

# T-GAP Training

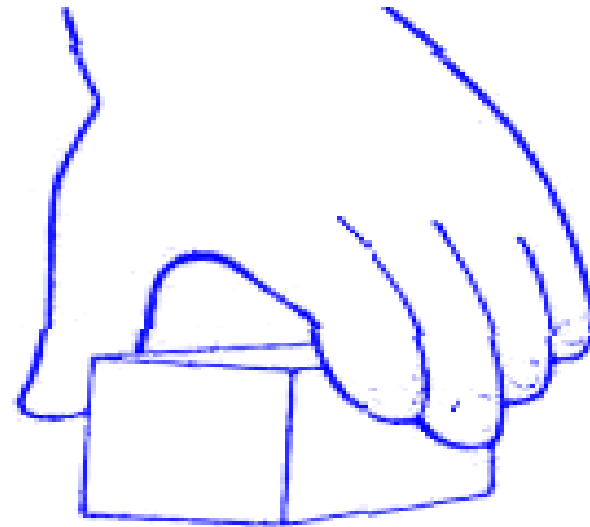
## Part 1: Background, Administration and Scoring

## Part 2: Photo Examples: Grasp Style Scoring Practice



# *Agenda*

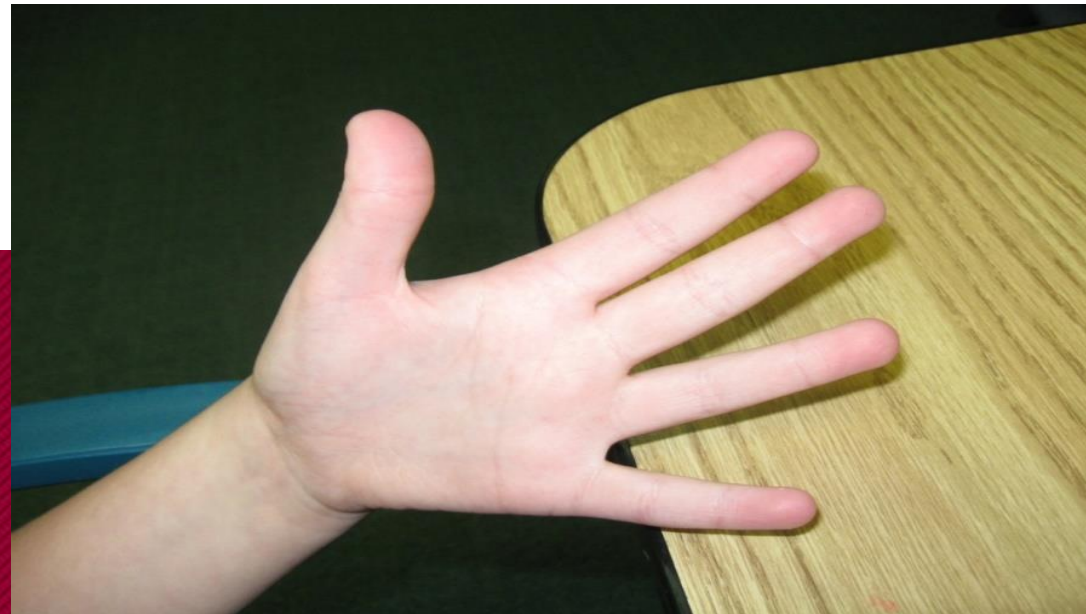
- Background
- Assessment of Thumb Hypoplasia
- T-GAP Standardization
- Administration
- Scoring
- Photo scoring practice



# ***Background: Normal thumb***

Congenital deficiency of the thumb greatly compromises hand function because the normal thumb contributes at least 40% of its usefulness. Vekris, Beris, Lykissas, Soucacos. Index finger pollicization in the treatment of the congenitally deficient thumb. *Ann Plast Surg.* 2011

The thumb is a specialized organ with unique functions that cannot be replicated by any other digit. Taghinia, Littler, Upton. Refinements in pollicization: a 30-year experience. *Plast Reconstr Surg* 2012





# ***Background: Typically developing thumb***

- Unique position of opposition at rest
- Saddle joint allows wide range of movement and rotation



## ***Background: Major developmental defects of the thumb***

- Constitute 16% of all birth deformities of the hand
- Frequently associated with partial or complete absence of the radius
- May present in isolation or as a component of a syndrome
- Bilateral involvement (62%)
- Absent or unstable thumb requires flexing or scissoring the fingers to stabilize an object



***In 2004, we had a large population of children with radial and thumb hypoplasia that underwent index pollicization***

- Surgical recreation of a thumb: taking the index finger to create an opposable thumb
- We wanted to develop an assessment protocol to understand how the new thumb functioned





***Literature review:***

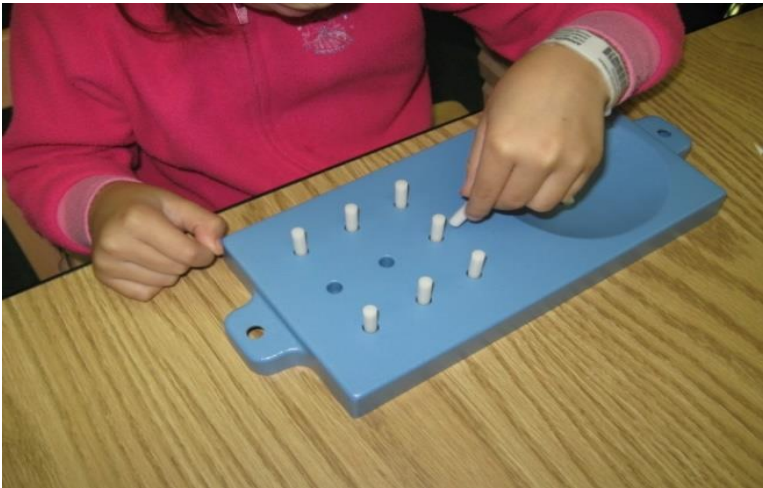
***Outcomes to measure thumb function following index pollicization commonly include strength and range of motion testing***



## ***Literature review: Outcome tools to measure dexterity***

- Repetitive grasping of pegs or blocks
- Scores based on speed of performance
- Age matched normative data
- Allow any grasp pattern including no thumb use

**9 Hole Peg Test**



**Functional Dexterity Test**



**Box and Blocks Test**





## ***Literature Review: Object Handling Assessments to Measure Thumb Use***

- Several described; none standardized
- Activities not age appropriate for young children
- All lacked a well-developed scale: Thumb use (Yes/No)
  
- Abnormal grasp patterns lacked standard terminology
  - Tricks moves
  - Side to side pinch
  - Modified manner
  - Deviant grasp patterns

# *We developed our own object handling assessment*

## **Thumb Grasp and Pinch Assessment (T-GAP)**

Tip pinch

Resistance

Lateral /Key pinch

Manipulation

Small grasp

ADL

Medium grasp

School

Large grasp



## ***2005 Hand Assessment Protocol***

- All patients with congenitally deficient thumbs were referred to OT for thumb function testing
- Included standard outcome measures: strength, ROM and dexterity
- Object handling assessment (T-GAP)
- Became our standard of care for establishing baseline skills, progress, and the effectiveness of surgery and therapy
- Aided families in understanding their child's thumb function, concerns and progress over time



In 2014, nine years of our thumb function assessments were reviewed

Kathleen Kollitz, MD

Fellowship at Mayo Clinic



Discovered the T-GAP as a new variable to measure hand dexterity

# Construct and Concurrent Validity: Results

**T-GAP scores were significantly correlated:**

<u>Dexterity Measure</u>	<u>P-Value</u>
Box and blocks test	.0048
Functional dexterity test	.014
Nine hole peg test	.0051

<u>Strength and Range of Motion</u>	<u>P-Value</u>
Tripod pinch strength	.0001
Key pinch strength	.017
Grip strength	.0083
Kapandji opposition	.0051
Active distal grasp span	.0005

**The varied grasp styles employed by these children were not entirely captured by standard outcome measures which are based on speed and allow any pinch pattern to be used including those that exclude the thumb.**

EDITOR'S CHOICE

## A New, Direct Measure of Thumb Use in Children After Index Pollicization for Congenital Thumb Hypoplasia

Kathleen M. Kollitz, MD,\* Wendy A. Tomhave, BA,† Ann E. Van Heest, MD,††  
Steven L. Moran, MD\*†

**Purpose** After index pollicization for congenital thumb hypoplasia, time-based hand dexterity tests do not indicate whether the new thumb is being used by a child. The Thumb Grasp and Pinch assessment (T-GAP) is a new outcome measure that classifies grasp and pinch styles to quantify use of the new thumb. The goal of this study was to establish concurrent validity and construct validity in the T-GAP.

**Methods** Data from children treated with index finger pollicization for congenital thumb hypoplasia were retrospectively reviewed. Measures of strength, range of motion, and scores on the Box and Blocks Test (BBT), 9-Hole Peg Test (NHPT), Functional Dexterity Test (FDT), and Task 7 (Heavy Objects) from the Jebsen-Taylor Test (JTT7) were recorded. Patients also completed the T-GAP consisting of 9 age-appropriate tasks, during which grasp patterns were classified. Spearman correlation coefficients were calculated comparing the T-GAP score with scores on the BBT, NHPT, FDT, and JTT7.

**Results** We evaluated 21 thumbs in 21 children an average of 71.7 months after pollicization surgery (range, 9–175 months). The T-GAP score was significantly correlated with BBT, NHPT, FDT, and JTT7 ( $R = 0.69, -0.60, -0.59,$  and  $-0.60,$  respectively). The T-GAP score was significantly correlated with tripod pinch, key pinch, and grip strength ( $R = 0.77, 0.75,$  and  $0.71,$  respectively) and with opposition and grasp span ( $R = 0.50$  and  $0.52,$  respectively). The T-GAP was the only functional measure correlated with parent and patient satisfaction with thumb function.

**Conclusions** Concurrent validity was supported by significant correlations between T-GAP score for all 4 dexterity measures. Construct validity was supported by significant correlations between strength and range of motion of the thumb and T-GAP score.

**Clinical relevance** This evaluation may help surgeons and therapists better understand results after pollicization and determine whether the new thumb is being incorporated into daily activities. (*J Hand Surg Am. 2018;43(11):978–986. Copyright © 2018 by the American Society for Surgery of the Hand. All rights reserved.*)

**Key words** Congenital thumb hypoplasia, dexterity measure, index pollicization, outcomes, thumb use.

+ Additional Material  
at [jhand surg.org](http://jhand surg.org)

# *T-GAP Inter and Intra Rater Reliability*

- The ICC's for inter rater trials were 0.887 and 0.901
- The ICC's for intra-rater trials were all above 0.88

## Inter- and Intrarater Reliability of the Thumb Grasp and Pinch Assessment for Children Following Index Pollicization for Congenital Thumb Hypoplasia

Wendy A. Tomhave, BA,\* Kathleen M. Kollitz, MD,† Steven L. Moran, MD\*†

**Purpose** The Thumb Grasp and Pinch (T-GAP) assessment quantifies functional hand use in children with congenital thumb hypoplasia by categorizing grasp and thumb use patterns during assessment activities that encourage a variety of grasp and pinch styles. This study aims to demonstrate interrater and intrarater reliability results of the T-GAP.

**Methods** A retrospective review was performed of children who had undergone index finger pollicization for congenital thumb hypoplasia and subsequent evaluation with videotaping of the T-GAP assessment. Following a training period, 4 occupational therapists scored 11 T-GAP videos on 2 separate occasions, separated by at least 2 weeks. Intraclass correlation coefficients (ICCs), standard error of measurements, minimum detectable change (MDC), and Pearson correlation coefficients were calculated.

