64TH CONFERENCE ON EXCEPTIONAL CHILDREN

WORKING TOGETHER TO ACHIEVE STUDENT SUCCESS

Positioned for Learning

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PUBLIC SCHOOLS OF NORTH CAROLINA
State Board of Education | Department of Public Instruction

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- Early Intervention
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Knowledge Broker

- I want to be your bridge

http://moblog.net/view/903301/human-bridge-

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Know why you do what you do!

Stop doing what doesn't work!

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Main Ideas

- Never too much sitting (6 hrs day/max)
- Position w/ abduction for some kids
- 24 hr positioning (postural management)
  - Sitting, standing, lying, moving
- Adjust your equip at least every 6 months
- Add activity
- There is no participation without activity
- Did I mention activity?

Hägglund et al., 2005

- Participants: 206 children with CP, without recurrent hip dislocations
- Only 3 developed dislocation: One not a surgical candidate and died soon after, one who moved into the area and one who refused to participate in program
- Results:
  - The number of children with severe contractures was reduced 70%
  - Severe scoliosis was reduced 60%

Hägglund's approach

- Early orthopedic surgery (between ages 4-6)
- Spasticity management
- Visits every 6 months by entire team
- Equipment adjusted every 6 months
- Every child has a 24-hour postural management program, including sitting, standing, and lying positions and activities delivered at home, school, and in the community

www.cpup.se

Headrests and Supports

- Will his head stay?
- Is it safe?
- Will it make him weaker? Stronger?
- Vision?
- Bus safety

Stealth I2I Headsupport

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Stealth's I2I Headsupport (vs headrest)

- Posterior
- Inferior chin support?

Headpod

Porter, 2009

- N= 60 GMFCS 5
- Fetal position during the last month of pregnancy was taken from antenatal records and parents were interviewed to identify preferred lying posture in the first year of life.
- At the time of the physical assessment ages ranged from 1 year and 1 month to 19 years with a median age of 13 years and 1 month.

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Porter, 2009

- Fetal presentation was found to be associated with the preferred lying posture with participants carried in a left occipito-anterior/lateral position more likely to adopt a supine head right lying posture, and vice versa.
- An association was also observed between the fetal position and asymmetrical postural deformity occurring later in life with participants carried in a left occipito-anterior/lateral presentation more likely to have a convex left spinal curve, a lower left pelvic obliquity, and a windswept hip pattern to the right.

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Porter, 2008

- The study provided evidence of an association between asymmetrical lying posture adopted in the first year of life and the direction of the subsequent pattern of postural deformity.

Porter, 2008

- If the child's head had been rotated to the right during supine lying, it was more likely that the scoliosis would be convex to the left, pelvic obliquity would be lower on the left, windswept hip pattern would be to the right and hip subluxation/dislocation would occur on the left.
- The likelihood of the deformities occurring in the same direction was also increased if consistent side lying on the right had been preferred.

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Deformity happens

- Predicted by fetal position
- Predicted by postural preferences
- FIGHT THIS!!!!

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Seated Mat Assessment

- It is essential to do a physical assessment of the individual in the unsupported seated position to determine the effect of gravity on posture. This evaluation should be performed on a firm surface and frequently requires 2 people to support the individual.
- This is a very HANDS ON process.
- Observe the posture that the individual adopts on their own.

From: http://sh-elearn.atutor.ca/go.php/20/content.php/cid/217/

Seated Mat Assessment

- Determine if the individual can sit hands free or is dependent on external support. This is determined by using the Level of Sitting Scale.
- Observe how limitations of Range of Motion (ROM) impact the seated position.
- Palpate the individual's bony landmarks. It helps to mark the landmarks with removable stickers. This allows you to visualize postural asymmetries more accurately.
- The sitting posture of the client should be observed from the front, back and right and left sides.

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Seated Mat Assessment

- Determine if a neutral pelvic position is possible. Begin by placing your hands on the pelvis and move the pelvis in all directions to see if a neutral position is possible.
- Then palpate the ASIS's to determine if there is rotation forward on one side.
- Move the pelvis forward and backwards to determine if there is a posterior or anterior tilt of the pelvis.
- Determine if the iliac crests are level or if there is a pelvic obliquity present.

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Mat Eval

- Look at the rest of the body with respect to the neutral pelvis. Observe the body above and below the pelvis. Evaluate the alignment of the hips and lower limbs and then check the trunk, shoulders, head and neck positions. Note any abnormalities.
- Observe the spinal alignment of the client in relation to the pelvis. Note any curvatures or rotation of the spine

Photo from: http://sh-elearn.atutor.ca/go.php/20/content.php/cid/218/ib/1//p_course/20

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Assessing for Optimal Seat Angle

- Recline supporting just the pelvis

WORKING TOGETHER T

#1 Priority

Get the butt all the way back in the chair!

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#2 Establish seat width and depth

- A little lateral squeeze offers stability
- Too much seat depth causes sacral sitting
- A short seat, instability
- For some, you need different lengths on each femur

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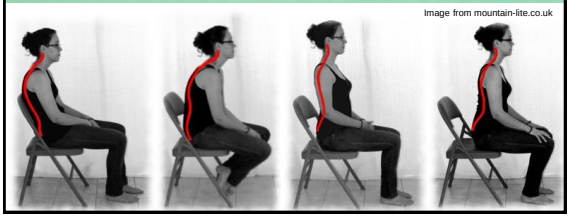
#3 set foot supports

- Match anatomy and ROM
- Try for hip abduction, external rotation (just a smidge), and loaded feet under the center of mass, or slightly behind it

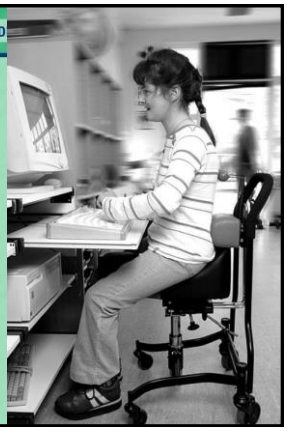
Image from mountain-lite.co.uk



WORKING TOGETHER TO ACHIEVE STUD

Remember it's hip flexion that's the trouble!

Try lots of options (high stool sitting)



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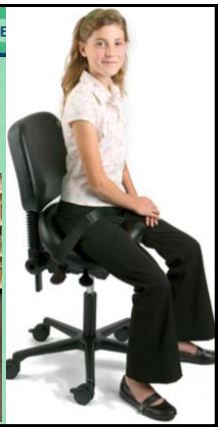
Aim for less hip flexion and abduction to keep the hip healthy



RESNA Paper

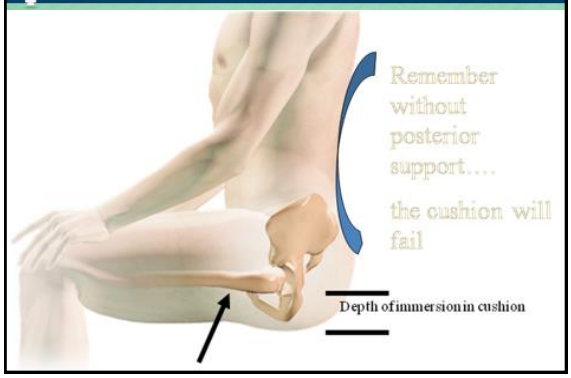
- http://resna.org/conference/program/workshop-handouts/WS23Lange.pdf

Anterior Chest Support

- Helps best if child is reclined 5-15 degrees
- If child is upright or inclined forward, they will just "hang"
- Make sure its low and not near airway
- Should be taken off occasionally
- Should not be used when pelvic harness is not on firmly

Anterior Pelvic Support

- Should be on firmly at all times
- If it's too loose child will slide
- If it's too loose child may feel insecure
- If it's too loose child may not be safe



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Inferior, superior and lateral foot supports

- Stabilize the feet – should be fully weighed (20% of body weight?)
- Use softer materials to allow for some movement
- Stabilize for work and transport
- Allow freedom during other times
- May have to be behind the pelvis if hamstrings are tight (match feet to lower leg angle)

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Head Support

- Use laterals if you need them
- Try to get total symmetry for vision and to stop contractures
- If head keeps falling, realign pelvis and try different shoulder positions – when it's right you did a good job!
- Don't recline past 15 degrees just for head support!!!!

The best seat is….

1) Ischial block
2) Pelvic contouring
3) Encourages abduction
4) Allows for external rotation (beveled front)

From childdevelopment.ca

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Assessing the Optimal Seat Angle

- Recline until you have the hip angle you wanted
- Now tilt forward or back until you like the line of gravity you want

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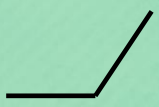
RECLINE

90° angle



Open seat angle

Closed seat angle

TILT

Upright

Posterior Tilt

Forward Lean or Anterior Tilt

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RECLINE and TILT

90° angle

Recline with anterior tilt

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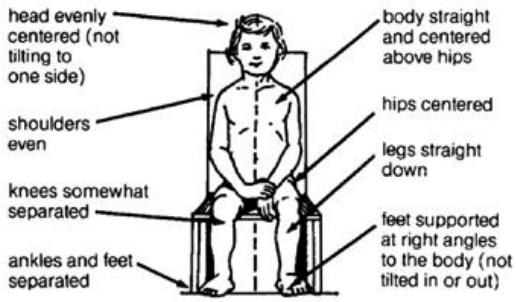
From dinf.ne.jp



Fixed or Flexible

- Determine if the abnormal postures observed are fixed or flexible.
- If the posture is fixed then it will need to be accommodated.
- If the posture is flexible:
  - How much of the posture is correctable?
  - How much pressure is needed to correct the posture?
  - Where is the pressure needed to correct the posture?
  - Can the client tolerate the amount of pressure needed to correct the posture?

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Hunter's Story

- Stand in school 60 min daily
- Uses a bike at school 1-3x/wk
- Stands and is pushed in a gait trainer daily x20 min
- Trains on power 1-3x/wk
- Has 3 sitting options at school
- Assists with sit to stand transfers
- Sits on potty 2x daily

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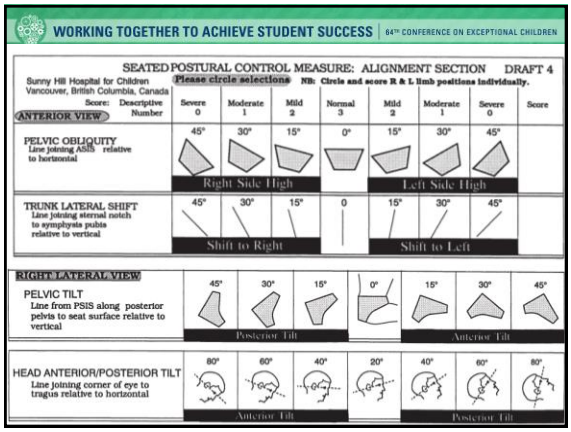
Assessment Tools

Seated Postural Control Measure (SPCM)

- observational scale of 22 seated postural alignment items
- 12 functional movement items,
- each scored on a four-point, criterion-referenced scale
- Form is free at: http://www.bcchildrens.ca/NR/rdonlyres/D27C1037-E14F-46DE-82DA-6DEC2C2FAFCC/11372/Scoringform.pdf



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1. *Lifts head upright and maintains position for 3 seconds*

If child's head is not flexed forward prior to test, instruct or assist child to do so. Upright position of the head is defined as that position in which central gaze is directed along the horizontal plane.

0. Does not initiate head lift
1. Initiates head lift
2. Lifts head, does not attain upright position, but holds position for 3 seconds
3. Lifts head upright and maintains position for 3 seconds

3. Leans forward, touches toy with preferred wrist or hand, re-erects

Small toy placed on board at child's midline at a distance of 1% times "arm length" anterior to the trunk midline

0. Does not lean forward and re-erect
1. Leans forward, but does not touch toy
2. Leans forward, touches toy, but does not re-erect
3. Leans forward, touches toy, re-erects

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6. ***Reaches forward, grasps and releases toy with preferred hand***

Small toy placed on board an "arm length" anterior to the trunk midline

0. Does not touch toy
1. Touches toy with palm or fingers
2. Grasps toy and lifts it off board for 3 seconds
3. Releases toy into large container placed conveniently by therapist

8. Removes and replaces lid of screw-lid jar

Jar placed on board anterior to child's midline at any location that a6commodates child's attempts to grasp jar.

0. Does not touch jar
1. Places one or both hands on jar
2 Unscrews and removes jar lid
3. Replaces jar lid and screws it closed

10. ***Places dice in jar, one at a time, with preferred hand, in 30 seconds***

Place dice and jar on board as indicated by paper guide immediately in front of child. Request child to place dice into jar, one at a time, using

one hand, as fast as possible. If at end of time period child has picked up a die but not completed placing it in the jar, give credit for that die.

0. Does not place any dice in jar
1. Places 1 die
2. Places 2 to 5 dice
3. Places 6 dice

12. ***Moves wheelchair forward 10*** *ft"* along 8-ft-wide corridor, turns right or left 90 degrees, and passes through 33-inD doorway

Allow one practice trial to ensure child understands the task. Maximum of 60 seconds allowed for completion of the task.

0. Does not move wheelchair forward 10 it without bumping into walls
1. Moves wheelchair forward 10 ft, but does not initiate a turn
2. Moves wheelchair forward 10 ft and turns to face doorway
3. Moves wheelchair forward 10 ft, turns, and passes freely through doorway

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Level of Sitting Scale (LSS)

- **Level 1 Unplaceable**

Child cannot be placed or held by one person in sitting position.

- **Level 2 Supported from Head Downward**

Child requires support of head, trunk and pelvis to maintain the sitting position.

- **Level 3 Supported from Shoulders or Trunk Downwards**

Child requires support of trunk and pelvis to maintain sitting.

- **Level 4 Supported at Pelvis**

Child requires support only at the pelvis to maintain sitting.

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Level of Sitting Scale (LSS)

- Level 5 Maintains Position, Does Not Move

Child maintains the sitting position independently if he/she does not move limbs or trunk.

- Level 6 Shifts Trunk Forward, Re-erects

Child, without using hands for support, can incline the trunk at least 20˚ anterior to the vertical pane and return to the neutral (vertical) position.

- Level 7 Shifts Trunk Laterally, Re-erects

Child, without using hands for support, can incline the trunk at least 20˚ to one or both sides of midline and return to the neutral position.

- Level 8 Shifts Trunk Backward, Re-erects

Child, without using hands for support, can incline the trunk at least 20˚ posterior to the vertical plane and return to the neutral position.

Level of Sitting Scale (LSS)

- To assess the level of sitting, the individual is first asked/assisted to assume the sitting position on a high mat or bench with thighs supported to the back of the knees, feet unsupported.
- For the Level of Sitting Scale, sitting position is defined as:
  - "hips & trunk can be flexed sufficiently so that the trunk (defined by a line joining the first thoracic vertebra & the sacrum) is inclined at least 60°,
  - head position is either neutral with respect to the trunk or flexed,
  - the position can be maintained for a minimum of 30 seconds, with due regard for the comfort and safety of the individual."

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Level of Sitting Scale (LSS)

- Maintenance of sitting for 30 seconds is required to pass Levels 2 to 5.
- If the sitting position is independently maintained for 30 seconds, the individual is then requested to shift his trunk & re-erect (levels 6 - 8)

From http://sh-elearn.atutor.ca/go.php/20/content.php/cid/393/

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Assessment Tools

- The SAS and the SACND are based on NDT thinking - about counting pathological movements etc. and both need more development to remove those sections and we don't know if they are sensitive to change.
- The TIS and TCMS are only for GMFCS levels I-III.
- The SATCo needs a specific bench with a strap if the kids can't sit independently (most of the kids who need seating!)

How much time do you want to spend on Dynamic Seating?

- 3 min
- 5 min
- 10 min

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Dynamic Seating

- Miller's hardware
- PDG Bentley
- Sunrise Rock Active
- Snug Seat XPanda
- Body Point HipGrip

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A DYNAMIC SEATING SYSTEM FOR CHILDREN WITH CEREBRAL PALSY

- Hahn, ME, Simkins, SL, and Gardner, JK, Kaushik, G
- Journal of Musculoskeletal Research, Vol. 12, No. 1 (2009) 21–30

Study Design

- N=12 children with neuromuscular dysfunction (mean age 6.0, SD 2.7 years) were included in the study,
- RCT 0,3,6 mos
- Kid Rock locked vs. dynamic seating components that allowed limited range of motion in the hip and knee

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Measures

- ROM
- Modified Ashworth Scale
- GMFM
- PEDI

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Outcomes

- Both groups improved in motor function over time, particularly in the categories of Sitting and Crawl/Kneel.
- Measures of disability improved in both groups for the categories of self-care, mobility, and social function.

Other Findings

- Trend in ROM improvement in dynamic group
- Trend in improved Lying and Sitting for static group
- Trend in improved Standing and Walking in dynamic group
- Trend towards normal “tone” in dynamic group

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Snug Seat/R82 X-Panda

- **DYNAMIC SEATING vs RIGID SEATING: A QUANTITATIVE COMPARISON USING 3D MOVEMENT ANALYSIS IN PATIENT AFFECTED BY CP**
- Martino Avellisa PT, Veronica Cimolinb PhD, Luigi Piccininic PhD, Andrea Cazzanigaa PhD, Anna Carla Turconic PhD, Manuela Gallib PhD

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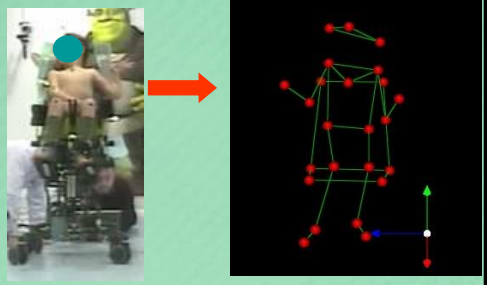
Subjects

- N=10 w/ CP
- Age range: 6-19 years,
- with spastic and dystonic tetraparesis type V



It meaures the Cartesian coordinates X Y Z of markers positioned on the body of the subjects

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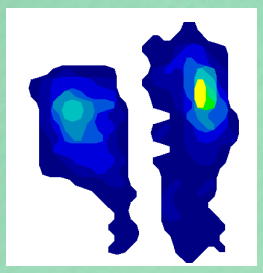

Pressure Sensor System (Tekscan, USA)

It measures the pressure distribution on the interface surfaces (backrest and headrest)

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MODALITY OF CARRYING OUT TRIALS

•TRIALS TAKE OVER

- 5 seconds
- External disturbance (clap)
- Pause (about 10 seconds)
- External disturbance (clap)
- Pause (about 10 seconds)
- External disturbance (clap)
- Pause (about 10 seconds)

} 2 sessions { DYNAMIC CONFIGURATION / STATIC CONFIGURATION

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KINEMATIC PARAMETERS

- Time progress of X, Y coordinates of markers located on sternum, head and wrist→ Range of Motion (ROMSx, ROMSy, ROMHx, ROMHy, ROMWx, ROMWy)
- Speed and acceleration of the markers of sternum and head
- Pelvis angle → Range of Motion (ROMp)
- "Average Jerk" → It measures the smoothness of the motion

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KINEMATIC RESULTS - 1

- 7/10 subjects presented a greater Range of Motion of the trunk in the dynamic configuration
- The static configuration had more torque in ant/post direction

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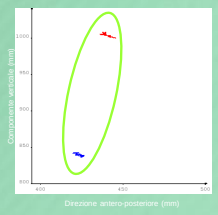
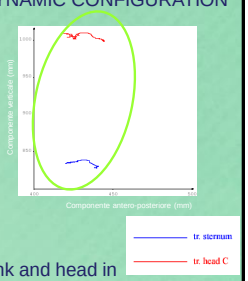
SUBJECT # 1073 (S.B.)

STATIC CONFIGURATION



DYNAMIC CONFIGURATION



Greater Range of Motion of the trunk and head in forward-backward direction in dynamic configuration

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KINEMATIC RESULTS - 2

6/10 subjects tended to slip forward in the static configuration

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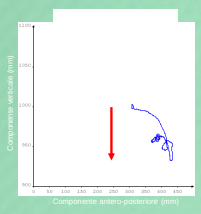
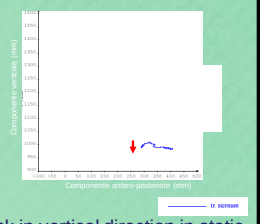
SUBJECT #1134 (R.C.)

STATIC CONFIGURATION



DYNAMIC CONFIGURATION



Greater range of Motion of the trunk in vertical direction in static configuration → indicative of greater sliding of the patient in static configuration

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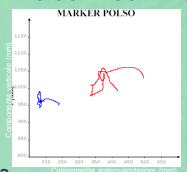
KINEMATIC RESULTS - 3

- 65% of the limbs presented larger Range of Motion in static configuration
- Decreased dystonia!

STATIC CONFIGURATION

DYNAMIC CONFIGURATION



Subject # 1033

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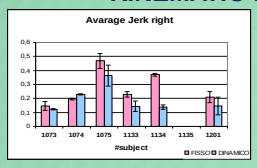
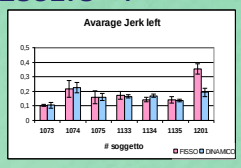
KINEMATIC RESULTS - 4





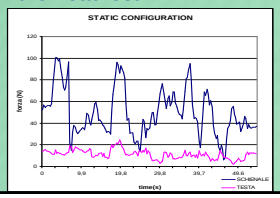
About the "Average Jerk" index over totality of 13 upper limbs evaluated we can see that:

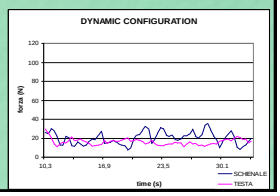
- 8/13 (61%) remain unchanged (1073, 1074, 1075sx, 1133sx, 1134sx, 1135sx)
- 5/13 (39%) present a decrease of the value in dynamic configuration as regards static configuration (1075dx, 1133dx, 1134dx, 1201), showing a larger smoothness of the movement in dynamic configuration

WORKING TOGETHER TO ACHIEVE STUDENT SUCCESS | 64TH CONFERENCE ON EXCEPTIONAL CHILDREN

PRESSURE DISTRIBUTION RESULTS

- N=4
- Forces exerted towards the backrest in dynamic configuration were, in general, less than these exerted in static configuration.
- No significant differences seen in forces exerted on the headrest





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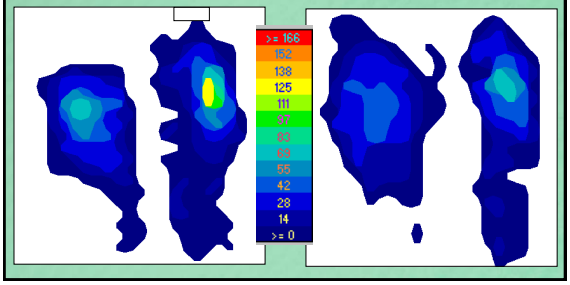
SUBJECT #1075 (N.A.)

PRESSURE DISTRIBUTION RESULTS

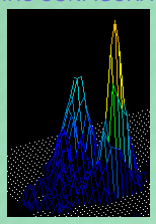
STATIC CONFIGURATION DYNAMIC CONFIGURATION

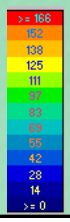


SUBJECT #1075 (N.A.)

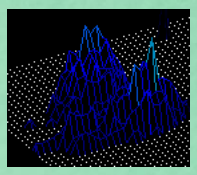
PRESSURE DISTRIBUTION RESULTS

STATIC CONFIGURATION





DYNAMIC CONFIGURATION



CONCLUSIONS

- The dynamic configuration improves the stability and comfort of users during a thrust on the backrest
- The pelvis stays in place
- In some subjects the non-specific movements of the upper limbs are more contained and smoother
- The dynamic system follows the back of the children decreasing the force towards the backrest avoiding possible injury risks.

Miedaner, 1993

- N=12 age 17 to 58 months of age,
- spastic CP quadriplegia or diplegia
- During 67% of the testing situations, the child's ability to perform fine motor tasks improved so the child was able to complete one or more of the tasks they were unable to do without positioning

Harris, 2005

- Review Article
- Adaptive seating interventions have a positive impact on stabilization of the pelvis
  - slightly anterior-tilted position
  - thighs in flexion
  - abduction

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Carlberg, 2005

- Children with severe CP who could not sit (GMFCS 4 and 5)
- top-down recruitment of postural muscles
  - excessive degree of antagonistic co-activation
  - incomplete adaptation of the EMG-amplitude to task specific constraints

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Stavness, 2006

- Review Article
- The majority of the evidence supports the positive effects of a neutral to slightly forward orientation (whole chair tilted) on upper-extremity function.
- Only one study did not demonstrate such effects.
- Of the supporting studies, one suggested the addition of an abduction orthrosis (AO), one recommended the entire functional sitting position (FSP) package (this orientation plus a hip-belt, footrests, AO, and cutout tray), and one established the long-term effects of the FSP.

Stavness, 2006

- One less rigorous study opposed the addition of an abduction orthosis.
- With the exception of one study, most of the evidence states that seat angle does not affect functional abilities.
- Evidence supports that children with CP should be fitted for wheelchairs that place them in a FSP, which includes; orientation in space of 0 degrees -15 degrees, a hip-belt, an AO, footrests, and a cutout tray, with the addition of a sloped forward seat of 0 degrees -15 degrees, to improve upper-extremity function.
- The exact seat angle and orientation in space within the 0 degrees -15 degrees range should be determined on an individual basis.

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Michael, 2007

- Review Article
- Posterior tilt can reduce pressures at the interface under the pelvis

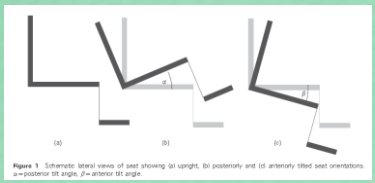

Figure 1 Schematic lateral views of seat showing (a) upright, (b) posteriorly and (c) anteriorly tilted seat orientations. α=posterior tilt angle, β=anterior tilt angle.

