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Providing Intervention for Children With Unilateral Cerebral Palsy

Lisa K. Kenyon PT, DPT, PhD, PCS

- Presenter Disclosure: Financial: Lisa Kenyon has received an honorarium for presenting this course. Non-financial: Lisa Kenyon has no relevant non-financial relationships to disclose.

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Learning Outcomes

After this course, participants will be able to:

- List at least three commonly occurring functional issues experienced by children who have unilateral cerebral palsy.
- Discuss at least three outcome measures for use with children who have unilateral cerebral palsy.
- Describe at least four applications of evidence-based intervention activities to promote acquisition of functional skills in children with unilateral cerebral palsy.

Commonly Occurring Functional Issues In Children Who Have Unilateral CP

Providing Intervention for Children With Unilateral Cerebral Palsy

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Video: Common Movement Issues in Unilateral CP

Video: Common Movement Issues in Unilateral CP

Video: Common Movement Issues in Unilateral CP

Ambulation in Children with Unilateral CP

- A majority walk independently by ~3 yo
  - Most achieve independent ambulation by 15-24 mo (without an assistive device)
  - Severe intellectual impairment greatest predictor of not walking by age 5 (increases risk by 56-fold)

Q1

Unilateral CP: Other Common Issues

- May appear frustrated
- Often aware of their deficits at a young age
- Parents may have conflicting feelings
  - Thankful that the child has mild impairments
  - But still need to grieve
- If mildly involved, teachers and others may not recognize the child's issues

Unilateral CP: Other Common Issues

- Goodman & Yude 2000
  - School-aged children with hemiplegia may experience increased stress
    - May feel conspicuous and uncomfortable
      - Always being “last”
      - Not picked for sports or games
      - May need help during mealtimes
      - May need help with self-care skills

Commonly Occurring Gait Issues In Children Who Have Unilateral CP

Gait in Children with Unilateral CP

- Most commonly observed gait pattern
  - Plantarflexion throughout the gait cycle, full extension or recurvatum of the knee in stance phase, hyperflexion of the hip, and increased lordosis

- Common gait abnormalities: Equinus (64%), stiff knee (56%), in-toeing (54%), excessive hip flexion (48%) and crouch (47%)
  - Some may only have foot/ankle deviations

Q2 & Q3

Tustin & Patel 2017

- Casting offers short-term improvement in ankle dorsiflexion in children with cerebral palsy who have an equinus deformity
  - The influence of this improvement in ROM on function is unknown
  - It is also unknown if this short-term improvement helps to avoid surgical interventions

Q7

4 Gait Patterns in Hemiplegia

Winters, Gage, Hicks. *J Bone Joint Surg Am*. 1987;69(3):437-441

4 Homogenous Gait Patterns in Hemiplegia

- Group I Gait Pattern (Most mild)
  - Primary abnormality = drop foot in the swing phase
- Group II Gait Pattern
  - Primary abnormality = Tight heel cord in the stance phase AND drop foot swing phase

4 Homogenous Gait Patterns in Hemiplegia

- Group III Gait Pattern
  - More proximal involvement (restricted motion of the knee) AND an equinus deformity of the ankle
- Group IV Gait Pattern
  - Restricted motion of the hip AND knee AND an equinus deformity

Terminology in the Literature

WGH Group I, WGH Group II, etc….

WGH Group I Gait Pattern

- Characterized by plantar flexion of the ankle in the swing phase
  - Results in an equinus position at initial contact
- But the heel cord is **NOT** tight
  - Adequate dorsiflexion in the stance phase.

WGH Group I Gait Pattern

- Knee hyper-flexes at “foot strike”
  - Compensation for foot drop
  - Forces the hip into increased flexion
    - To maintain the body over the stance foot (base of support) and to clear the swinging limb with dropped foot
- The pattern of pelvic tilt results in an increased lordosis throughout the gait cycle

Interventions – WGH Group I Gait Pattern

- Classically this gait pattern has been addressed with heel cord lengthening
  - This can make things WORSE
    - The heel cord isn't SHORT!!!
    - Dorsiflexion of more than zero degrees during stance
- Weakness or under-activity of the anterior tib relative to the gastrocnemius/soleus is more likely the root problem
  - Selectivity?

WGH Group II Gait Pattern – Most Common

- Characterized by a static or dynamic contracture of the gastrocnemius/soleus muscles = persistent plantarflexion during BOTH swing and stance
- As a result, the tibia and foot function as one long lever that will not permit the usual "rocker" motion of the tibia on the foot
  - This forces the knee into hyperextension during mid to late stance

WGH Group II Gait Pattern

- In addition, advancement of the trunk is curtailed and the step length on the opposite is decreased

- To maintain the center of gravity over the foot, flexion of the hip and pelvic lordosis are increased

WGH Group III Gait Pattern

- Proximal musculature is “more involved” than in Group III than in Patterns in Group I or II
- In typical gait:
  - The knee flexes to ~*35* degrees in the late stance, just before toe-off
  - Flexion increases to *65* degrees by the middle of the swing after the activity of the quadriceps muscles has ceased
- In the WGH Group III pattern:
  - The quadriceps and hamstrings BOTH remain active
  - This simultaneous contraction of flexor and extensor muscles limits flexion of the knee during swing (Stiff Knee)

WGH Group IV Gait Pattern

- Crucial difference btw Group III and IV Patterns: Reduction of sagittal plane hip motion in Group IV
- In Group IV Pattern:
  - Increased activity of the iliopsoas and hip adductors prevents the hip from reaching full extension at terminal stance

"Comparing" Groups

- In general, there was a progression of involvement in the 4 groups
- The combined average walking speed
  - For Groups I and II = 95 cm/sec
  - For Groups III and IV centimeters = 83 cm/sec
- Subjects in Groups I and II appeared to have the least residual damage to the central nervous system as compared to subjects in Groups III and IV