**Results** The T-GAP raw scores were 16 to 55, demonstrating a range of mild to severe hand grasp differences. The ICCs for the interrater reliability trials were 0.887 and 0.901. Intrarater ICCs were all above 0.88. The MDC for each trial was 8.1 and 6.7 points. Pearson correlation coefficients calculated for each rater and each pair of raters were above 0.8 in all cases.

**Conclusions** Interrater and intrarater reliability testing results for the T-GAP were excellent in all cases; this strongly suggests that results from T-GAP assessments are reliable. The high ICCs suggest that raters can classify and score children's hand function consistently.

**Clinical relevance** This study, in conjunction with previous work, suggests that the T-GAP may be an ideal approach to assessing the outcomes of pollicization and provide a means of ongoing assessment of children's grip and pinch function. (*J Hand Surg Am.* 2018; ■ (■):1.e1-e8. Copyright © 2018 by the American Society for Surgery of the Hand. All rights reserved.)

**Key words** Assessment, dexterity, pollicization, reliability, thumb.

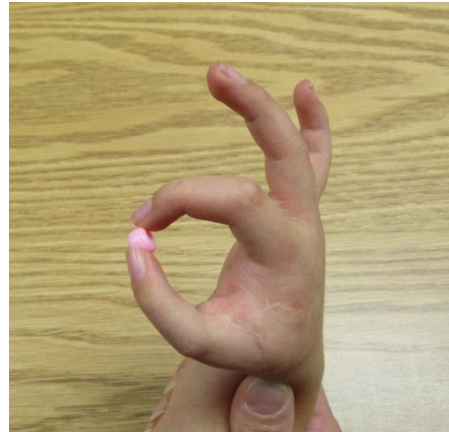
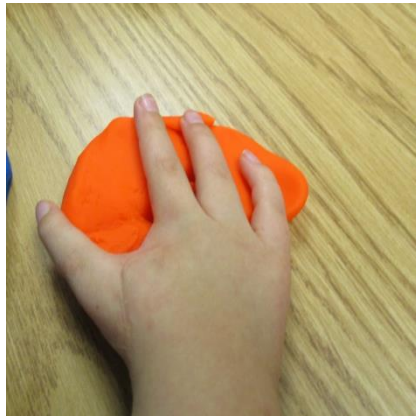


- Inter rater and intra rater reliability results were excellent in which raters could classify and score children's hands consistently



# Validation Studies concluded that understanding typical and atypical grasp and thumb use patterns can potentially facilitate the choice of strategies:

- in the therapeutic process
- to determine the success of surgical treatment
- to aid in future surgical decision making




# The T-GAP has been expanded to study outcomes in other congenital thumb conditions

Original Manuscript



## Abductor Pollicis Longus Tendon Abnormalities and Release in Children With Congenital Clasped Thumb

HAND  
1-10  
© The Author(s) 2022  
Article reuse guidelines:  
[sagepub.com/journals-permissions](https://sagepub.com/journals-permissions)  
DOI: 10.1177/15589447221141475  
[journals.sagepub.com/home/HAN](https://journals.sagepub.com/home/HAN)

Jacqueline S. Israel<sup>1</sup> , Teresa A. Jeardeau<sup>2</sup>, Wendy A. Tomhave<sup>3</sup>,  
and Steven L. Moran<sup>2</sup>

### Abstract

**Background:** Congenital clasped thumb is associated with deficient thumb extensor tendons. Reconstruction includes tendon transfer. Here, we describe a variant of the abductor pollicis longus (APL) tendon, not previously reported, contributing to the flexion deformity. The purpose of this study is to report examples of and offer surgical repair techniques for APL variants identified in patients with clasped thumb. **Methods:** We reviewed records of 11 consecutive patients undergoing reconstruction for clasped thumb. Surgical anatomy of the APL tendon was evaluated in all patients, followed by release of aberrant APL attachments. Participants were invited to return for an in-person assessment with a certified hand therapist. Data were collected regarding intraoperative findings, surgical techniques for reconstruction, postoperative thumb motion, and patient and caregiver satisfaction. **Results:** Eleven children (12 thumbs) underwent aberrant APL release and rerouting between 2019 and 2021. Preoperatively, all thumbs were passively correctable to 0° of extension. In all patients, the APL was found to terminate palmar to the metacarpophalangeal (MCP) joint, creating an MCP flexion moment when tensioned. The average age at surgery was 7 years (range: 1-15 years), and the average follow-up was 14.2 months (range: 1-21 months). The mean postoperative thumb radial abduction was 55° (range: 20°-75°). **Conclusions:** When reconstructing clasped thumbs, surgeons should explore the presence of APL abnormalities. Release and centralization of the APL can improve thumb position and function. This technique may avoid the need for extra-anatomical tendon transfer in patients with clasped thumb.



Researchers in Norway and Finland in 2023 studied the T-GAP following thumb reconstruction and reported:

moderate concurrent validity  
moderate to strong construct validity  
strong inter and intra rater reliability

## Validity and Reliability of the Thumb Grasp and Pinch Assessment for Children After Reconstruction of Congenital Hypoplastic Thumbs

Ida Neergård Sletten, MD, PhD,\* Mona Irene Winge, MD,\* Camilla Helleveuo, MD,† Anne Birgit Stavenes, OT,\* Inger Helen Bolstad, OT,\* Jarkko Jokihäärä, MD, PhD†‡

**Purpose** The Thumb Grasp and Pinch Assessment (T-GAP) is a new instrument for evaluating thumb use in children with congenital hypoplastic thumbs. The assessors video-record the children while they perform nine specific activities and score their grasp types using T-GAP. A high T-GAP score indicates more mature grasp patterns. The developers reported the instrument's validity and reliability for index finger pollicization. This study investigated T-GAP's validity and reliability in children with reconstructed hypoplastic thumbs.

**Methods** Four hand surgeons and two hand therapists from two hospitals rated video clips of 20 Manske type II and IIIa hands twice in 17 patients who performed the T-GAP at least 1 year after opposition transfer and thumb ligament reconstruction. To investigate the validity, we calculated correlation coefficients for T-GAP scores and clinical outcomes, including thumb ROM, grip and pinch strength, and visual analog scale assessments of thumb function and appearance. To estimate T-GAP's inter- and intrarater reliability, we calculated intraclass correlation coefficients and their 95% confidence intervals (CIs).

**Results** Thumb Grasp and Pinch Assessment score showed a strong linear correlation ( $r = 0.815-0.944$ ) and a moderate to strong nonlinear correlation ( $\rho = 0.527-0.744$ ) with visual analog scale assessments of thumb function and appearance, respectively; a moderate nonlinear correlation ( $\rho = 0.464$ ) with grip strength; and a moderate nonlinear correlation ( $\rho = 0.541$ ) with thumb MCP joint range of motion. The intraclass correlation coefficient for the interrater reliability was 0.892 (95% CI, 0.768-0.954) in round 1 and 0.898 (95% CI, 0.754-0.959) in round 2, and for intrarater reliability, the mean was 0.882 (95% CI, 0.785-0.980).

**Conclusions** Thumb Grasp and Pinch Assessment score had a moderate to strong construct validity and a moderate concurrent validity. Both inter- and intrarater reliability was strong.

**Clinical relevance** This study supports the T-GAP instrument's validity and reliability for assessing functional outcomes in congenital hypoplastic thumb reconstruction. (*J Hand Surg Am.* 2023; ■(■):1.e1-e8. Copyright © 2023 by the American Society for Surgery of the Hand. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

**Key words** Congenital thumb hypoplasia, reliability, Thumb Grasp and Pinch Assessment, validity.



**C**REDIBLE EVALUATION OF TREATMENT outcomes is crucial in studies on children with congenital upper limb anomalies (CULA).

During the last decades, researchers have increasingly used patient-reported outcome measures (PROMs) to supplement objective measurements of

From the \*Division of Orthopaedic Surgery, Oslo University Hospital, Oslo, Norway; the †Department of Hand Surgery, Tampere University Hospital, Central Hospital, Tampere, Finland; and the ‡Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland.

Received for publication August 23, 2022; accepted in revised form December 20, 2022. No benefits in any form have been received or will be received related directly to this article.

**Corresponding author:** Ida Neergård Sletten, MD, PhD, Division of Orthopaedic Surgery, Oslo University Hospital, Postboks 4950 Nydalen, 0424 Oslo, Norway; e-mail: [ida.sletten@icloud.com](mailto:ida.sletten@icloud.com).

0363-5023/23/ ■ ■ ■ -0001  
<https://doi.org/10.1016/j.jhsa.2022.12.017>

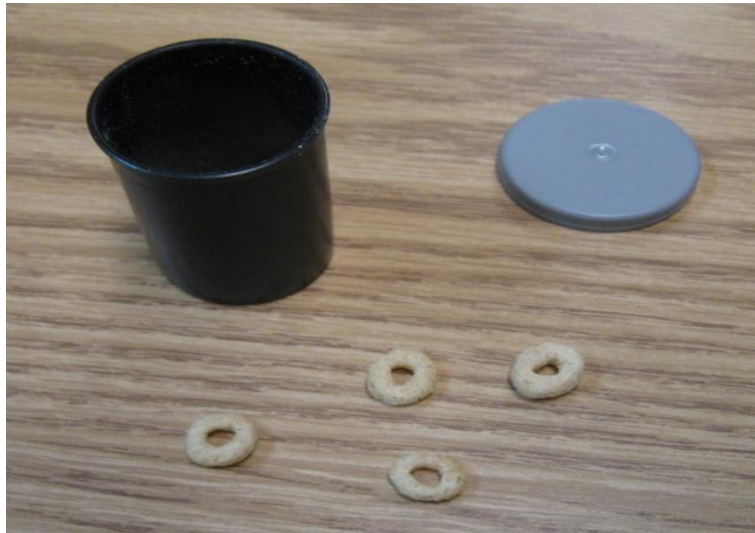


# ***T-GAP Thumb Grasp and Pinch Assessment***

- Developmentally appropriate activities for young children
- Standardized 18 months – 18 years
- Object size and shape can encourage specific grasp styles

## **Tip Pinch**

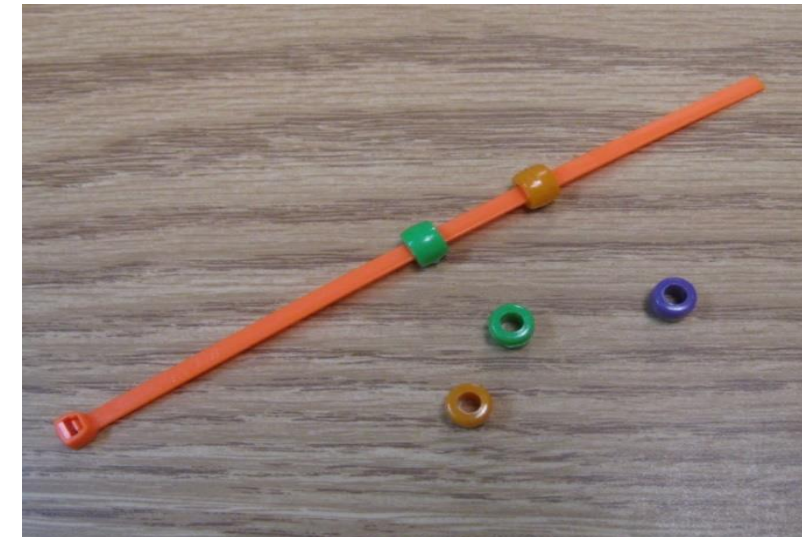
18 months – Age 4



Ages 5 – 7



Ages 8 - 18



# *Activities promote specific qualities and grasp type*

## **5-7 Year Old Activities**

- **Tip pinch** – put pennies into a bank
- **Lateral key pinch** – turn key to open padlock
- **Small grasp** – pull cap off marker
- **Medium grasp** – turn the end of a kaleidoscope
- **Large grasp** – open a jar of peanut butter





# ***5-7 Year Old Activities (continued)***

- **Manipulation** – form a bowl out of play dough
- **Resistance** – pull back foam pull on sling shot
- **School** – color inside a circle
- **ADL** – tie shoelaces into a knot







**Sturdy medium size piggy bank and 3 pennies**

Place the bank and three pennies in front of the child. Ask the child to pick up and put each penny into the piggy bank

**Score:** How the penny is held



**Padlock (2 3/8" tall) with vinyl-coated key**

Demonstrate how to insert the key and turn it to open the padlock then demonstrate how to relock the padlock. Ask the child to unlock and lock the padlock two times.

