Spasticity

0 = No increase in muscle tone

1 = Slight increase in muscle tone

2 = Increase in tone through most of range but the part is easily moved

3 = Considerable increase in tone, passive movement is difficult

4 = Affected part is rigid in flexion or extension

Common spastic muscles in CP hemiplegia include:

Biceps, Pronator Teres, FCU, Adductor Pollicus

Sensory Impairment

- Tizard is 1954 was the first investigator to point out that children (50%) with hemiplegic cerebral palsy have concomitant sensory deficits

- The severity of motor impairment has been shown to correlate with sensory deficits.

Kinnucan, Van Heest, Tomhave. Correlation of motor function and stereognosis impairment in upper limb cerebral palsy. *J Hand Surg Am* 2010; 35 (8): 1317-1322

- Stereognosis has been found to be the most sensitive discriminator of the degree of sensory impairment

Van Heest, House, Putnam. Sensibility deficiencies in the hands of children with spastic hemiplegia. J Hand Surg Am. 1993; 18 (2): 278-281

Stereognosis

- Stereognosis is the tactile recognition in identifying objects placed in the hand.
- With vision occluded, child is given 12 objects and asked to name them.

Block	Safety pin
Key	Bead
Penny	Glove
Pencil	Spoon
Marble	Paper clip
String	Button

Stereognosis Testing

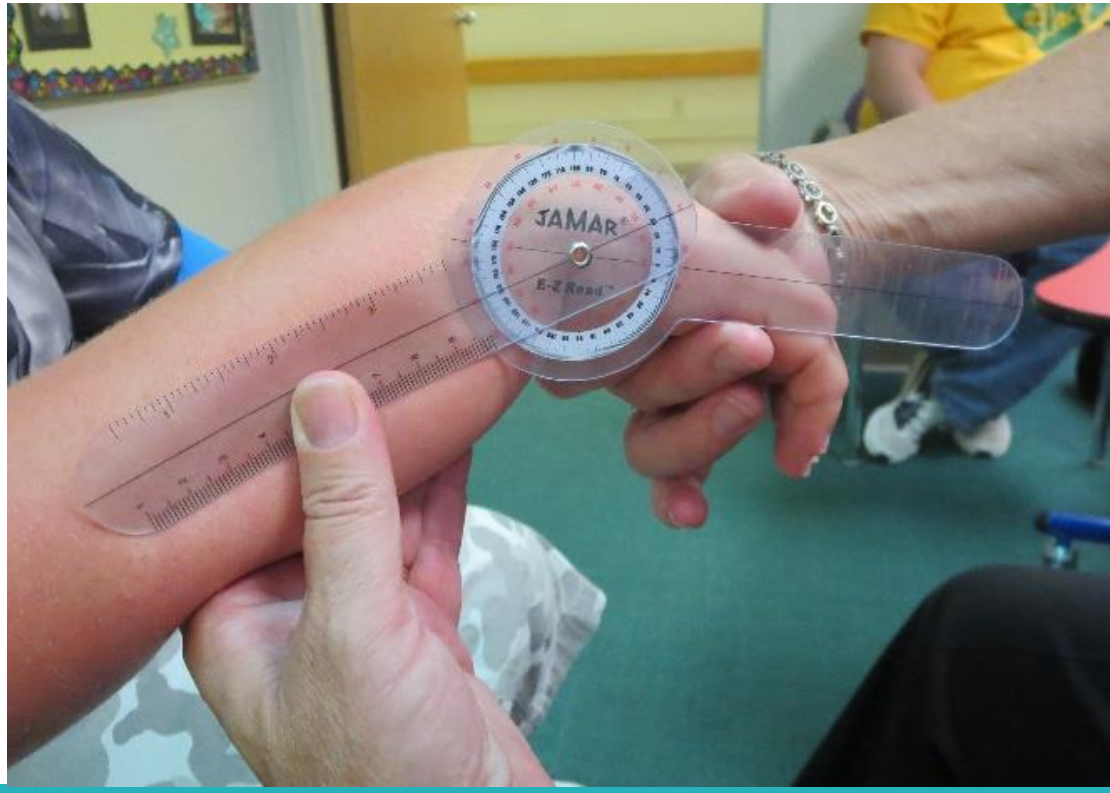
- Results from a recent study we conducted on 37 children with hemiplegic cerebral palsy who were candidates for tendon transfer surgery:
  - the mean stereognosis score for the affected hand was 6.1 objects
  - the mean score for the dominant hand was 11. 1 objects (range was 5-12)

- There was a significant correlation between stereognosis and dexterity: children with greater sensibility impairment in their dominant hand, had greater dexterity impairment.