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Chung, 2008

- Review Article
- Conflicting findings were reported for saddle seats and optimal seat/back angle for improving sitting posture/postural control.
- Significant improvements were reported with seat inserts, external supports, and modular seating systems.
- Evidence supporting effects of postural control on functional abilities was limited.

Clinically applicable findings

10°	anterior tilt	Increased back extension
15°	anterior tilt	Decreased postural stability
0°	seat, 90° back	Decreased EMG activity
5°	posterior tilt	Improved lower limb stability
5°	anterior tilt	Decreased head stability
20°	forward tilted bench	Increased trunk extension

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Great Assessment Form!

- http://sh-elearn.atutor.ca/get.php/pmr.pdf

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Take Home Message

- Go Slow
- Be Thorough
- Ask for help
- Keep up with new ideas

Image from genengnews.com

The Effects of Mobility on Cognition

People over age 50

- We have lots of evidence that exercise improves brain function, memory and decreases the onset and severity of dementia
- We also know that going out and interacting with others has the same result
- Can this data be applied directly to the young developing brain?
- Is using a gait trainer or other mobility devices exercise? Exploration? Both? Even more powerful?

Lobo, 2013

- Grounded perceptual motor experience forms cognition
- Exploration through early behaviors, such as gait trainer use, facilitates development
- Infants and children with limited exploration are at risk for global development impairments
- Gait trainer use targets exploratory behaviors and is a feasible and effective way to advance a range of abilities across developmental domains and time

To be effective…

- Must be efficient (easy to move)
- Be used often (3-5x/wk 15-60 min/day)
- Allow head to be upright for optimal vision
- Allow hands free to explore environment

PT and OT Drive Brain Development

Why?

- Vision
- Hands
- Language
- Emotional (seeing faces)
- Cause and Effect
- Spatial Awareness
- Others???

Photos from kellyozley.com

What drives brain development?

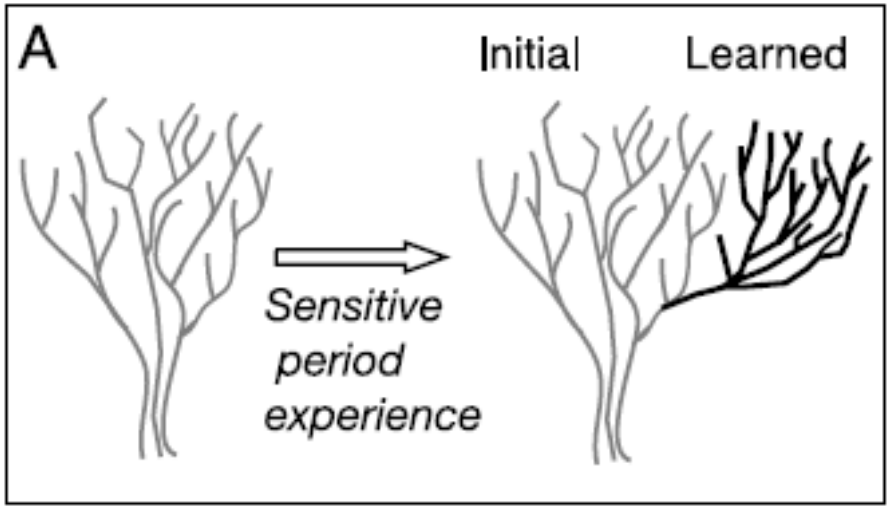
- Experience
- Exploration
- Encountering problems and solving them

From www.ecmhc.com

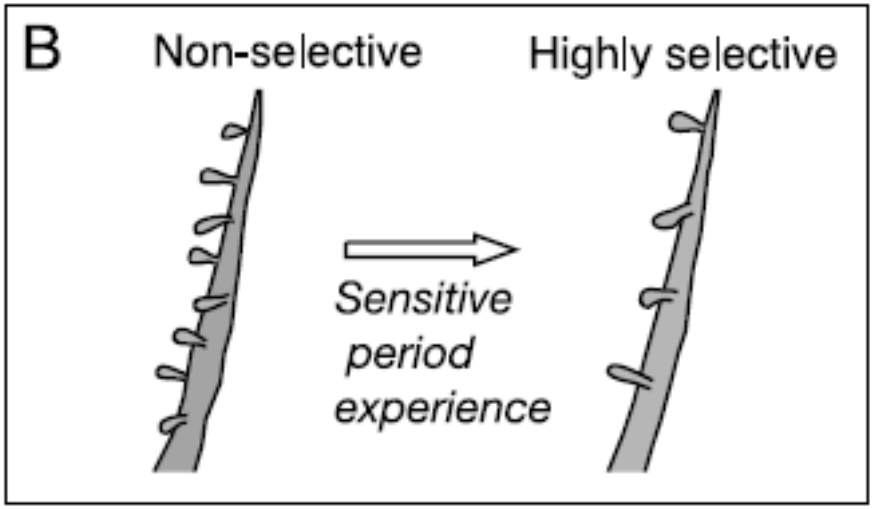
How does the brain “get better”?

- Budding
- Pruning

Axon elaboration



Synapse elimination



From http://faculty.washington.edu/losterho/knudson_critical_periods_jcn_2004.pdf

How this happens

1) Elaboration of a new axonal projection field, establishing

novel connections as instructed by experience.

(DeBello et al., 2001; Antonini & Stryker, 1993)

2) Loss of dendritic spines, suggesting the selective

elimination of unused synaptic inputs (Wallhausser-Franke et al., 1995; Scheich, 1987)

These changes happen best during “sensitive periods”

Lorenzo’s ducks imprinted on him

Photo from cerebromente.org

Sensitive Period

- Once the sensitive period for a particular ability is past, the development of the brain has progressed past the point at which information can be simply absorbed.
- The child must then be taught the ability, resulting in expenditure of conscious effort, and not producing results as great as could be produced if the sensitive period had been taken advantage of

-From Wikipedia (source: Montessori)

Dr. Andreas Guzzetta, M

- Università di Pisa, Depaertment of Developmental Neuroscience, Italy
- Pediatrics, Neuroradiology and Neurology.

Two avenues for hope using neuroplasticity

Stop axonal regression (save what you already have)

– by “walking” early

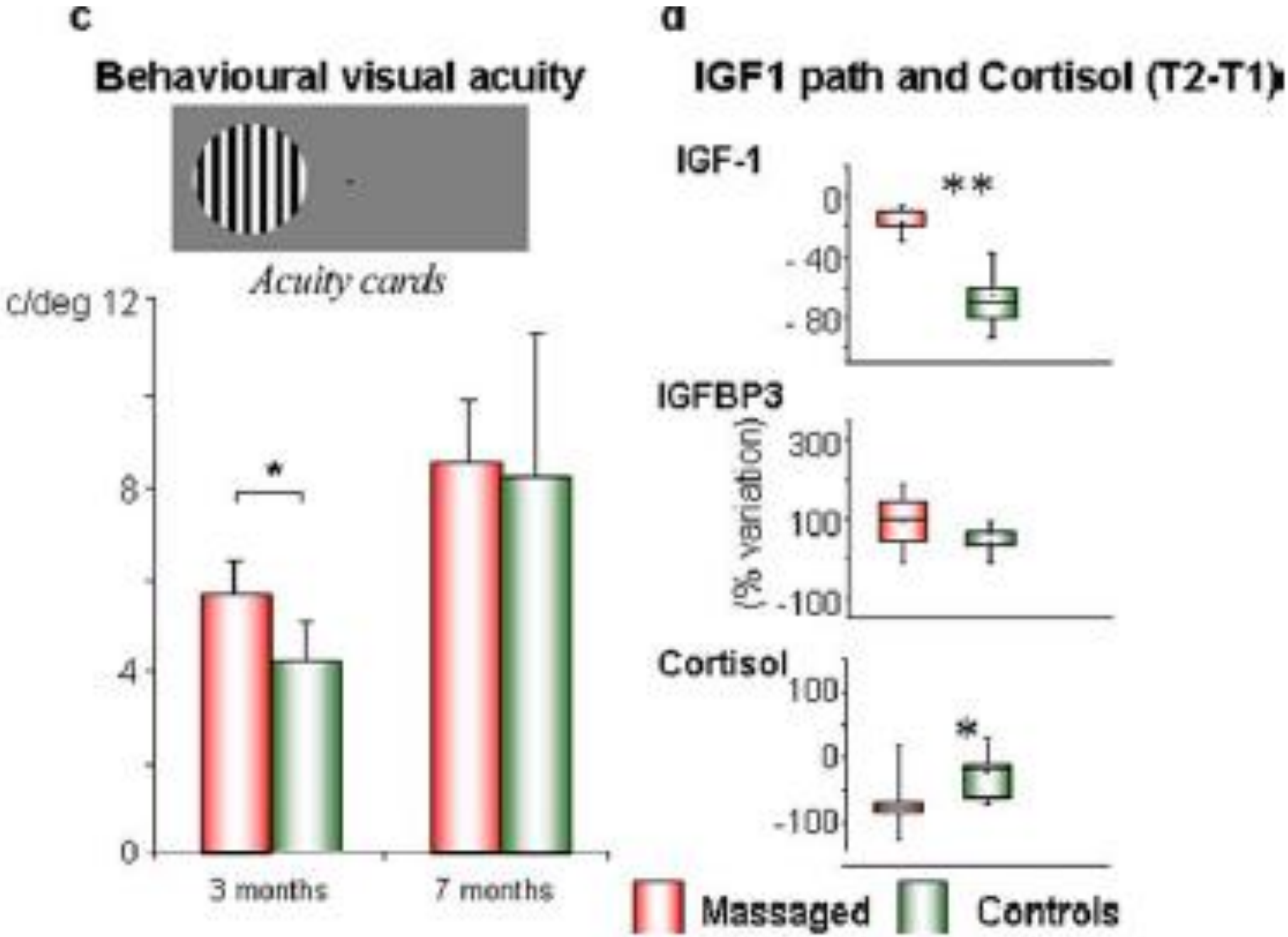
Use germinal matrix to grow around the lesion (PVL)

– by “walking” early

- Teaching a child to walk using a gait trainer may be a great way to do stimulate the fibers in the germinal matrix to keep growing and to slow axonal withdrawal
- Teaching a child with learning issues to use a switch toy, may be a great way to jumpstart learning, language and cognition
- To maximize neuroplasticity, all therapeutic activities have to be fun, frequent, focused, family-friendly and financially feasible (Eyre, 2010)

Guzetta, 2009, 2011, 2013

- Licking leads to kicking (in rats)
- Massage and stimulation leads to better function and brain scans in infants (PREMM)


c
Behavioural visual acuity
Acuity cards
c/deg 12
8
4
0
*
3 months
7 months
d
IGF1 path and Cortisol (T2-T1)
IGF-1
0
- 40
- 80
**
IGFBP3
(% variation)
300
100
-100
Cortisol
100
0
-100
*
Massaged
Controls

Guzzetta, 2009, 2011, 2013

- Infants learn from watching (UPBEAT)
- 4 weeks' duration, from the infant's 9th-13th post-term week of age. Three sessions of 5 min each will be performed each day for 6 days/week (total of 6 h over 28 days). Parents will repeatedly show the infant a grasping action on a set of three toys, presented in random order

Intervention

3 x 5 min sessions per day,

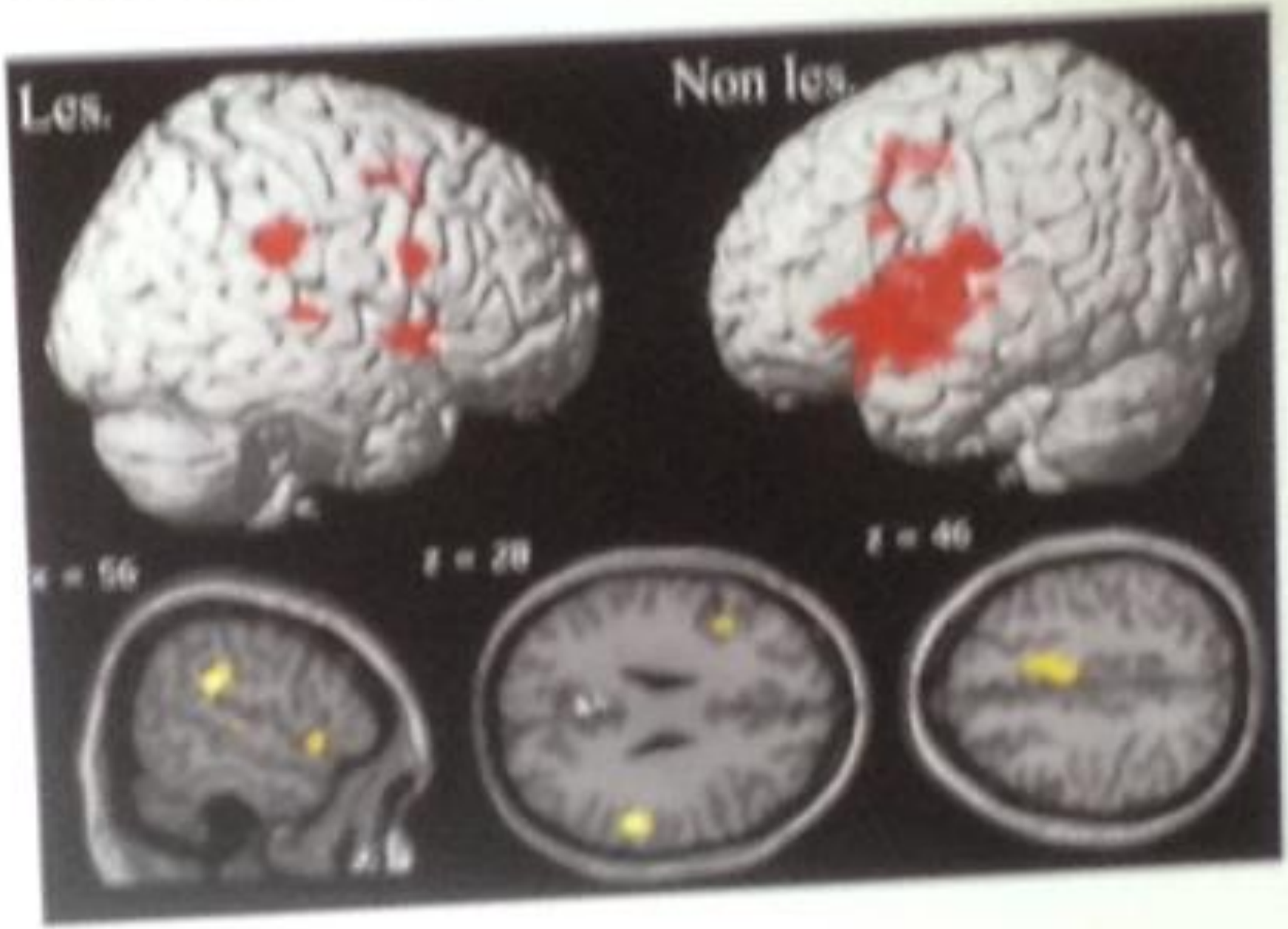
6 days per week,

4 weeks (9 -13 post-term wks)

Action Observation Training

Toy Observation Training

Observation therapy: changes in the cortical activation



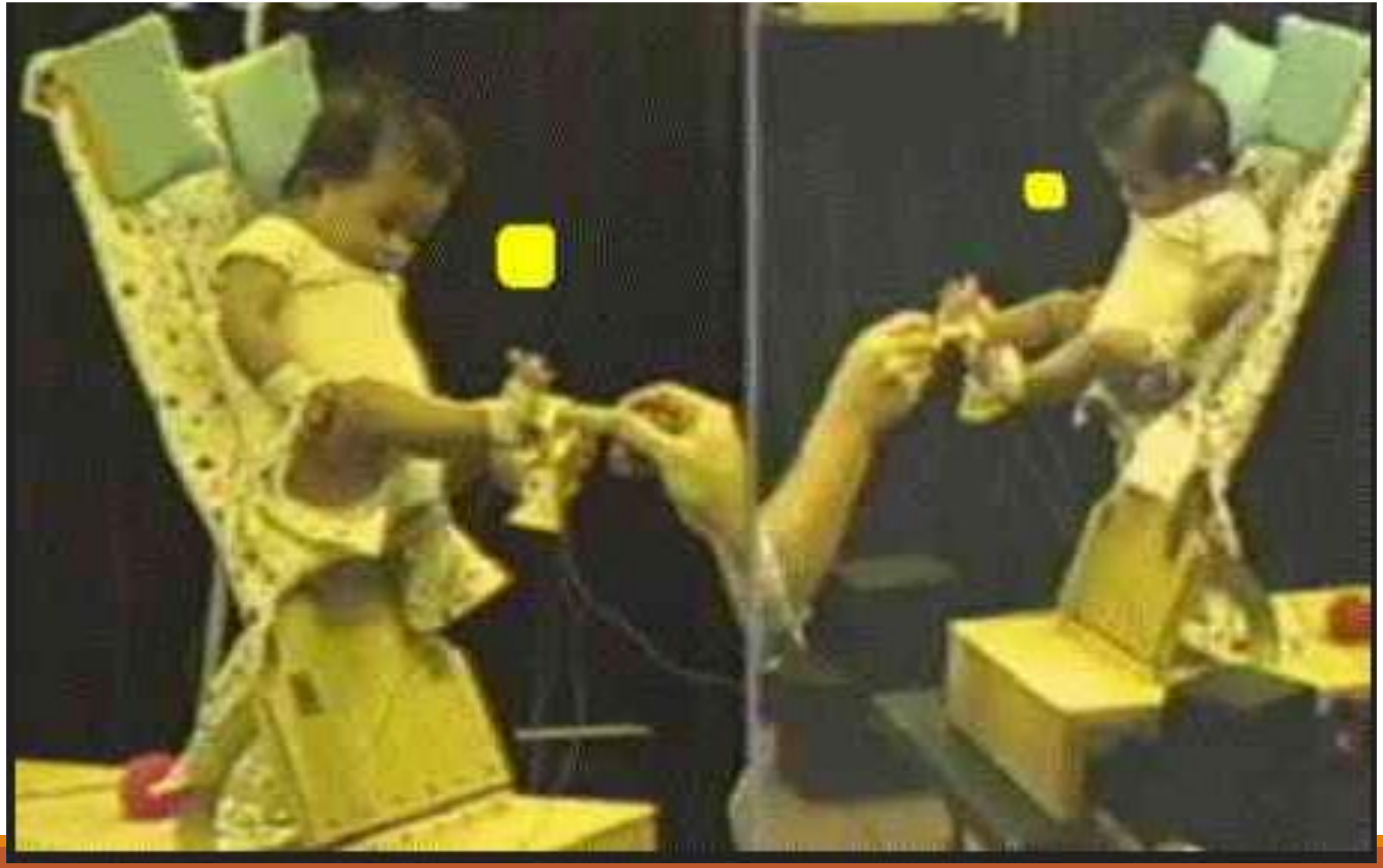
What did they do?

- Grasping
- Banging
- Fingering
- Mouthing
- Switching
- Hand to hand
- Squeezing
- Pressing
- Poking
- Slapping
- Scooting
- Dropping
- Rubbing

For the Feet

- Kicking
- Foot to foot
- Hands to feet
- Hitting toys with feet
- Passive cycling of feet

Galloway, 2004



Your feet work before your hands!

- Typical babies can “play” and activate switches with their feet before they can do these same activities with their hands
- The central pattern generator makes stepping “automatic”, “reflexive” and easy to elicit
- A body weight support treadmill system or gait trainer can help you elicit cause/effect and/or self initiated mobility

GET A KICK TOY!

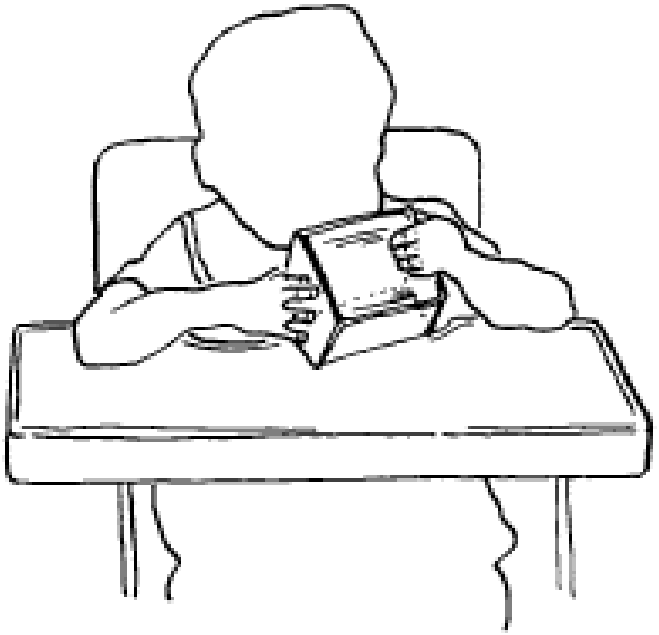
Depravation has consequences

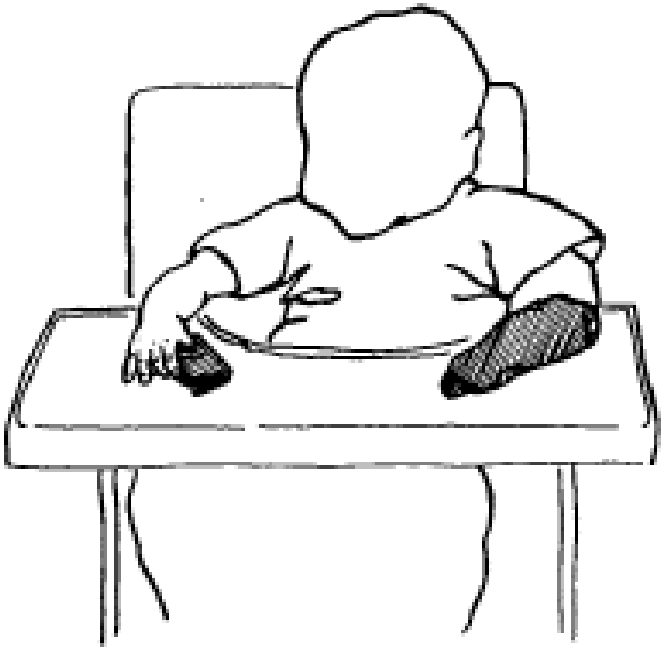
- We know that lack of mobility and opportunity for exploration leads to motor, language, cognitive, social and visual abnormalities

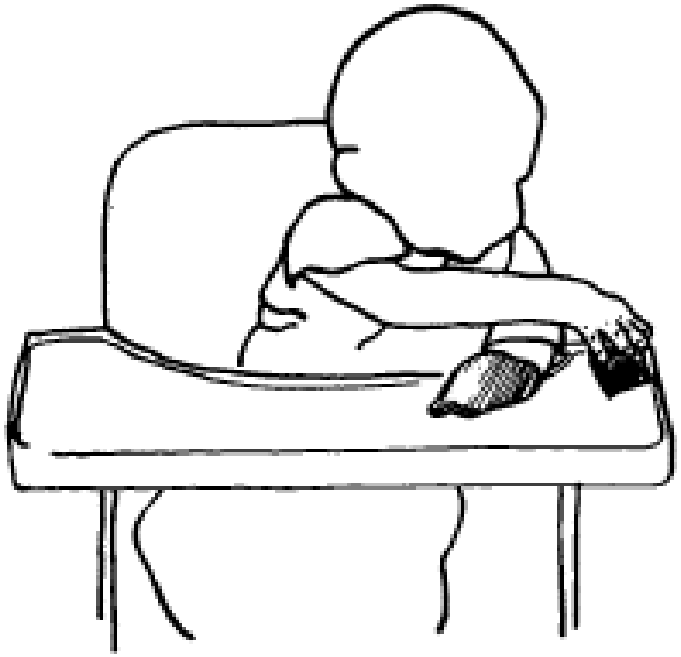
Lack of Use Has Negative Consequences

- Experiment created agnosia
- When the infant doesn't use her hand, her brain figures out how to work without it
- 4-12 months, < 20 minutes

Umansky, 1973







The opposite is also true

- If the child uses their hands, the brain alots more "space" (wiring) for it
- The more you use the hand, the better and more efficient the pathways get

Cocker, 2009

- A child less than one year of age with a diagnosis of hemiplegic cerebral palsy.
- A single-subject ABAB design with a 6-month follow-up evaluation
- The mCIMT involved constraint of the non-affected limb for 1-hour a day for 30 consecutive days as the child was engaged in developmentally appropriate, task specific activities implemented by therapists and parents.
- He was completing developmental motor tasks at his chronological age despite motor deficits resulting from a right-sided hemiparesis.

Gordon, 2011

- 90 hours of CIMT and bimanual training leads to greater improvements than 60 hours of the same treatments
- What is the correct dosage for mobility?