**Score:** How the key is held



**Small circumference marker (3/8" wide)**

Place a marker in front of the child. Ask the child to pull off the cap then put the cap on tightly then pull the cap off again.

**Score:** How the marker is held



**Kaleidoscope (9 " long and 2 1/2" wide)**

Demonstrate how to use the kaleidoscope by holding it horizontally and looking through it while rotating the end. Ask the child to look through the kaleidoscope and turn the end three times.

**Score:** How the kaleidoscope is held



**1 pound peanut butter jar (3" wide and 5" tall)**

Place the peanut butter jar in front of the child and ask the child to take the cover off and put the cover back on.

**Score:** How the jar is held



**Full-size container of moldable clay**

Demonstrate how to form moldable clay into a bowl then form into a ball and place on the table. Ask the child to make a bowl. You can help start the shape if needed.

**Score:** How the clay is held



**Slingshot with foam pull**

Demonstrate how to hold the slingshot, grasp the round end of the pull and pull back with moderate force then release. Ask the child to do this sequence twice

**Score:** How the foam pull is held



**6" x 9" white drawing pad and a crayon**

Place a peanut butter jar on the paper and draw a circle around it with the crayon. Ask the child to color in the circle with the crayon.

**Score:** How the crayon is held



**Child-size lace-up shoe with long, flat laces**

Place the shoe in front of the child and ask the child to tie a knot with the laces. You can show how to make a knot if needed.

**Score:** How the laces are held



	<b>T-GAP Activity Ages 18 months – 4 years</b>	<b>T-GAP Activity Ages 5 – 7 years</b>	<b>T-GAP Activity Ages 8 – 18 years</b>
<b>Tip Pinch</b>	Pick up 3 Cheerios one at a time and release into a film container <i>Score how the Cheerio is held</i>	Pick up 3 pennies one at a time and release into a piggy bank <i>Score how the penny is held</i>	Thread 5 plastic beads onto a zip tie <i>Score how the bead is held</i>
<b>Lateral Key Pinch</b>	Open a zippered pencil case and remove 2 markers <i>Score how the zipper tab is held</i>	Turn a vinyl coated key to open a Padlock <i>Score how the key is held</i>	Turn a vinyl coated key to open a Padlock <i>Score how the key is held</i>
<b>Small Grasp</b>	Pull cap off a large diameter marker <i>Score how the marker is held</i>	Pull cap off a small diameter marker <i>Score how the marker is held</i>	Remove cap from ballpoint pen <i>Score how the pen is held</i>
<b>Medium Grasp</b>	Separate 5 Duplo style blocks that are stacked together <i>Score how the <u>duplos</u> are stabilized</i>	Turn end of kaleidoscope 3 times <i>Score how the kaleidoscope is held</i>	Make a telescope with a 6" x 9" sheet of paper and place rubber band over <i>Score how the paper tube is held</i>
<b>Large Grasp</b>	Open a 4 oz. container of bubbles <i>Score how the container is stabilized</i>	Twist cap from a 1# peanut butter jar <i>Score how the jar is held</i>	Twist cap off from a 1# peanut butter jar <i>Score how the jar is held</i>
<b>Manipulation</b>	Form moldable clay into a bowl <i>Score how the moldable clay is held</i>	Form moldable clay into a bowl <i>Score how the moldable clay is held</i>	Rotate a pencil 3 times in a handheld pencil sharpener <i>Score how the pencil is held</i>
<b>Resistance</b>	Open a drawstring bag <i>Score how the bag is held when opened</i>	Pull back foam pull on slingshot <i>Score how the foam pull is held</i>	Pull back foam pull on slingshot <i>Score how the foam pull is held</i>
<b>School</b>	Open a box of 8 crayons and remove one <i>Score how the crayon is held</i>	Color inside a circle with a crayon <i>Score how the crayon is held</i>	Write name with a no. 2 pencil <i>Score how pencil is held</i>
<b>ADL</b>	Put sock on over toes <i>Score how the sock is held open</i>	Tie shoelaces into a knot <i>Score how the laces are held</i>	Tie shoelaces into a bow <i>Score how the laces are held</i>

## ***T-GAP Scoring and Interpretation***

- 5-10 minutes to administer
- 9 activities are video recorded
- Scored during a subsequent viewing

### ***3 Components of Hand Dexterity***

- T-GAP score
- Thumb use score
- Number of grasp styles





# Scoring hierarchy is based on principles of hand development and includes compensatory grasp styles

- Grasp patterns develop from flexion to extension and abduction
- Hand development develops from ulnar to radial grasps
- Palmar grips immobilize an object and progress to distal patterns that permit manipulation
- Refinement of intrinsic hand function
- Skillful distal finger control with object translation
- Complex rotation of objects within the hand

# 8 Point Hierarchical Scale

## Grasp and Pinch Style Scoring

- 0 No Grasp, Passive Stabilization
- 1 Palmar Grasp, Finger Flexion; No Thumb Use
- 2 Ulnar Scissor Grasp; No Thumb Use
- 3 Radial Scissor Grasp; No thumb Use
  
- 4 Cylindrical Grasp; Thumb to Fingers
- 5 Lateral Key Pinch; Thumb to Index
- 6 Tip Pinch; Thumb to Finger Tip
- 7 Tripod Pinch; Thumb to Distal Index/Long

**The Thumb Grasp and Pinch Assessment  
T-GAP Score form  
5 years – 7 years**



T-GAP Activity	LEFT (Score 0-7)	RIGHT (Score 0-7)
Pick up 3 pennies one at a time and release into a piggy bank <b>(tip pinch)</b> <i>Score how penny is held</i>		
Turn a key to open a padlock <b>(lateral key pinch)</b> <i>Score how key is held</i>		
Pull cap off a small diameter marker <b>(small grasp)</b> <i>Score how marker is held</i>		
Turn end of kaleidoscope 3 times <b>(medium grasp)</b> <i>Score how kaleidoscope is held</i>		
Remove cap from a peanut butter jar <b>(large grasp)</b> <i>Score how jar is held</i>		
Form Play-Doh into a bowl <b>(manipulation)</b> <i>Score how Play-Doh is held</i>		
Pull back foam pull on slingshot <b>(resistance)</b> <i>Score how foam pull is held</i>		
Color inside a circle with a crayon <b>(school)</b> <i>Score how crayon is held</i>		
Tie shoelaces into a knot <b>(ADL)</b> <i>Score how laces are held</i>		

**Grasp and Pinch Style Scoring**

- 0 No Grasp, Passive Stabilization
- 1 Palmar Grasp, Finger Flexion; No Thumb Use
- 2 Ulnar Scissor Grasp; No Thumb Use
- 3 Radial Scissor Grasp; No thumb Use
  
- 4 Cylindrical Grasp; Thumb to Fingers
- 5 Lateral Key Pinch; Thumb to Index
- 6 Tip Pinch; Thumb to Finger Tip
- 7 Tripod Pinch; Thumb to Distal Index/Long

**T-GAP Total Score**

Left Hand \_\_\_\_\_/63  
Right Hand \_\_\_\_\_/63

**Number of Grasp Styles: Points 1-7**

Left Hand \_\_\_\_\_  
Right Hand \_\_\_\_\_






**Thumb Usage: Points 4-7**

Left Hand \_\_\_\_\_/9  
Right Hand \_\_\_\_\_/9



# Grasp-Pattern-Hierarchy:-No-Use-of-Thumb-

T-GAP-Scoring:-0--3-Points-

Standard-Grasp-Patterns	Variation-Grasp-Patterns
<p><b>No-Grasp, Passive Stabilization (0-points)</b> Passive stabilization using fingertips or side of hand</p> 	<p><b>None</b> No variation for No-Grasp, Passive Stabilization</p>
<p><b>Palmar Grasp, Finger Flexion (1-point)</b> Finger flexion, all fingers to palm</p> 	<p><b>Distal Flexion of Fingers (1-point)</b> Finger flexion without use of palm</p> 
<p><b>Ulnar Scissor Grasp (2-points)</b> Finger stabilization between small/ring fingers If four web spaces are present; also between ring/long fingers</p> 	<p><b>Scissors Multiple Fingers (2-Points)</b> Weaves objects between multiple fingers</p> 
<p><b>Radial Scissor Grasp (3-points)</b> Finger stabilization between the index/long fingers</p> 	<p><b>Distal Finger Scissoring (3-points)</b> Distal pinch between non-adjacent finger tips</p> 

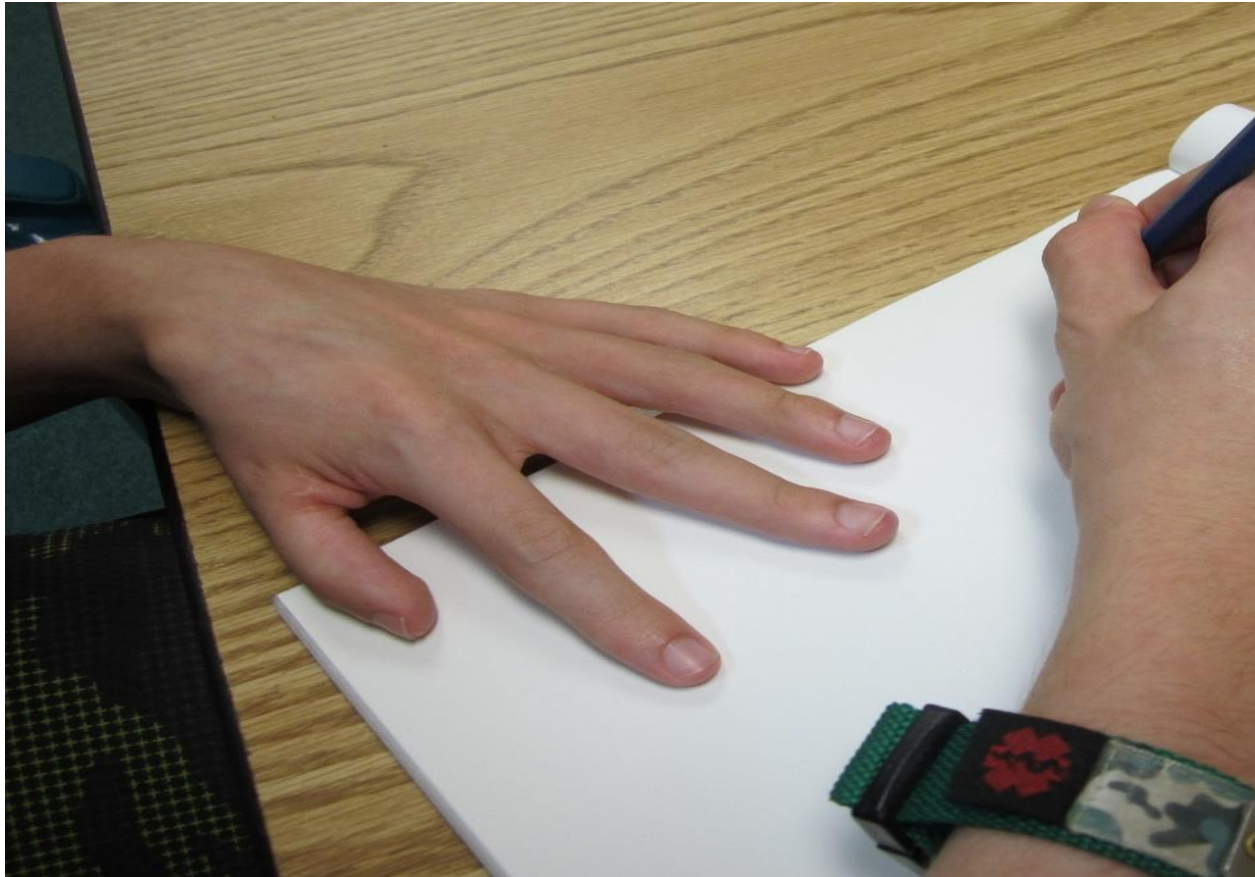
# Grasp-Pattern-Hierarchy:-Use-of-Thumb-