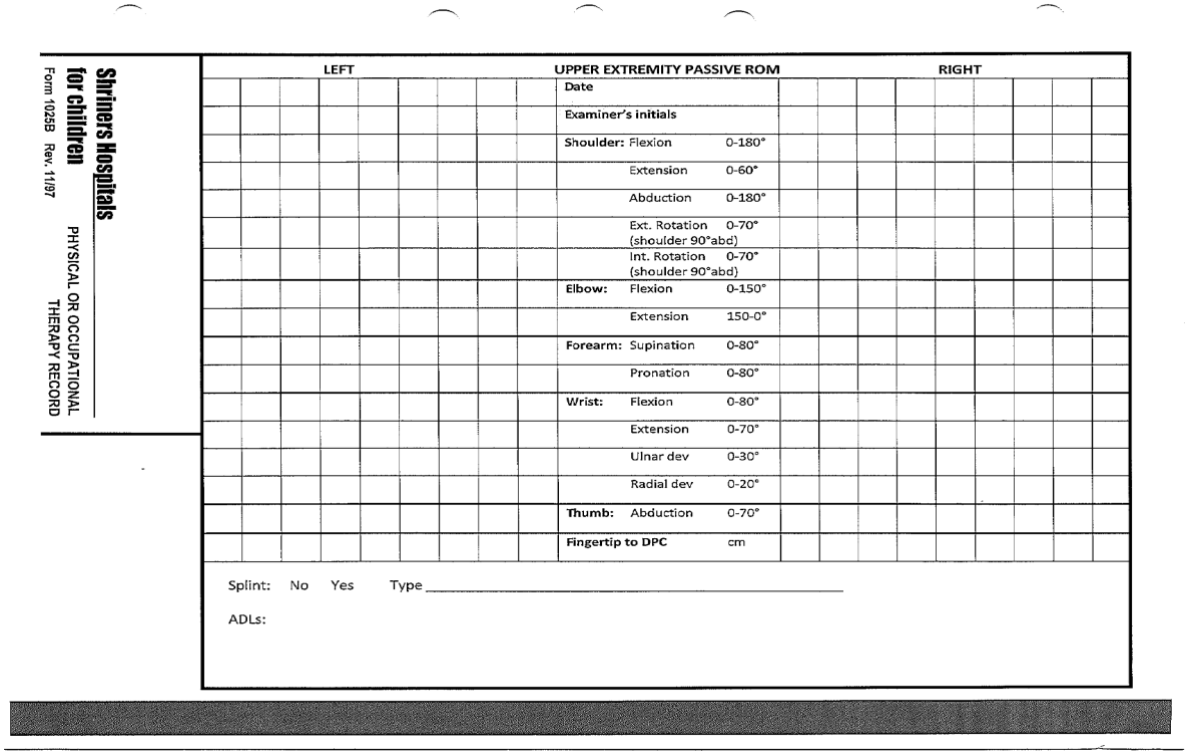
Tomhave, Van Heest, Bagley, James. Affected and contralateral hand strength and dexterity measures in children with hemiplegic cerebral palsy. *J Hand Surg Am. May 2015; Vol 40, Issue 5: 900-907*

Range of Motion

- Goniometer to measure AROM / PROM
  - Shoulder flexion and external rotation
  - Elbow extension
  - Forearm supination
  - Wrist extension and radial deviation
  - Wrist/finger extension
  - Thumb abduction



ROM Form



Shriners Hospitals for children
Form 1025B Rev. 11/97
PHYSICAL OR OCCUPATIONAL THERAPY RECORD