Ideas to get hands going

- First measure using the MACS or AHA (for unilateral)

I. Handles objects easily and successfully.

II. Handles most objects but with somewhat reduced quality and/or speed of achievement.

III. Handles objects with difficulty; needs help to prepare and/or modify activities.

IV. Handles a limited selection of easily managed objects in adapted situations.

V. Does not handle objects and has severely limited ability to perform even simple actions.

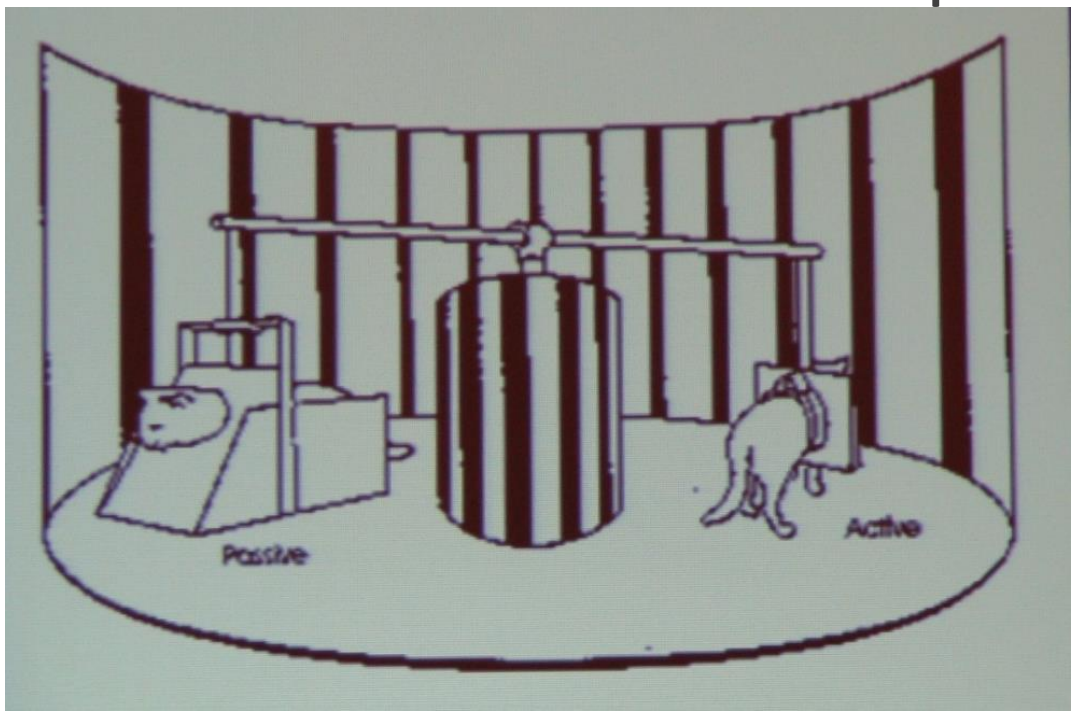
From macs.nu

Crawling is not good enough

- Vision is stimulated better when child is upright
- You need peripheral visual flow that results from your actions (not passive!)

Peripheral visual flow is vital

- Only cat that is moving “carousel” benefits
- Passive cat has no visual perception gains



(Kermoian R (1997) Locomotion Experience and psychological development in infancy. In: J Furumasu (Ed), *Pediatric powered mobility: Developmental perspectives, technical issues, clinical approaches (pp. 58-69). Arlington, VA: RESNA)*

Peripheral visual flow

- Movement stimulates this as next video shows.

You need to initiate the movement to learn

- If you just follow the GPS, do you learn the route?
- If someone else always drives?
- Children pushed in their chairs did not learn the route to their classroom, the ones who used power chairs, bikes, gait trainers and self propelled standers, did learn the route

Campos JJ, Anderson DI, Barbu-Roth MA, Hubbard EM, Hertenstein MJ, David W. Travel Broadens the Mind. Infancy. 2000;1(2):149-219.

- The onset of locomotion heralds one of the major life transitions in early development and involves a pervasive set of changes in perception, spatial cognition, and social and emotional development.
- The onset of locomotion, sets in motion a family of experiences and processes that in turn mobilize both broad-based and context-specific psychological reorganizations.
- We conclude that, in infancy, the onset of locomotor experience brings about widespread consequences, and after infancy, can be responsible for an enduring role in development by maintaining and updating existing skills.

Fox and Bell, 1995

- Crawling Experience is Related to Changes in Cortical Organization during Infancy: Evidence from EEG Coherence
- Mobility facilitates better brain organization

Crawling is not good enough

Over weeks of crawling, infants' judgments became increasingly accurate, and exploration became increasingly efficient. **There was no transfer over the transition from crawling to walking.**

Instead, infants learned, all over again, how to cope with slopes from an upright position.

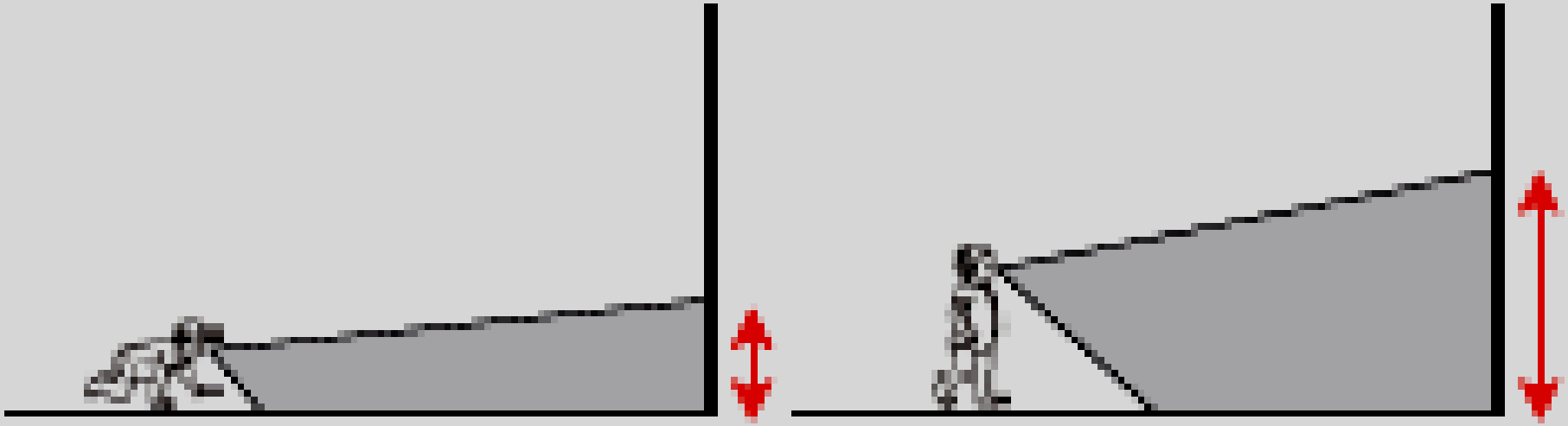
Adolph KE. Learning in the development of infant locomotion Monogr Soc Res Child Dev. 1997;62(3):I-VI, 1-158

Vision and Locomotion

- Prelocomotor infants who received locomotor-training (via a powered-mobility device) showed powerful effects on visual proprioception.

Uchiyama I, Anderson DI, Campos JJ, et al.
Locomotor experience affects self and emotion.
Dev Psychol. Sep 2008;44(5):1225-1231.

Highest Point Visible

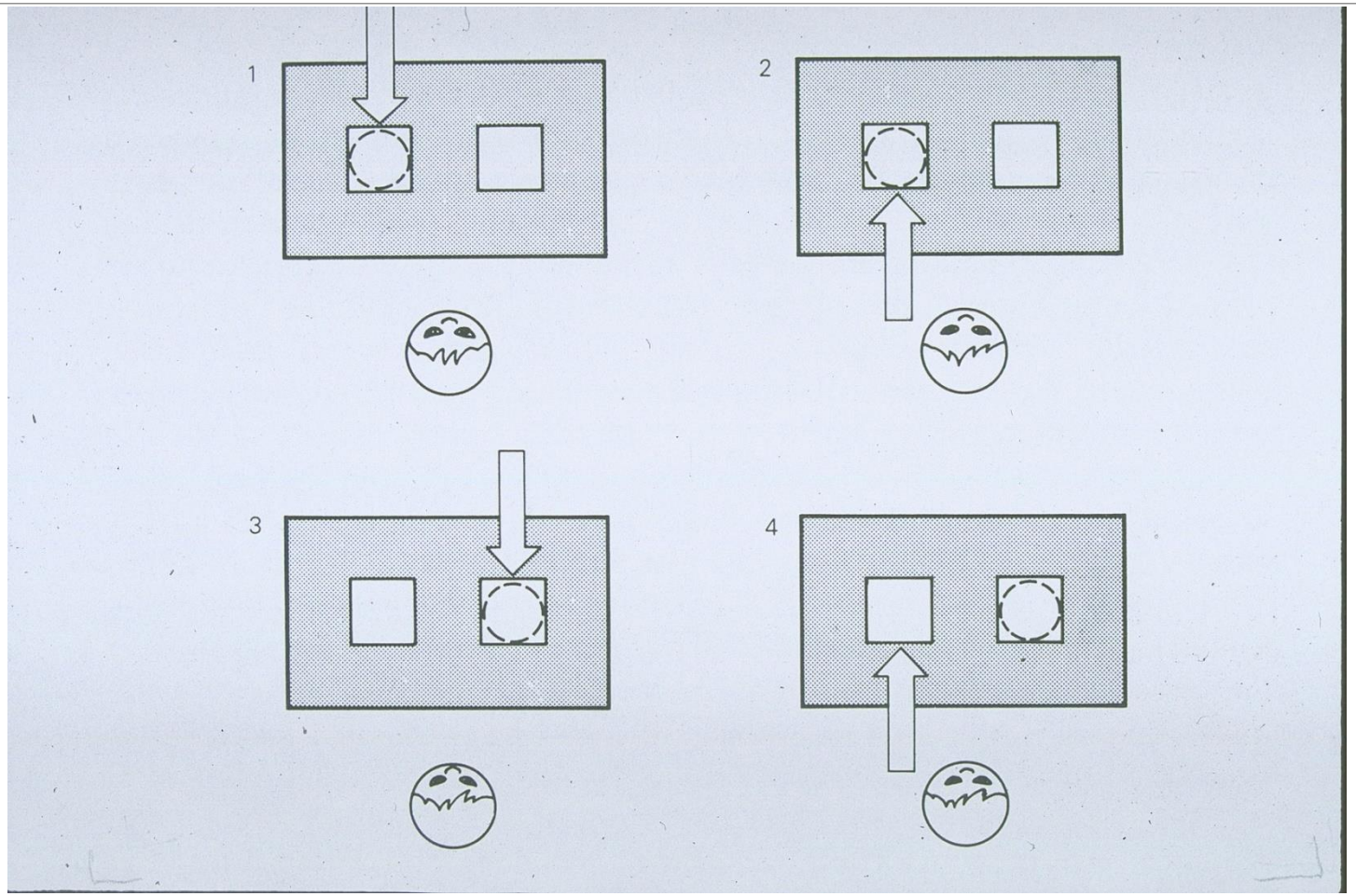


Kretch, Franchak, & Adolph (In prep)

Study Design

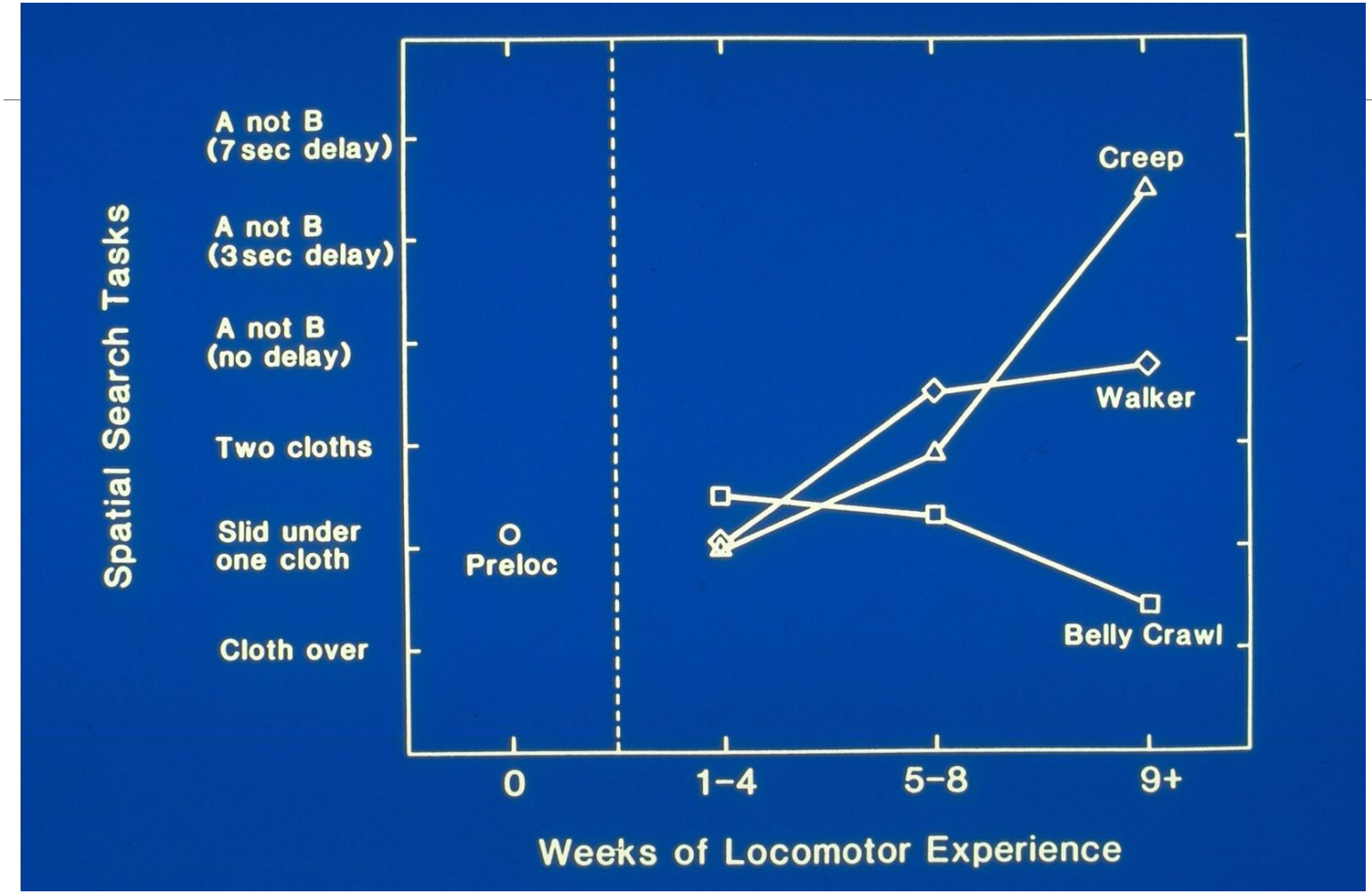
- All babies 8.5 months old
- Randomly assigned to baby walker 15 min 2x/day or no walker
- Pairs were matched for chronological age and developmental age

Testing Procedure



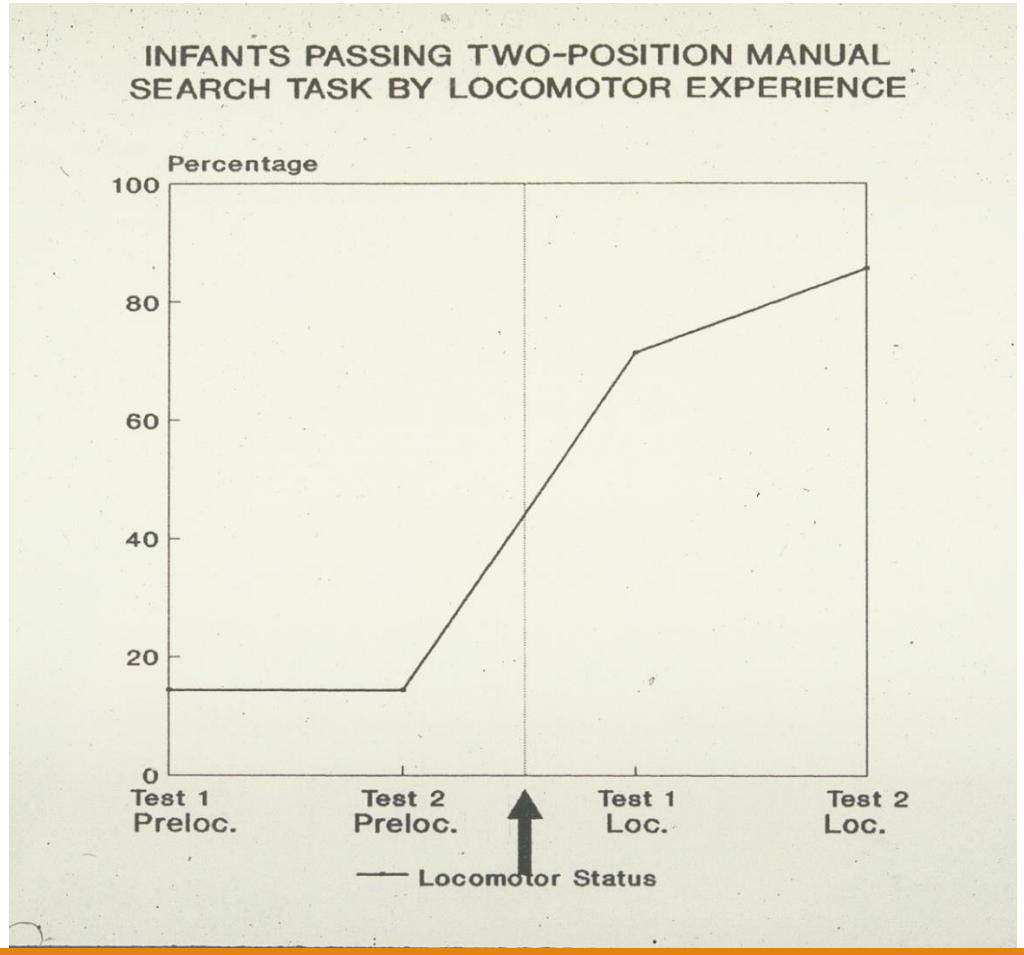
INFANTS PASSING TWO-POSITION MANUAL SEARCH TASK BY LOCOMOTOR EXPERIENCE

Belly Crawling Does Not Facilitate Object-Permanence Performance



Locomotor Experience: A Facilitator of Spatial Cognitive Development
Rosanne Kermoian, Joseph J. Campos *Child Development,* Vol. 59, No. 4 (Aug., 1988), pp. 908-917

Infants with Spina Bifida



Spatial Cognition in Infants with Myelomeningocele Impact of Mobility

University of California Berkeley Infant Studies Laboratory

M Rivera, J Campos, D Anderson, S Radtka, A Dahl, P Gutierrez

University of California San Francisco/San Francisco State University Graduate Program in Physical Therapy

Introduction

- Wealth of experimental evidence showing dramatic changes in cognitive, social, and emotional functioning after the onset of locomotion [1]
- Studies with typical developing infants demonstrates specific transitions in visual proprioception, wariness of heights, spatial search and coding, distance perception, and social referencing [1]

- Randomized controlled trials with a "powered mobility device" illustrate that psychological changes occur after locomotion onset [2]
- Findings imply that infants with motoric disabilities are at risk for a spectrum of psychological delays
- An investigation with infants with sacral myelomeningocele (MMC) demonstrate spurts in spatial search and joint visual attention after the onset of crawling [3]

Objectives

- The objective is to further investigate the effects of mobility delays in infants with lumbar and sacral MMC. Infants will be investigated longitudinally from immobility to mobility and measure various aspects of spatial cognition
- Specific aims
  - Document changes longitudinally in three spatial cognitive processes as infants progress from immobility to independent mobility
- Hypothesis
  - Infants with MMC will show marked improvement on all spatial cognitive paradigms following the onset of crawling experience, while age by itself will not significantly affect performance

Acknowledgements and Contacts

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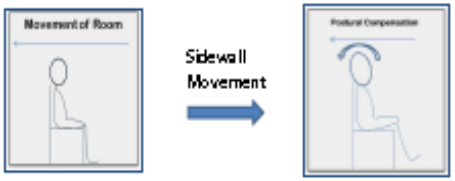
Children's Hospital Oakland, Kaiser Permanente Oakland, University of California San Francisco Benioff Children's Hospital

Contact: mariarivera@berkeley.edu

Visual Proprioception

- "Optically produced awareness of self motion that results from covariation between optic flow and self motion" [4]
- The *Moving Room* simulates the effects of optic flow by moving a visual reference point around a stationary posture
- Optic flow is stimulated by wall movement which mimics global (whole room) or peripheral (side wall) effects

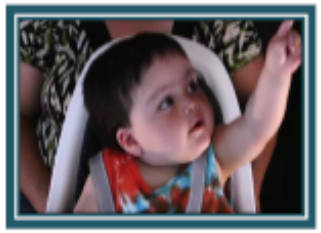


- Mobility facilitates perception of peripheral optic flow which has been identified in assisting in postural control and locomotion [5]

- Pressure transducers located under chair recording changes in the distribution of forces during a perturbation

Joint Visual Attention

- Mobility increases communication and mutual visual attention regarding objects and events in distal or allocentric space
- This paradigm captures spatial comprehension by following the gaze and point of an examiner in allocentric space
- Record the infant's visual attention after the examiner's gaze and point



Form Extraction

- Between 6 to 9 month infants display the ability to discern variations in form
- Mobility provides distinct advantages in object perception by changing the visual perspective and thus extracting distinctions in forms [1]
- During the training phase infants are exposed to a series of similar shapes and forms. During test trials infants are exposed to similar and a novel shape. Record the test trials noting distinctions in looking time to the novel shape

Significance

Delays in the Onset of Mobility

↓

Diminished Perceptual Experiences
Reduced Attention to Events/Objects

↙ ↓ ↘

Allocentric Space | Forms | Visual Proprioception

- Although acknowledging the role of genetics and other cognitive processes, the study will demonstrate the crucial role of mobility in facilitating psychological transitions
- Ultimately this research will promote a range of early mobility interventions enhancing psychological development

References

1. Campos JJ, Anderson DI, Barbu-Roth MA, Hubbard EM, Hertenstein MJ, Witherington D. Travel Broadens the Mind. Infancy. 2000; 1(2): 149-219.

2. Uchiyama I, Anderson DI, Campos JJ, et al. Locomotor experience affects self and emotion. Dev Psychol. Sep 2008; 44(5): 1225-1231.

3. Campos JJ, Anderson D, Iida-Kawakami R. Locomotor experience influences the spatial cognitive development of infants with spina bifida. Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie. 2009; 41(4): 231-238.

4. Gibson JJ. The senses considered as a perceptual system. Boston: Houghton Mifflin, 1966.

5. Higgins CI, Campos JJ, Kermoian R. Effect of Self-Produced Locomotion on Infant Postural Compensation to Optic Flow. Developmental Psychology. 1996; 32(5): 836-841.

36.00 x 24.00 in

Experimental Setting

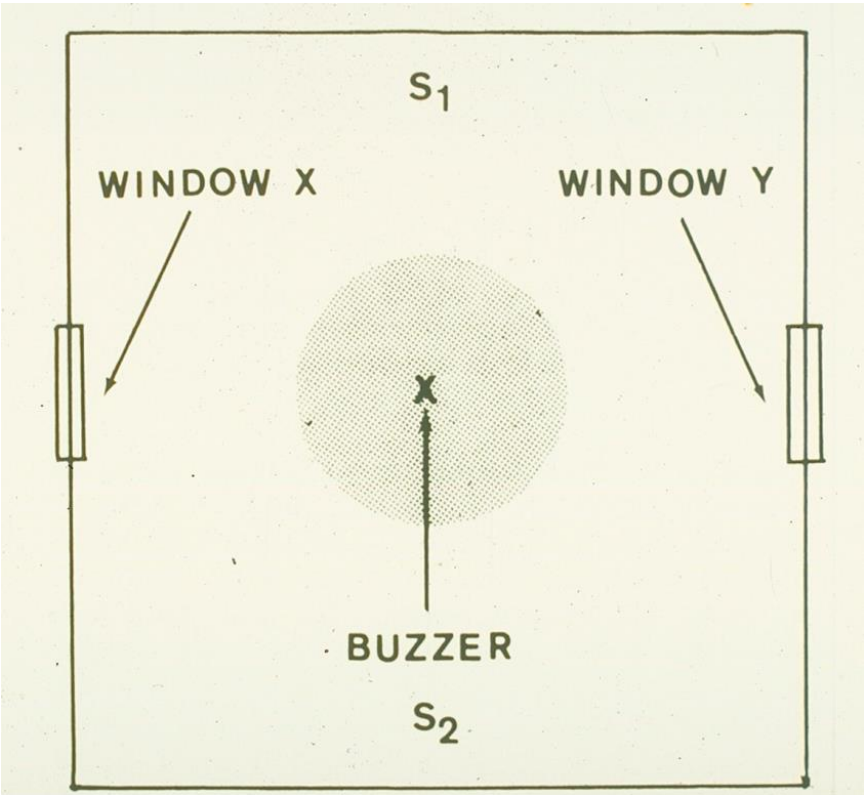
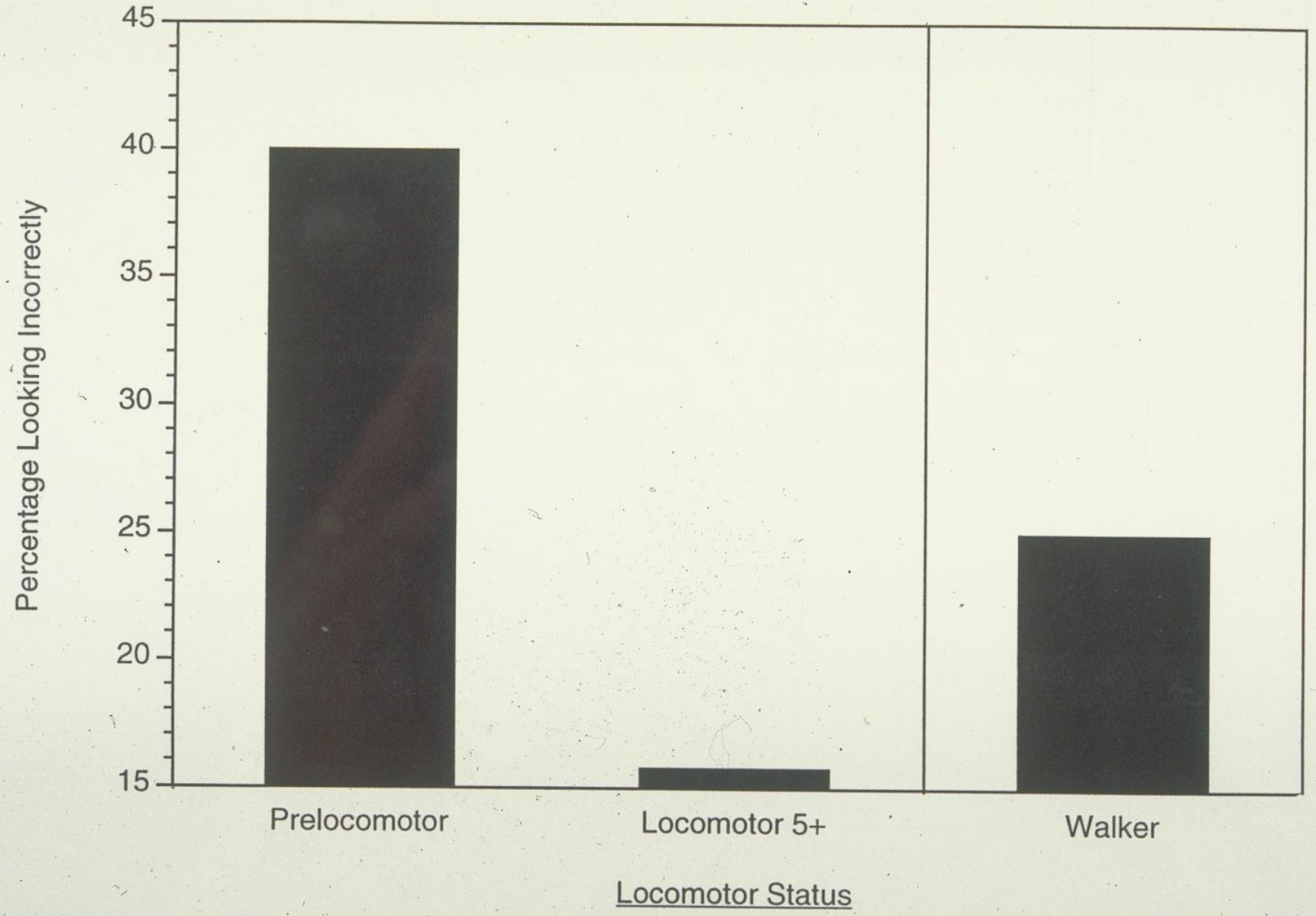


Figure 1. The experimental space.