T-GAP-Scoring:-4--7-Points-

Standard-Grasp-Patterns	Variation-Grasp-Patterns
<p><b>Cylindrical Grasp (4-points)</b> Thumb opposition with proximal grasp of all fingers</p> 	<p><b>Distal Cylindrical (5-points)</b> Thumb opposition with distal grasp of all fingers</p> 
<p><b>Lateral Key Pinch (5-points)</b> Thumb opposition to side of index finger or index to side of thumb</p> 	<p><b>Lateral Cylindrical (5-points)</b> Encircling grasp of thumb and index finger</p> 
<p><b>Tip Pinch (6-points)</b> Thumb opposition to tip of index finger</p> 	<p><b>Tip to Non-Index Finger (5-points)</b> Thumb opposition to tip of ring, long, or small finger</p> 
<p><b>Radial Digital Grasp (7-points)</b> Thumb opposition to index and long fingers</p> 	<p><b>Proximal Radial Digital Grasp (6-points)</b> Thumb opposition with proximal index/long fingers</p> 



***0 Points:***  
***No grasp or pinch***  
***Passive stabilization of hand***



**1 Point:**

***Palmar Grasp, Finger Flexion; No Thumb Use***

***Variation***

**Palmar Grasp, Finger Flexion (1 point)**

Finger flexion; all fingers to palm



**Distal flexion of fingers (1 point)**

Finger flexion without use of palm





**2 Points:**  
***Ulnar Scissor Grasp; No Thumb Use***

***Variation***

**Ulnar Scissor Grasp (2 points)**

Finger stabilization between small/ring.

If 4 web spaces present also between ring/long fingers



**Scissors Multiple Fingers (2 Points)**

Weaves objects between multiple fingers



# 3 Points: Radial Scissor Grasp; No Thumb Use

## Variation

### Radial Scissor Grasp (3 points)

Finger stabilization between the index/long for long/ring fingers



### Distal Finger Scissoring (3 points)

Distal pinch between non adjacent finger tips





# 4 Points: Cylindrical Grasp

## Variation

**Cylindrical Grasp; Thumb To All Fingers (4 points)**  
Opposed thumb with proximal grasp of all fingers



**Distal Cylindrical (5 points)**  
Distal grasp of all fingers to opposed thumb





# 5 Points: Lateral Key Pinch

**Lateral Key Pinch (5 points)**  
Opposes thumb to side of index finger



## Variation

**Lateral Cylinder (5 points)**  
Encircling grasp of thumb and index finger

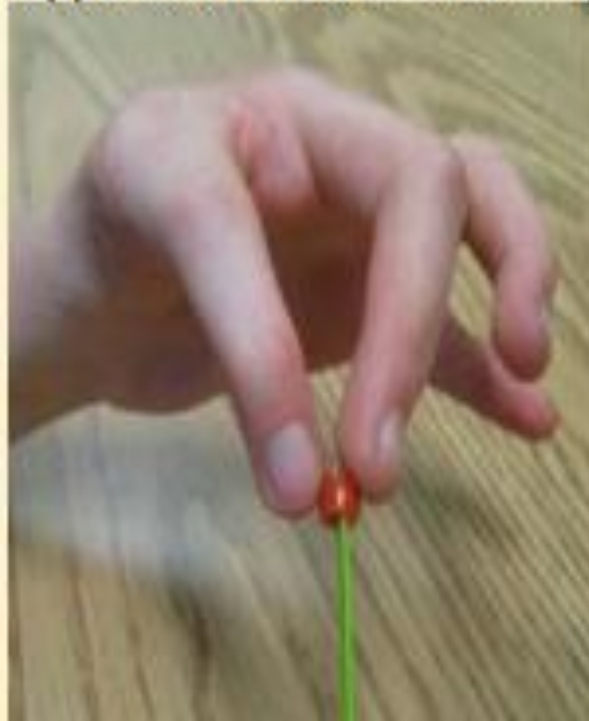


# *6 Points: Tip Pinch*

## *Variation*

### **Tip Pinch (6 points)**

Opposes thumb to side or tip of index finger



### **Tip to Non-Index Finger (5 points)**

Opposes thumb to tip of ring, long or small finger



# 7 Points: Tripod Pinch

## Radial Digital Grasp (7 points)

Opposes thumb to index and long fingers



## Variation

## Proximal Radial Digital Grasp (6 points)

Supports objects proximally thumb/index/long fingers





# ***Scoring Guidelines***

- Score the most frequent pattern observed
- Two patterns equally used, score the higher value
- Know what portion of the task you are scoring when videotaping
- Use the two-page scoring guide

## ***Videotaping Tips and Set-up***

- Mobile tablet or handheld camera
- Tripod – tallest setting over child's head or shoulder
- Record each task in order as the administration guide
- Have testing materials ready, out of the child's view
- Don't allow too much time beyond what's requested
- Switch hands to show tasks twice, using the left and right hands

# Part 2 Photo Training

## Grasp Style Scoring Practice





*Thread beads onto a plastic zip tie: ages 8 -18*

*Score: How the bead is held*

*Correct score: Radial scissor grasp: 3 points*



## *Tie shoelaces into a knot: ages 5-7*

*Score: How the laces are held*

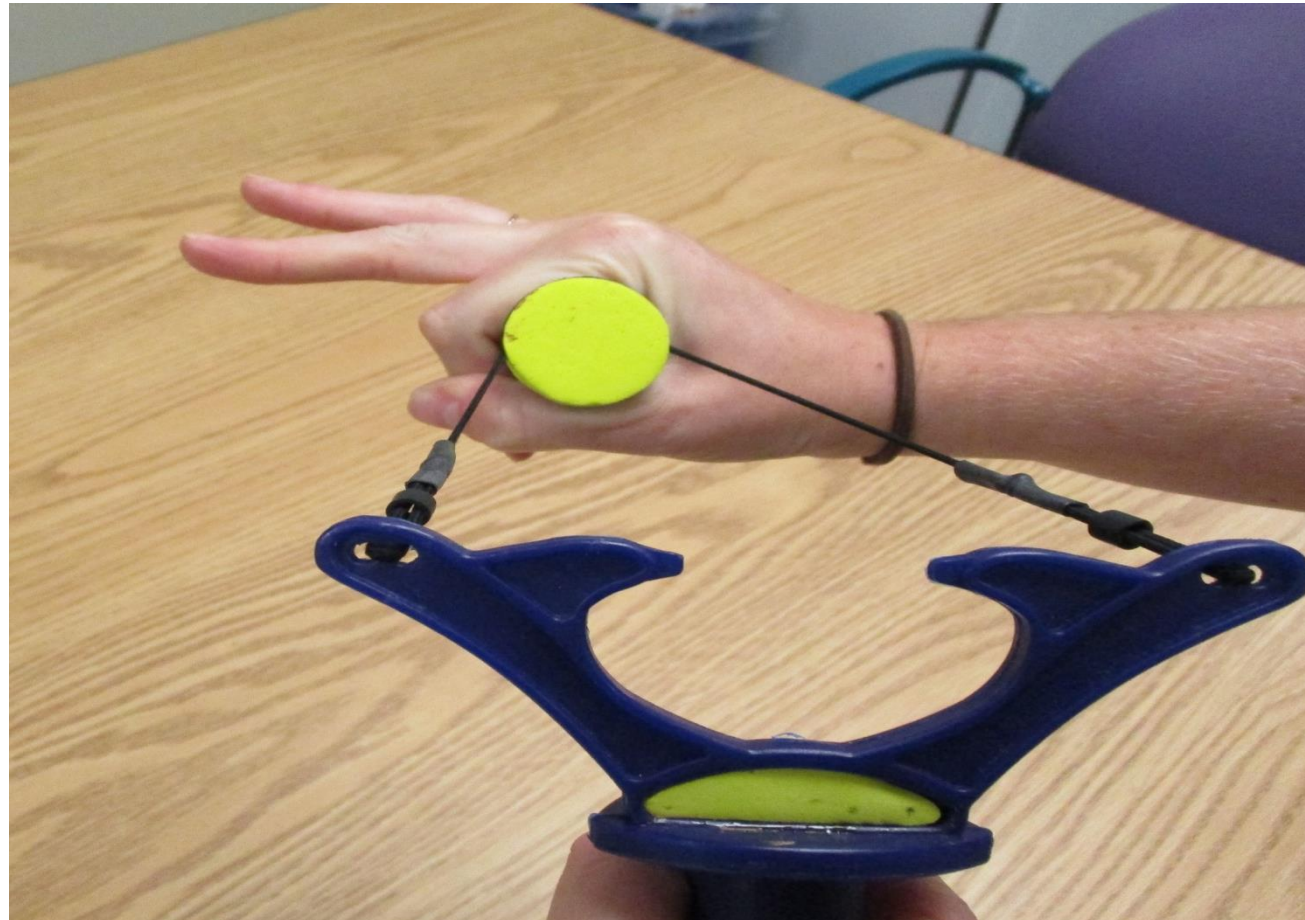
*Correct score: Variation pattern, scissors multiple fingers - 2 points  
weaves objects between multiple fingers*



*Pull back foam pull on sling shot: ages 5-7 and 8-18*

*Score: How the foam pull is held*

*Correct score: Variation pattern: Lateral cylinder - 5 points  
Encircling grasp of thumb and index*