LEFT	UPPER EXTREMITY PASSIVE ROM		RIGHT
	Date		
	Examiner's initials		
	Shoulder: Flexion	0-180°	
	Extension	0-60°	
	Abduction	0-180°	
	Ext. Rotation (shoulder 90°abd)	0-70°	
	Int. Rotation (shoulder 90°abd)	0-70°	
	Elbow: Flexion	0-150°	
	Extension	150-0°	
	Forearm: Supination	0-80°	
	Pronation	0-80°	
	Wrist: Flexion	0-80°	
	Extension	0-70°	
	Ulnar dev	0-30°	
	Radial dev	0-20°	
	Thumb: Abduction	0-70°	
	Fingertip to DPC	cm	

Splint: No Yes Type _____

ADLs:

- We record active and passive ROM to identify areas of concern and monitor changes over time
- Full passive ROM can be overcome by the application of gentle sustained stretching whereas contractures cannot
- Degree of active movement varies
- No active wrist extension candidate for tendon transfer surgery or botox

Grip Strength

- Standardized assessment using a dynamometer
- Child is seated - elbow at 90, forearm neutral
- Squeeze the two handles together as hard as possible
- Average of 3 separate maximum voluntary contractions
- Normative data
  - Mathiowetz – norms – ages 6-19
  - Lee Valkov – norms – ages 3-5

Affected and contralateral hand strength and dexterity measures in children with hemiplegic cerebral palsy. May 2015

The contralateral / dominant hands had:
60% stronger grip strength
32% stronger pinch strength
Strength results similar to normative values

Pinch Strength

- Standardized assessment using a pinch gauge
- 3 types of pinch
  - 3 Point pinch
  - Key/lateral pinch
  - 2 Point pinch

Normative data

- Mathiowetz - ages 6 - 19
- Lee Valkov - ages 3-5

Box and Blocks Test of Manual Dexterity

- Standardized to measure unilateral gross dexterity skills
- Norms
  - Jongbloed ages 3 - 10
  - Mathiowetz ages 6 - 19
- Test kit consists of a large wooden box with a center divider, with 200 2-inch blocks on one side.
- Child is asked to move blocks one at a time over the partition as quickly as possible
- Score is the number of blocks moved in 1 minute, for each hand

Box and Blocks Test

Tomhave, Van Heest, Bagley, James. Affected and contralateral hand strength and dexterity measures in children with hemiplegic cerebral palsy. *J Hand Surg Am. May 2015; Vol 40, Issue 5: 900-907*

- Dexterity in the affected and unaffected hands of children with CP hemiplegia as measured by the box and blocks test was statistically significantly less than published norms.

- Assessment of the dexterity of the dominant hand may reveal opportunities for therapeutic intervention that improve fine motor function.

Shriner's Hospital Upper Extremity Evaluation (SHUEE)

- Video based evaluation that assesses the spontaneous functional use and the segmental dynamic alignment of the involved UE while performing 16 functional tasks
- Developed for children ages 3 to 18 with hemiplegic CP
- Bimanual activities for each segment encourages movement at the thumb, fingers, wrist, forearm and elbow

SHUEE

Spontaneous Functional Analysis

9 activities are given a score 0 – 5

Total number/45 is converted to a percentage score

A score is given to each subscale and converted to a percentage

Modified House Scale

0 = Does not use

1 = Poor passive assist (uses a stabilizing weight only)

2 = Passive assist (can hold object placed into hand and may stabilize it)

3 = Poor active assist (can actively grasp object and hold it weakly)

4 = Active assist (actively grasp and stabilize well)

5 = Spontaneous use (performs bimanual activities easily)

SHUEE

- Dynamic positional analysis (16 activities)

  Total score/72 is converted to a %

  Thumb (in palm/closed/open)

  Fingers (flexion/neutral/extension)

  Wrist (flexion/neutral/extension) (ulnar/radial deviation)

  Forearm (extreme pronation/pronation/neutral/supination)

  Elbow (extreme flexion/ flexion/extension)

- Grasp/release analysis

  Looks at wrist alignment and hand's ability to grasp and release an object with wrist flexed, extended, and neutral

SHUEE

- Administered in 15 minutes, scored in 30

- SHUEE assists in clinical decision-making
  - Therapy
  - Orthotics
  - Botox
  - Orthopedic Surgery
- Outcome assessment

- Manual that offers training and case studies available free through the electronic supplement to the original article

- Structured courses are offered several times per year

- Shriners Hospitals for Children- Greenville 864-240-6277

Assisting Hand Assessment

- The AHA measures how effectively the affected hand and arm is used in bimanual performance.
- Developed for children with hemiplegic cerebral palsy or obstetric brachial plexus palsy
- Semi-structured play session– videotaped and scored at a subsequent viewing
- It is the child's spontaneous and normal way of handling objects when playing that is assessed, not their best capacity to grasp, release, or manipulate objects when prompted to use their affected hand.