Localization Following Rotation



Understanding Referential Gestures

- Following the gaze or point gesture
  - Direction of gaze or finger is the landmark
  - NEED THIS FOR LANGUAGE
  - (so mobility leads language)

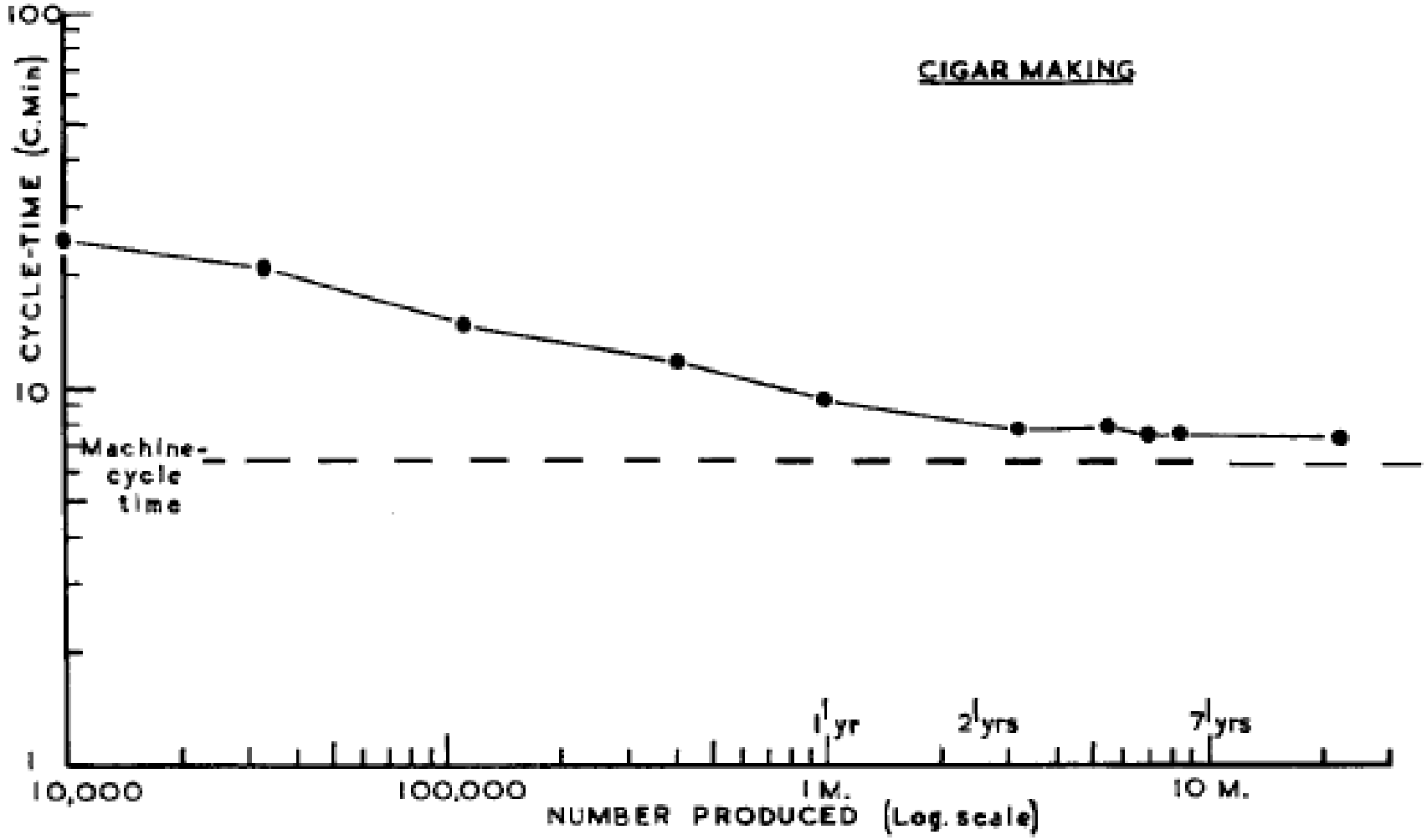


Figure 2. Practice and speed in cigar-making. Each point is the average cycle-time over one week's production for one operator. The ordinate is the total production by the operator since beginning work.

How many repetitions does it take for a baby to learn a new skill?

(Gaby is 9 months old)

How far do babies walk every day?

29 football fields!

6 hrs/day

500-1,500 Steps/hr)

(Adolph 2003)

New data – 39 football fields and over

10,000 steps a day!

What about kids with delays?

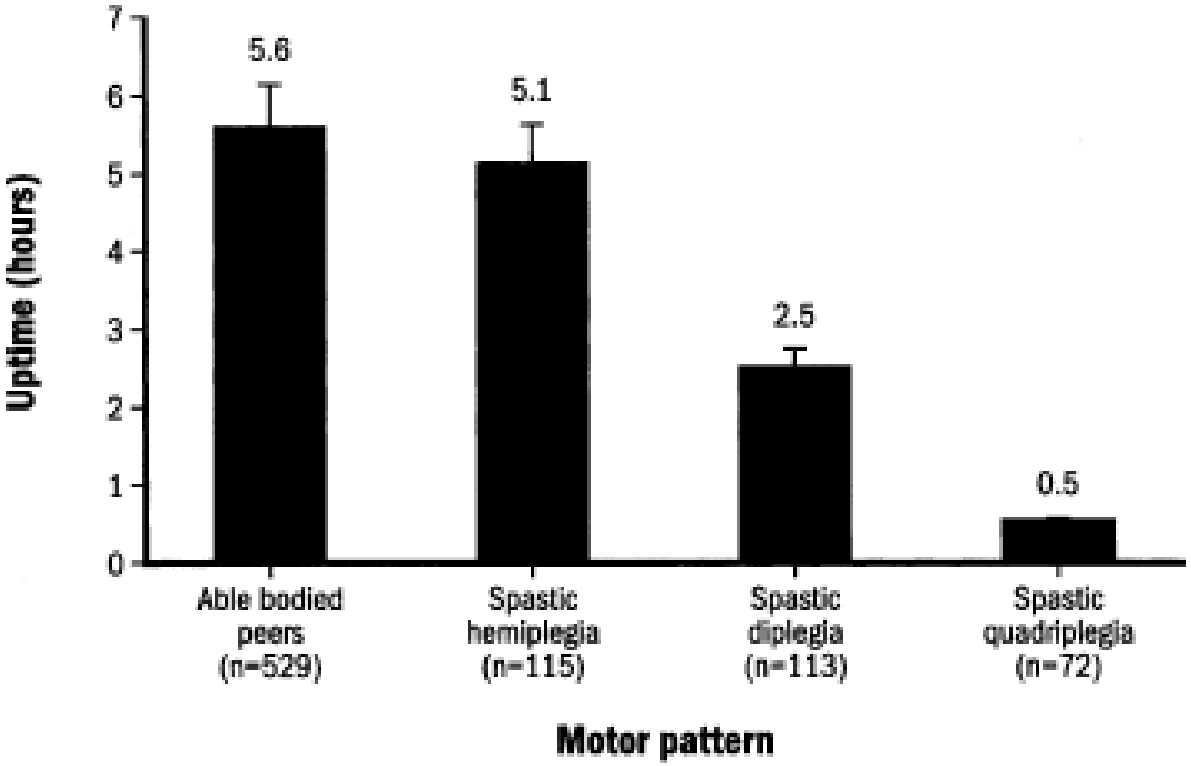
- What’s the proper dosage of activity

Kristie Bjornson, PhD, PT
Seattle Children's Hospital

Phys Ther. 2007 Mar;87(3):248-57. Ambulatory physical activity performance in youth with cerebral palsy and youth who are developing typically.

What Are They Really Doing? Dev Med Child Neurol. 2008 Mar;50(3):166

Physical Activity Measurement in Cerebral Palsy Pediatr Phys Ther. 2008 Fall;20(3):247-53.



Monitor Activity!

- Can we use Fitbit to monitor activity?
- $100
- Fitbit.com

Collect data during one bout

- GPS
- Current and average speed
- Distance Traveled

Monitoring Heart Rate

- Free app for your phone (uses flash from camera)
- Pulse oximeter on a lanyard ($69)

Babies can’t wait

- The brain has a critical period to develop sensory and motor systems that are efficient
- This peaks at age 2 years and then DECREASES
- If the child is not rolling by 6 months, sitting at 9 months, crawling by 12 months or walking by 18 months, they are two standard deviations from the mean and at highest risk to meet this magic moment of have maximal efficient self generated mobility to allow the brain to maximize cognition and language.

We know we need to do this but…

- Parents aren’t ready
- We have no funding
- The house is too small
- But maybe she’ll get better

Wasted time and lost neurons

- Every day after age 2 years, the ability to change/enhance the brain starts to decrease
- Stop waiting and act
- Use whatever you have or can make, borrow or salvage

Dosage for training?

- 30 min 3-5x/wk?
- 90 hours w/in 6 weeks? (Gordon, 2013)
- 1x/wk for 60 min is not enough!

Power Mobility (Livingstone and Paleg, 2014)

1. With access to a specialized power mobility device, it is possible for infants with disabilities to have augmented experiences as early as 8 months of age

2. Children can begin learning to maneuver a power mobility device below 14 months of age and those able to use a joystick have demonstrated competent control as young as 18-24 months

3. For children with minimal mobility experience, a power mobility device can promote overall development as well as functional mobility.

Power Mobility (Livingstone and Paleg, 2013)

4. For children with inefficient mobility, power mobility may enhance independence and participation in family, school and community life

5. There is no evidence that using power mobility at a young age impedes development of ambulation or other motor skills.

6. Children with conditions that limit early functional mobility may benefit from power mobility to promote independence and support overall development.

Power Mobility (Livingstone and Paleg, 2013)

7. Mobility experience in a power mobility device may support development of self-initiated behavior and learning

8. Many children with severe intellectual and/or sensory impairments can learn to use a power mobility device competently with appropriate practice and environmental support

9. Successful learning of power mobility skills may depend at least as much on practice time and quality of learning support within the child's environment as the child's motor, cognitive or sensory abilities

The tiny robot is ringed with sensors that can determine the obstacle-free roaming space, and will either allow infants to bump obstacles or will take control from the infant and drive around the obstacle itself.

Galloway, J.C., Ryu, J., & Agrawal, S.K. (2008). Babies driving robots: self-generated mobility in very young infants. *Intel Serv Robotics.*

- Early experiences, especially mobility, builds better brains
- You have access to technology, and a moral and ethical obligation to give each student the best evidenced based intervention you can
- Go back to work next week and pick one kid; **increase their activity and participation** and change their life forever

Meet some new People

- Turn to 3-5 neighbors
- Did you have an “aha” moment?
- Did you shift and think of something you might do differently? And why…
- Was there a particular kiddo that came to mind and you had a new idea?

Sleeping and Lying

IMAGE FROM PHISIOFUNCTION.CO.UK

Lying and Sleep Systems

- Introduction of the 24 hour postural management program
- Evidence based practice for the use of lying and sleeping systems)

24 hour postural management

- Pick one kid to start
- Make sure everyone is one board'
- Start slow and re-assess often
- You will have to go to where the child sleeps

YOU ALONE HAVE THE OPPORTUNITY TO HELP ONE CHILD HAVE LESS PAIN AND DEFORMITY

Take Home Points

- At school and at home, when children "rest" it must be with neutral hips, knees, ankle, spine, head, etc

What is postural management?

- 24 Hour Positioning
- Standing
- Sitting
- Lying
- Activity

Prevent Deformity!

- Gericke, Poutney and others have published low level studies saying it works
- Hagglund (Sweden) has done large RCT showing it works

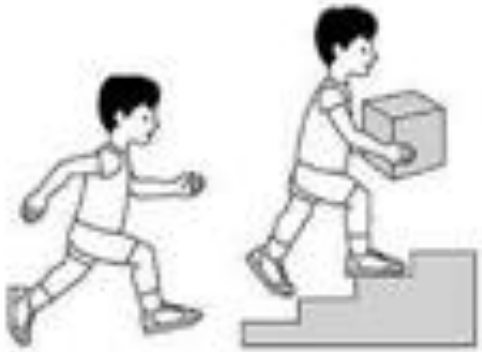
Who needs 24-hr Positioning?

- GMFCS 3-5
- Kids at risk for deformity/contracture
- Other groups?

Gross Motor Function Classification System (GMFCS)

Level	Description
I	Level I: **Walks Without Restrictions**; limitations are present in more advanced motor skills
II	Level II: **Walks Without Assistive Devices**; limitations are present in walking outdoors and in the community.
III	Level III: **Walks With Assistive Mobility Devices**; limitations are present in walking outdoors and in the community.
IV	Level IV: **Self Mobility With Limitations**; children are transported or use power mobility outdoors and in the community.
V	Level V: **Self Mobility Is Severely Limited**; even with use of assistive technology.

Palisano, R et al. Developmental Medicine and Child Neurology 1997; 39: 214-223



GMFCS Level I

GMFCS Level II

GMFCS Level III

GMFCS Level IV

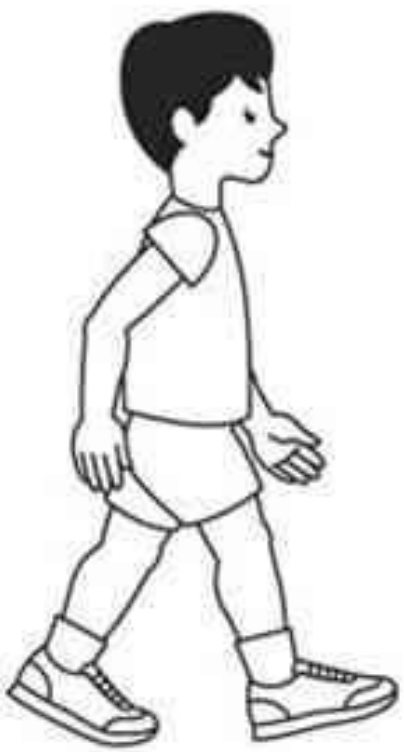
GMFCS Level V

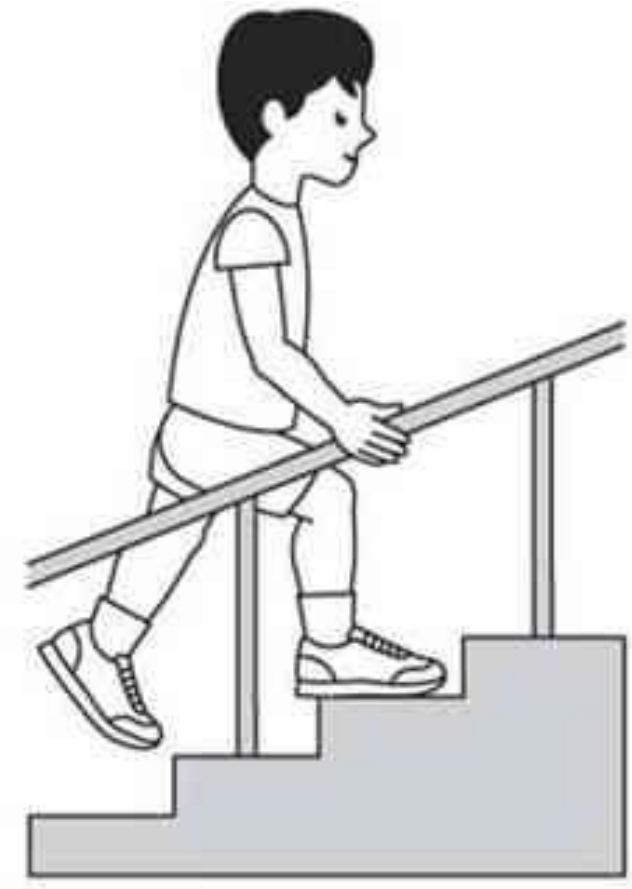
Level 1

- Uses no assistive devices (such as crutches)
- Can walk indoors and outdoors and climb stairs no limits.
- Can perform usual activities such as running and jumping
- Has decreased speed, balance and coordination

Level 2

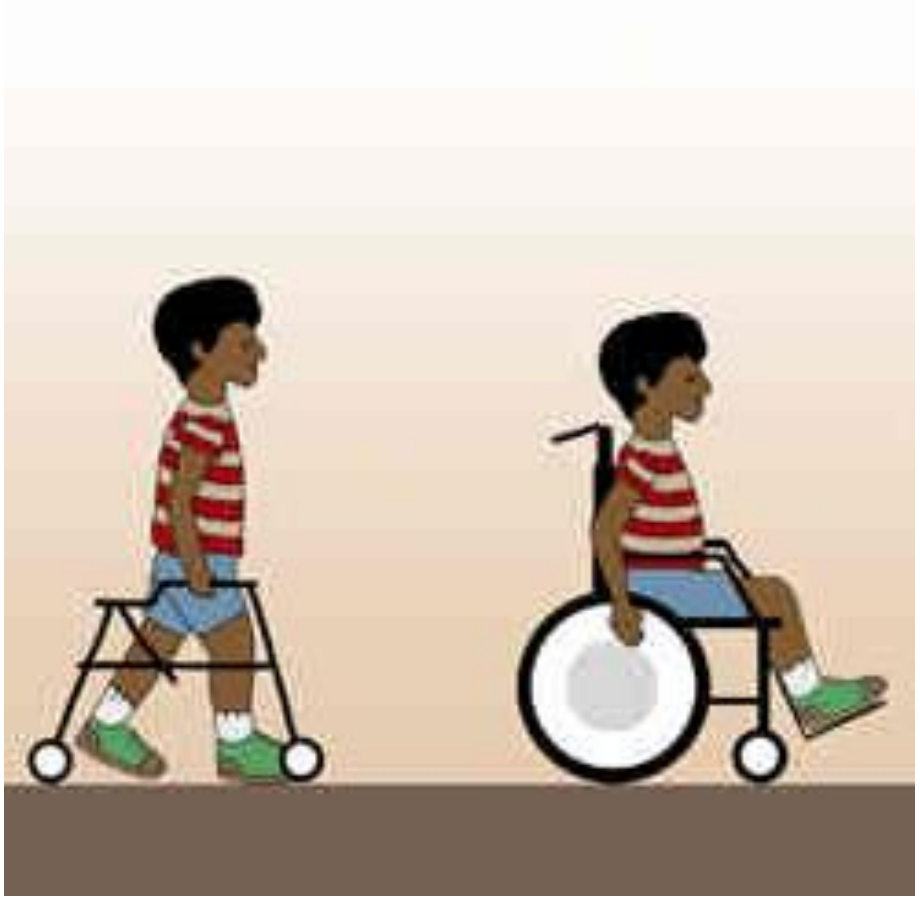
- Is limited in outdoor activities
- Has the ability to walk indoors and outdoors and climb stairs with a railing
- Has difficulty with uneven surfaces, inclines or in crowds.
- Has minimal ability to run or jump.





Level 3

- Walks with assistive mobility devices indoors and outdoors on level surfaces
- May be able to climb stairs using a railing
- May propel a manual wheelchair (with assistance needed for long distances or uneven surfaces)