GMFCS LEVELS & WGH GAIT Pattern

- DOBSON et al *Devel Med Child Neurol*. 2011;55(3):429-435
  - WGH Group I: >90% of the children functioned at GMFCS Level I
  - WGH Group II: ~80% of the children functioned at GMFCS Level I
  - WGH Group IV: <30% of the children functioned at GMFCS Level I

NOTE: None of the children in the study demonstrated a WGH Group III gait pattern

Select Outcome Measures

Select Outcome Measures

- Children's Hand-use Experience Questionnaire
- Quality of Upper Extremity Skills Test
- Participation and Environment Measure - Children and Youth

Children's Hand-use Experience Questionnaire (CHEQ)

- Developed for children and adolescents with decreased function of one hand
  - Unilateral CP
  - Obstetric brachial plexus palsy
  - Upper limb reduction deficiency

- On-line questionnaire that can be completed by children and parents

Children's Hand-use Experience Questionnaire (CHEQ)

- Evaluates children's perceived quality of performance when using their affected hand in functional activities
  - The experience of children and adolescents in using the affected hand or hand prostheses during activities typically performed with 2 hands
- CHEQ (6-18 years)
- CHEQ (3-8 years)

Q4

Children's Hand-use Experience Questionnaire (CHEQ)

- CHEQ is available for use free of charge

- ACTIVE LINK: https://www.cheq.se/

Quality of Upper Extremity Skills Test

- An outcome measure designed to evaluate movement patterns and hand function in children with cerebral palsy
  - Ages 18 mo to 8 years
- Reliable and valid

Quality of Upper Extremity Skills Test

- Evaluates quality of upper extremity function in children with CP
- 4 domains:
  - Dissociated movement
  - Grasp
  - Protective extension
  - Weight bearing
- 36 items - Administration time 30 - 45 minutes
- Items related to quality of movement, not to chronological age
- Administered within the context of play

Quality of Upper Extremity Skills Test

- 36 items
- Administration time 30 - 45 minutes
- Items relate to quality of movement, not to chronological age
- Administered within the context of play

Quality of Upper Extremity Skills Test

- Manual available on-line at no cost

- ACTIVE LINK: https://slpemad.files.wordpress.com/2015/06/1992_quest_manual.pdf#:~:text=%20%20%20Title%20%20%20QUEST%3A%20Quality,Created%20Date%20%20%204%2F12%2F2006%201%3A38%3A04%20PM%20

Participation and Environment Measure - Children and Youth

- Designed to help parents, service providers and researchers better understand the participation of children and youth
- Measures participation in the home, school and community, along with environmental factors within each setting
  - Encourages use of strategies to address modifiable factors within each setting to better support a child's participation
- Parent questionnaire

Q6

Participation and Environment Measure - Children and Youth

- Children 5 to 17 yo with and without disabilities.
- Takes ~25–40 minutes to complete
- 25 types of activities
  - Examples: “Computer and video games” at home, “Classroom activities” at school, and “Neighborhood outings” in the community

Participation and Environment Measure - Children and Youth

- Cost: $99.00 Canadian
- ACTIVE LINK: https://canchild.ca/en/shop/2-pem-cy-participation-and-environment-measure-children-and-youth
- Also a version for younger children – YC-PEM: https://canchild.ca/en/resources/223-young-children-s-participation-and-environment-measure-ycpem

Evidence-based Interventions

Intervention Evidence

- Constraint induced movement therapy (CIMT)
- Bi-manual training
- Motor learning principles

CIMT

- Different than CIMT with adults
  - Adults: learned non-use
  - Children: Developmental disuse
- Must focus on age-appropriate activities
  - Must be of interest to individual child

CIMT

- Improvements in performance have been noted with as little as 2 hours/day, 3 times per week
- No evidence that one type of restraint is more effective than another in children
  - Glove
  - Mitt
  - Sling
  - case

CIMT

- Really a task oriented method to induce repeated practice
  - Motor learning principles – part and whole task practice

- Repeated doses of CIMT have been shown to have an additive effect

Q8

Bi-manual Training

- Practice specificity
- Task-oriented bimanual training focused on meaningful activities and goals
- Does not use a restraint
- HABIT – Hand-arm bi-manual intensive training

Bi-Manual Training

- Environmental modification should be used to elicit bi-manual upper extremity coordination
  - How can we incorporate this into our sessions?

Q9

Motor Learning Principles – Implicit vs Explicit

- The key difference
  - The amount of declarative knowledge about movement execution that is accumulated by the learner
- Explicit motor learning – discovery learning: places a high demand on working memory
- Implicit motor learning – analogy instructions or error-minimizing approaches

van der Kamp et al 2018

- Implicit motor learning interventions are recommended for children with CP, particularly for those with right unilateral CP
  - Implicit motor learning interventions may be more beneficial for children with right unilateral cerebral palsy

Q10

van der Kamp et al 2018

- If used, explicit motor learning interventions should consist of a single verbal instruction
- The amount and complexity of verbal instructions and feedback provided to children with unilateral CP should be minimized

General Intervention Principles For Children Who Have Unilateral CP

General Intervention Objectives

- Increase symmetry
- Tolerance and awareness of sensory inputs
- Control at “middle” joints
  - Knee
  - Elbow
- Body over limb movements
- Don’t forget the trunk!