Assisting Hand Assessment

- The AHA test kit consists of a number of specific toys that encourage bimanual hand use

- Two versions
  -Small Kids: 18 months to 5 years
  -School Kids: board game for children 6-12 years

- 22 observable actions; 4 point rating scale
  - 4 = effective
  - 3 = somewhat effective
  - 2 = ineffective
  - 1 = does not do

AHA

Activities include:

- General usage (initiates, chooses AH when closer to objects)
- Arm use items (moves upper arm, moves forearm, reaches)
- Grasp – release (varies types of grasp, puts down, stabilizes, readjusts)
- Fine motor adjustments (calibrates, moves fingers)
- Coordination (orients objects, coordinates arms)
- Pace (proceeds, pace)

AHA Summary

- Excellent functional assessment
- Breaks down a wide range of arm and hand skills
- Only assessment that really looks at spontaneous play
- 15 minutes to administer, 30 minutes to score
- Specialized training to become a certified rater
- Very popular in studying outcomes

www.ahanetwork.se

TREATMENT

Treatment for Scapular Stabilizers

- To stabilize the scapula and stretch the tight muscles in the front of the shoulder

- Focus on activities to engage the shoulder girdle
  - Wheelbarrow walking and UE weight bearing
  - In supine, scapular protraction exercises
  - In sitting work on squeezing your shoulder blades together
  - Rolling over a bolster on extended arms to pick up objects
  - “Big ball war”
  - Side-sitting with UE weight bearing and reaching
  - Wall push ups

Passive Range of Motion Stretching

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PASSIVE ROM STRETCHING EXERCISES

Occupational Home Program for _____

Perform all of these exercises 1-2 times a day, 10 repetitions each.

Support behind the elbow and at the wrist. Slowly move the arm into a straight position. Hold for a count of 5.	
Position the elbow close to the body with the elbow bent at a 90° angle. Gently rotate the forearm so the palm is facing upwards (flat wrist). Hold for a count of 5.	
Support the hand flat, including the fingers. Bend the hand back at the wrist in a slow, gentle manner. Hold for a count of 5.	
Support the hand and forearm. Gently bring the hand to the side, towards the thumb. Hold for a count of 5.	
Support the hand and the thumb low while gently bringing the thumb out away from the hand, like an L. Hold for a count of 5.	

If you have questions,
please call Occupational Therapy at 612-596-6216

Self Range of Motion Stretching

Active Range of Motion Strengthening

Shriners Hospitals for Children®

Twin Cities
Pediatric Specialty Services
Orthopaedics

Occupational Therapy

ACTIVITIES FOR ELBOW, FOREARM, WRIST, & THUMB FOR CHILDREN WITH CP

Elbow Extension (activities that encourage arm straightening with items placed away from body)

Table hockey/air hockey	Bowling	Balloon volleyball
Badminton	Frisbee	Basketball
Throw a ball overhand	Swing a bat	Hang clothes up
Put on socks	Reach over head to put shirt on	Comb hair
Pull pants up and down	Zoom ball	Wheelbarrow crawl

Forearm Supination (activities that promote forearm rotation from palm down to palm up)

Clapping games	"Pat-A-Cake"	Turn puzzle pieces over
Turn pages of a book	Blowing bubbles	"Give me five"
Unlock a door with a key	Turn playing cards over	Playing with a Slinky
Play with a puppet facing you	Throw a ball underhand	Carry dishes to the sink
Place a sticker on palm of hand and turn hand to see it	Pour water from one container to another	Put toothpaste on a toothbrush

Wrist Extension (activities that promote lifting the hand up at the wrist)

Blow and pop bubbles	Throw a ball	Swing a bat
Use a rolling pin	Pull apart play dough	Stack cups
Crawl on all fours	Wheelbarrow walk	Scooterboard activities
Cat's Cradle string game	Brush hair	Wash your face
Draw on a chalkboard or easel	Screw/unscrew container lids	Roll play dough into snakes

