

Wendy Tomhave OTR/L

Occupational Therapist
Clinical Research Specialist
Shriners Children's Twin Cities



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Rehabilitation Resource Website
wendytomhave.com

Use of the Thumb Grasp and Pinch Assessment in Pediatric Patients

September 1, 2023

My Background

Shriners Children's 31 years
Pediatric Orthopedics
Specialty Clinics



Clinical Research Interests

- Congenital Hand
- Upper Extremity Cerebral Palsy
- Arthrogryposis
- Upper Limb Prosthetics
- Assessment of the Hand



Shriners Children's: Hand Surgeons



Steven Moran, MD

Mayo Clinic, Rochester
Plastic and Reconstructive Surgery

Shriners Children's, Twin Cities
Pediatric Hand Surgery



Ann Van Heest, MD

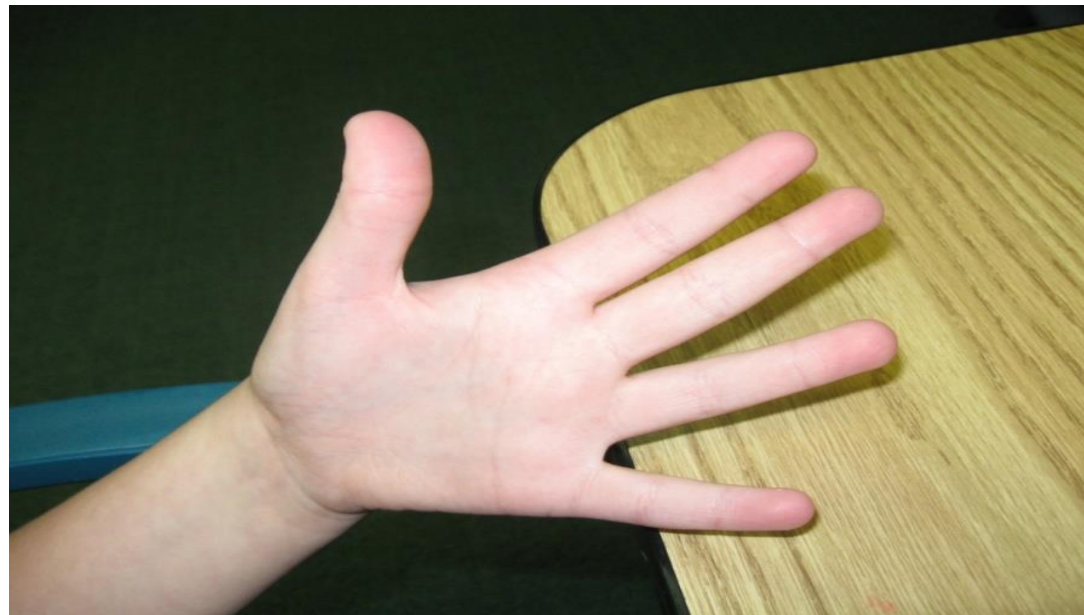
University of Minnesota Department of Orthopedic Surgery

Gillette Children's Specialty Healthcare

Shriners Children's, Twin Cities
Pediatric Hand Surgery

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: Thumb Differences

- Constitute 16% of all birth deformities of the hand
- Absent or unstable thumb requires flexing or scissoring the fingers to stabilize an object



Most Common: Radial Longitudinal Deficiency Failure of Formation

- Affects the radial aspect of the arm
- Incidence 1 in 30,000 live births
- Mild thumb hypoplasia to complete absence of the radius



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

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.

Causes: Radial Longitudinal Deficiency

- Majority of the cases are sporadic
- Disrupted limb bud development
- 1/3 of patients have a known syndrome (CoULD registry)
 - VACTERAL (14%)
 - Holt-Oram (17%)
 - Other syndromes (8%)
 - TAR (5%)
 - Fanconi's anemia (2%)
- Occurs bilaterally in 50% of the cases
- Exposure to teratogens (thalidomide and radiation) can yield radial deficiencies



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.

Goldfarb, GA: ASSH Review Course on Congenital Hand Differences

Radial Longitudinal Deficiency: 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



Our team studied past literature and developed a thumb assessment protocol in 2006

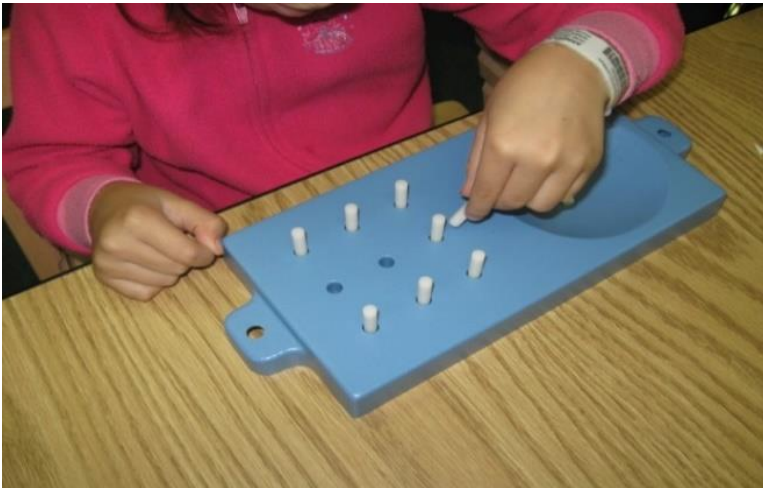
Common outcome tools to measure flexibility and strength



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

Manske 1992

Grasp/release

- 7 large objects, 7 smaller objects

Thumb use given a percentage score

- normal thumb
- modified fashion
- no use

Goldfarb 2007

Grasp/release

- pop can, block, turn a key, bead
- Thumb use yes/no

Manske PR, Rotman MB, Dailey LA. Long-term functional results after pollicization for the congenitally deficient thumb. *J Hand Surg Am.* 1992 Nov;17(6):1064-72. doi: 10.1016/s0363-5023(09)91063-2. PMID: 1430939.