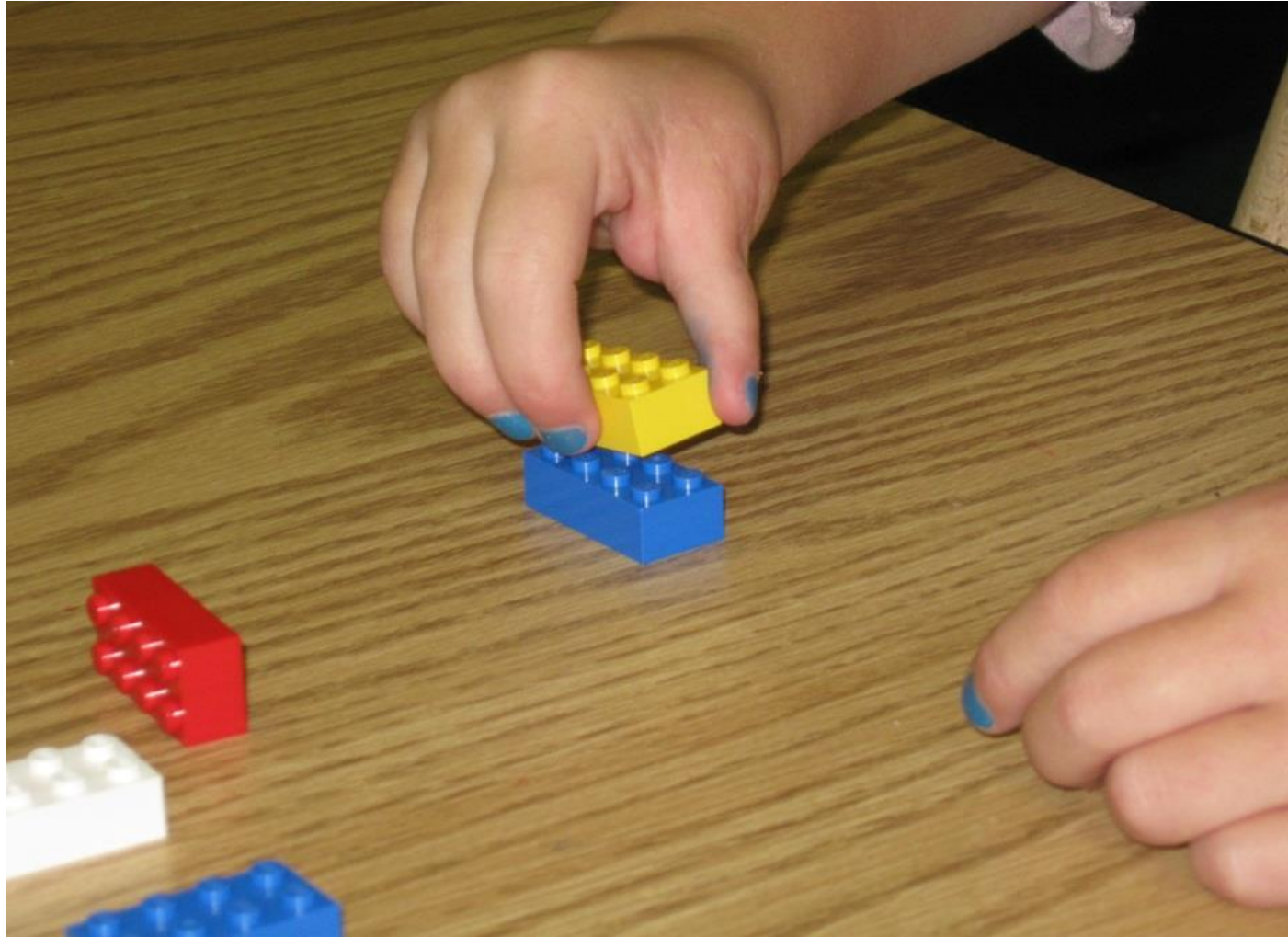




*Separate 5 duplo type blocks that are stacked together: ages 18 months-4 years*

*Score: How the duplos are stabilized*

*Correct score: Radial digital grasp - 7 points*



*Tie shoelaces into a bow: ages 8-18 years*

*Score: How the laces are held*

*Correct score: Variation pattern distal flexion of fingers - 1 point*



*Turn key in a padlock: ages 5-7 and 8-18 years*

*Score: How the key is held*

*Correct score: Lateral /key pinch – 5 points*

*With index pollicization this includes the index to the side of the thumb*

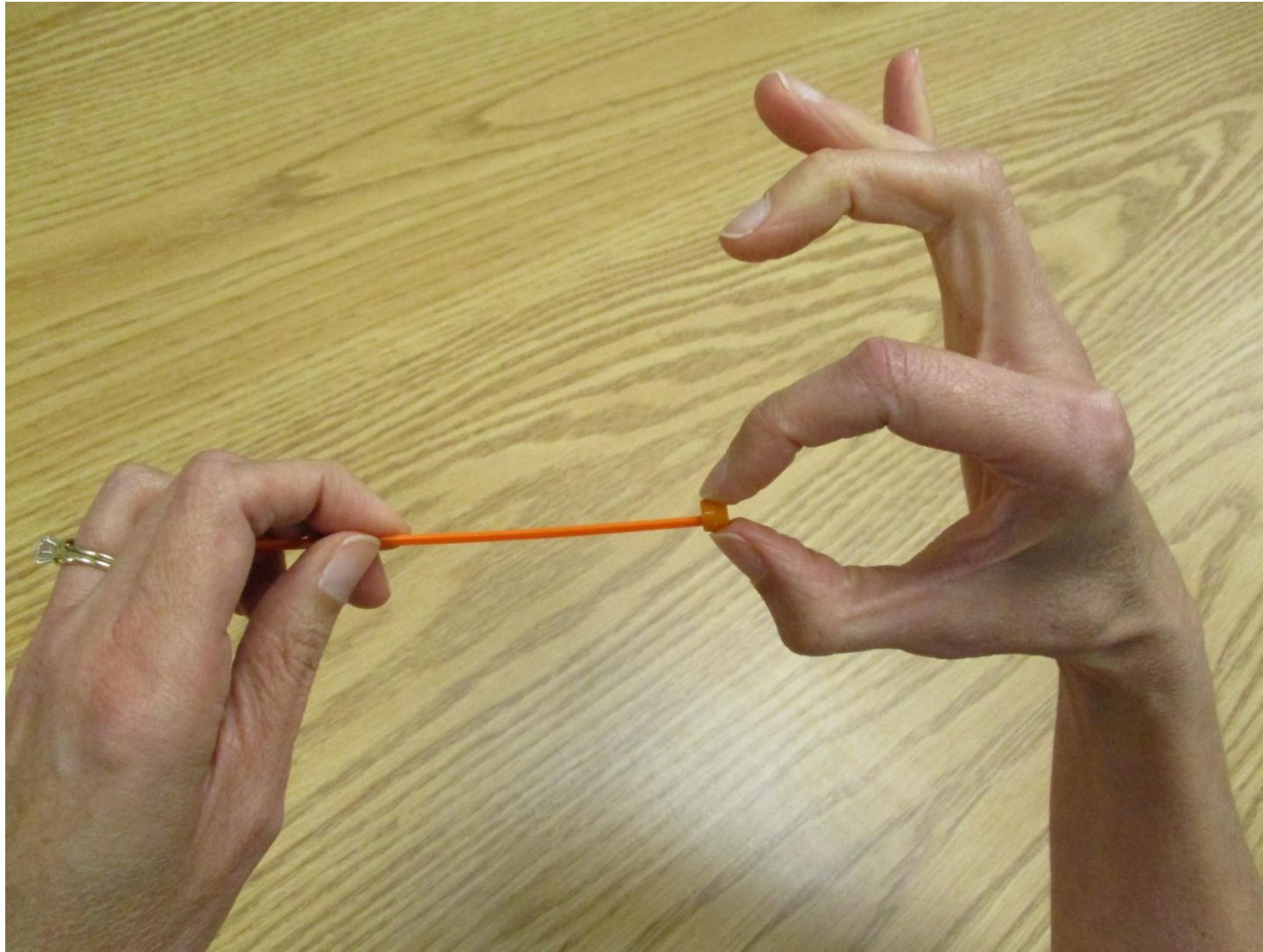




*Thread a bead onto a plastic zip tie: ages 8-18*

*Score: How the bead is held*

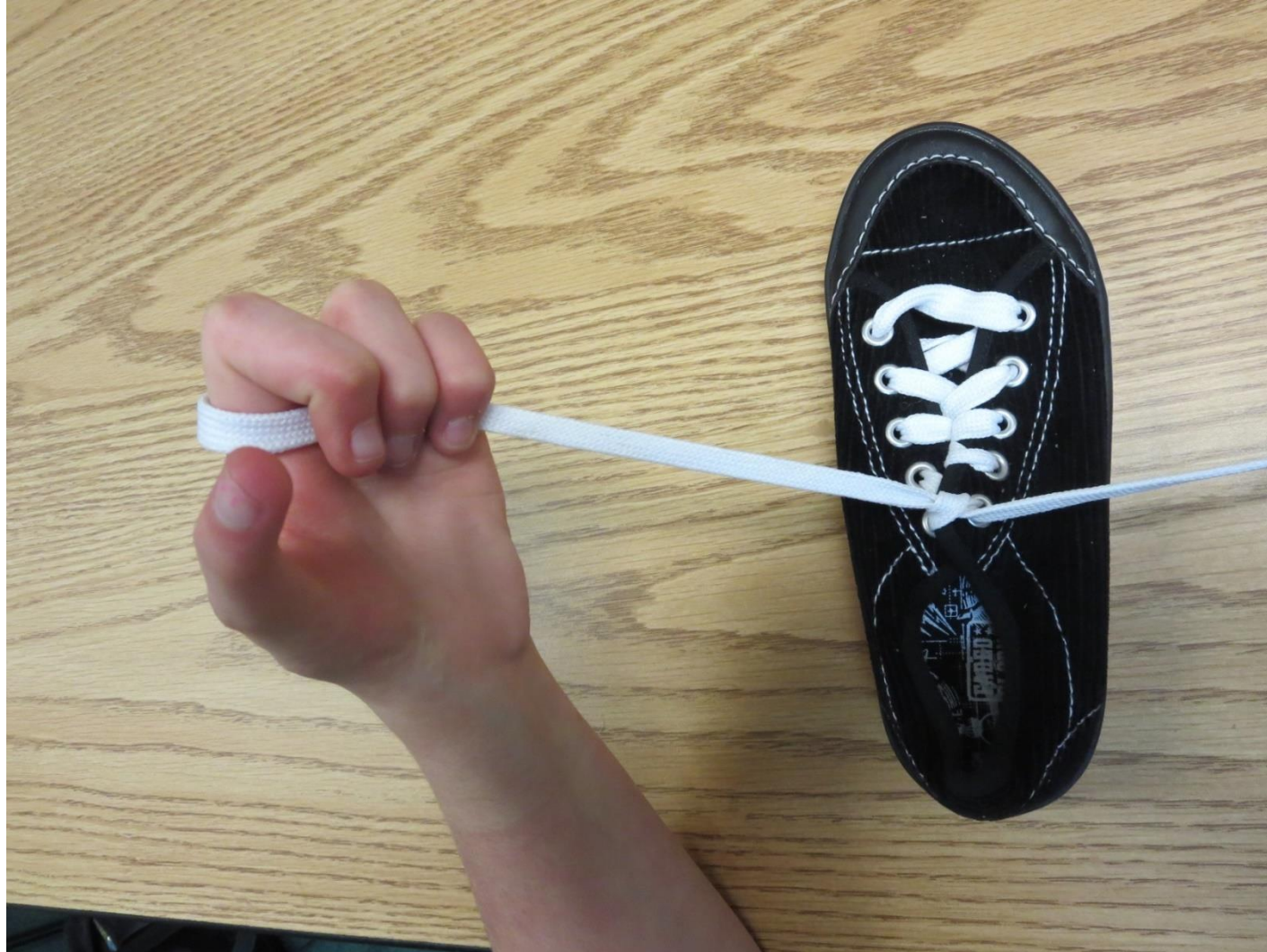
*Correct score: Tip pinch - 6 points*



*Tie shoes laces into a knot: ages 5 – 7*

*Score: How the laces are held*

*Correct score: Variation pattern – distal flexion of fingers; no thumb use – 1 point*