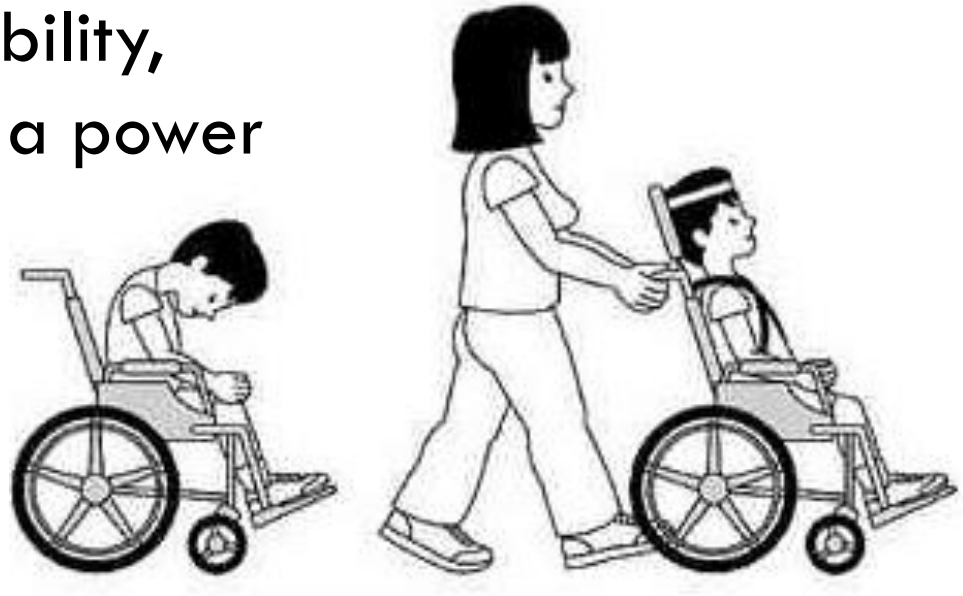


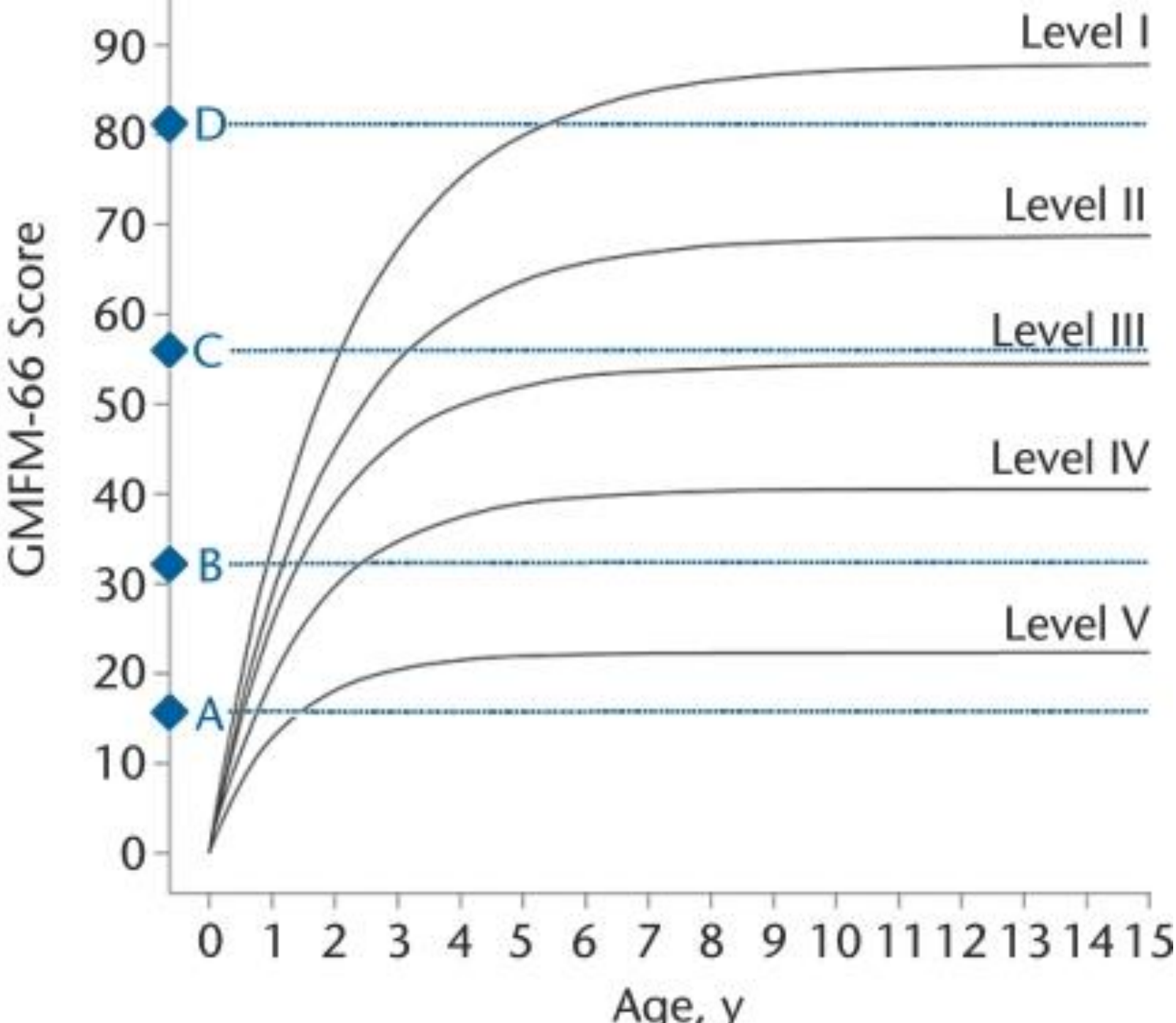
Level 4

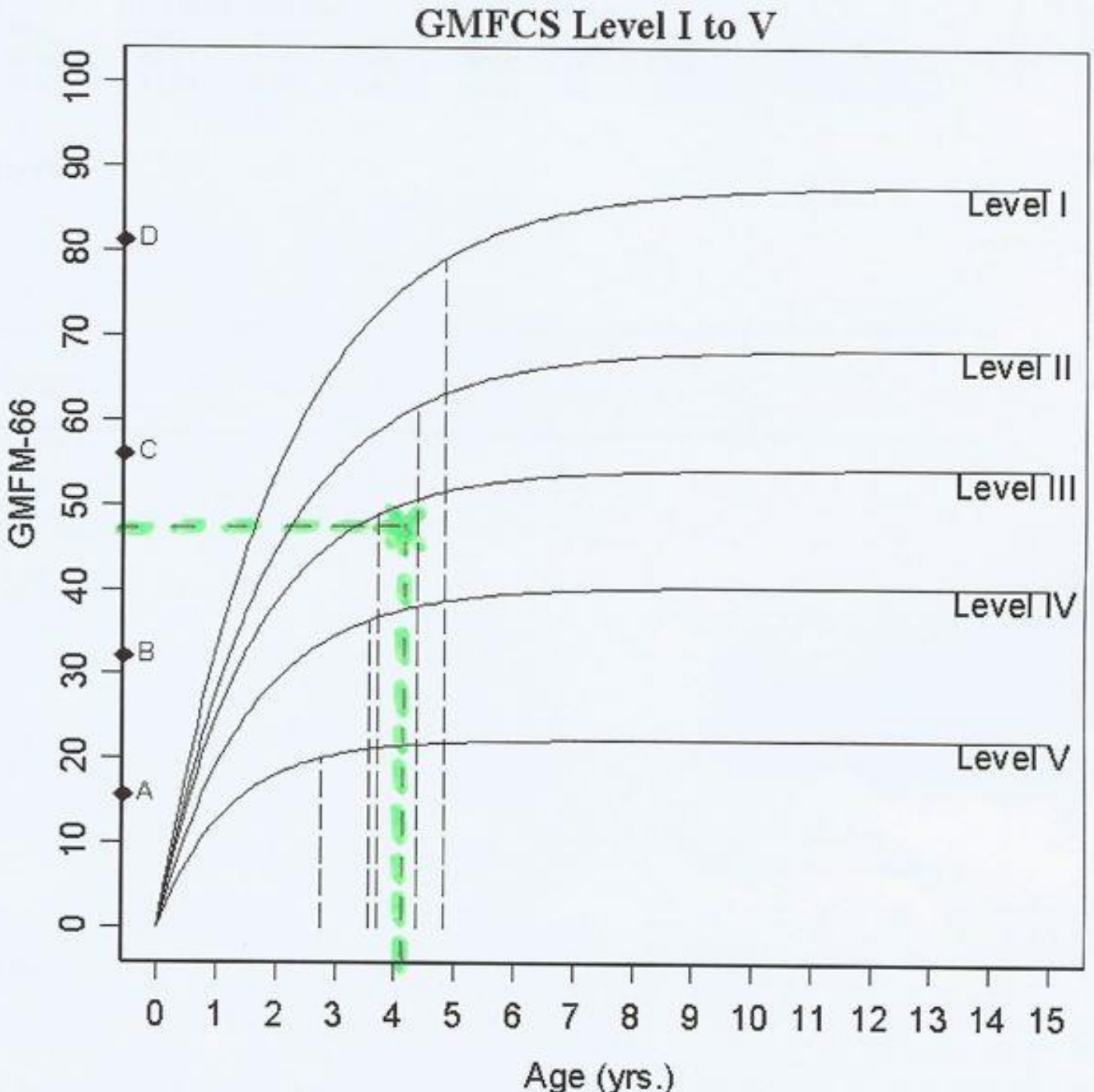
- Self-mobility severely limited even with assistive devices
- Uses wheelchairs most of the time and may propel their own power wheelchair

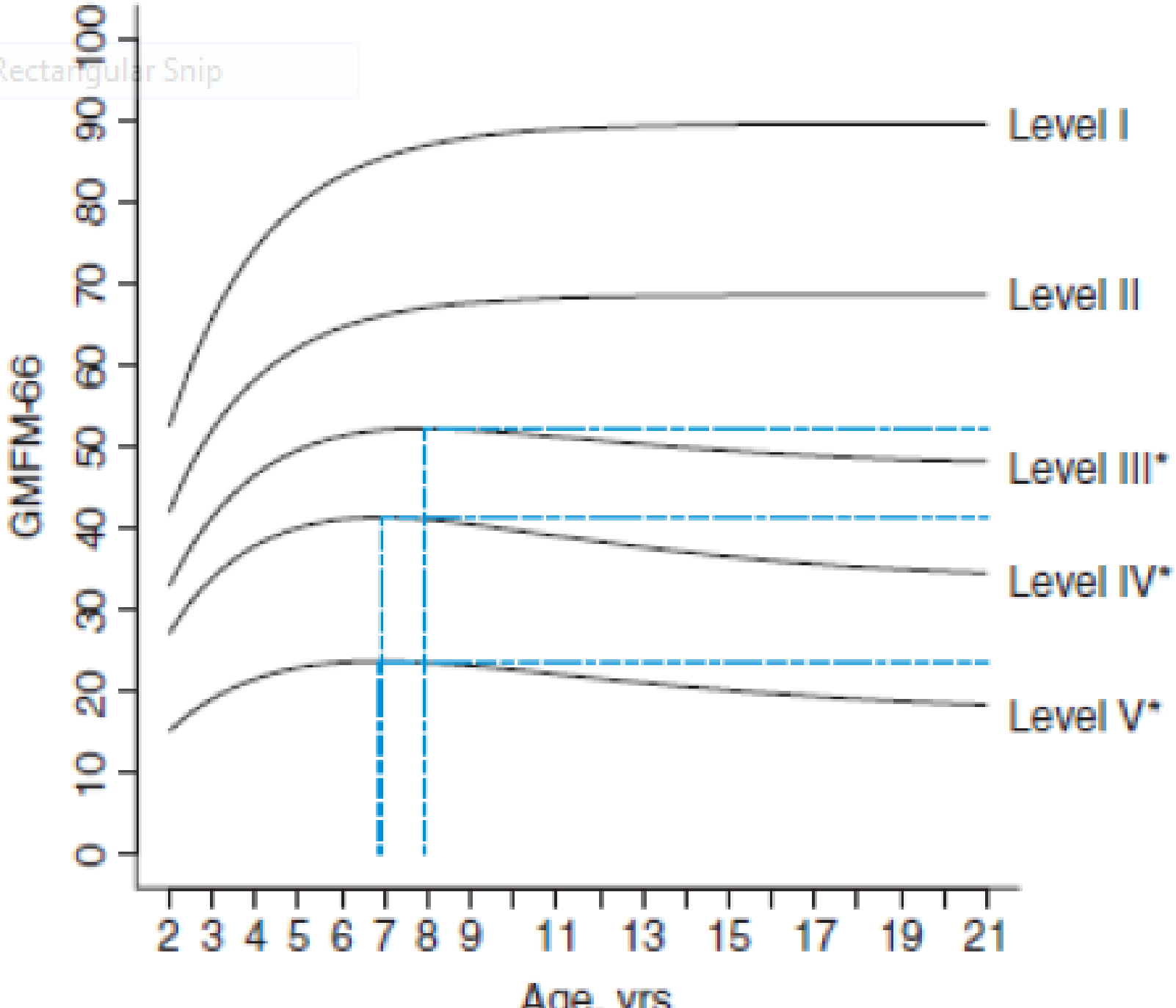
Level 5

- Has physical impairments that restrict voluntary control of movement and the ability to maintain head and neck position against gravity
- Is impaired in all areas of motor function.
- Cannot sit or stand on their own even with equipment.
- Cannot do independent mobility, though may be able to use a power wheelchair




GMFM-66 Score
90
80
70
60
50
40
30
20
10
0
D
C
B
A
Level I
Level II
Level III
Level IV
Level V
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Age, y


GMFCS Level I to V
GMFM-66
100
90
80
70
60
50
40
30
20
10
0
D
C
B
A
Level I
Level II
Level III
Level IV
Level V
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Age (yrs.)


Rectangular Snip
GMFM-66
0
10
20
30
40
50
60
70
80
90
100
Level I
Level II
Level III*
Level IV*
Level V*
2
3
4
5
6
7
8
9
11
13
15
17
19
21
Age, yrs

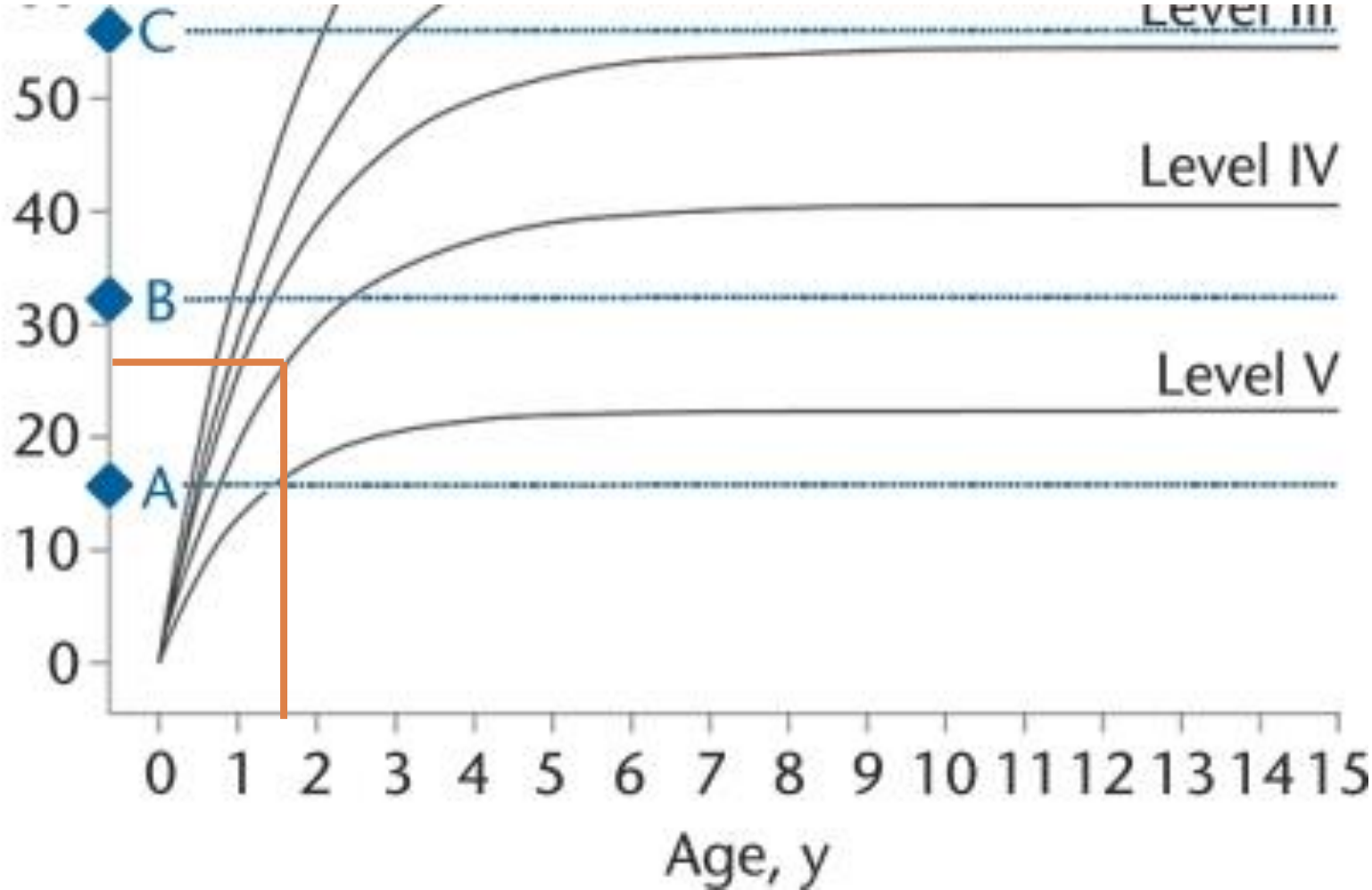
Bartlett, 2014

- N=429
- 58% and 75% of the variance in motor function explained by:
- Primary impairments (spasticity, quality of movement, postural stability, and distribution of involvement)
- Secondary impairments (strength, range of motion limitations, and reduced endurance)
- Adaptive behavior was a significant determinant only for Group 2 and participation in community programs was significant only in Group 1

Alice at 18 mos

Score = A:42, B:20, C:3, D:0, E:0

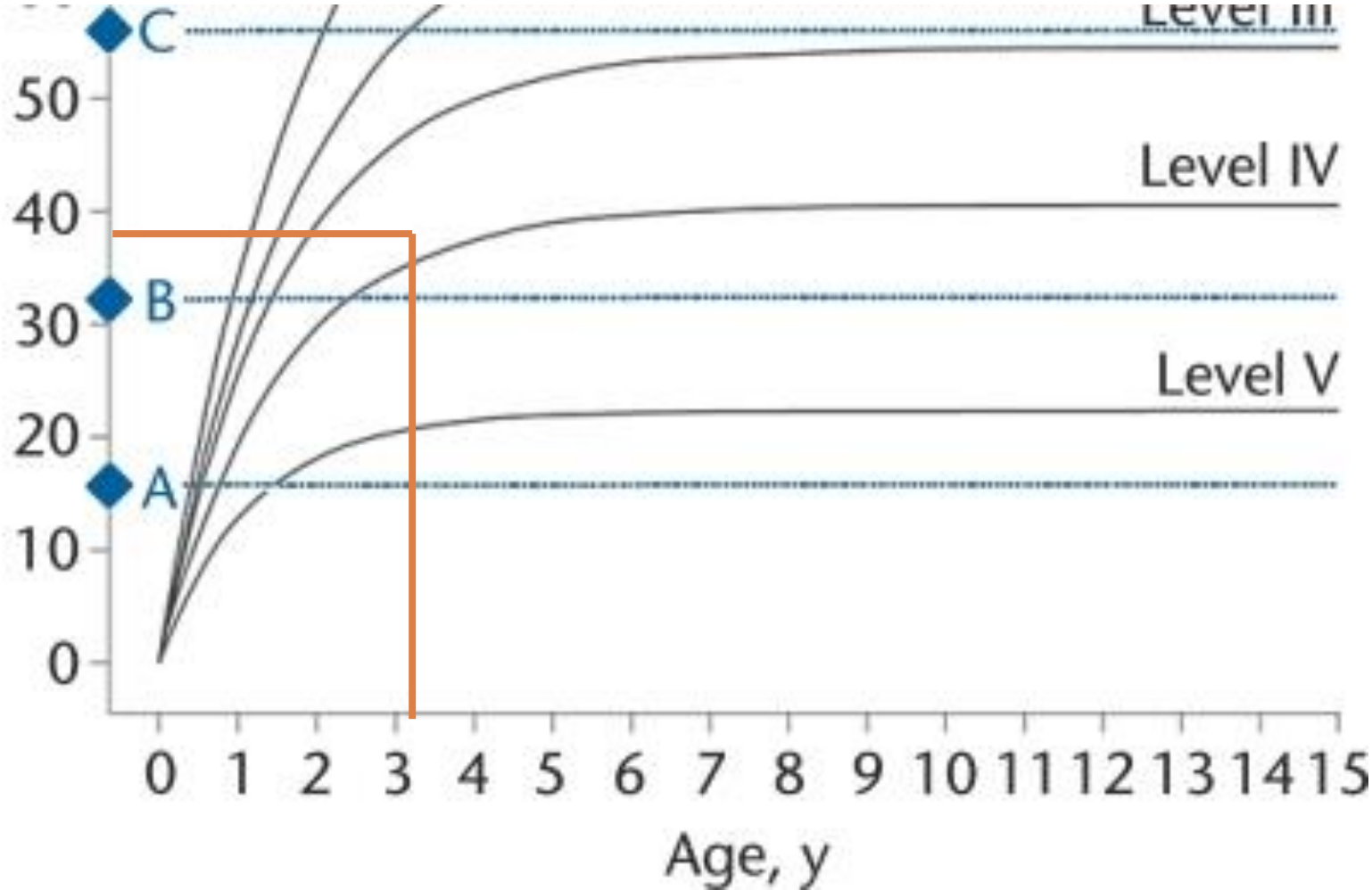
90%+33%+7%+0%+0%/5= 26%



Alice at 37 mos

Score = A:51, B:38, C:13, D:0, E:0

100%+63%+31%+0%+0%/5= 39%



GMFM-66 Percentiles by Age

GMFCS Level IV

Age		Percentile																				
		3	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	97
2 years	0 mo	21.2	23.1	25.7	27.4	28.6	29.6	30.4	31.2	31.9	32.6	33.3	33.9	34.6	35.2	35.9	36.6	37.3	38.2	39.3	40.8	41.7
	3 mo	21.2	23.2	25.9	27.5	28.7	29.7	30.6	31.4	32.1	32.8	33.5	34.1	34.7	35.4	36.1	36.8	37.5	38.4	39.5	41.0	42.0
	6 mo	21.7	23.7	26.5	28.2	29.4	30.5	31.4	32.2	33.0	33.7	34.3	35.0	35.7	36.3	37.0	37.8	38.5	39.5	40.6	42.1	43.1
	9 mo	22.1	24.2	27.1	28.8	30.2	31.2	32.2	33.0	33.8	34.5	35.2	35.9	36.6	37.3	[illegible]	[illegible]	39.6	40.5	41.6	43.2	44.2
3 years	0 mo	22.4	24.7	27.7	29.5	30.9	32.0	32.9	33.8	34.6	35.4	36.1	36.8	37.5	38.2	38.9	39.7	40.5	41.5	42.7	44.3	45.4
	3 mo	22.8	25.1	28.2	30.1	31.5	32.7	33.7	34.6	35.4	36.2	36.9	37.7	38.4	39.1	[illegible]	[illegible]	41.5	42.5	43.7	45.4	46.5
	6 mo	23.2	25.5	28.8	30.7	32.2	33.4	34.4	35.3	36.2	37.0	37.7	38.5	39.2	40.0	40.7	41.5	42.4	43.4	44.6	46.4	47.5
	9 mo	23.5	25.9	29.3	31.3	32.8	34.0	35.1	36.0	36.9	37.7	38.5	39.2	40.0	40.7	41.5	42.4	43.3	44.3	45.5	47.3	48.4
4 years	0 mo	23.8	26.3	29.7	31.8	33.3	34.6	35.7	36.6	37.5	38.3	39.1	39.9	40.7	41.5	42.3	43.1	44.0	45.1	46.3	48.2	49.3
	3 mo	24.0	26.7	30.2	32.3	33.8	35.1	36.2	37.2	38.1	38.9	39.8	40.5	41.3	42.1	42.9	43.8	44.7	45.8	47.1	48.9	50.1
	6 mo	24.3	27.0	30.6	32.7	34.3	35.6	36.7	37.7	38.6	39.5	40.3	41.1	41.9	42.7	43.5	44.4	45.4	46.4	47.8	49.6	50.8
	9 mo	24.5	27.3	30.9	33.1	34.7	36.0	37.2	38.2	39.1	40.0	40.8	41.6	42.4	43.3	44.1	45.0	45.9	47.0	48.4	50.2	51.4

To find these charts google "GMFM and percentiles"
www.canchild.ca

She's 5th percentile Level 3

Age		3	5	10
2 years	0 mo	37.0	38.2	40.0
	3 mo	37.1	38.4	40.2
	6 mo	37.4	38.6	40.5
	9 mo	37.6	38.8	40.7
3 years	0 mo	37.8	39.1	41.0
	3 mo	37.9	39.3	41.3
	6 mo	38.1	39.5	41.6
	9 mo	38.3	39.7	41.8

netchild.nl/pdf/classification-scpe.pdf

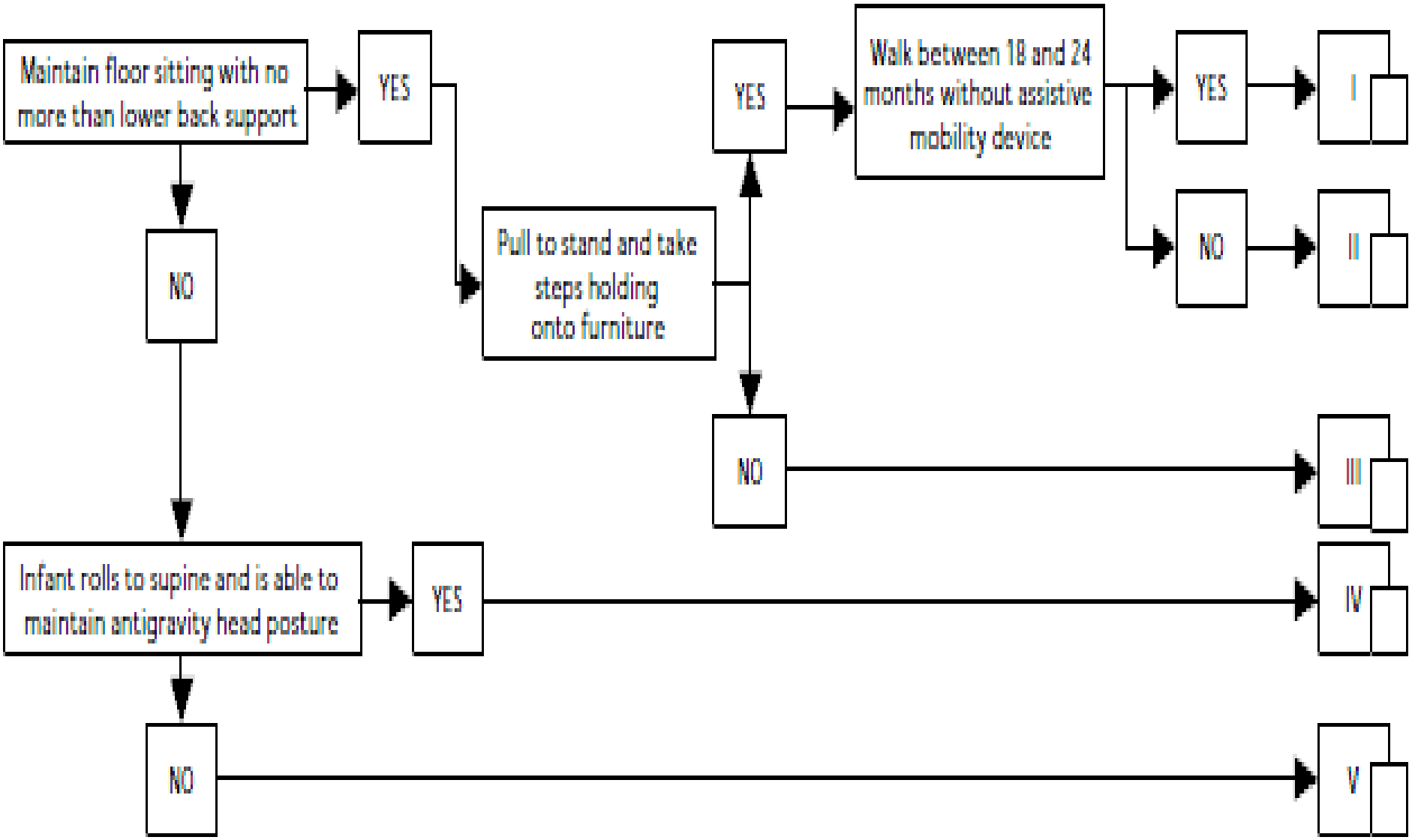
- Come from Utrecht

perrin@dehoogstraat.nl

b. by mail to:

Revalidatiecentrum De Hoogstraat
o.v.v. Perrin project
Rembrandtkade
Postcode letters Utrecht
The Netherlands

Before 2nd Birthday



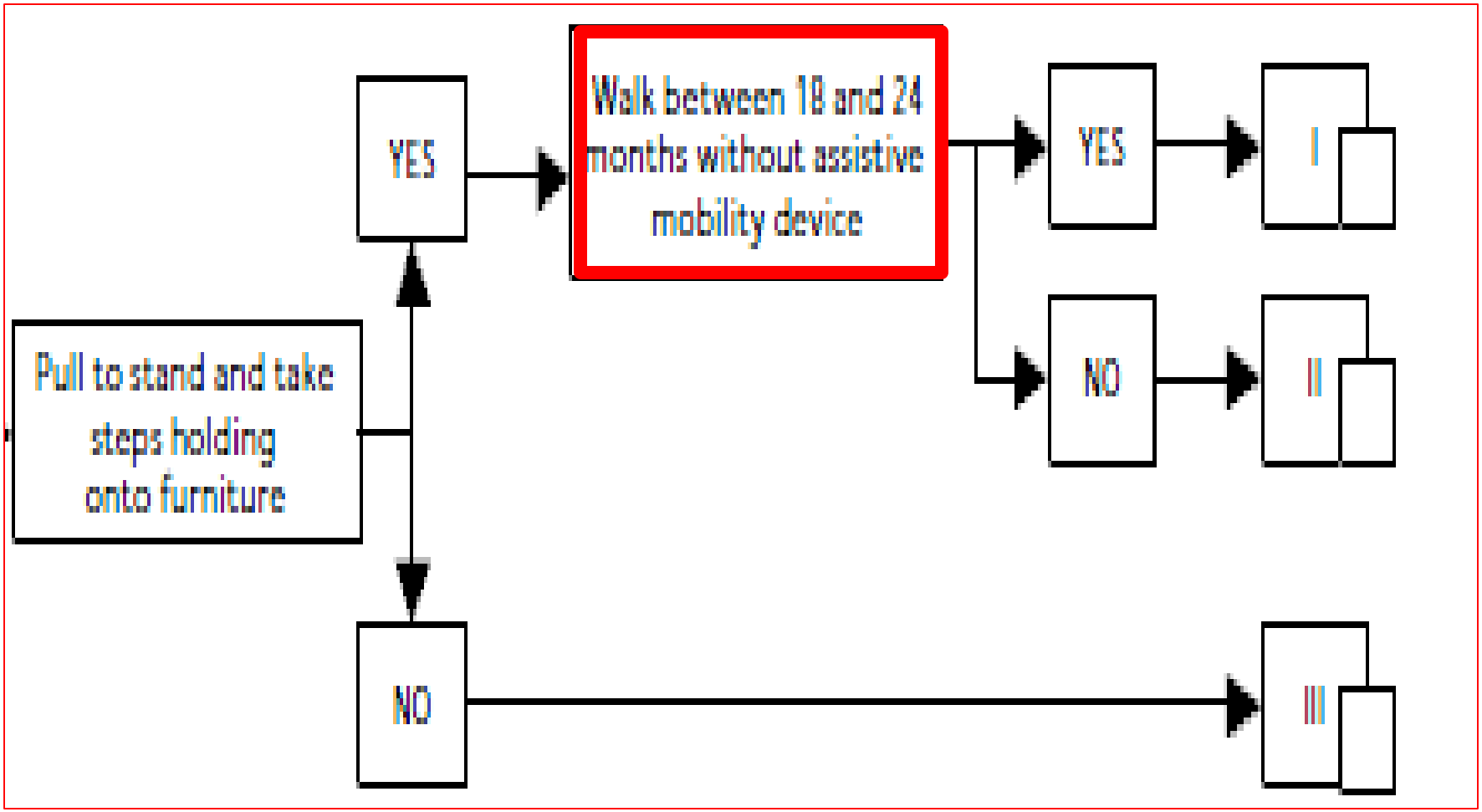
Before Age 2

- If you can't pull to stand and cruise, YOU WILL NEVER WALK INDEP

The evidenced based cold hard truth!