Goldfarb CA, Wustrack R, Pratt JA, Mender A, Manske PR. Thumb function and appearance in thrombocytopenia: absent radius syndrome. *J Hand Surg Am.* 2007 Feb;32(2):157-61. doi: 10.1016/j.jhsa.2006.10.019. PMID: 17275588.

Descriptions of Abnormal Grasp Patterns

- 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



Scoring Hierarchy is Based on Principles of Hand Development and Includes Compensatory Grasp Styles

- Reflexive grasp with no use of the thumb
- Hand develops from the ulnar to the radial side of the hand
- Develops from palmar grips immobilize an object and progress to distal patterns that permit manipulation
- Refinement of intrinsic hand function
- Learn to use key pinch, tip and tripod pinch
- Stabilize and manipulate objects at the fingers

T-GAP Scoring Hierarchy

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

2006 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, 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 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 jhandsurg.org

T-GAP Inter and Intra Rater Reliability

- Four therapists scored 11 videotaped T-GAP assessments twice separated by at least 2 weeks
 - The ICC's for inter rater trials were 0.887 and 0.901
- Intra-rater ICC's in all cases ranged from 0.878 – 0.915 which is considered excellent

The high ICC's suggest raters could classify and score children's hands consistently and results from T-GAP assessments are reliable.

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.



Understanding Atypical and Typical Grasp and Thumb Use Patterns Can Potentially Facilitate the Choice of Strategies:

- in the therapeutic process
- the success of surgical treatment
- 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
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Jacqueline S. Israel¹ , Teresa A. Jeardeau², Wendy A. Tomhave³, and Steven L. Moran²

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 Completed Validation Studies of 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.



CREDIBLE 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.

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Corresponding author: Ida Neergård Sletten, MD, PhD, Division of Orthopedic Surgery, Oslo University Hospital, Postboks 4950 Nydalen, 0424 Oslo, Norway; e-mail: ida.sletten@icloud.com.

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Thumb Grasp and Pinch Assessment (T-GAP)

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

Measures 3 components of hand dexterity

- Final T-GAP Score
- Thumb Use Score
- Number of Grasp Styles



T-GAP Thumb Grasp and Pinch Assessment

- Developmentally appropriate activities for young toddlers to young adults
- Standardized 18 months – 18 years
- Three different age groups