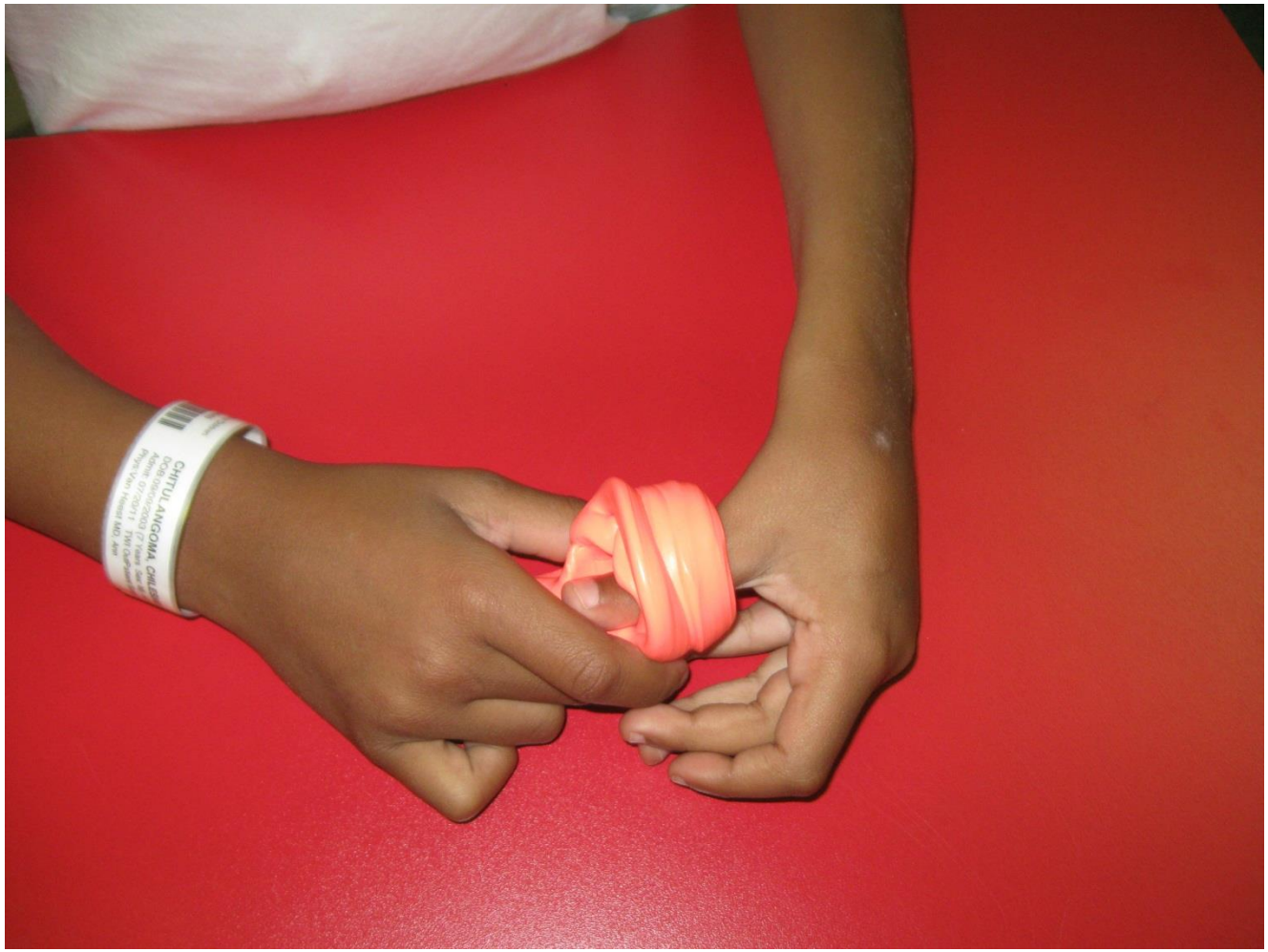
Thumb Abduction (activities that promote lifting the thumb out and away from the hand)