General Intervention Objectives -UE

- Promote and encourage use of the involved UE
  - Encourage and reward success
  - Be careful that UE demands are not too great
    - This may reinforce child's negative image of the involved UE
- Forearm mobility
  - Supination
  - Controlled pronation

General Intervention Objectives

- Don't just treat the involved side
  - Weight shifts with control to each side
  - Rotation to each side – rotation with extension and rotation with flexion
  - Use of each side as a mover and as a stabilizer
- "Work" in the hemiplegic space to increase awareness of the involved side
  - This will look different at different ages

General Intervention Principles

- Utilize graded sensory inputs to help with body schema and body awareness
  - Proprioceptive inputs
  - Avoid struggles with tactile defensiveness
- Focus on weight shifting and control to each side
  - Mover
  - Stabilizer

General Intervention Principles

- Promote a midline orientation
  - And the ability to weight sift off midline to each side
- Trunk rotation
  - Upper body
  - Lower body
  - With extension
  - With flexion

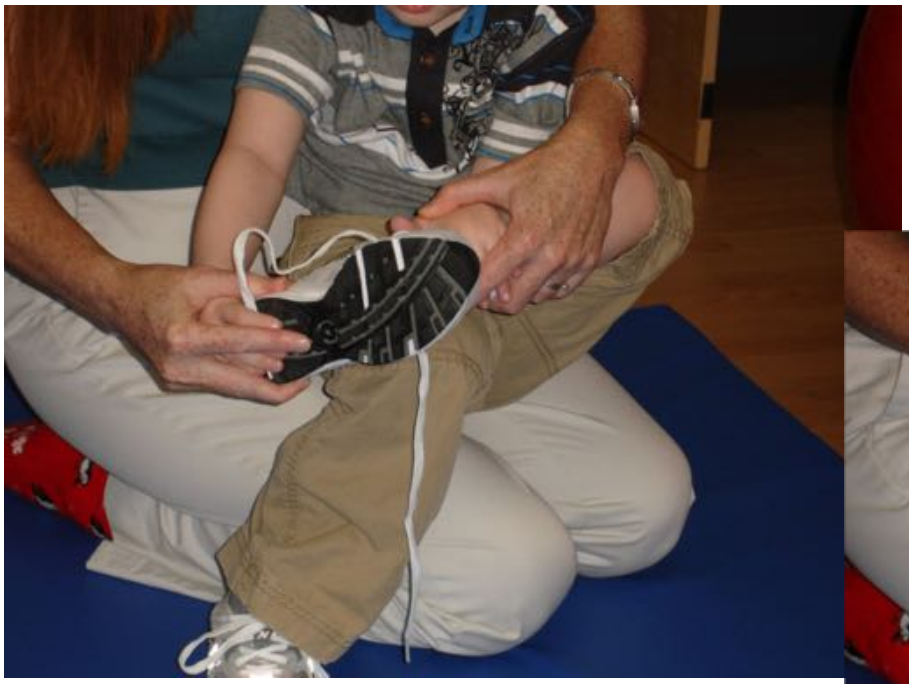
General Intervention Principles

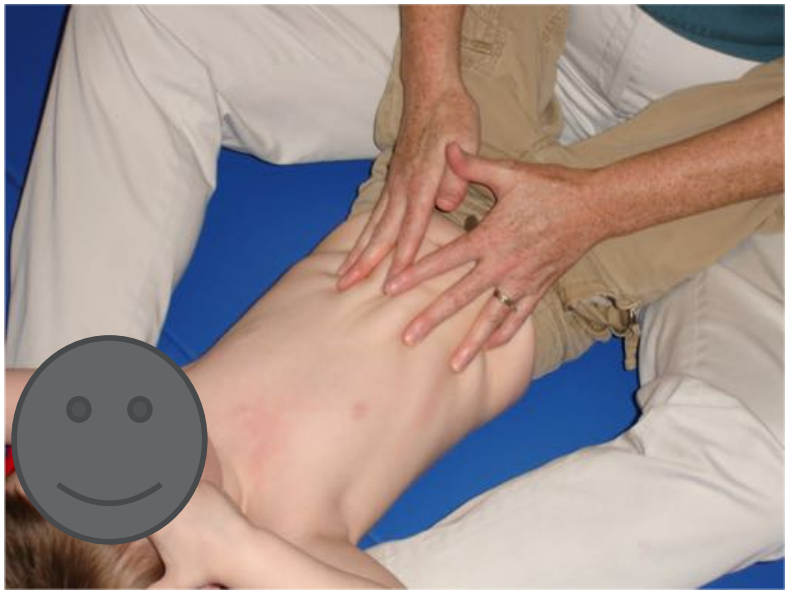
- Promote scapulohumeral mobility
  - Elongation of musculature
  - Look at how scapula “sits”
  - Scapular stability
- Watch for contractures
  - Prevention