Tip Pinch

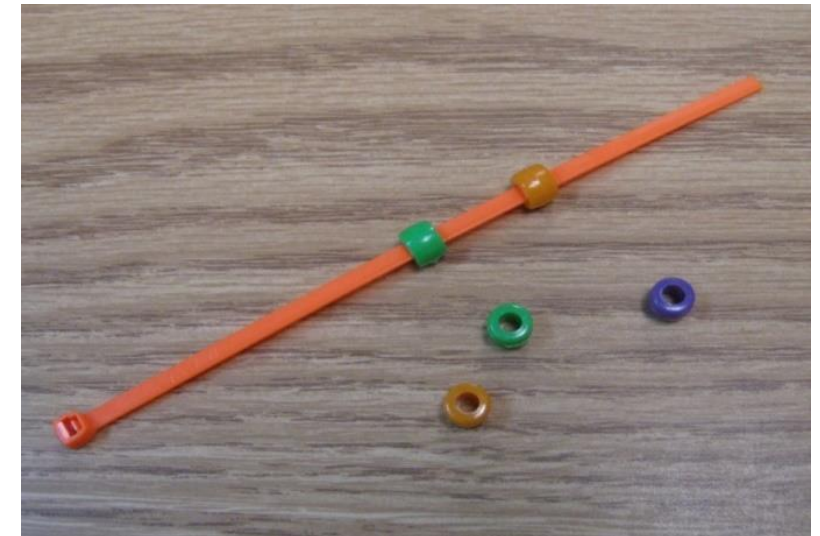
18 months – Age 4



Ages 5 – 7



Ages 8 - 18



Activities to Promote Specific Qualities and Grasp Type

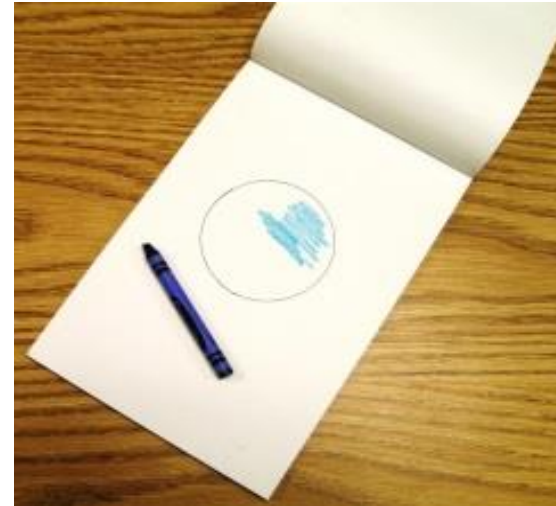
5-7 Year Old Activities

- **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

**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 (tip pinch) <i>Score how penny is held</i>		
Turn a key to open a padlock (lateral key pinch) <i>Score how key is held</i>		
Pull cap off a small diameter marker (small grasp) <i>Score how marker is held</i>		
Turn end of kaleidoscope 3 times (medium grasp) <i>Score how kaleidoscope is held</i>		
Remove cap from a peanut butter jar (large grasp) <i>Score how jar is held</i>		
Form Play-Doh into a bowl (manipulation) <i>Score how Play-Doh is held</i>		
Pull back foam pull on slingshot (resistance) <i>Score how foam pull is held</i>		
Color inside a circle with a crayon (school) <i>Score how crayon is held</i>		
Tie shoelaces into a knot (ADL) <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