Cut with scissors	Use tongs to pick up and drop cottonballs	Flick paper wads/marbles/ checkers with thumb
Finger feeding	Color with wide tip markers	Squish play dough balls
Throw a tennis ball	Stack cones or cups	Hold a glass
Hold paper towel roll and insert blocks with other hand	Grasp pennies and put in a piggy bank	Look through binoculars/kaleidoscope/ View-Master

Occupational Therapist_____ **Date**_____

Revised 3/14

Resistive Strengthening



Bilateral Arm/Hand Activities

Fine Motor Skills: In Hand Manipulation

- Mild arm / hand involvement

- Further evaluate:

  - Finger to palm translation
  - Separate the two sides of their hand
  - Manipulate objects within their hand
  - Activate intrinsic muscles
  - Control objects out at their fingertips

- Develop home exercise program to focus on specific areas of weakness

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Fine Motor Skills: In-Hand Manipulation

Hand skills are part of everyday tasks at home and school. In-hand manipulation is the ability to hold and adjust objects while holding them. Fine motor skills, such as in-hand manipulation, are important for activities such as writing, doing fasteners, and cutting with scissors. Here are some fun ideas to work on in-hand manipulation.

- Pick up pennies one at a time, up to 5, then release each one into a piggy bank
- Twirl pencil in one hand like a baton, 5 times each direction
- With one hand, turn over objects (e.g. coins, caps, blocks) on table or within hand
- Hold pencil/marker/crayon in hand as if to write, then inch fingers up and down writing utensil
- Roll small balls of play-doh between fingertips
- Tear strips of paper and crumple into a ball using one hand
- Pick up 2-3 beads, then string them on a pipe cleaner or piece of string
- Play with Legos, Duplos, or K'nex
- Use double sided marker or crayon, flip in hand to use each end
- Use a hole punch to create holes on a piece of paper or paper plate, then lace string through the holes
- Unscrew cap off of an object (e.g. toothpaste, small jar)
- Pick up a small object and "hide" it in your palm. Then pick up another. See how many you can "hide" in your palm.

Additional Resource for other hand skills such as writing, finger isolation, and thumb use.
www.therapystreetforkids.com

Questions – 612-596-6216 (Shriner's Hospital for Children-Twin Cities Occupational Therapy Department)