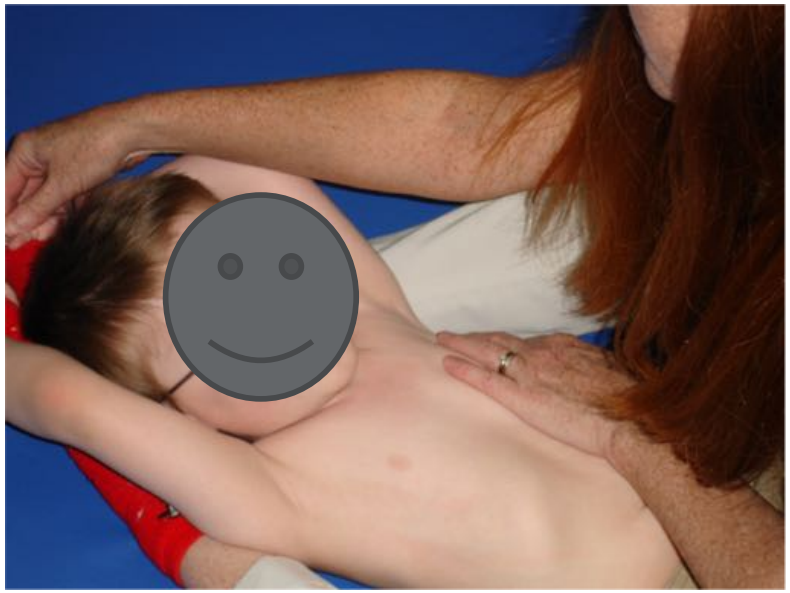
General Intervention Principles

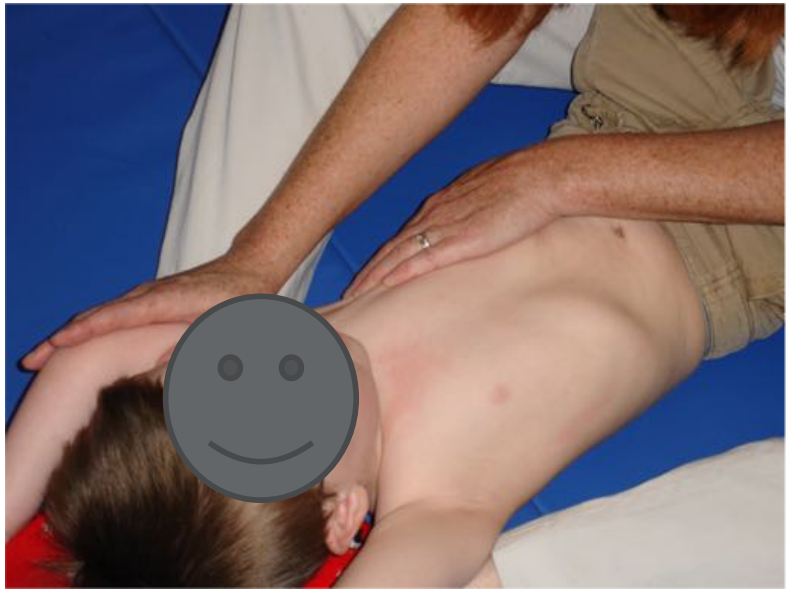
- Try to incorporate the involved hand in activities as much as possible
  - Non-involved hand over the involved hand - makes the activity bilateral in nature
  - Put your hand over the child's hand
  - Have the involved hand actively assist
    - Holding an object or weight bearing