Scoring Guidelines

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

Grasp Pattern Hierarchy: No Use of Thumb

T-GAP Scoring: 0 - 3 Points

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

Grasp Pattern Hierarchy: Use of Thumb

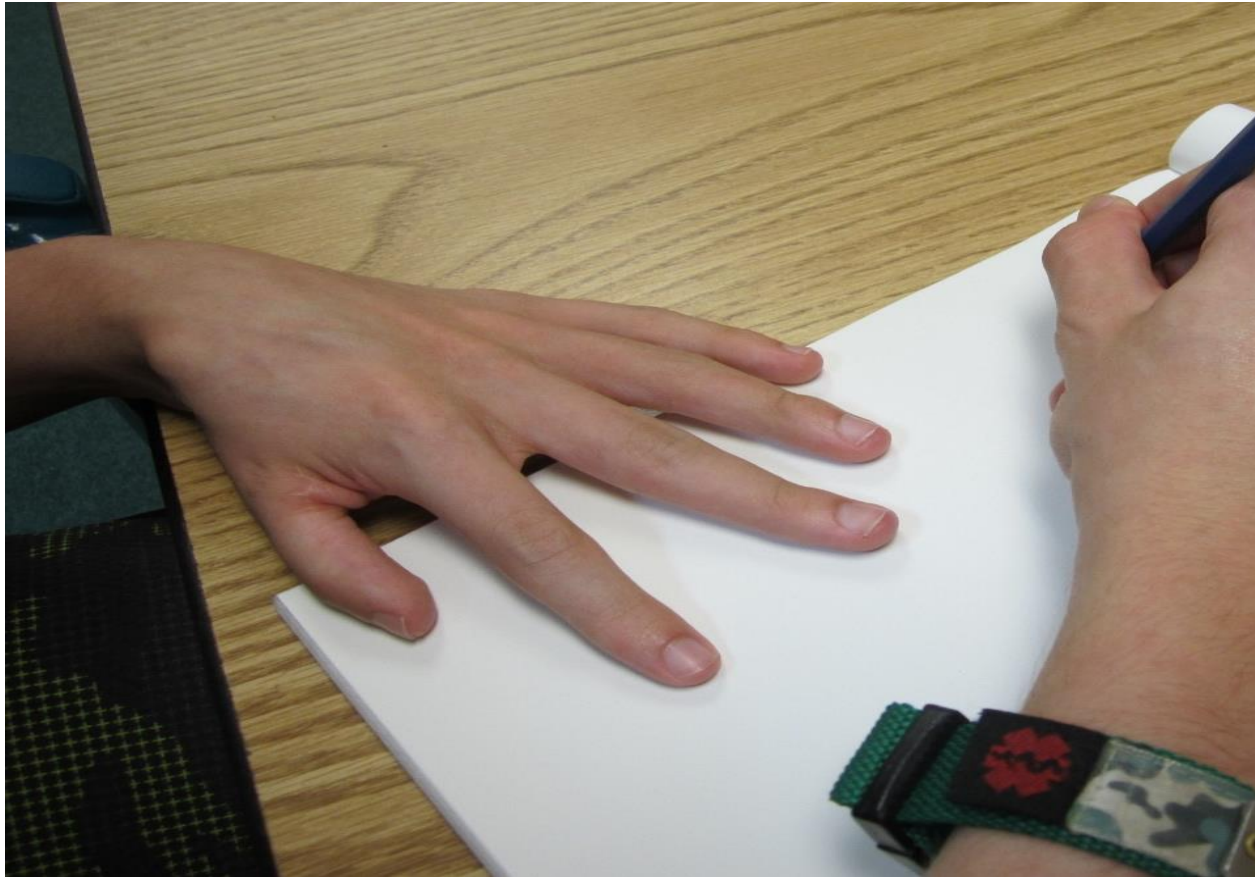
T-GAP Scoring: 4 - 7 Points

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

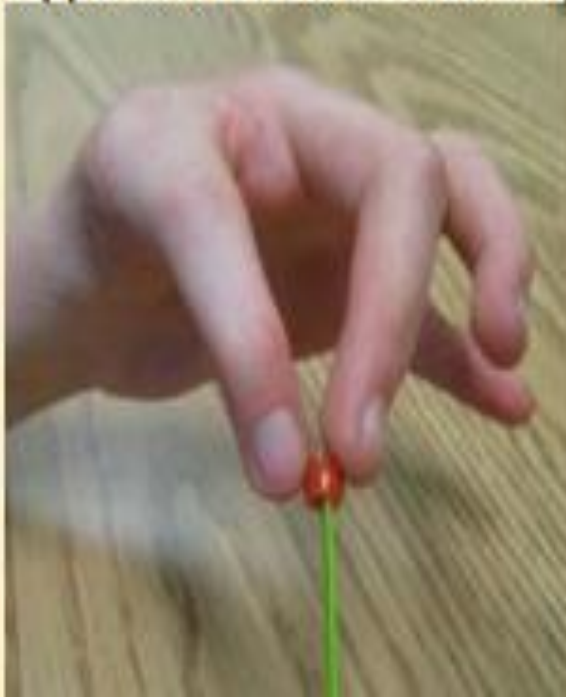


6 Points: Tip Pinch

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

Variation

Tripod Pinch (7 points)

Thumb opposition to index and long fingers



Proximal Tripod Pinch (6 points)

Thumb opposition with proximal index/long fingers

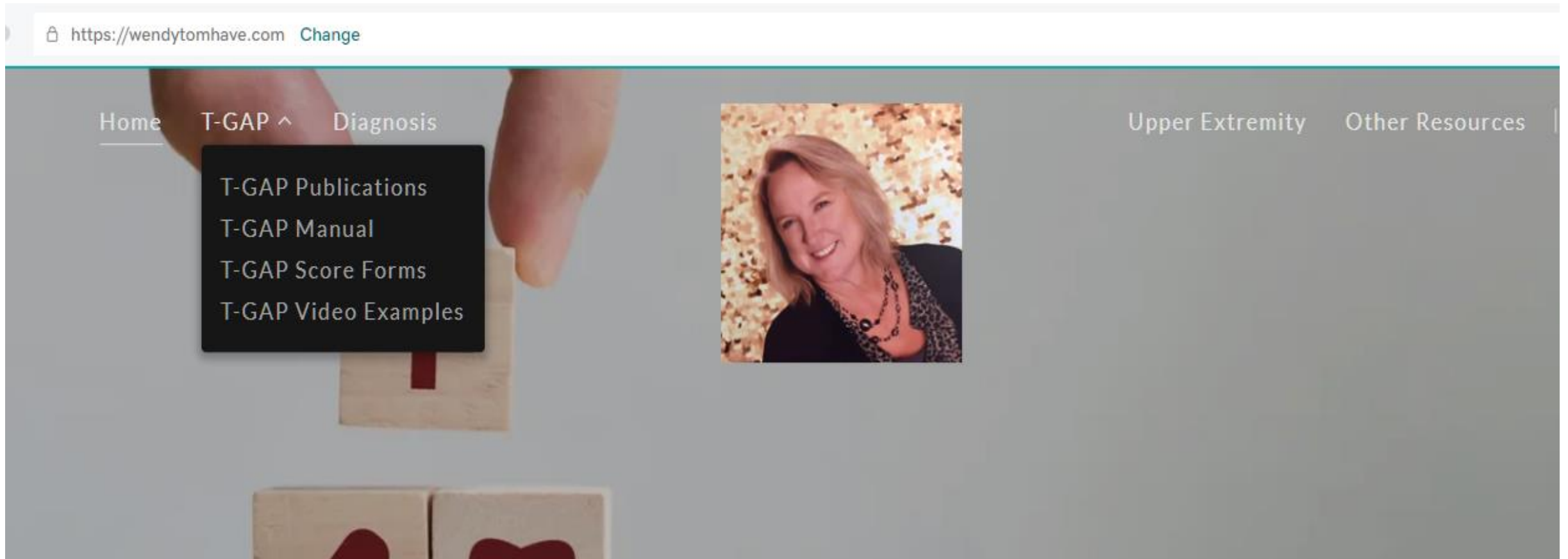


T-GAP Training: Self Study Format

Test Kit Handouts are available free of charge :

<https://www.wendytomhave.com>

<https://www.shrinerschildrens.org/en/our-care-providers/wendy-a-tomhave-otr-14705>



T-GAP Training

Administration and Scoring Manual



Shriners
Children's

T-GAP

Administration and Scoring Manual for the Thumb Grasp and Pinch Assessment

Wendy A. Tomhave, OTR/L^a
Kathleen M. Kollitz, MD^c
Ann E. Van Heest, MD^{b,a}
Steven L. Moran, MD^{c,a}

Shriners Children's Twin Cities^a
215 Radio Drive
Woodbury, Minnesota, 55125
612-596-6100

University of Minnesota^b
2450 Riverside Avenue South
Minneapolis, Minnesota 55454
612-884-0600

Mayo Clinic^c
200 First Street SW
Rochester, MN 55905
507-284-2736

Correspondence:

Wendy Tomhave, OTR/L
wendytomhave@gmail.com

Steven Moran, MD
Moran.steven@mayo.edu

- 27 pages
- Description
- Purpose
- Background
- Administration
- Scoring
- Forms

T-GAP Training

Part 1: Background, Administration and Scoring

Part 2: Photo Examples: Grasp Style Scoring Practice



T-GAP Training: Part 3: Video Scoring Examples

T-GAP Sling Shot

Score how the foam pull is held.