Hand Splinting

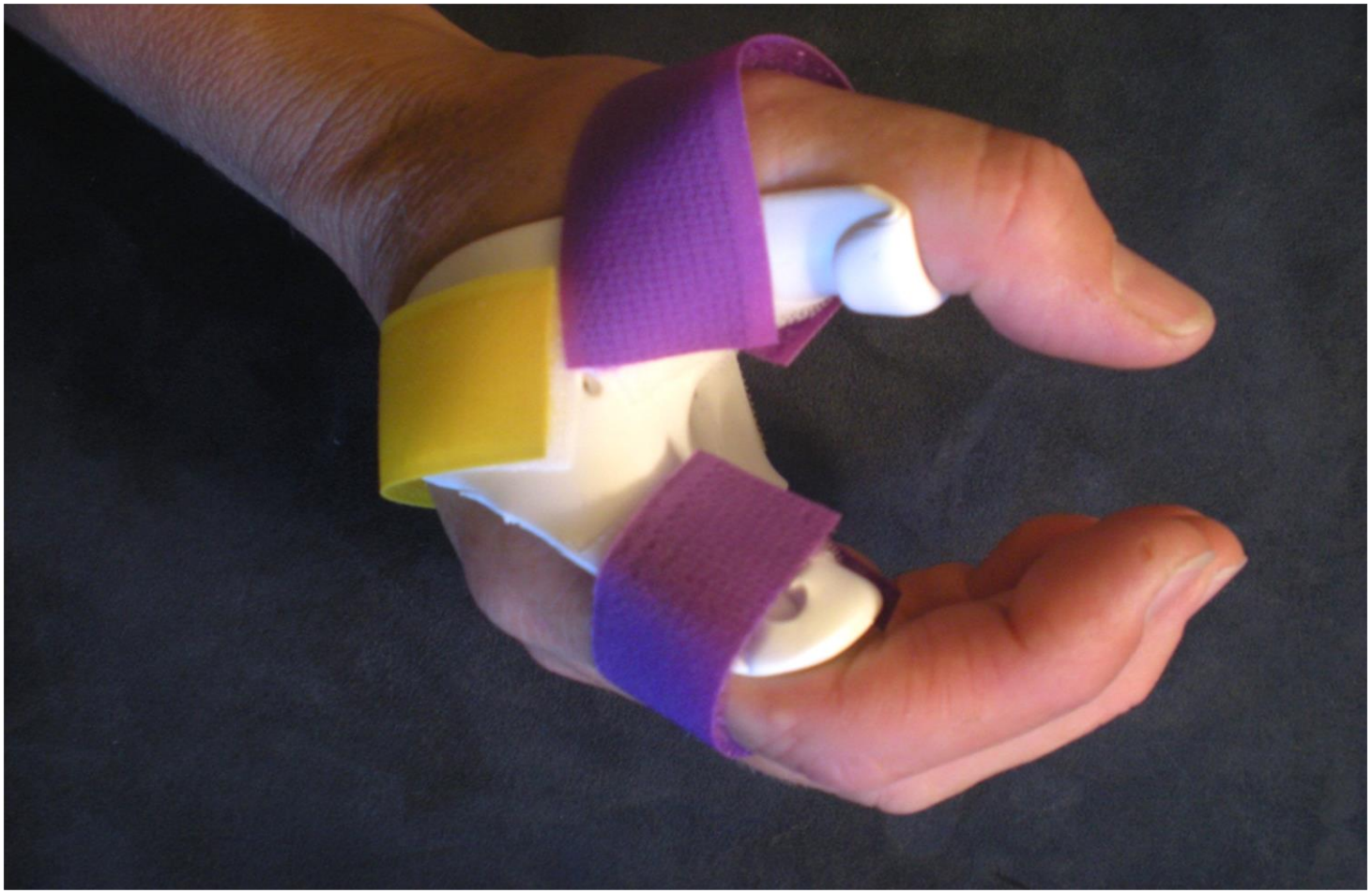
Resting Hand Splints

Soft Daytime Benik Wrist/Thumb Support

Thumb Loop Splint

McKie Thumb Abduction Splint

C Bar splint to abduct the thumb

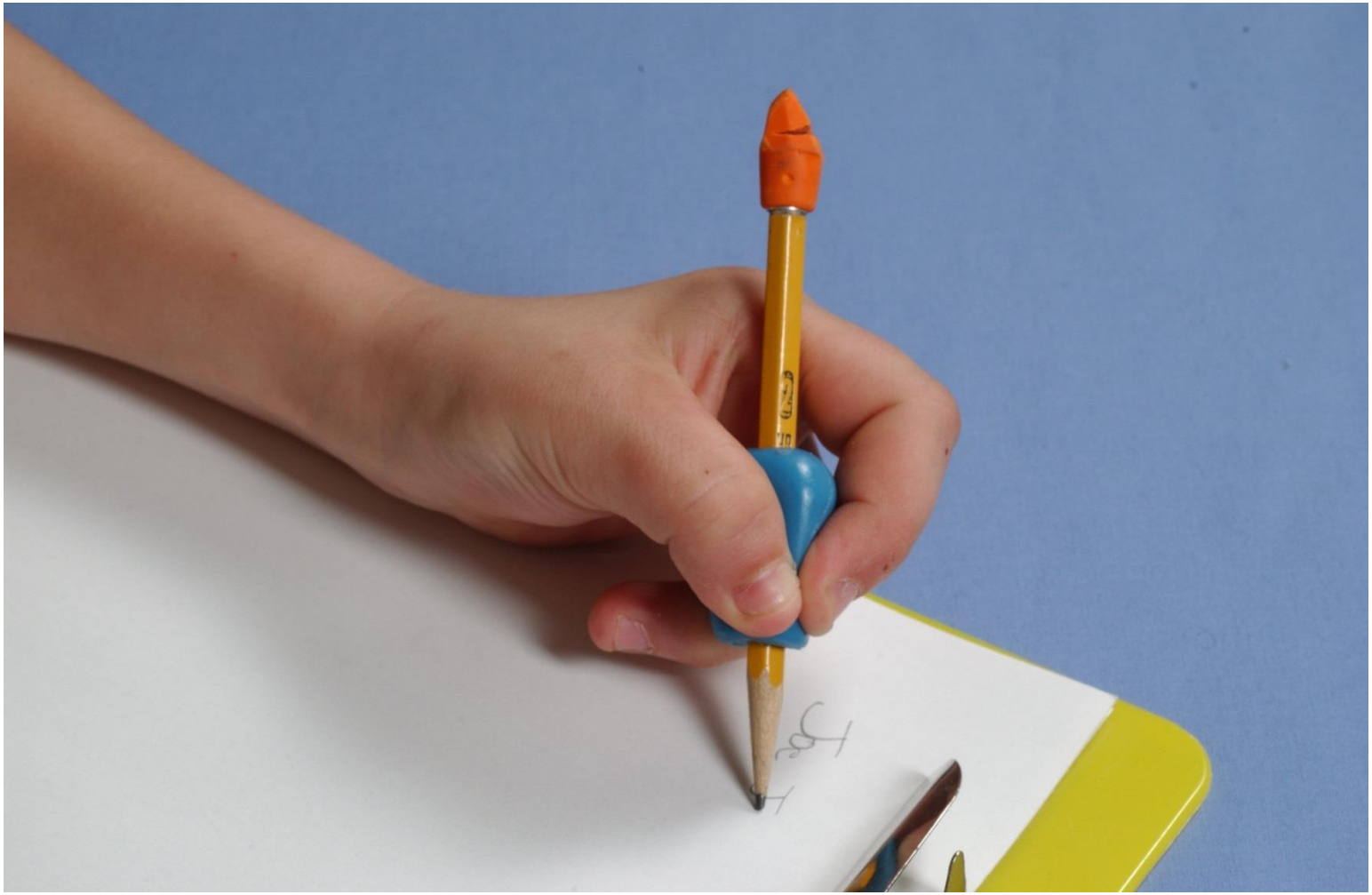


Encourage arm / hand use for ADLs

New shoe tying method

Lower body dressing to work on reach and elbow extension

Identify hand grasp concerns



Handwriting

- Positioning
  -Table height
  - Paper tilt

- Pencil grasp
  - How do they hold their pencil
  - Where the movement is occurring
  - Do they have an open arch
- Letter Formation

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Created June 2015

Handwriting

There are many reasons why handwriting may be more difficult for your child. Some common problems are spacing/sizing of letters and words, understanding how to form letters, placement of letters on paper, and overall legibility. Here are some suggestions for helping your child with handwriting.

Learning and Practicing Writing Letters/Numbers

- Write in clay, play-dough, or sand
- Write on a chalkboard or white board. Then, trace over it with a wet rag or another color
- Write on a mirror using “window markers”
- “Wikki stix” can be used to form letters on a table
- Use your finger to trace a letter on child’s back or hand. Then, have them guess the letter
- Use magnets when first learning letters to work on recognition and memory