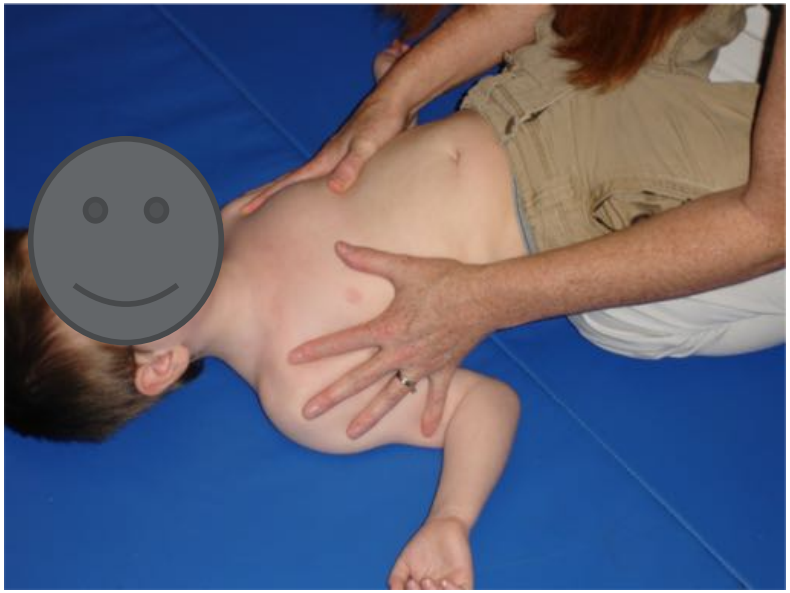
Select Preparation Activities





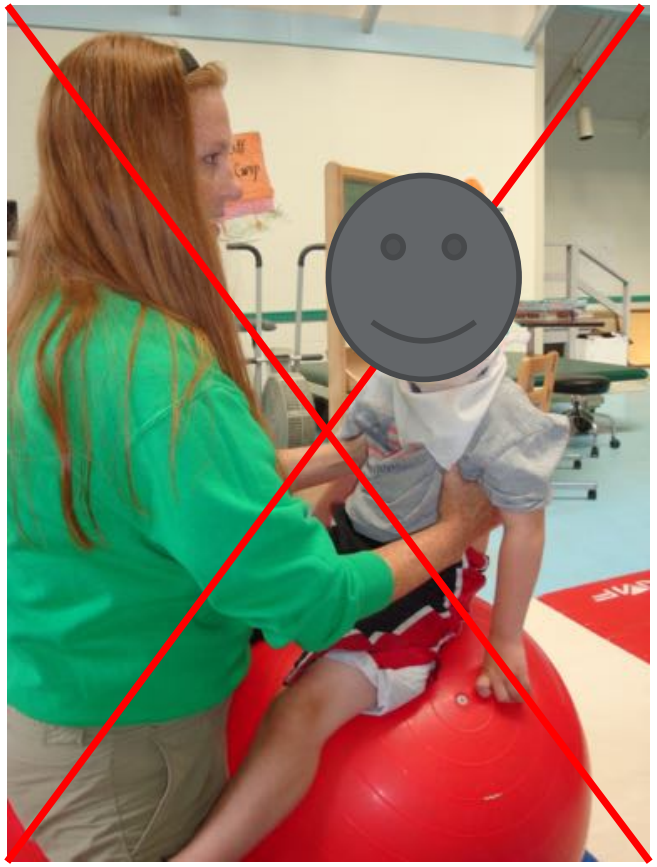


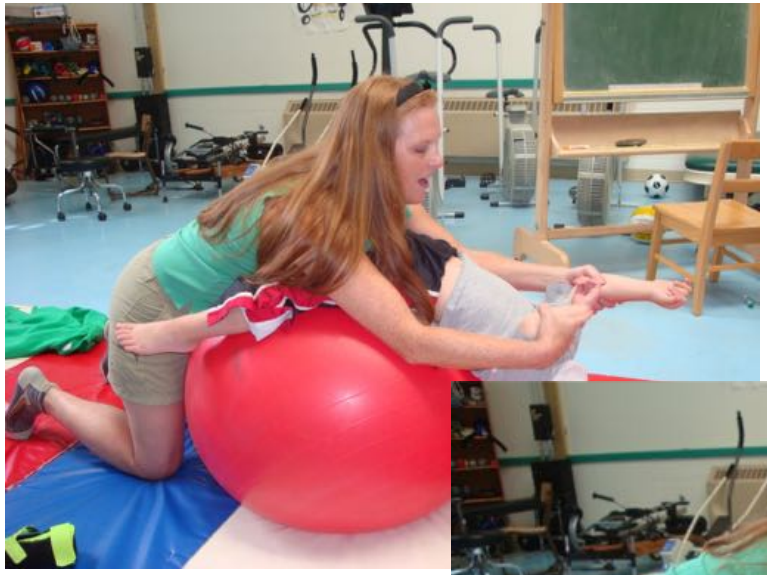


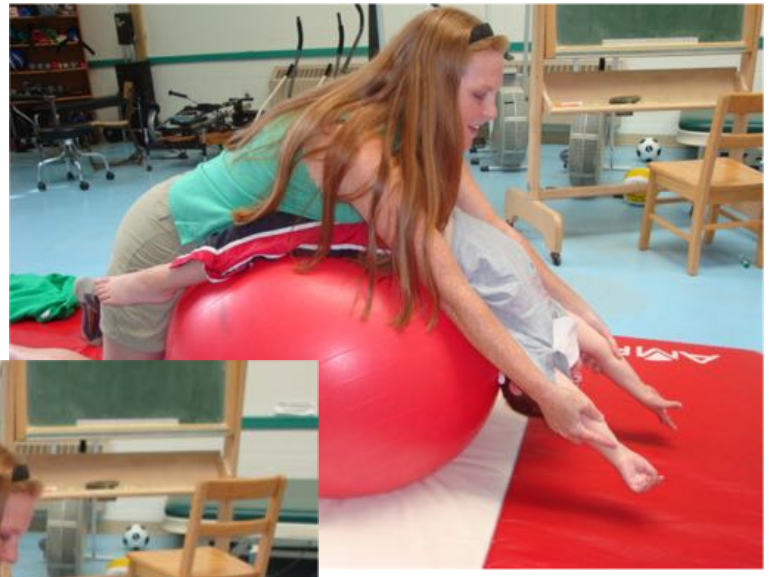


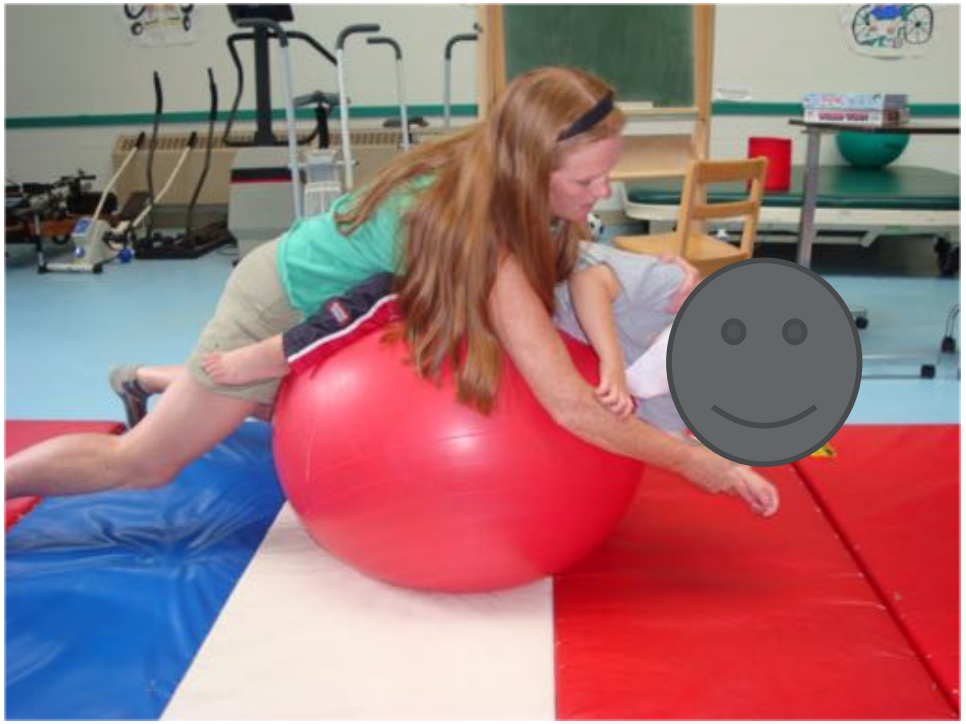
Video: Preparation for Movement

Using the Therapy Ball