T-GAP Write Name

Score how the pencil is held.

T-GAP Shoe Tying



Photo Scoring Examples

Rotate pencil in a hand held pencil sharpener – ages 8 – 18 years

Score: how the pencil is held

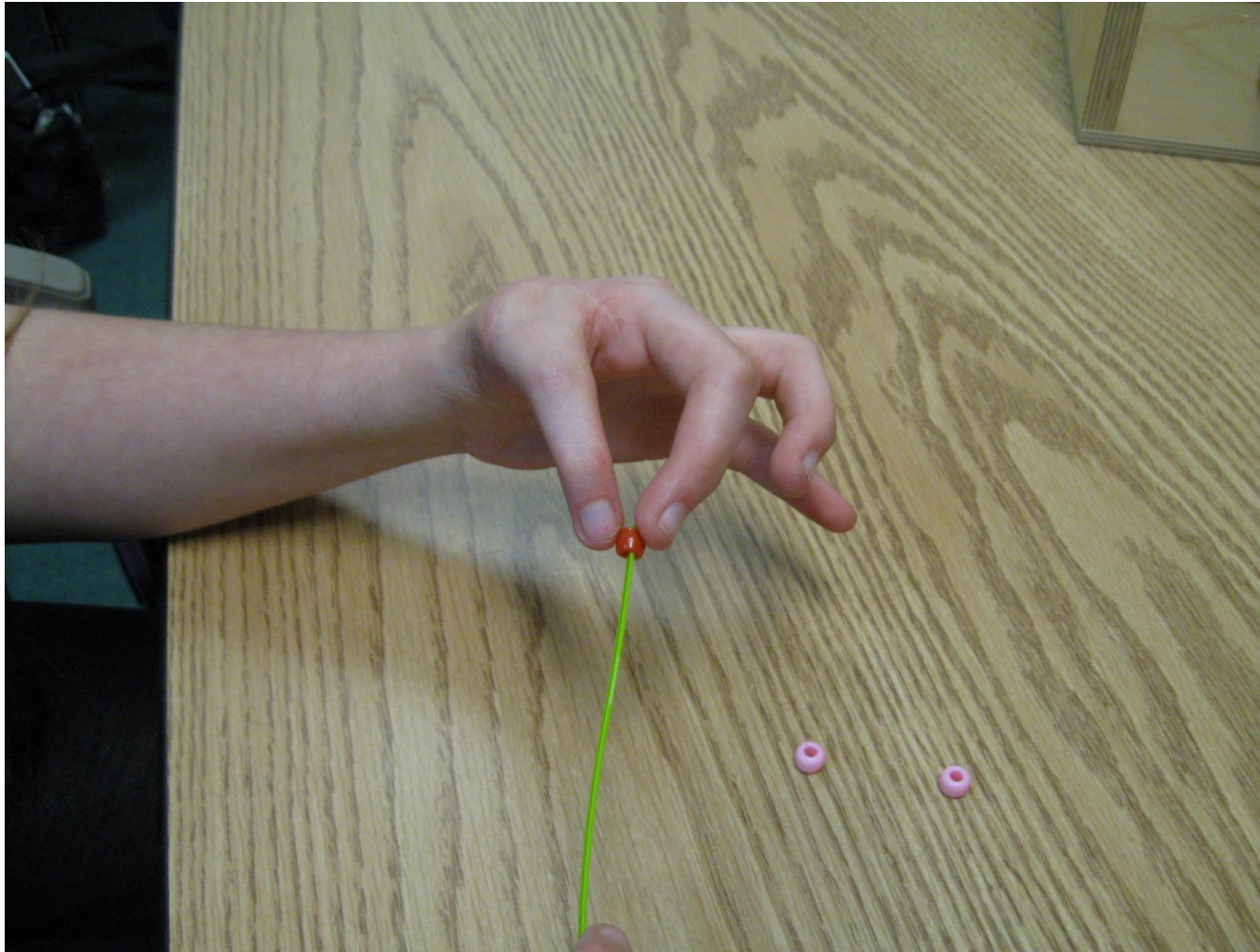
Correct score: Cylindrical grasp; thumb to all fingers – 4 points