- Have letters preprinted on a sheet of paper. Write over them with a marker, crayon, squeeze bottle of glitter, etc.
- Handwriting Programs: Handwriting without Tears, StartDOT Handwriting, Loops and Other Groups

Word Spacing

- After writing a word, use your finger as a spacer. Start the next word next to finger
- Instead of using your finger, decorate a small popsicle stick and use that as own personal word spacer
- Other spacing methods could be using stickers, making a dot, or putting a dash in between words

Paper and Pencil Grips

- “Sky, Grass, Dirt” paper – http://www.startdothandwriting.com/resources
- Graph, larger lined, or highlighted paper
- Pencil grip examples – http://www.thepencilgrip.com/

Posture

- Have paper on a slanted surface (e.g. slant board/table or use a 3-ring binder)
- Sit in a chair with feet flat on the floor or a foot rest
- Tilt paper to the left if right handed. Tilt paper to the right if left handed.

Other

- Encourage writing as something fun to do – buy a special notebook and pencil, pen, and/or pencil grip for your child to use when writing.
- Have them practice by writing a few sentences about their favorite toy, what they did last weekend, or another topic.
- Circle the best word or letters and then explain why those were the best
- http://therapystreetforkids.com/Handwriting.html

Questions? – 612-596-6216, Shriner’s Hospital for Children-Twin Cities
Occupational Therapy Department

Thank You for your attention!