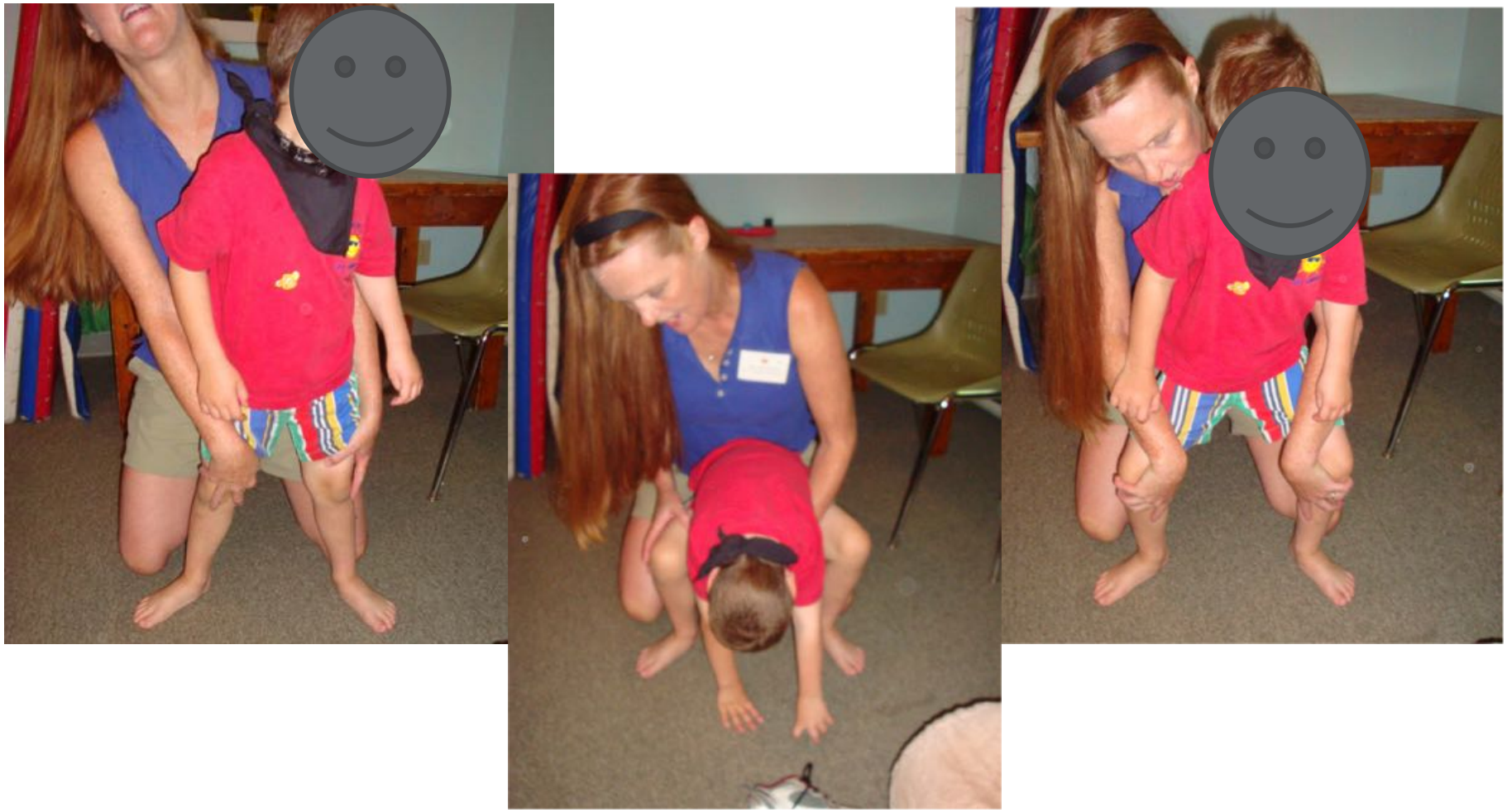




Video: Using the Ball

Video: Preparation for Movement

Select LE Activities



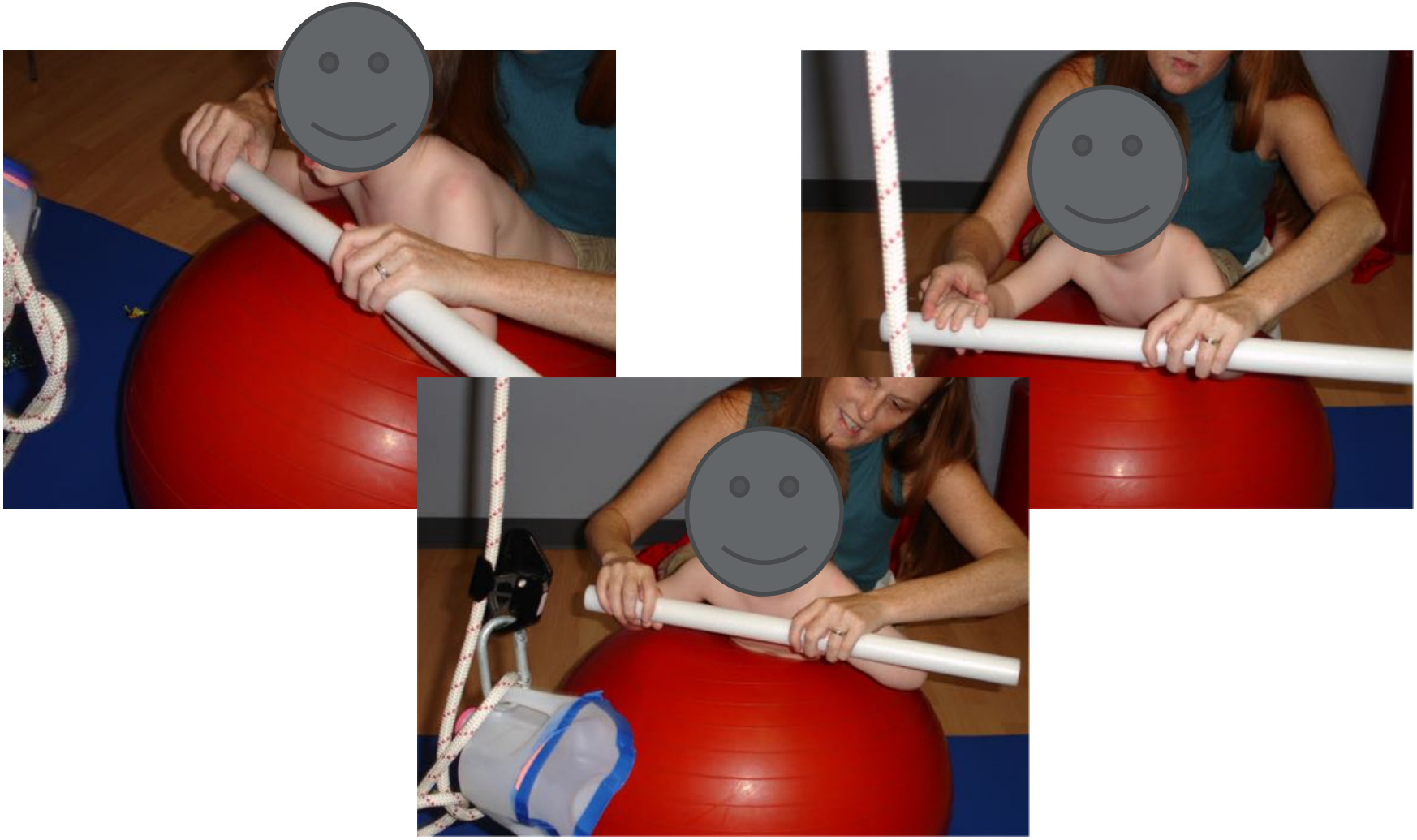
Other Select LE Activities

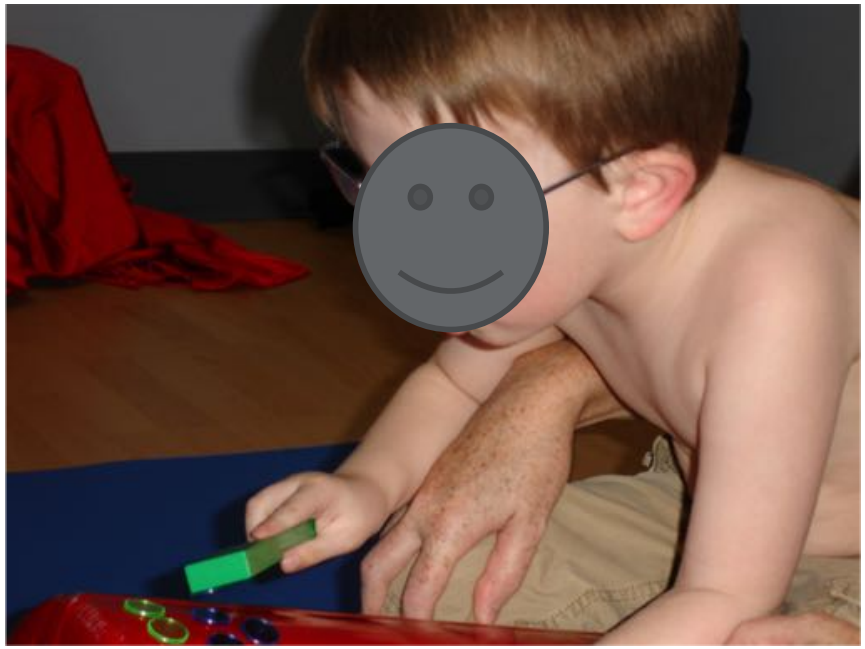
- Step ups on a bench
  - On both sides
  - Facilitation