*Rotate pencil in a hand held pencil sharpener*

*Score: How the pencil is held*

*Correct score: Cylindrical grasp; thumb to all fingers – 4 points*





*Write name: ages 8-18 years*

*Score: How the pencil is held*

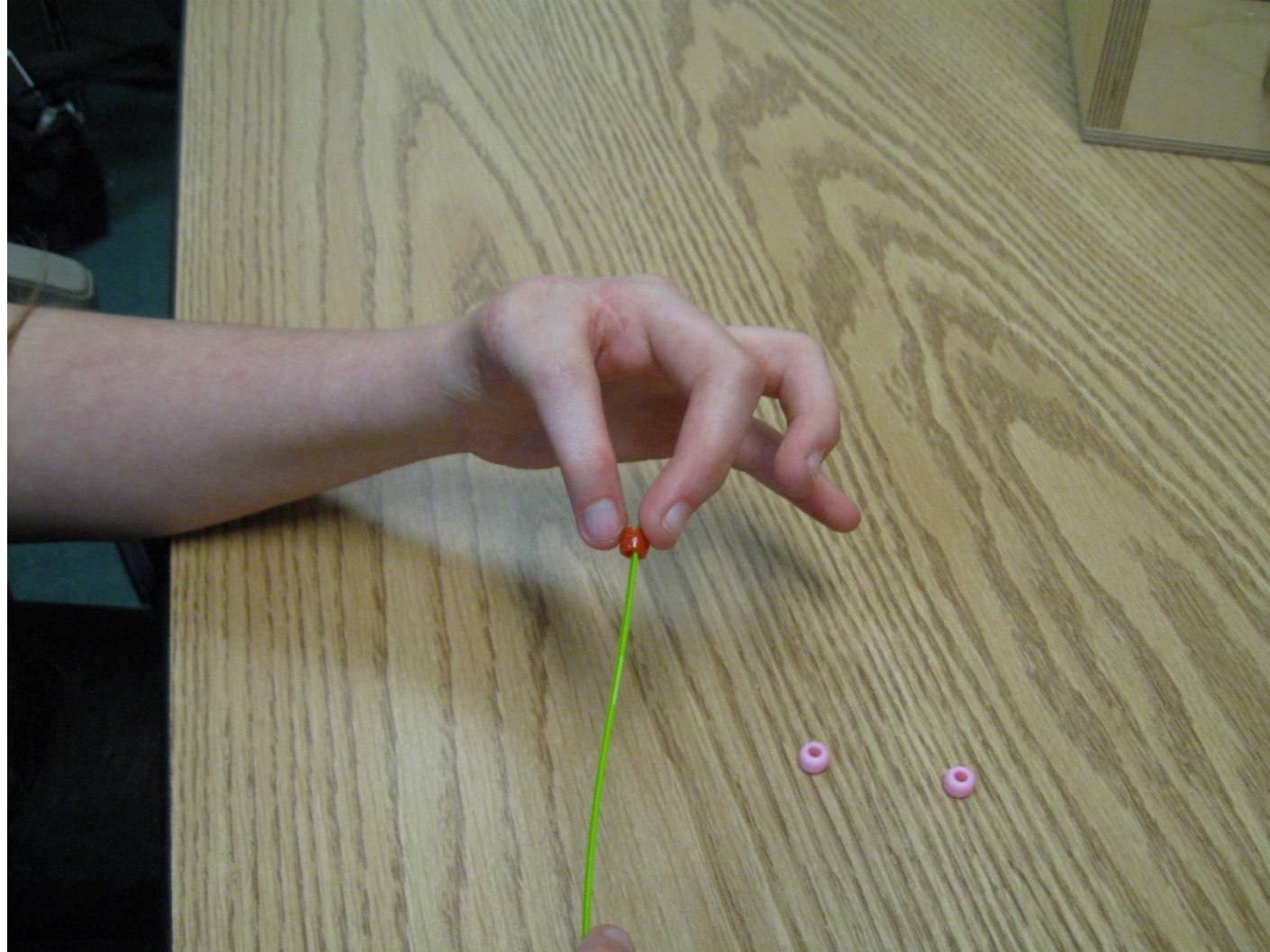
*Correct score: Variation – proximal radial digital grasp – 6 points*



*Thread beads onto a plastic zip tie: ages 8 -18 years*

*Score: How the bead is held*

*Correct score: Tip pinch – 6 points*





*Rotate a pencil three times in a handheld pencil sharpener: ages 8-18*

*Score: How the pencil is held*

*Correct score: Radial scissor grasp – 3 points*





*Separate 5 duplo type blocks that are stacked together: ages 18 months-4 years*

*Score: How the duplos are stabilized*

*Correct score: Variation ,distal cylindrical; distal grasp of all fingers to opposed thumb –5 points*



*Turn a key in padlock: ages 5-7 years*

*Score: How the key is held*

*Correct score: Lateral / key pinch; opposes thumb to side of index – 5 points*



*Thread 5 beads on a plastic zip tie: ages 8-18 years*

*Score: How the bead is held*

*Correct score: Tip pinch – 6 points*





*Thread 5 beads on a plastic zip tie: ages 8-18 years*

*Score: How the bead is held*

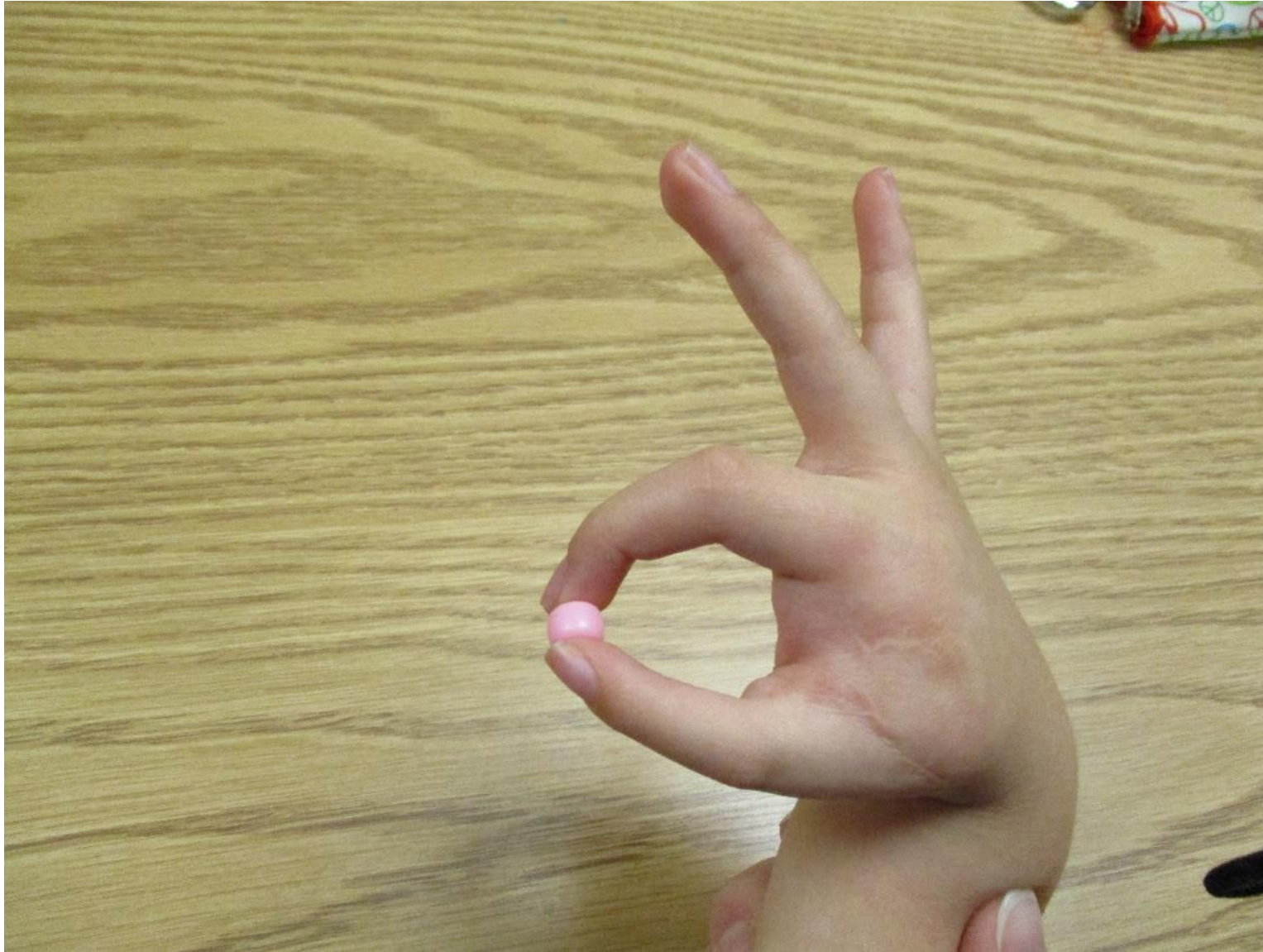
*Correct score: Variation – distal finger scissoring, no use of thumb – 3 points*