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

Score: how the bead is held

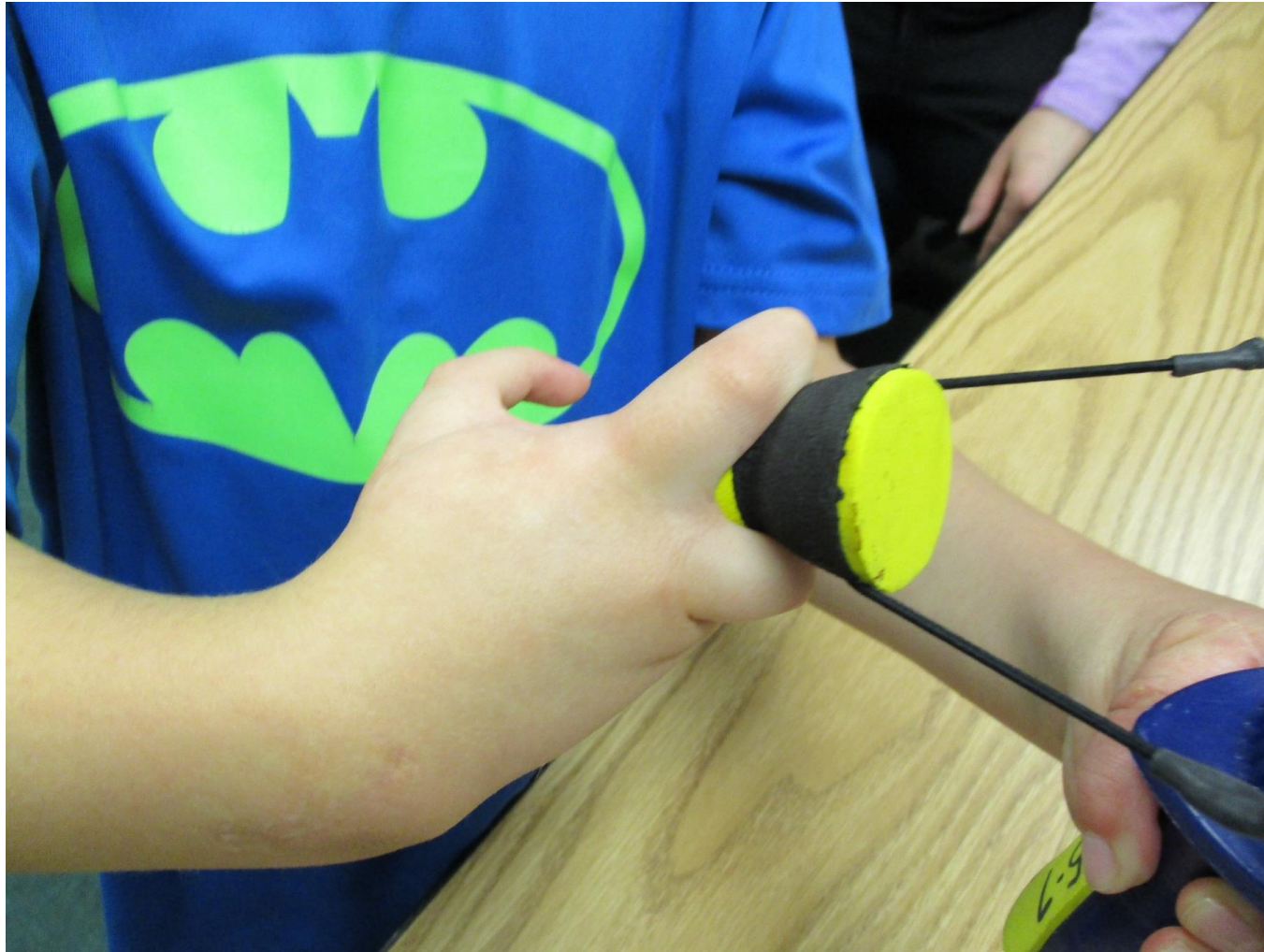
Correct score: tip pinch – 6 points



Pull foam pull back on sling shot – ages 5-7 years

Score: how the foam pull is held

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



Pull cap off marker : ages 5-7

Score: how the marker is held

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



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



Stack 5 duplo style blocks - ages 18 months – 4 years

Score: how the blocks are held

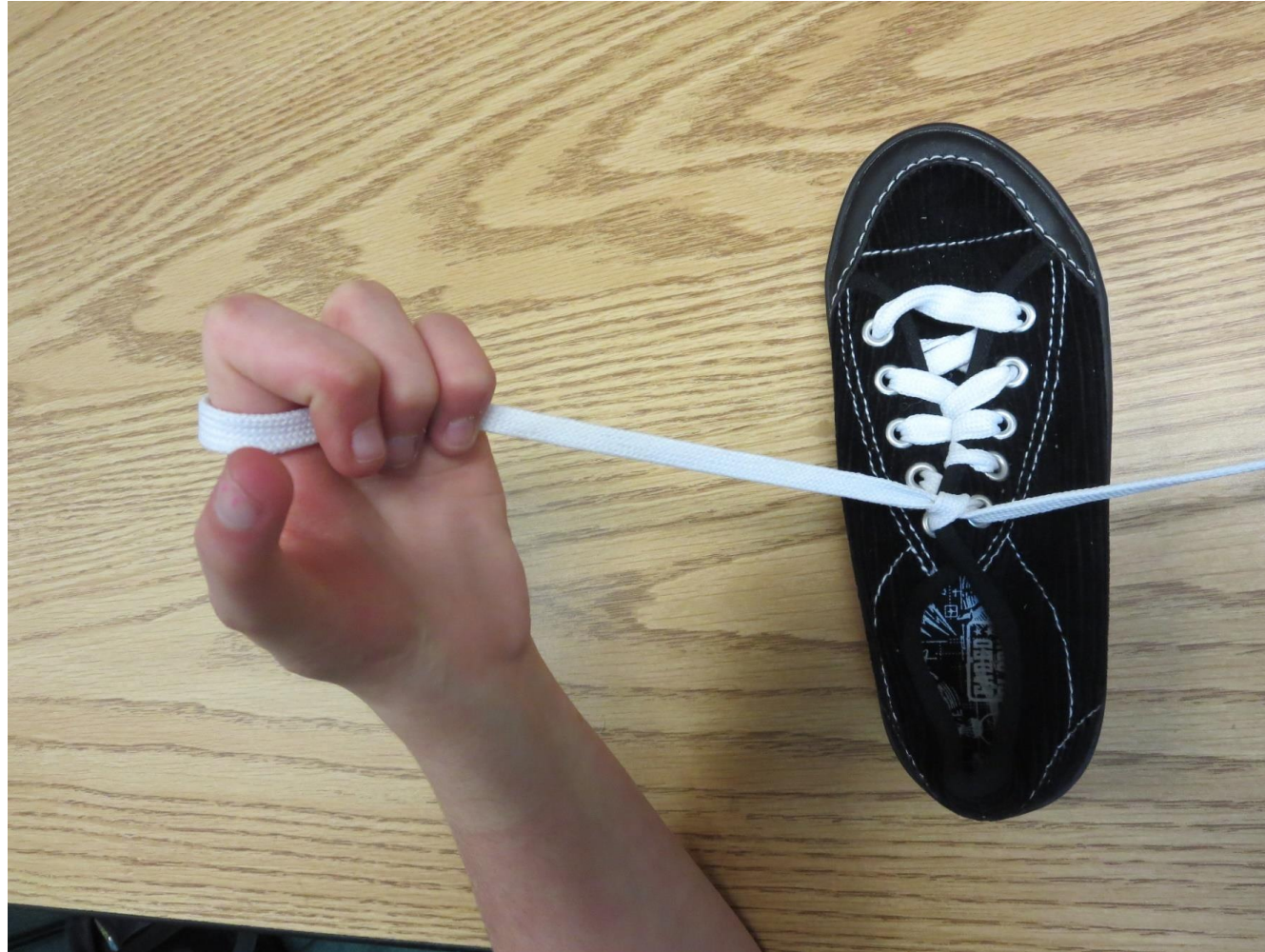
Correct score: both hands variation distal cylindrical; distal grasp of all fingers to opposed thumb: 5 points



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



T-GAP Materials and Upper Extremity Resources for Treating Functional Hand Dexterity

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- Fine motor activities
- In-hand manipulation
- Pinch strength and control
- Finger flexion and extension activities
- Thumb flexion and abduction activities
- Hand strengthening
- Hand and finger stretching
- Hand strength and dexterity norms

Pinch Strength and Control

Activities that promote pinch strength and control:

- Roll out play dough into a pancake or snake shape. Pinch off and roll into small balls. Cut with scissors or plastic knife.
- Eye droppers: Place drops of colored water on a paper towel or coffee filter
- Pop beads or Legos- Pull apart and push together
- String beads
- Use clothespins to pick up cotton balls or other small objects. Clamp clothespins around the edge of a container.
- Lite Brite
- Squirt guns- Squirt water at balloons to push them across a finish line or squirt water at balloons to keep them up in the air.