- Tap ups on a bench
  - Try changing speeds
  - Use a piece of colored tape on the bench to work on eye-foot coordination

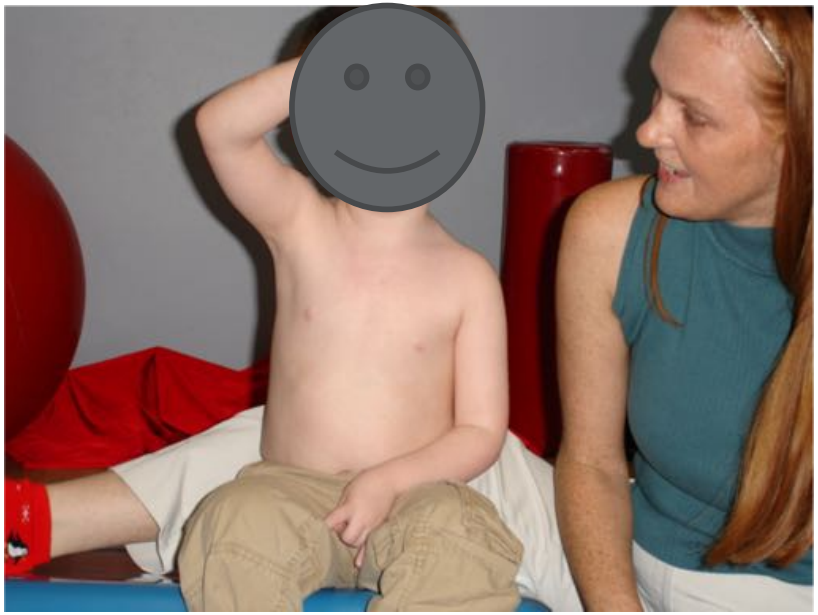
Other Select LE Activities

- Agility tasks
  - Rapid starts and stops
  - Rapid changes in direction
  - Obstacle avoidance
  - Turns