*Thread beads onto a plastic zip tie: ages 8-18*

*Score: How the bead is held*

*Correct score: Tip pinch - 6 points*





*Turn key to open a padlock: ages 5-7 and 8-18 years*

*Score: How the key is held*

*Correct answer: Radial scissor grasp, no thumb use – 3 points*

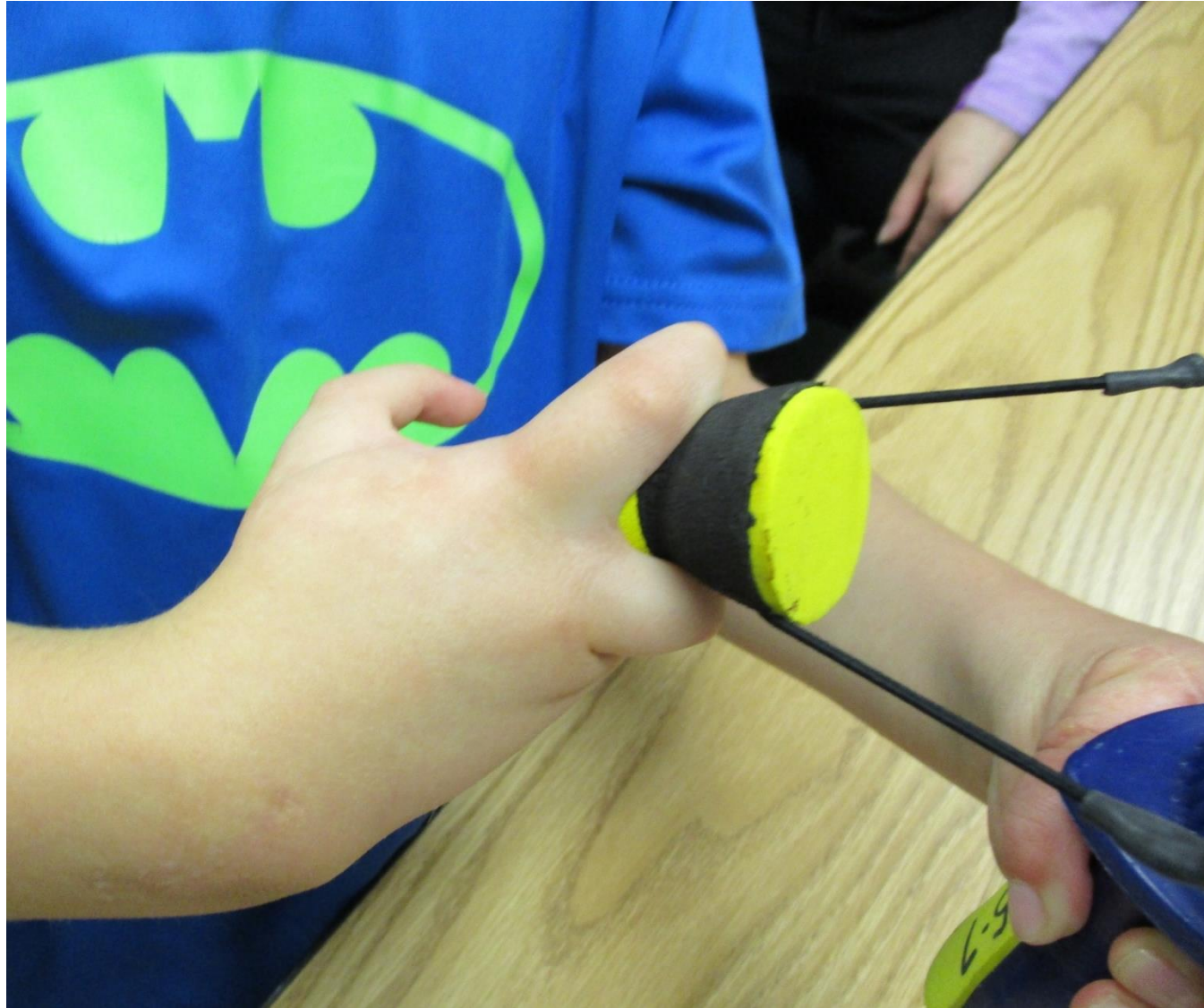




*Pull foam pull back on sling shot – ages 5-7 and 8-18 years*

*Score: How the foam pull is held*

*Correct score: Radial scissor grasp, no thumb use – 3 points*



*Remove cap from ball point pen – ages 8-18 years*

*Score: How the pen is held*

*Correct score: Variation – proximal radial digital grasp – 6 points*





*Open zippered pencil case- ages 18 months – 4 years*

*Score: How the zippered pull tab is held*

*Correct score: Variation; distal finger flexion, no thumb use – 1 point*





*Pull cap off marker : ages 5-7*

*Score: How the marker is held*

*Correct score: Palmar grasp – finger flexion; no thumb use – 1 point*



*Form moldable clay into a bowl: ages 18 months – 4 years*

*Score: How the play doh is held*

*Correct score: Right hand - No grasp: passive stabilization - 0 points*

*Left hand - Radial digital grasp – 7 points*





## *Tie shoelaces into a bow: ages 8 – 18*

*Score: How the laces are held*

*Correct score: Ulnar scissor grasp, no thumb use – 2 points*





*Pick up pennies one at a time and release into a piggy bank: ages 5-7*

*Score: How the penny is held*

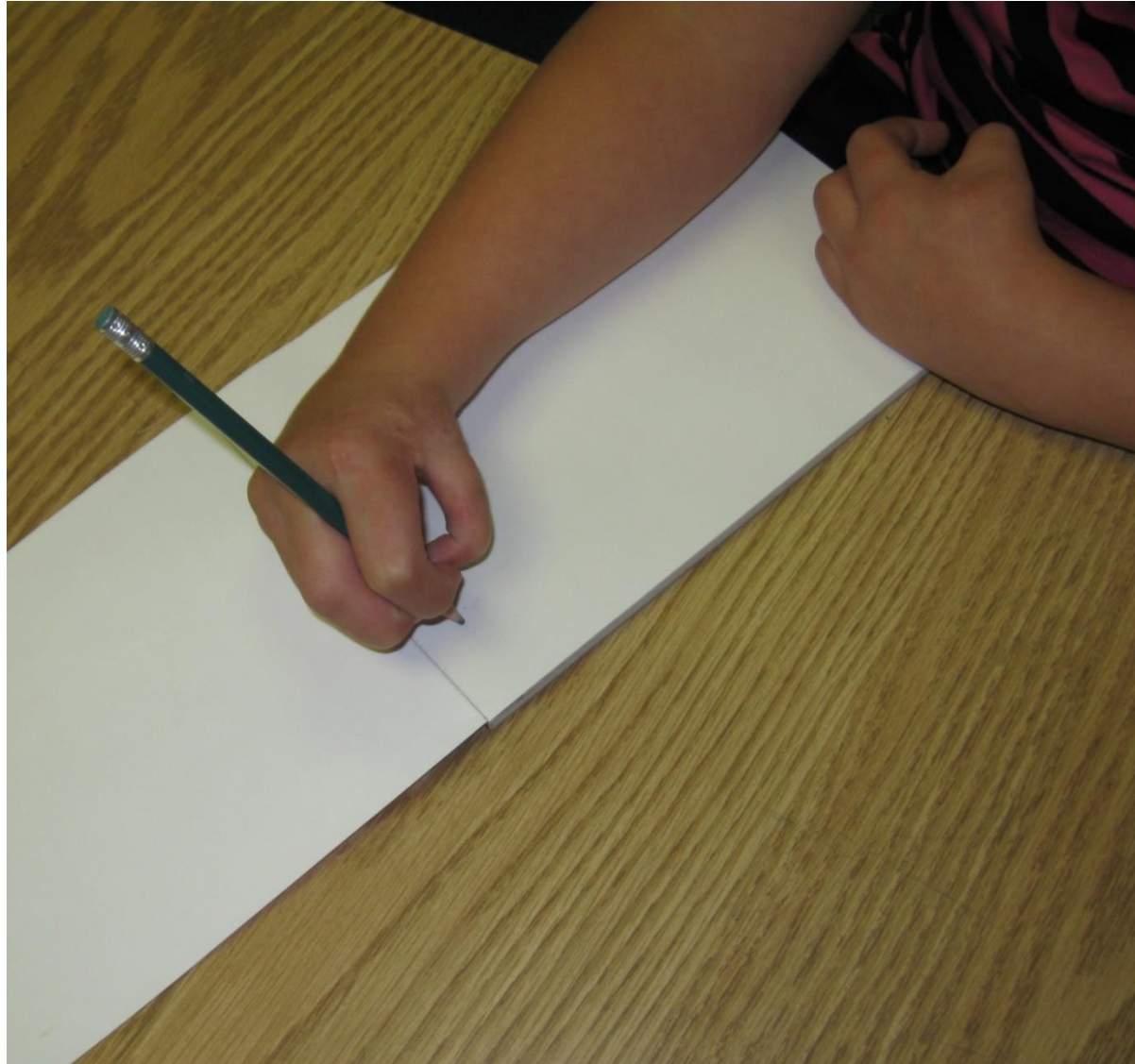
*Correct score: Variation, tip to non index finger - 5 points*



*Write name with a pencil: ages 8-18*

*Score: How the pencil is held*

*Correct score: Radial scissor grasp – 3 points*





## *Tie shoelaces into a knot: ages 5- 7*

*Score: How the laces are held*

*Correct score: Variation, scissors multiple fingers, no thumb use – 2 points*





*Turn a key in padlock: ages 5-7*

*Score: How the key is held*

*Correct score: Right hand - Radial scissor grasp – 3 points*



*Remove cap from small marker: ages 5-7 years*

*Score: How the marker is held*

*Correct score: Variation, distal flexion of fingers -1 point*





*Write name using a pencil: ages 8 - 18*

*Score: How the pencil is held*

*Correct score: Radial digital grasp – 7 points*





*Write name with a pencil: ages 8 – 18*

*Score: How the pencil is held*

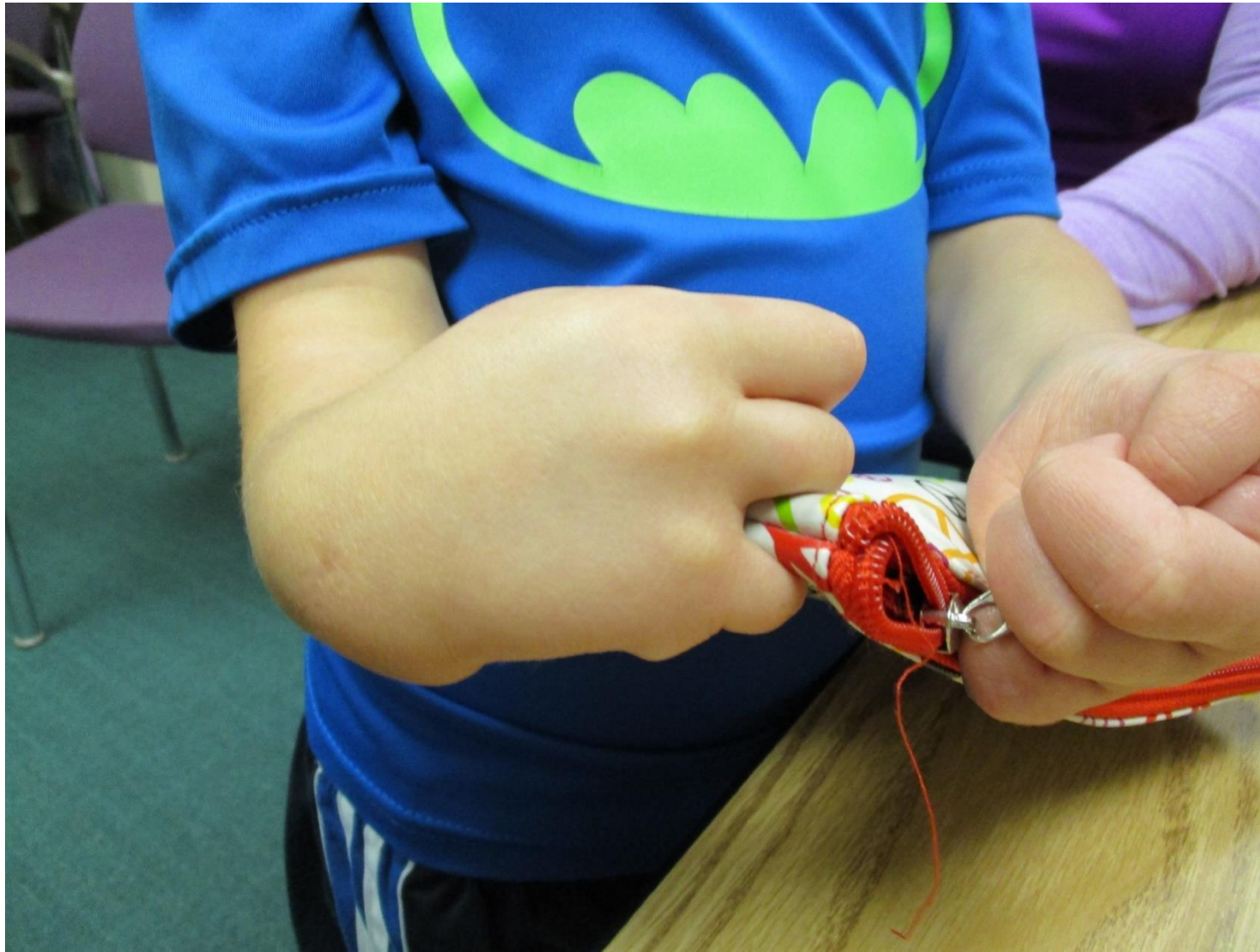
*Correct score: Variation, scissors multiple fingers - 2 points*