- Wooden knob puzzles
- Wind-up toys
- Stamp pads and stamps
- Pick up items with tongs or tweezers
- Dressing boards or dolls with snaps, buttons, and zippers
- Games: Jenga, Pick Up Sticks, Don't Spill the Beans, Operation
- Place coins in a piggy bank
- Bang cymbals together
- Strum a guitar
- Play the piano using individual fingers



Perform _____ activities for _____ minutes per day using the left hand right hand

Therapist: _____

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Universal Thumb Assessment



Thumb Assessment

Name	Assessment Date
------	-----------------

Hand Dominance: L ___ R ___ Affected Hand: L ___ R ___ Both ___

Thumb MP Joint is Unstable: Left Yes No Right Yes No

Thumb Position at Rest: Left Flexed (inside palm) Extended (outside palm) Normal

Right Flexed (inside palm) Extended (outside palm) Normal

Joint Flexion Creases

	Left		Right	
	Present	Absent	Present	Absent
Thumb MP				
Thumb IP				

STRENGTH (3 trials)

	Left		Right	
			Grip	
			Key (Lateral Pinch)	
			Tripod Pinch	

Box and Block Test

	# of Blocks in 60 seconds
Left	
Right	

9-Hole Peg Test

	Time
Left	
Right	

Range Of Motion

Left		Motion	Right	
Active	Passive		Active	Passive
		T-ARC 0-90° 0°=extension 90°=flexion		
		CMC Radial Abduction		
		Thumb CMC Extension		
		Thumb MP Flex/Ext		
		Thumb IP Flex/Ext		

Thumb Assessment

Kapandji Opposition Test

Thumb to:	Left Hand	Right Hand
Lateral Side Second Phalanx Index		
Lateral Side of Third Phalanx Index		
Index Fingertip		
Middle Fingertip		
Ring Fingertip		
Small Fingertip		
Small Finger DIP Crease		
Small Finger PIP Crease		
Small Finger Proximal Crease - MCP		
Distal Volar Crease		