Select UE Activities

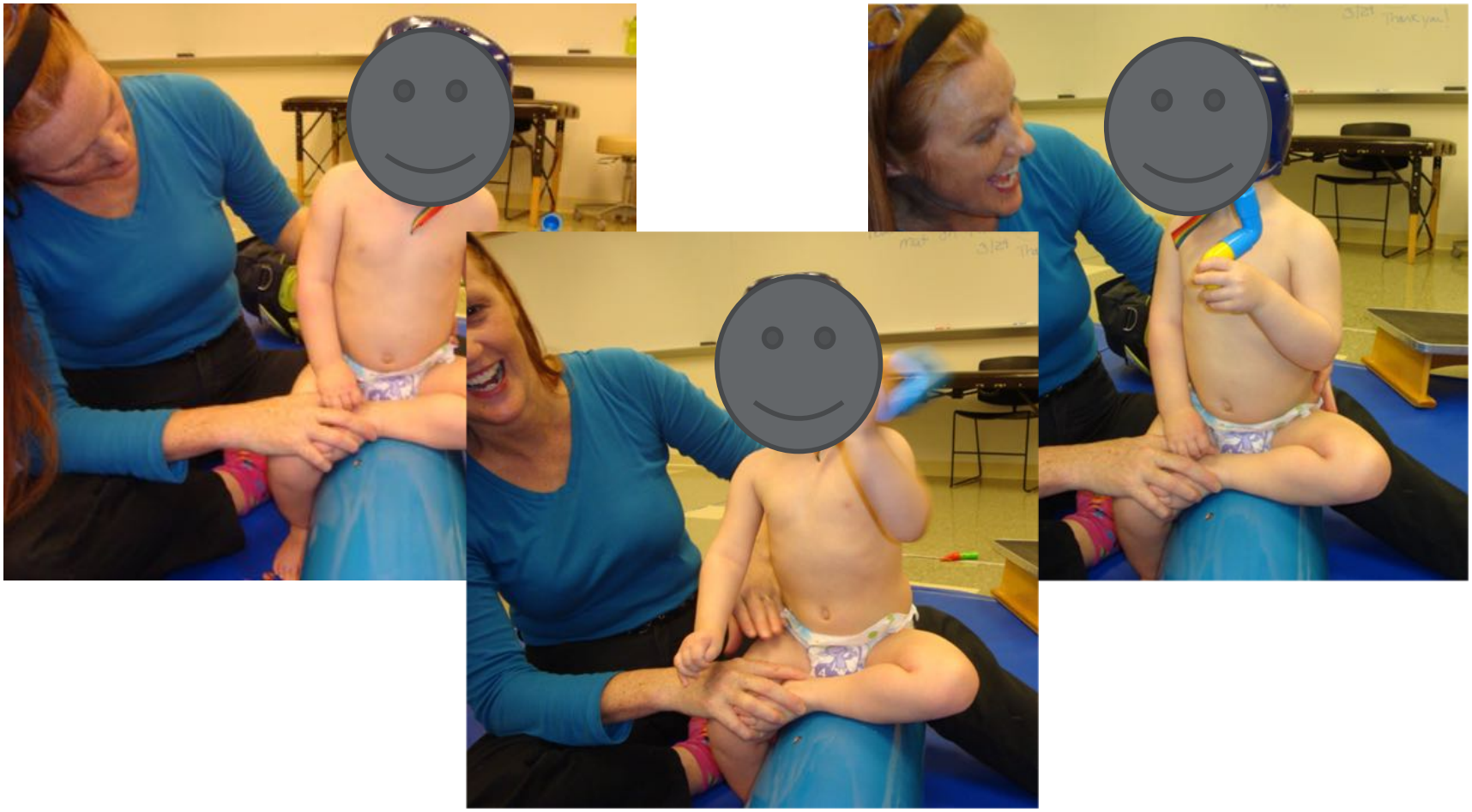






Similar Activity – Different Task Demands

(Due to Different LE Positioning & Then a Different Play Activity)



Bolster Use

Video – Bolster Use

Video – Bolster Use

Video – Sit to Stand

Select References

- van der Kamp J, Steenbergen B, Masters RSW. Explicit and implicit motor learning in children with unilateral cerebral palsy. Disabil Rehabil. 2018:40(23):2790–2797.
- Pavãoa SL, Silva FPS, Dusing SC, Rocha NACF. Clinical tools designed to assess motor abilities in children with cerebral palsy. Dev Neurorehabil. 2017;20(3):149–159.
- Amer A, Eliasson, A-C, Peny-Dahlstrand M, Hermansson L. Validity and test–retest reliability of Children's Hand-use Experience Questionnaire in children with unilateral cerebral palsy. Dev Med Child Neurol. 2016;58(7):743-749.
- Tustin K, Patel A. A critical evaluation of the updated evidence for casting for equinus deformity in children with cerebral palsy. Physiother Res Int. 2017;22(1):e1646.
- Kara OK, Livanelioglu A, Yardımcı BN, Soylu AR. The effects of functional progressive strength and power training in children with unilateral cerebral palsy. Pediatr Phys Ther.2019;31(3):286–295.
- Charles JR, Gordon AM. A repeated course of constraint-induced movement therapy results in further improvement Dev Med Child Neurol. 2007; 49 (10):770-773.
- Naylor CE, Bower E, Modified constraint-induced movement therapy for young children with hemiplegic cerebral palsy: a pilot study. Dev Med Child Neurol. 2007; 49 (6).
- Eliasson AC, Krumlinde-Sundholm L, Gordon AM, Feys H, etal. Guidelines for future research in constraint-induced movement therapy for children with unilateral cerebral palsy: an expert consensus. Dev Med Child Neurol. 2013; 56 (2).
- Charles J, Gordon AM. Development of hand-arm bimanual intensive training (HABIT) for improving bimanual coordination in children with hemiplegic cerebral palsy. Dev Med Child Neurol. 2006; 48; 931-936.
- Winters, Gage, Hicks. Gait patterns in hemiplegia. J Bone Joint Surg Am. 1987;69(3):437-441.

Review the Learning Outcomes:

Any Questions?

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