- Statistically, Alice will always need a gait trainer to walk in school and the community.
- You can still work on independent stepping in her home or classroom or walking with a walker.
- Dare to reach for goals within her means.

Before 2nd Birthday



Before 2nd Birthday

- In order for this to happen,
- You have to introduce the assistive device WAY before 18-24 months
- STOP WAITING
- Start a movement!

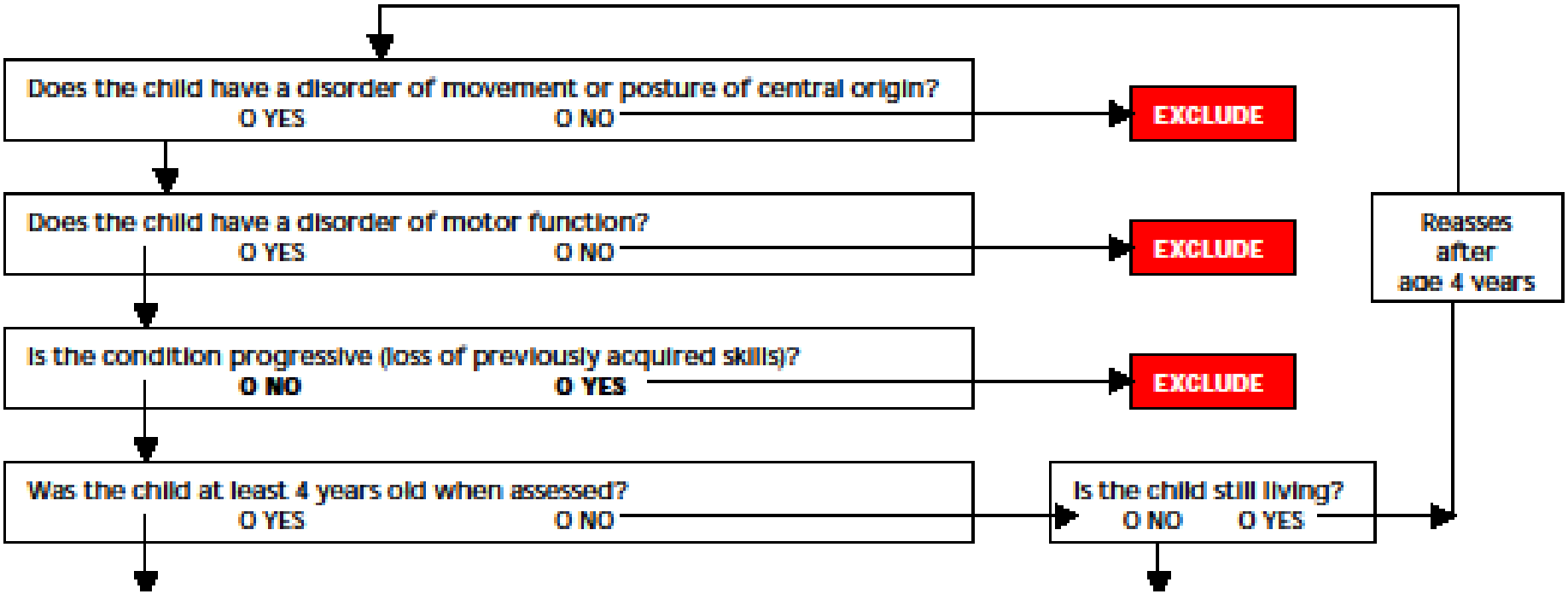
Walk between 18 and 24 months without assistive mobility device

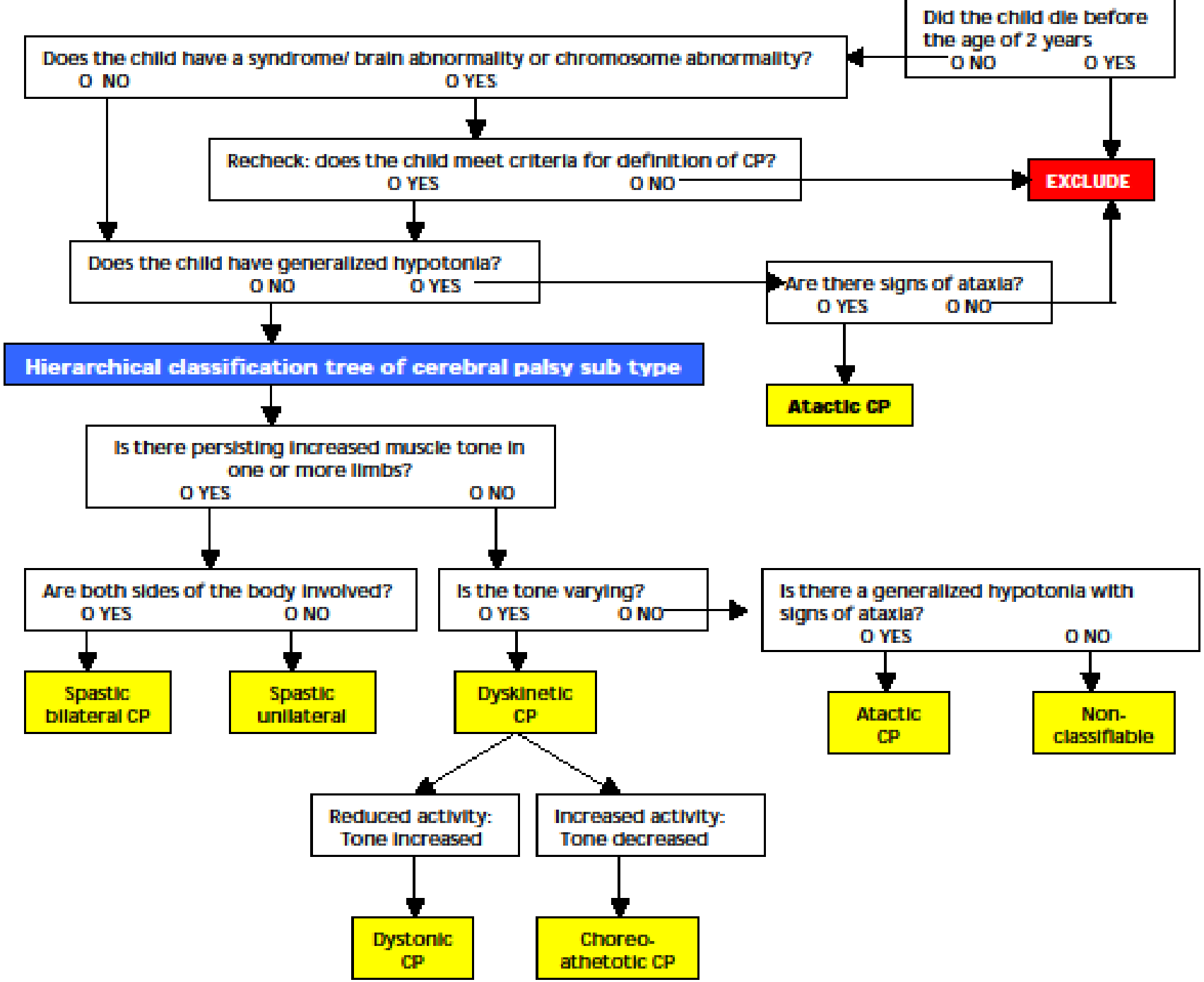
Who is GMFM/GMFCS valid for?

http://www.netchild.nl/pdf/classification-scpe.pdf

Classification of CP – Classification tree diagnosis and subtype CP

- **Start op top of the flow chart**
- **Check every step by crossing the option button of choice**
- **When you get to a** yellow (diagnosis) **or** red (exclude) **box, please circle it!**




Did the child die before the age of 2 years
O NO
O YES
Does the child have a syndrome/ brain abnormality or chromosome abnormality?
O NO
O YES
Recheck: does the child meet criteria for definition of CP?
O YES
O NO
EXCLUDE
Does the child have generalized hypotonia?
O NO
O YES
Are there signs of ataxia?
O YES
O NO
Atactic CP
Hierarchical classification tree of cerebral palsy sub type
Is there persisting increased muscle tone in one or more limbs?
O YES
O NO
Are both sides of the body involved?
O YES
O NO
Is the tone varying?
O YES
O NO
Is there a generalized hypotonia with signs of ataxia?
O YES
O NO
Spastic bilateral CP
Spastic unilateral
Dyskinetic CP
Atactic CP
Non-classifiable
Reduced activity: Tone increased
Increased activity: Tone decreased
Dystonic CP
Choreo-athetotic CP

Sitting can be a destructive posture

- Too Long (>6 hrs/day)
- Gravity is not disadvantaged
- Hamstrings and hip flexors tighten
- Scoliosis
- Hip Dyslocation
- Breathing
- Digestion

Sleep

- Learning is transferred from short term to long term memory during sleep
- Kids who are non-ambulatory have multiple sleep issues incl apnea
- Heat build up is #1 finding as cause of disrupted sleep
- Can we do better?

Sleep quality and respiratory function in children with severe cp using night-time postural equipment: a pilot study (Hill, 2009)

- 10 children ages 3-16
- GMFCS 4,5
- 2 nights in sleeping lab
- No difference in the quality of sleep overall
- 3 children-improvement in the SpO2 with the system

Options in the USA

- Jenx from Sammons
- Leckey from Otto Bock
- Bits and pieces

Jenx Dreama from Sammons

Use of a lying hip abduction system in children with bilateral CP: a pilot study

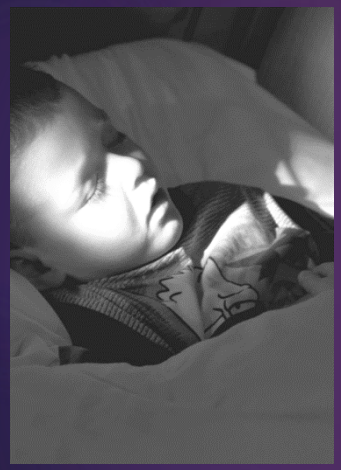
Hankinson& Morton 2002

- 14 children
- Ages 4-14
- Subluxed hip
- 18months in sleeping sys.

- **<u>7 complete the intervention</u>**
  - 13% improvement on the Rt hip
  - Lt hip decrease of 3%
  - 2 improve walking
  - ABD easier
  - Less pain
  - Sitting position
  - Easier caregivers treatment

Products

Bed time story…

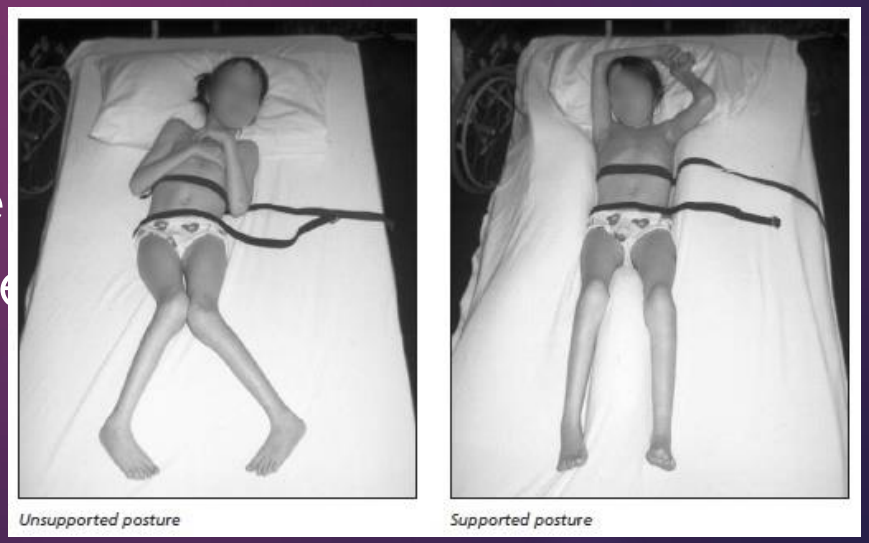


LECKEY
sleepform

Goldsmith 2000

- N=31 children
- Symmetrisleep Nighttime Equipment
- One year use
- No baseline data, no information of other treatments

- **Interview-questionnaire**
  - The majority lie straighte
  - Sleep-as well if not bette
  - muscle tone-reduced
  - pain-slightly less



Recipes….

- Would your students benefit from a structured lying program?
- Do you already have the tools you need?
- How should you begin?

Choose one student

- Do a full assessment
- Identify goals
- Write a plan of who will do it and what they will use
- How will you assess?
- How will you progress/modify?
- Can it also be done at home?

LET'S GET SOMETHING STRAIGHT!

GINNY PALEG, DSCPT, MPT, PT

WE FOUGHT THE INSURANCE COMPANIES!

- And won!
- BC/BS Anthem has changed their policy of calling standing "experimental".
- United funded one stander but not another.
- Lesson: Get help from everyone including the manufacturer of the product you are using.
- Contact your states free legal system.
- Family has to be willing to work on their insurance company and verify coverage and benefits
- HR folks need to be behind them.

LMN

- Getting funding starts with an appropriate letter of medical necessity (LMN)
- Learn what to say and what not to say
- LMNbuilder.com
- Contact the manufacturer for help
- Surf the web
- Never submit the same letter for different kids!

IT'S IN THERE

- IDEA 2004 requires IEP teams to consider the assistive technology needs of all children with disabilities. (20 U.S.C. 1414(d)(3)(B)(v))
- The IEP team makes decisions about assistive technology devices and services based on the child's unique needs so that he/she can be more confident and independent. The law requires schools to use assistive technology devices and services "to maximize accessibility for children with disabilities." (20 U.S.C. 1400(c)(5)(H))
- If the IEP team determines that a child needs assistive technology devices and services, the school district is responsible for providing these and cannot use lack of availability or cost as an excuse.

IT'S IN THERE

- IDEA defines an 'assistive technology device' as any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, **maintain**, or improve functional capabilities of a child with a disability. (20 U.S.C. 1401(1))
- IDEA defines an 'assistive technology service' as any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes - (A) the evaluation, (B) purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices, (C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing, (D) coordinating and using other therapies, interventions, or services with assistive technology devices, (E) training or technical assistance for such child, or(F) training or technical assistance for professionals (20 U.S.C. 1401(2))

THE LAW THAT GETS DME FUNDED BY MEDICAID

- EPSDT
- http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Benefits/Early-and-Periodic-Screening-Diagnostic-and-Treatment.html

GET ‘ER DONE

Other Necessary Health Care Services

States are required to provide any additional health care services that are coverable under the Federal Medicaid program and found to be medically necessary to treat, correct or reduce illnesses and conditions discovered regardless of whether the service is covered in a state's Medicaid plan. It is the responsibility of states to determine medical necessity on a case-by-case basis.

UNITED HEALTHCARE

- Apply for their grant

APPEALS

- Get help form the manufacturer of the device
- Go through the intake process with your state's disability attorney
- File a complaint with your state's insurance commissioner
- Call me

PEREDO, 2010

- Caregivers of children with motor disabilities completed an interview survey for children 0–21 years.
- 108 parents/caregivers reported 467 (mean = 4.3 per patient) pieces of owned equipment.
- The mean age of children was 7.1 years (± 5.0), and 49% were female. The most common diagnoses were cerebral palsy (45%), 'Other' diagnoses including intellectual disability (19%), genetic abnormality (13%), spina bifida (13%), and neuromuscular diseases (7%).

PEREDO, 2010

- Survey participants described use of the following types of equipment: orthotics (82%), bath chair (37%), seating device (34%), stander, (19%), augmentative communication devices (17%), walker (14%), and gait trainer (10%).
- Reasons for "non-use" of equipment included: outgrown (19%), not useful (14%), and child refusal (15%).
- Physicians were the sole prescriber for 15% of families, whereas physical or occupational therapists most commonly recommended new equipment (76%).

PEREDO, 2010

- Based on parental report, children with neuromuscular disabilities use most equipment that is medically recommended.
- The majority of equipment needs are identified by therapists. Pediatricians can benefit from additional expertise in the provision of medical equipment for children.

GOALS OF THIS EDUCATIONAL MODULE:

- Be familiar with evidence.
- Be able to write individual measurable achievable goals for a standing program.
- Be able to design and implement an evidence based standing protocol.
- Be familiar with different types of standers.

IN PRESS: DOSING FOR ADULTS

The following dosages are recommended to improve:

- ROM: 130-193 minutes a week; 30 minutes 4-7 times a week; moderate to strong evidence
- BMD: 300-360 minutes a week; 60 minutes 5-6 times a week; low to moderate evidence
- Activity and Participation: 145-200 minutes a week; 60 minutes 3 times a week; moderate to strong evidence
- Muscle Strength: 91 minutes a week; 30 minutes 3 times a week; weak, inconclusive evidence
- Spasticity and Tone: 161-165 minutes a week; 30 minutes 6 times a week or 60 mins 3x wk: weak, inconclusive evidence

IN PRESS: DOSING FOR ADULTS

- Mental function/QOL: 210-293 minutes a week; 60 minutes 4-5 times a week; very weak, inconclusive evidence
- Sensory function/Pain: 81-194 minutes a week; 30 minutes 3-7 times a week; very weak, inconclusive evidence
- Cardiovascular/Pulmonary function: 111-211 minutes a week; 30 minutes 4-7 times a week; very weak, inconclusive evidence
- Digestive/Bowel function: 135-202 minutes a week; 30 minutes 5-7 times a week: very weak, inconclusive evidence
- Skin integrity: 107-203 minutes a week; 30 minutes 4-7 times a week: very weak, inconclusive evidence
- Urinary/Bladder function: 131-241 minutes a week; 45 min 3-6 times a week: very weak, inconclusive evidence

PALEG, 2013

- Systematic review and evidence-based clinical recommendations for dosing of pediatric supported-standing programs.
- Ginny Paleg, PT, MPT, DScPT, Beth A. Smith, PT, DPT, PhD, and Leslie B. Glickman, PT, PhD.
- **Pediatric Physical Therapy**

GLICKMAN, GEIGLE AND PALEG (2010)

- A systematic review of supported standing programs.
- Journal of Pediatric Rehabilitation Medicine: An Interdisciplinary Approach 3 (2010) 1–17.
- Good place to get research to support your goals in an LMN.
- Available on my website www.ginnypaleg.com.

WWW.GINNYPALEG.COM

- Paleg, G. Standing Strong. Advance for PT. April 11, 2005 p39.
- Paleg, G. and S. Marino. Stand and Deliver: A Comparison of Self-Propelled Standers. Exceptional Parent Magazine. April 2000 p44-46.
- Paleg, G. Ask The Therapist- Hip Stability and Learning to Stand. Exceptional Parent Magazine. March 2000 p68.
- Paleg, G. Using Standing Aids as Tools for Nonweight-Bearing Treatments. The Advance for Physical Therapy. Oct. 28, 1996 p17

WHY SHOULD MY CLIENTS STAND?

- Prevent Contractures, Scoliosis and Hip Dislocation (Martinsson, 2010)

CLINICAL DOSING RECOMMENDATIONS FOR KIDS ALL 5X/WK

- Bone Mineral Density (60-90 minutes/day based on Levels of evidence: 2-4).
- Hip Biomechanics (60 minutes/day in 15-30 degrees of total bilateral hip abduction nd 10-15 degrees of external rotation, based on Levels of evidence: 2-5).
- Range of Motion (45-60 minutes/day based on Level of evidence: 2).
- Spasticity (30-45 minutes/day based on Level of evidence: 2).
- There are many more reasons that have not yet been proven by an RCT

TAYLOR, 2009

- N= 386 members of the APTA Pediatric Section and School-Based Special Interest Group.
- Ambulatory status dictated need for the prescription of standing-frame programs
- Pressure relief rated very important most frequently.
- More than 50% of respondents indicated social and educational benefits were very important.
- A majority of respondents prescribed standing-frame programs for 30–45minutes daily

STANDING IS EXERCISE FOR KIDS WITH GMFCS IV!

ISRALEI-MENDLOVIC, 2014

- N=30 w/ CP aged 6-12 years
- Children with GMFCS IV increased their Heart Rate and reduced Heart Rate Variability values during the GMFM assessment, the repeated task and during passive standing, while no such effect was noted among children with GMFCS V
- This may imply that the HR autonomic regulation system has an opportunity to be influenced by training

FEWER SUPPOSITORIES! (MAY 2014)

OCCUP THER INT. 2014 MAY 16. DOI: 10.1002/OTI.1370. [EPUB AHEAD OF PRINT] EFFECTIVENESS OF STANDING FRAME ON CONSTIPATION IN CHILDREN WITH CEREBRAL PALSY: A SINGLE-SUBJECT STUDY. RIVI E1, FILIPPI M, FORNASARI E, MASCIA MT, FERRARI A, COSTI S.

- Single-subject research design in one chronically constipated child with CP and quadriplegia, Gross Motor Function Classification System Level V
- Daily diary and the Bristol Stool Scale
- The standing frame did not affect the frequency of evacuations or the characteristics of the stool
- Reduced the inductions of evacuation and the related pain suffered by the child

What helps BMD?

Paleg,

- Static loading
- Loading and Unloading
- Twisting

Several older studies showed positive results

- But… usually only 1 or 2 areas increased in BMD while 1 or 2 others remained the same
- Change probably due to poor nutrition, inadequate sunlight, and/or seizure medications
- No study actually measured amount of weight bearing or loading!