*Open a zippered pencil pouch: ages 18 months – 4 years*

*Score: How the metal zipper tab is held*

*Correct score: Left hand - Ulnar scissor grasp - 2 points*

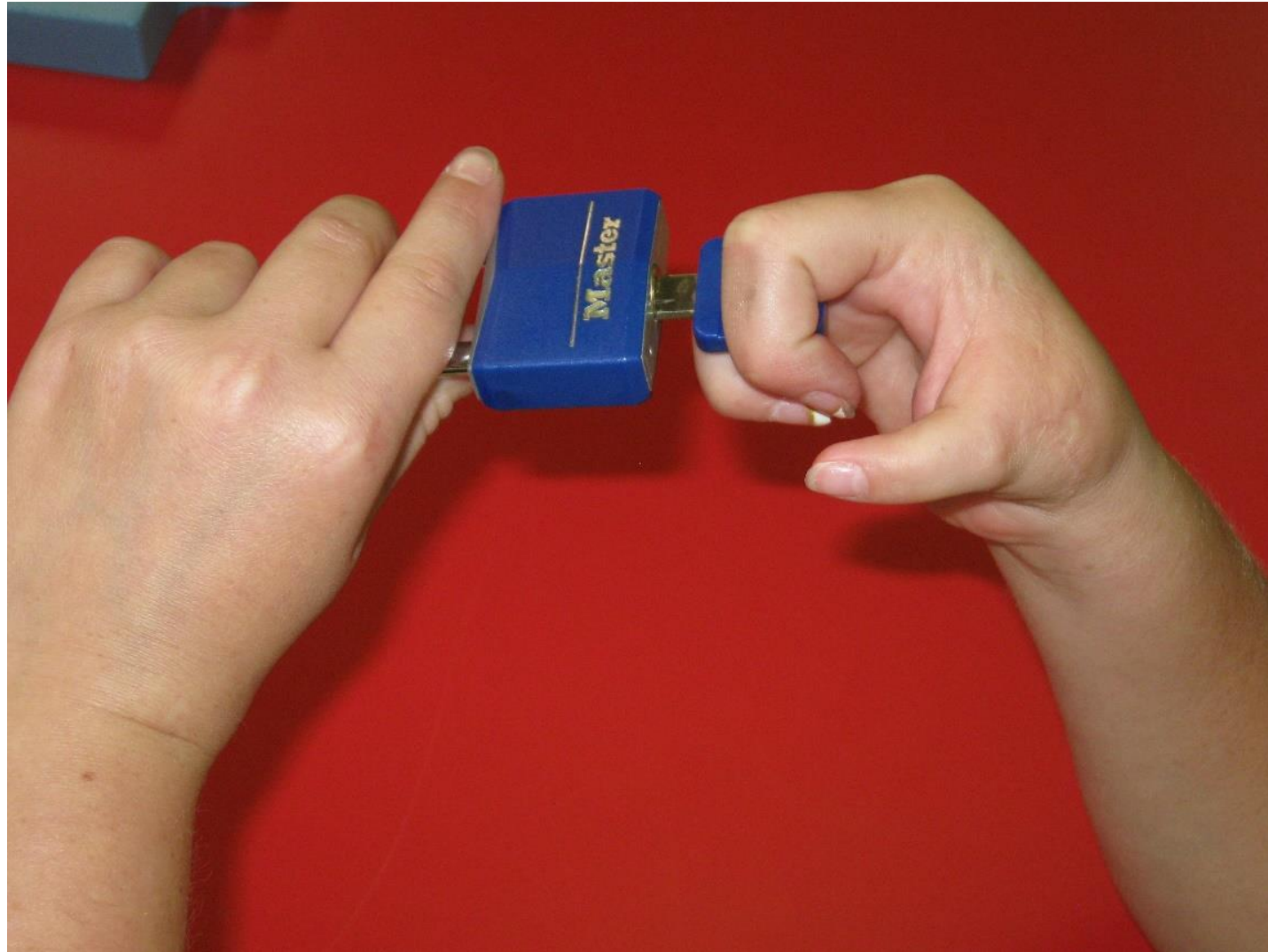




*Turn a vinyl coated key in a padlock: ages 5 -7*

*Score: How the key is held*

*Correct score: Right hand- Radial scissor grasp - 3 points*

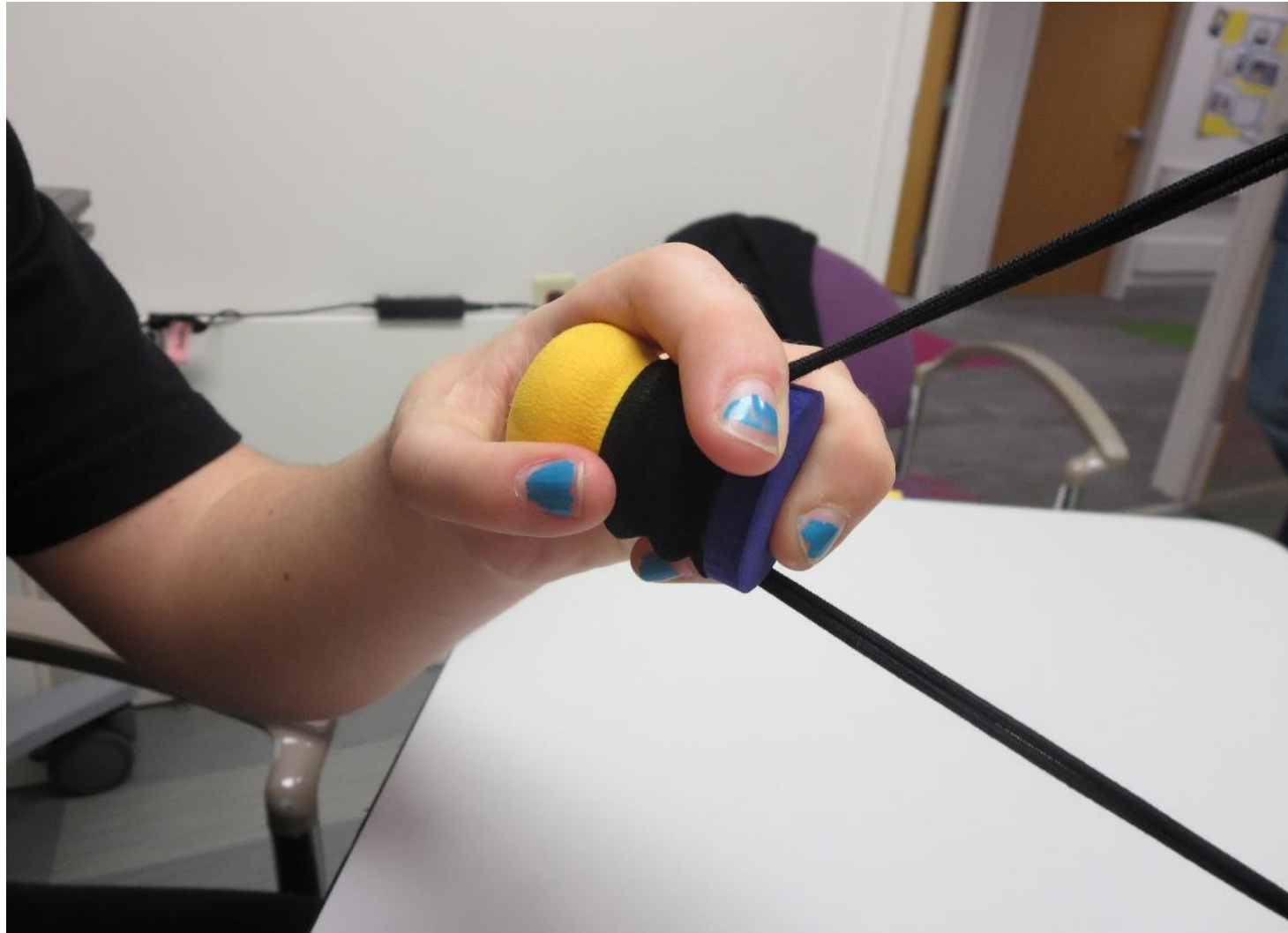




*Pull foam pull back on sling shot ages 5-7*

*Score: How the foam pull is held*

*Correct score: Cylindrical grasp, thumb to all fingers - 4 points*



*Open zippered pencil case: ages 18 months – 4 years*

*Score: How the metal zipper tab is held*

*Correct score: Left hand - Variation, distal finger scissoring – 3 points*





## *Pull cap off small marker: ages 5-7*

*Score: How the marker is held*

*Correct score: Right hand - Radial scissor grasp – 3 points*

*Left hand - Cylindrical grasp - 4 points*





*Write name with a pencil: ages 8-18*

*Score: How the pencil is held*

*Correct score: Variation, Proximal radial digital grasp – 6 points*



# References

- Colen DL, Lin IC, Levin LS, Chang B. Radial Longitudinal Deficiency: Recent Developments, Controversies, and an Evidence-Based Guide to Treatment. *J Hand Surg Am*. 2017 Jul;42(7):546-563. doi: 10.1016/j.jhsa.2017.04.012. PMID: 28669420.
- Oberg KC, Feenstra JM, Manske PR, Tonkin MA. Developmental biology and classification of congenital anomalies of the hand and upper extremity. *J Hand Surg Am*. 2010 Dec;35(12):2066-76. doi: 10.1016/j.jhsa.2010.09.031. PMID: 21134615.
- Goldfarb CA, Ezaki M, Wall LB, Lam WL, Oberg KC. The Oberg-Manske-Tonkin (OMT) Classification of Congenital Upper Extremities: Update for 2020. *J Hand Surg Am*. 2020 Jun;45(6):542-547. doi: 10.1016/j.jhsa.2020.01.002. Epub 2020 Feb 21. Erratum in: *J Hand Surg Am*. 2020 Aug;45(8):771-772. PMID: 32093994.
- Bhat AK, Acharya AM. Current concepts in the management Radial Longitudinal Deficiency. *J Clin Orthop Trauma*. 2020 Jul-Aug;11(4):597-605. doi: 10.1016/j.jcot.2020.05.027. Epub 2020 Jun 25. PMID: 32684696; PMCID: PMC7355065.
- Goldfarb, Wustrack, Pratt, Mender, Manske. Thumb function and appearance in thrombocytopenia: Absent radius syndrome *J Hand Surg* 2007, Vol. 32A
- Manske, Rotman, Dailey. Long-term functional results after pollicization for the congenitally deficient thumb. *J Hand Surg Am* 1992 Nov;17(6):1064-72.
- Kollitz KM, Tomhave WA, Van Heest AE, Moran SL. A New, Direct Measure of Thumb Use in Children After Index Pollicization for Congenital Thumb Hypoplasia. *J Hand Surg Am*. 2018 Nov;43(11):978-986.e1. doi: 10.1016/j.jhsa.2018.02.025. Epub 2018 Mar 28. PMID: 29605519.
- Kollitz KM, Tomhave W, Van Heest AE, Moran SL. Change in Hand Function and Dexterity with Age after Index Pollicization for Congenital Thumb Hypoplasia. *Plast Reconstr Surg*. 2018 Mar;141(3):691-700. doi: 10.1097/PRS.0000000000004119. PMID: 29481400.
- Tomhave WA, Kollitz KM, Moran SL. Inter- and Intrarater Reliability of the Thumb Grasp and Pinch Assessment for Children Following Index Pollicization for Congenital Thumb Hypoplasia. *J Hand Surg Am*. 2019 Jul;44(7):618.e1-618.e8. doi: 10.1016/j.jhsa.2018.09.009. Epub 2018 Oct 23. PMID: 30366734.
- Forman M, Canizares MF, Bohn D, James MA, Samora J, Steinman S, Wall LB, Bauer AS; CoULD Study Group. Association of Radial Longitudinal Deficiency and Thumb Hypoplasia: An Update Using the CoULD Registry. *J Bone Joint Surg Am*. 2020 Oct 21;102(20):1815-1822. doi: 10.2106/JBJS.20.00281. PMID: 33086350.

***Thank you for your attention!***

***Locate the Final Training Module Part 3: Video Clip Examples***