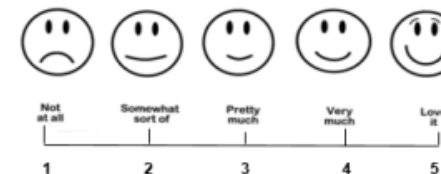
FACES QUESTIONNAIRE

1. Point to the face that shows how happy you are with the way your thumb looks.

Parent: Left: _____ Patient: Left: _____
Right: _____ Right: _____

2. Point to the face that shows how happy you are with the way your thumb works.

Parent: Left: _____ Patient: Left: _____
Right: _____ Right: _____



Activities of Daily Living

Activities you are unable to complete because of your hand difference? _____

T-Gap Score: Left _____ Right _____ Percentage of Thumb Use: Left _____ Right _____

Concerns /Plan: _____

Long Term Thumb Use Patterns in Pediatric Patients Following Index Pollicization

Paula Pino Pommer MD et al

Described the T-GAP Thumb Use Score and assessed predictors of thumb use postoperatively.

23 patients – long term follow up 10.5 years

Compared children with mild RLD to more moderate / severe forms

Comprehensive hand assessments including the T-GAP

	Mild cases RLD	Mod/Severe Cases
Total T-GAP Score (normal 55):	42	31
Thumb Use Score:	8/9	4/9



Long Term Thumb Use Patterns in Pediatric Patients Following Index Pollicization

Paula Pino Pommer MD et al

Predictors of a lower T-GAP Score: Index stiffness / Decreased A/PROM elbow and wrist ulnar deviation / lower Kapandji score

Predictors of a lower thumb use score: Limited active wrist ulnar deviation
Decreased percentage of tripod pinch strength

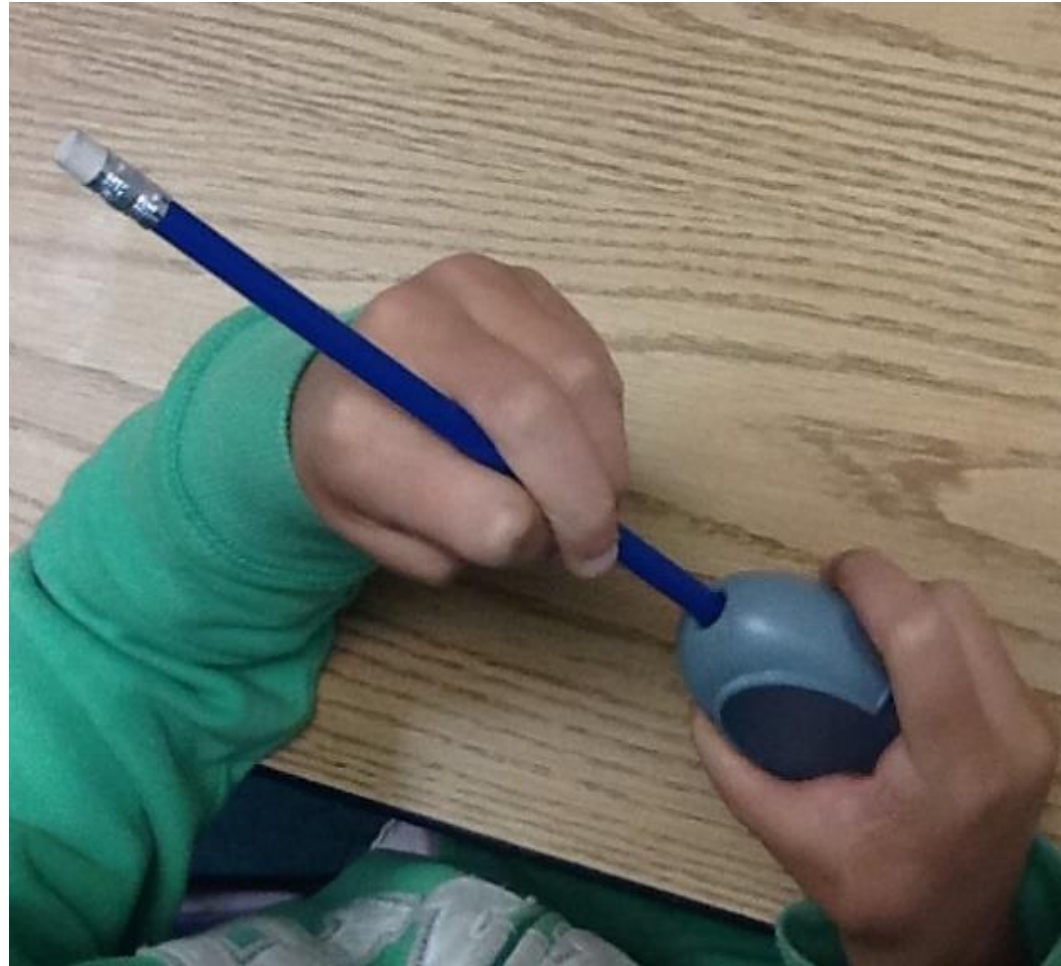
Understanding which specific factors predict better thumb use after index pollicization can shape and define the goals and expectations of surgery.

A key factor is successful correction of wrist radial deviation to potentially influence thumb function after pollicization

Video Scoring Examples

<https://wendytomhave.com/m/login?r=%2Ft-gap-video-examples>

Thank You For Your Attention!



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