Stuberg and deJong,1992

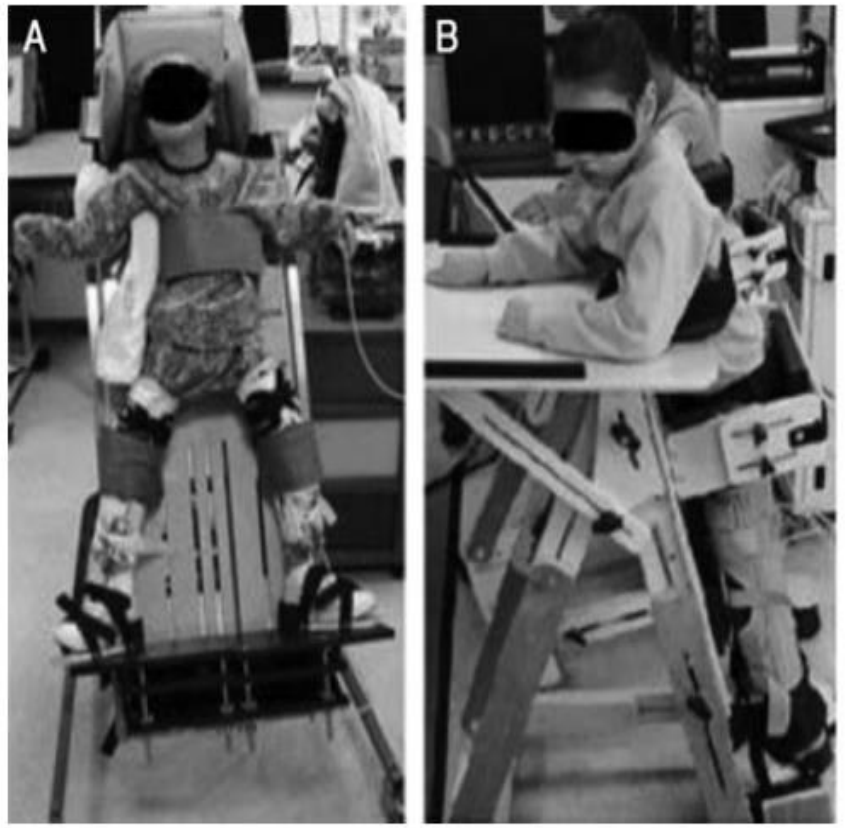
- Oxford Level 5 (never published)
- A significant difference in BMD of the femur and tibia was found in comparing the children with DD and the non-disabled controls (Table 1). The mean value at the femur was approximately 1/3 of normal and 1/2 of normal at the tibia.
- Significant loss for the tibia took place over the summer time interval.

Katz and Snyder, 2006 (Harvard RCT)

- Oxford Level 5, never published
- It is feasible to have non-ambulatory children participate in a rigorous standing program.
- Weightbearing increases BMD at weight-bearing bones only if compliance is sustained at least 7.5 hours a week.
- The intensive use of standers (10h/wk) may have a beneficial effect on BMD of weight-bearing bones in non-ambulatory children.

Damcott et al., 2013

- Methods: Four children in passive standers and 5 in dynamic standers were followed for 15 months (standing 30 minutes/day, 5 days/week)
- Results: Increases in BMD were observed during dynamic standing: whereas, passive standing appeared to maintain the baseline BMD
- Conclusion: Increases in cortical bone through loading interventions



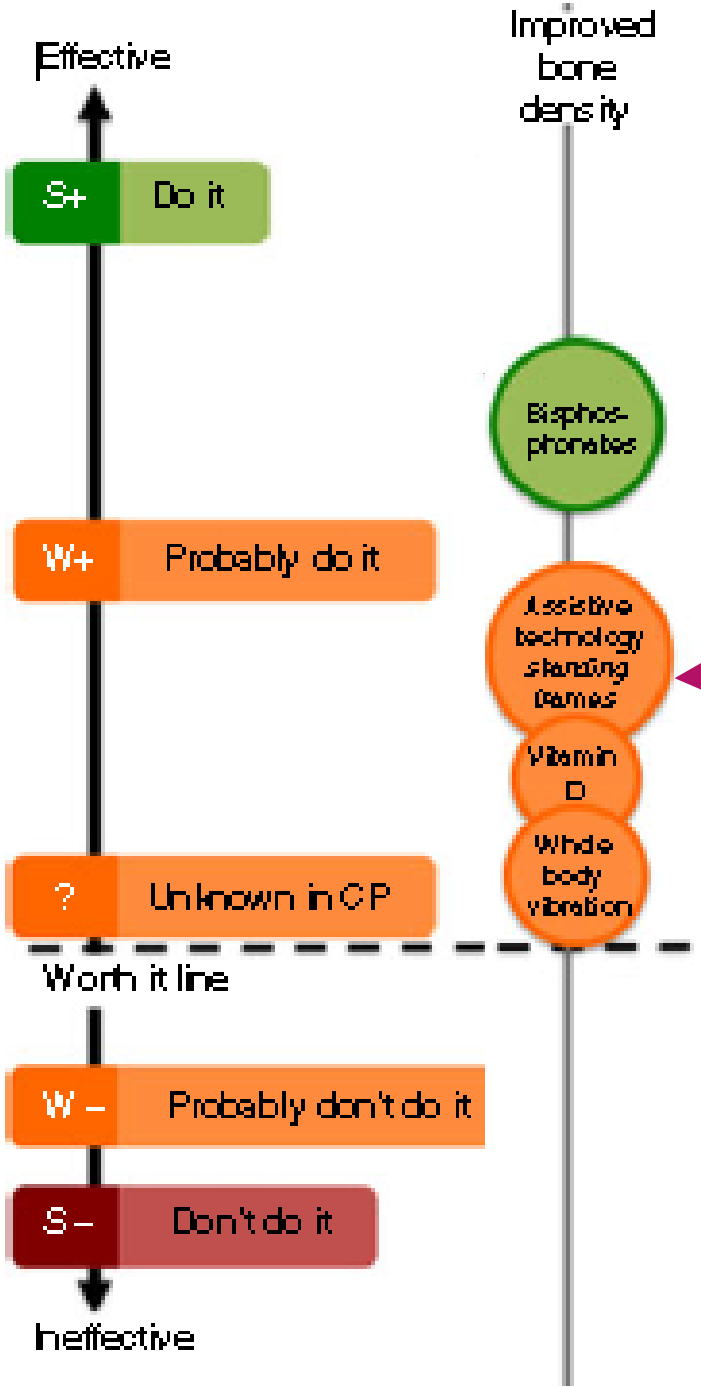
Uddenfelt et al., 2013

- Methods: Epidemiological retrospective study of 536 children with CP born between 1990 and 2005; data collected over 9-years
- Interpretation: Children at GMFCS Levels I–III had a similar incidence and pattern for fractures as normally developing children; Children at Levels IV and V had stunted growth
- Results:
  - Children using standing devices had a fourfold reduction in fractures without trauma
  - Regular loading exercises and early adequate nutritional intake could prevent fractures in children with severe CP

Novak et al. , 2013

- 178 systematic reviews identified from 1935-2013
- Data: 166 articles considered based on131 outcomes
- Results: 21green light (Go), 76 yellow light (Probably), and 26 red light (No) interventions
- Interpretation: Based on16% effective (ok to use), 70% probably effective from lower level studies (use sensitive outcome measure to monitor progress), and 6% ineffective (discontinue)

Systematic Review on ALL interventions for children with CP Iona Novak, 2013 (Australia)



Standers

Optimal dosage

- Bone mineral density (60-90 minutes/day, based on Levels 2-4 evidence)

QUESTIONS AND DISCUSSION ABOUT BMD

Video from youtube

Gibson et al., 2009

- Participants: 5 non-ambulatory children with CP ages 6-9 years
- Activity progression:
  - Stood in a standing frame for 1 hour, 5 days/week, for 6 weeks
  - No standing frame for 6 weeks
  - Each phase repeated
- Data:
  - Popliteal angle measures at baseline and weekly throughout the study period
  - Feedback from caregivers about ease of performing ADLs at the end of each standing and non-standing phase

Gibson et al., 2009

- Hamstrings significantly elongated during standing phases:
  - Mean improvement of 18.1degrees for first standing phase
  - Mean improvement of 12.1 degrees for second standing phase
- A trend for hamstrings to shorten during non-standing phases :
  - Mean change of -14.0 degrees for first non-standing phase
  - Mean change of -7.3 degrees for second non-standing phase
- Caregiver input: transfers and ADLs became easier after standing-frame usage phases

Curtis, 2014

- N=8 children with CP GMFM I-III, aged 4-10 years
- Trained intensive active dorsiflexion in an interactive dynamic stander using ankle movement to play custom computer games following a 10-week control period.
- Median active and passive ankle dorsiflexion increased significantly (5 and 10 degrees, respectively) with extended knee
- There was a small but clinically significant increase in GMFM scores

Martinsson & Himmelman, 2011

- Participant group: 205 non-ambulatory children with CP
- Control group: matched for age, motor ability, and surgery (from a national cerebral palsy follow-up study)
- Activity: 1 year of daily, straddled (abduction) weight bearing program
  - Positioning in maximally-tolerated hip abduction and hip and knee extension for 30, 60 and 90 minutes/day
- Results:
  - Participants using straddled weight-bearing after surgery had the largest decrease in migration percentage (MP)(n=20 controls; p=0.026)
  - Children using straddled weight-bearing at least 1 hour/day for prevention also improved (n=8, 63 controls; p=0.029)
  - Hip and knee contractures were found only in control group

60 Degrees ("OUCH")

Martinsson & Himmelman, 2011

Superstand HLT abduction foot system

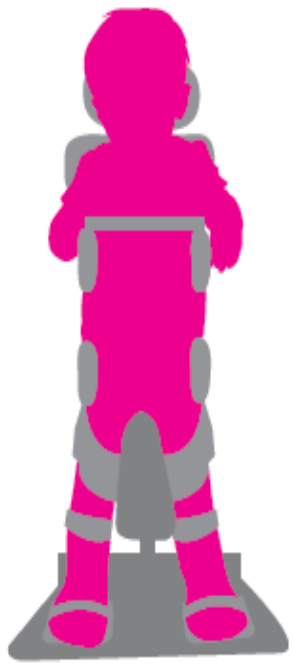
Sunny Hill Children's Hospital

www.childdevelopment.ca

http://www.childdevelopment.ca/Libraries/Hip_Health/sunnyhill_clinical_tool_Hip_Health_Full_FINAL.sflb.ashx

0-2 years

STANDING



Use a supine, prone or upright standing frame.

INFANTS IN STANDING: Introduce standing after 9-10 months of age.

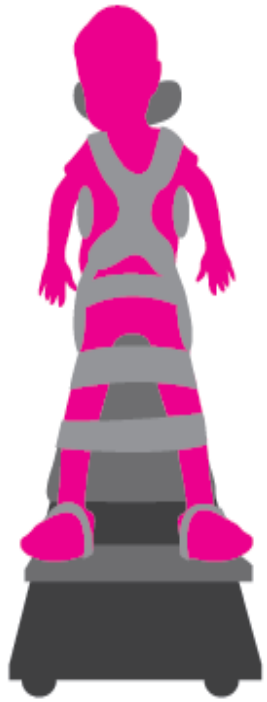
SUPPORTS: Head, trunk, upper limb (via a tray), pelvic, knee (via straps above and below the knee), pommel and foot. Use tilt to provide support and encourage head control.

HIP POSITION: Aim for **15°+ of hip abduction** [4], more if tolerated by the infant.

DOSAGE: Use daily as per the infant's tolerance.

2-6 years

STANDING



Continue with standing. Use a supine, prone or upright standing frame.

SUPPORTS: Head, trunk, upper limb (via a tray), pelvic, knee (via straps above and below the knee), pommel and foot. If needed use tilt to provide support and encourage head control.

HIP POSITION: Aim for **hip abduction 15-30°** [4, 6]. **Avoid 0° hip abduction** [7].

DOSAGE: Aim for **60-90 minutes per day** [3, 5].

And 10-15 degrees external rotation….

Footplates and pommel in abduction

- Foot plate needs to be fully adjustable
  - Dorsiflexion/plantar flexion
  - Supination/pronation
- Hip Internal/external rotation
- Leg length discrepancy
- Pelvis may slide down; may need a pommel
- Prone positioning may be easier for caregiver to achieve full hip neutral position than supine ("tush push")

Who should stand in abduction (and who shouldn't)

Yes - Abduct

- Hips at risk for subluxation
- Child is non ambulatory
- Tight adductors
- Child just had hip surgery

Nope – don't need to abduct

- Child has reached skeletal maturity
- No issues with hip alignment (subluxation)
- No issues with tight adductors
- Pain with abduction
- Unable to get abduction
- You cannot access a device to accomplish abduction

Main Message

Paleg,

Abduct 15-30 degrees with a touch of external rotation

- When hips are subluxing
- When adductors are tight/stiff

Salem et al., 2010

- Participants: 6 children with spastic CP (GMFCS II and III); average age of 6.5 years
- Design: A-B-A over a 9-week period:
  - Phase A: children received usual physical therapy treatment
  - Phase B: children received prolonged standing program 3 times/week, in addition to usual physical therapy treatment
- Data: gait analysis and clinical assessment of spasticity before and after each phase

Salem et al., 2010 results

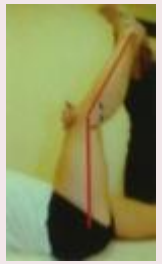
- Stride length , gait speed, stride time , stance phase time, double support time , muscle tone, and peak dorsi-flexor angle during mid-stance improved significantly following the intervention phase
- Demonstrated that gait pattern of children with cerebral palsy classified as GMFCS Levels II or III improved by a prolonged standing program
- However, improvements were not maintained at 3 weeks (Message: do not stop standing programs over summer break)

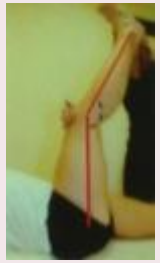
STANDING MAKES CHILDREN WITH CP WALK BETTER

When do you need to stand to improve ROM?

- Sweden
- CPUP (www.cpup.se)

Elisabet Rodby Bousquet, PT

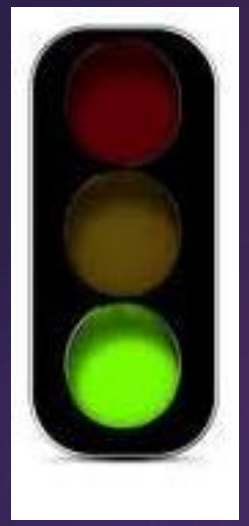
GMFCS I-III	Intervene Now!	Increase Therapy, see MD now	Monitor every 6 months
Hip Abduction	≤30°	>30° <40°	≥40°
Popliteal Angle 	≤130°	>130° <140°	≥140°
Knee Extension (neutral hip)	≤-10°	>-10° <0°	≥0°
Dorsiflexion (knee bent/soleus)	≤10°	>10° <20°	≥20°
Dorsiflexion (knee straight/gastroc)	≤0°	>0° <10°	≥40°
Hip IR	≤30°	>30° <40°	≥40°
Hip ER	≤30°	>30° <40°	≥40°
Ely's Test	≤100°	>100° <120°	≥120°
Hip extension	≤0°		≥0°

GMFCS IV-V	Intervene Now!	Increase Therapy, see MD now	Monitor every 6 months
Hip Abduction	≤20°	>20° <30°	≥30°
Popliteal Angle 	≤120°	>120° <130°	≥130°
Knee Extension (neutral hip)	≤-20°	>-20° <-11°	≥-10°
Dorsiflexion (knee bent/soleus)	≤10°	>0° <10°	≥10°
Dorsiflexion (knee straight/gastroc)	≤0°	>-10° <0°	≥0°
Hip IR	≤30°	>30° <40°	≥40°
Hip ER	≤30°	>30° <40°	≥40°
Ely's Test	≤90°	>90° <110°	≥110°
Hip extension	≤-10°	>-10° <0°	≥0°

LOSS OF HIP EXTENSION MEANS TROUBLE

- Hips and knees should be as straight as possible in the stander.
- Check that the pelvis is level and straight
- Look for symmetry of the spine and head too

Standing improves ROM



- Hips, knees, and ankles
- Levels 2-5 evidence
- Strong evidence

Optimal dosage

- Range of motion (45 -60 minutes/day, based on Level 2 evidence)
- 45 minutes for ambulatory children
- 60 minutes for non-ambulatory children

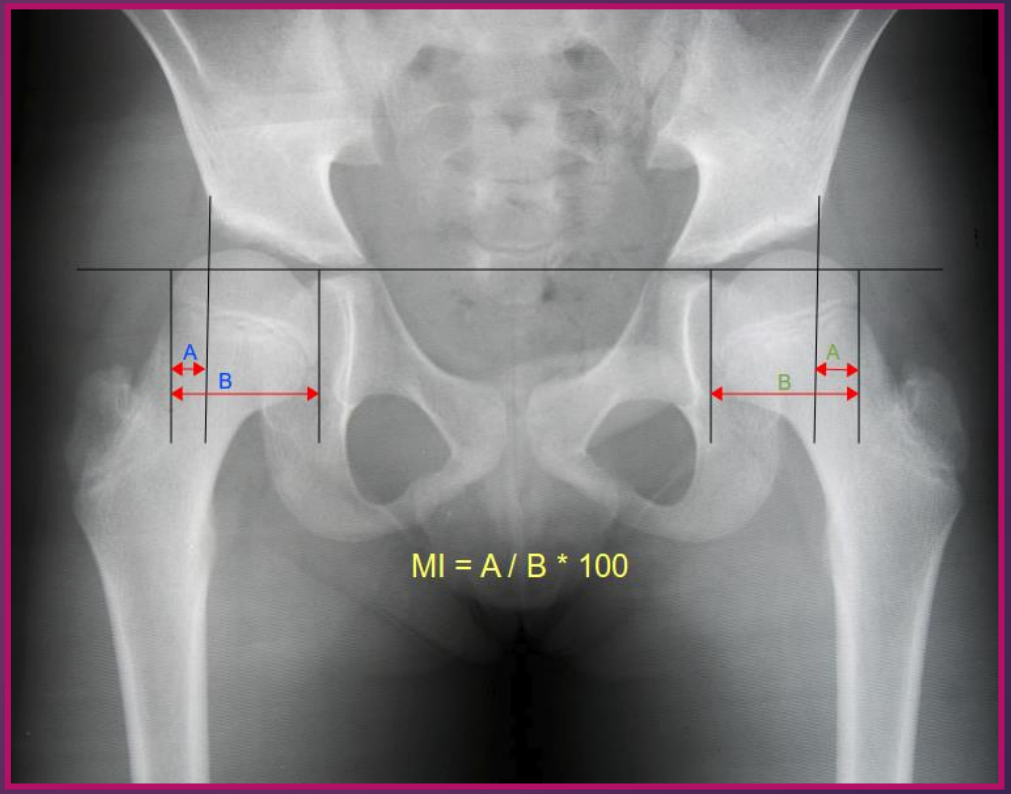
QUESTIONS/DISCUSSION ABOUT ROM

Normal hip development

- During 1st year of life, femoral head angles down and twists
- Acetabulum deepens in response to active movement
- Infant kicking and active weight bearing (gluteus medius) help develop hip socket

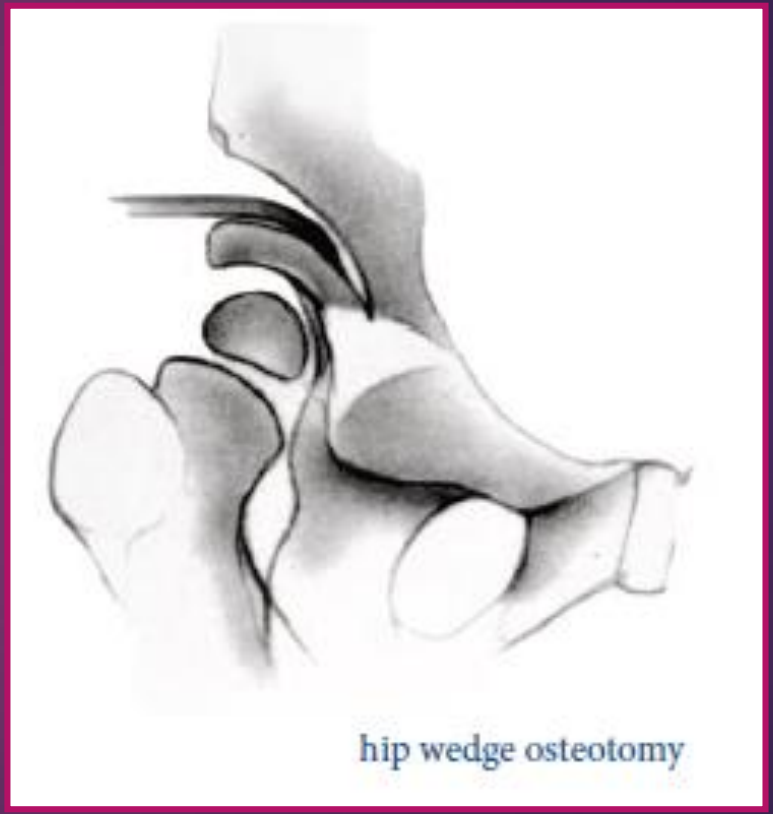
How is this measured?

Reimer's Index



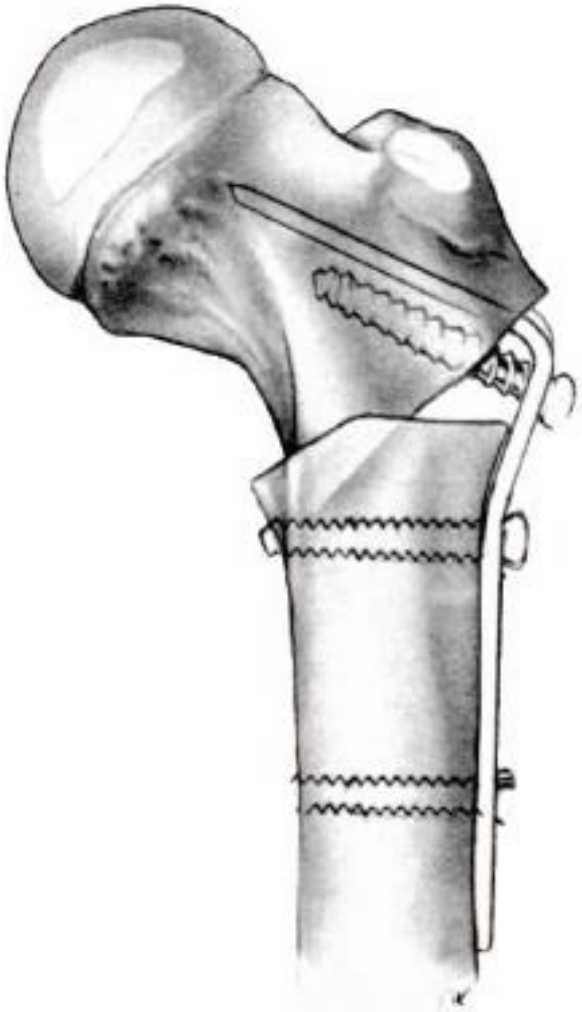
How do surgeons fix this?

- Bony surgery
- Soft tissue surgery
- Both (SEMELS – single event multilevel surgery)



Derotation osteotomy

post-op femur derotational osteotomy

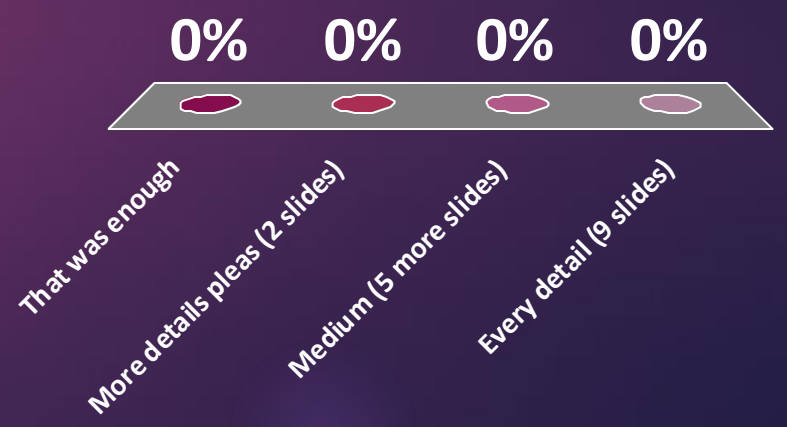


Blumetti, 2012

- N=22 children with CP GMFCS level IV
- The two goals identified by the patients and carers were standing transfers and supported walking.
- At the 2-year post-surgery assessment, 14 children (63.6 %) did not reach their pre-determined goals.
- In the questionnaire, 21.4 % of the families reported that surgery was not beneficial. The FMS score remained unchanged in 95.4 % of the patients.
- Fourteen patients (63.6 %) had at least one complication that prolonged their post-operative rehabilitation (e.g., neuropraxia).
- This study suggests that orthopedic surgery in children with CP at GMFCS level IV is unlikely to maintain or restore mobility. Furthermore, it carries a significant risk of complications.

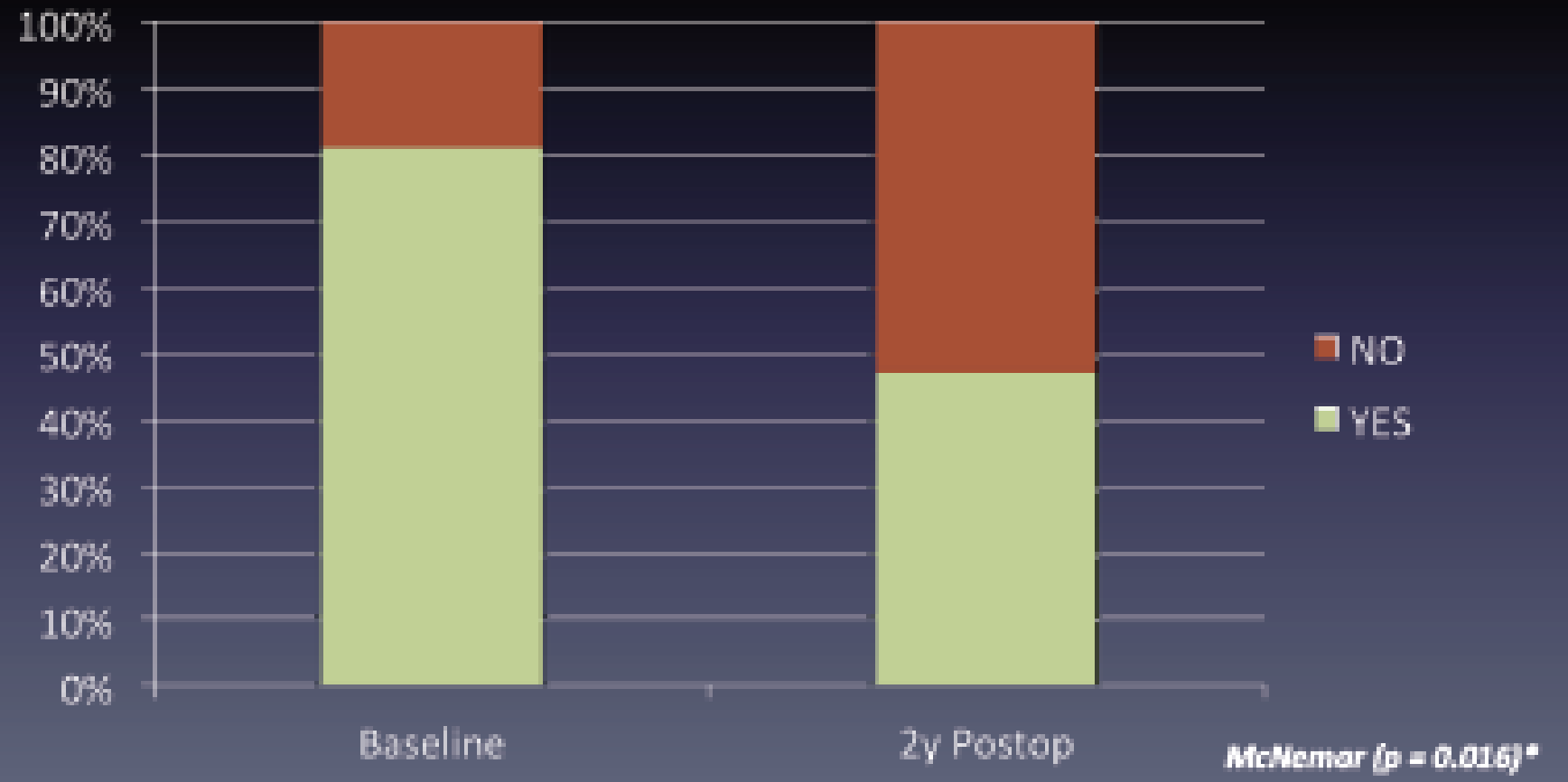
Hip surgery doesn't help the GMFM Level 4's at average age of 12 (range 7-16)

A. That was enough
B. More details pleas (2 slides)
C. Medium (5 more slides)
D. Every detail (9 slides)



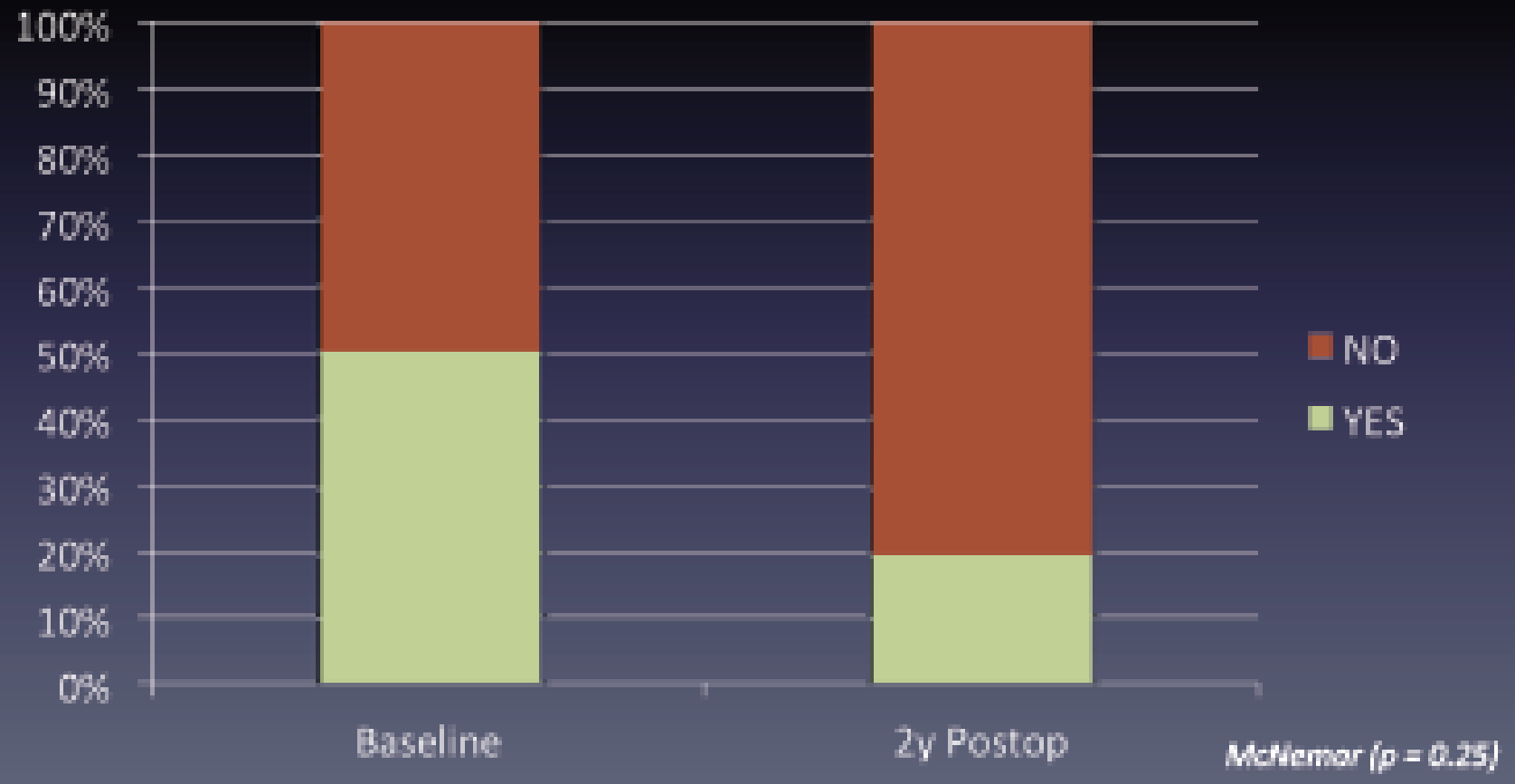
RESULTS

Supported Walking + Standing Transfers (n=20)



RESULTS

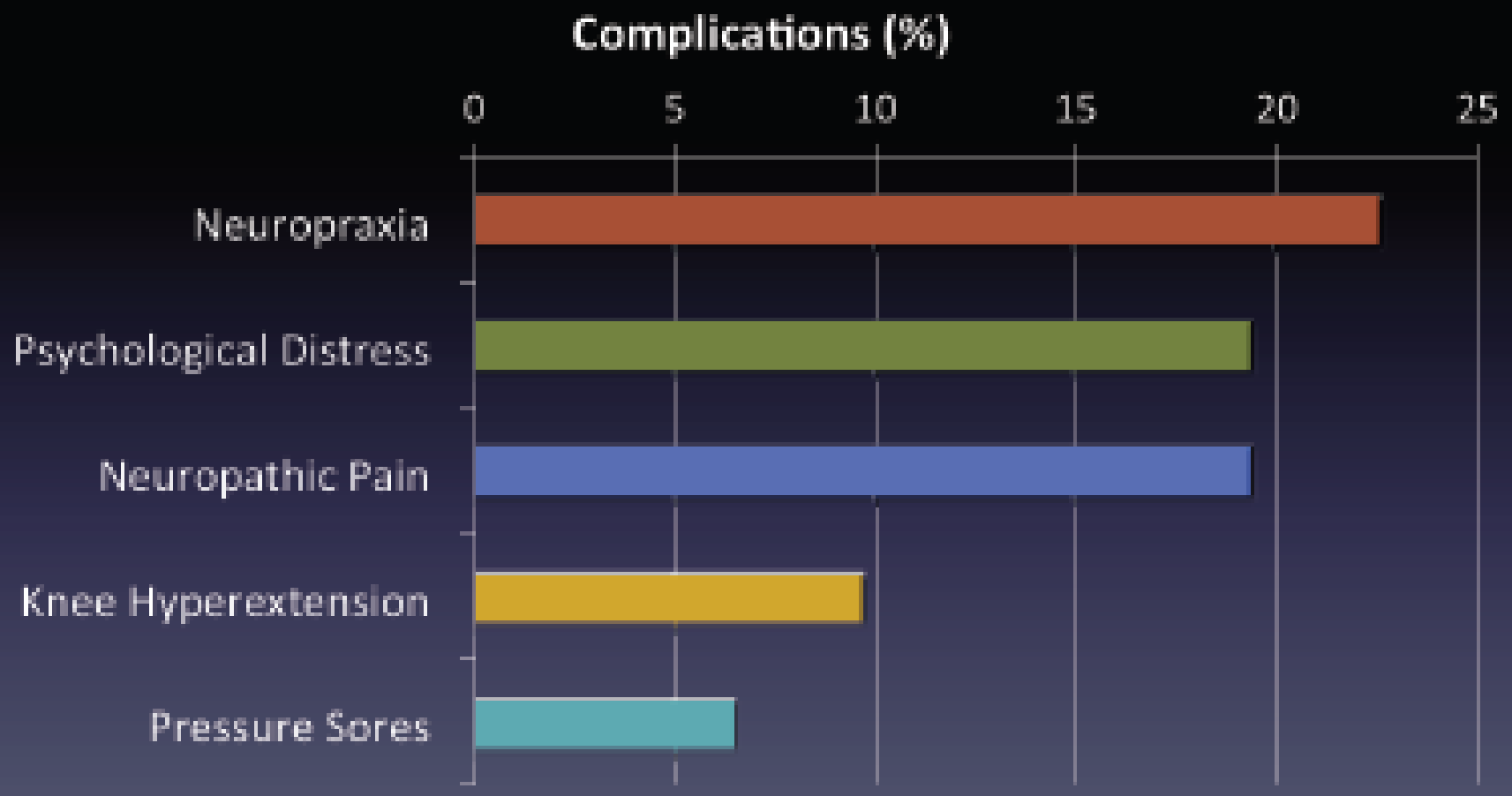
Standing Transfers (n=10)



RESULTS

Goals Set for GAS and COPM (n = 15)

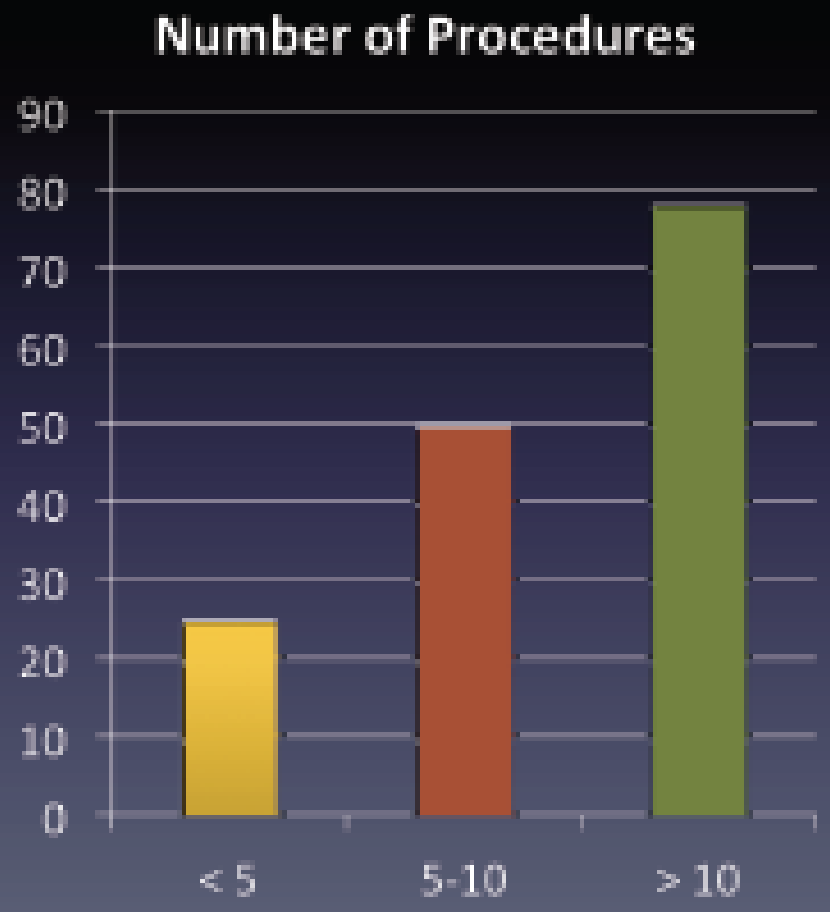
RESULTS

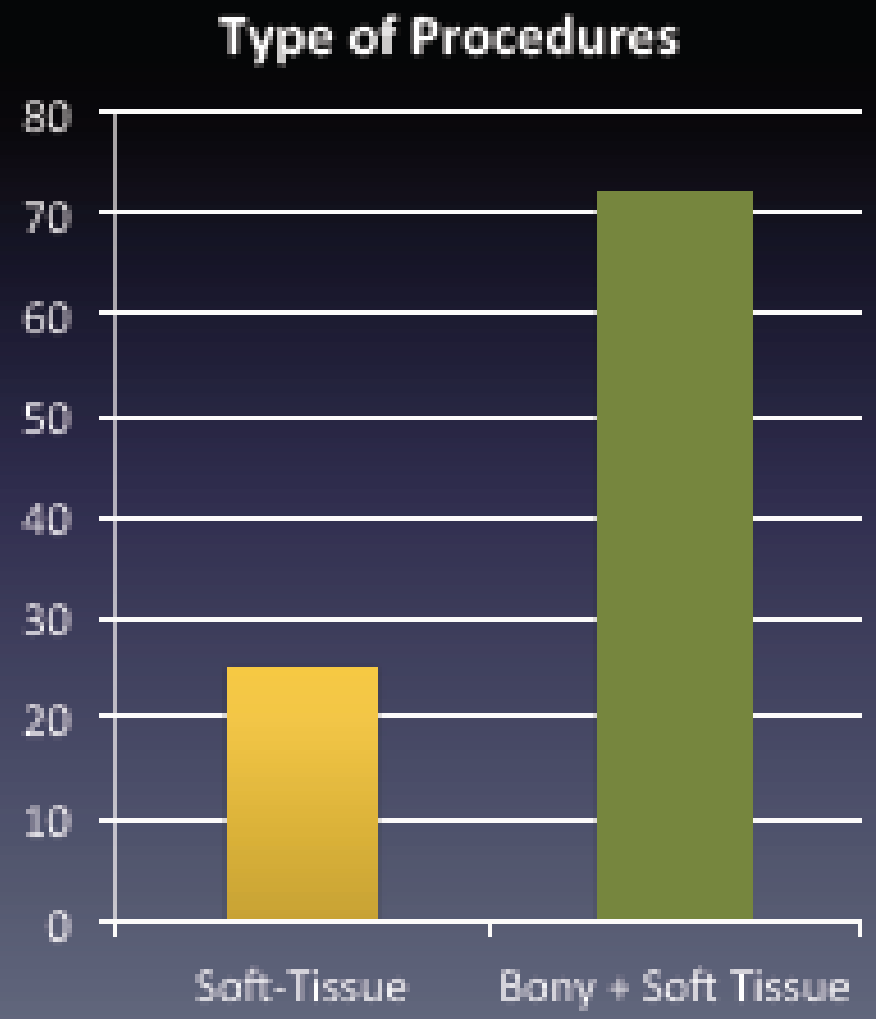


Overall Complication Rate = 51.6%

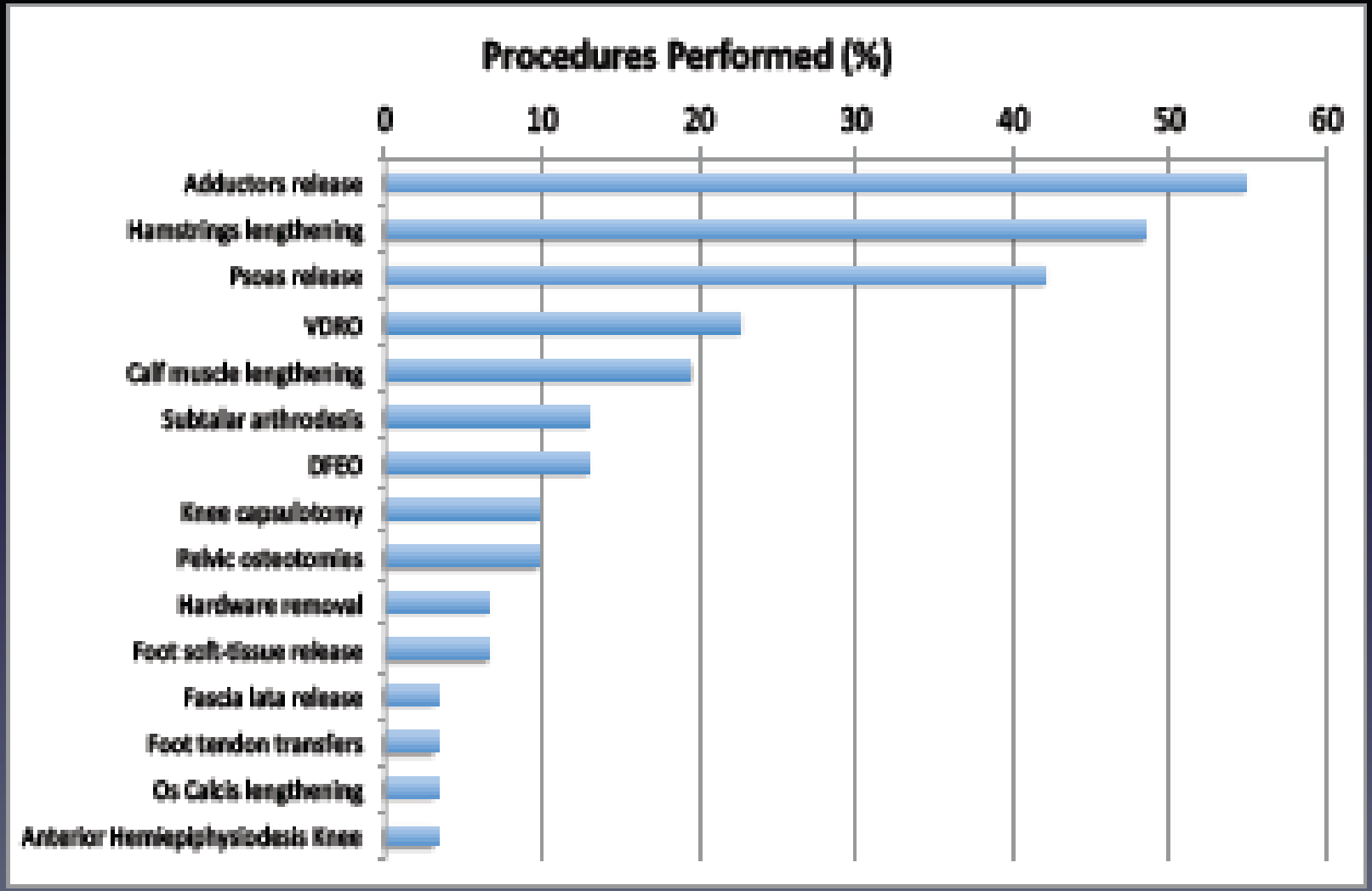
RESULTS

Complications (%)





RESULTS


Procedures Performed (%)
0
10
20
30
40
50
60
Adductors release
Hamstrings lengthening
Psoas release
VDRO
Calf muscle lengthening
Subtalar arthrodesis
DFEO
Knee capsulotomy
Pelvic osteotomies
Hardware removal
Foot soft-tissue release
Fascia lata release
Foot tendon transfers
Os Calcis lengthening
Anterior Hemiepiphysiodesis Knee

RESULTS

- **Questionnaire (n = 23 - 74%)**
  - 17% stated surgery was not worth it
  - 82% would agree to similar surgery in a relapse

DISCUSSION

- Mobility goals?
- Purpose of surgery
- Unable to change natural history
- Higher level of satisfaction
  - Satisfied that the treatment was offered
  - Better accept their child functional level

CONCLUSION

- **Most patients did not achieve their goals**
- **High rate of complications**
- **Orthopaedic surgery in GMFCS level IV**
  - Unlikely to restore or maintain mobility

Hip displacement and GMFCS

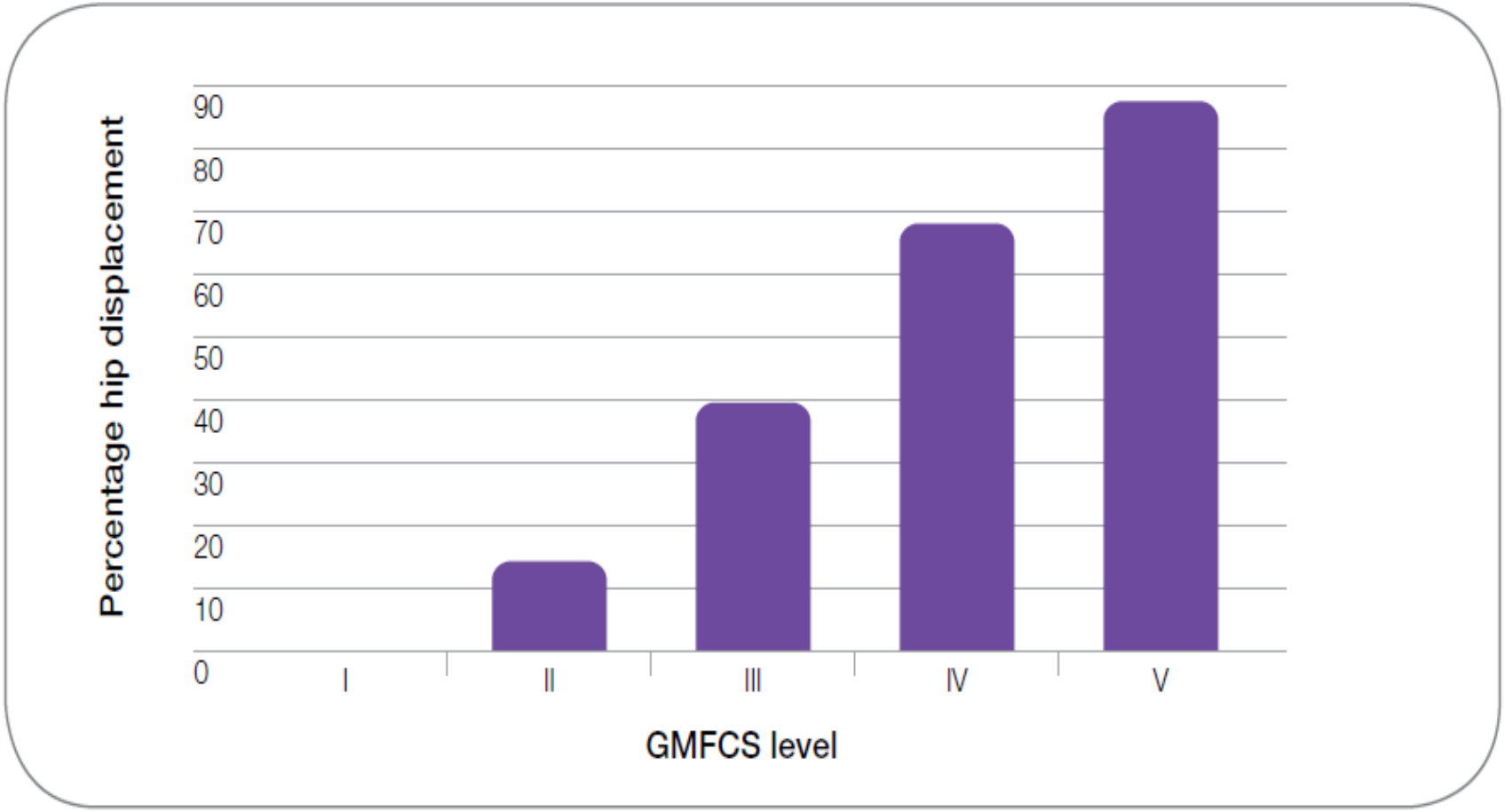


Figure 1: Hip displacement (migration percentage >30%) by GMFCS Level (Soo et al. 2006)

Why is this so important?

- Hip Dislocation
- Pain
- Increased spasticity
- Contractures
- Windswept
- Scoliosis
- Skin ulcerations
- Standing/sitting/lying problems
- Fractures

Hägglund et al., 2012

Martinsson & Himmelman, 2011

- Participant group: 205 non-ambulatory children with CP
- Control group: matched for age, motor ability, and surgery (from a national cerebral palsy follow-up study)
- Activity: 1 year of daily, straddled (abduction) weight bearing program
  - Positioning in maximally-tolerated hip abduction and hip and knee extension for 30-90 minutes/day
- Results:
  - Participants using straddled weight-bearing after surgery had the largest decrease in migration percentage (MP)(n=20 controls; p=0.026)
  - Children using straddled weight-bearing at least 1 hour/day for prevention also improved (n=8, 63 controls; p=0.029)
  - Hip and knee contractures were found only in control group

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  - Hip and knee contractures were found only in control group

Pountney et al., 2002

Postural management interventions have an important role in the prevention of hip dysplasia

Sitting, Standing, Lying (all in abduction)

These photos are NOT from Chailey, just used to make a point - abduction

Pountney et al., 2002

- Participants: 59 children with bilateral CP
- Activity (3 groups):
  - Use of a 24 hour postural management approach with Chailey Adjustable Postural Support (CAPS) System in lying, sitting, and standing (with either lying/sitting or sitting/standing supports)
  - Use of 2 items of CAPS system
  - Use of seat only and/or any other postural supports
- Data: X-rays measurements using Reimer's hip migration percentage (<33%=ok)
- Children using all 3 supports before hip subluxation maintained significantly more hip integrity than other groups ($p<0.05$)

Pountney et al., 2002

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  - Use of seat only and/or any other postural supports
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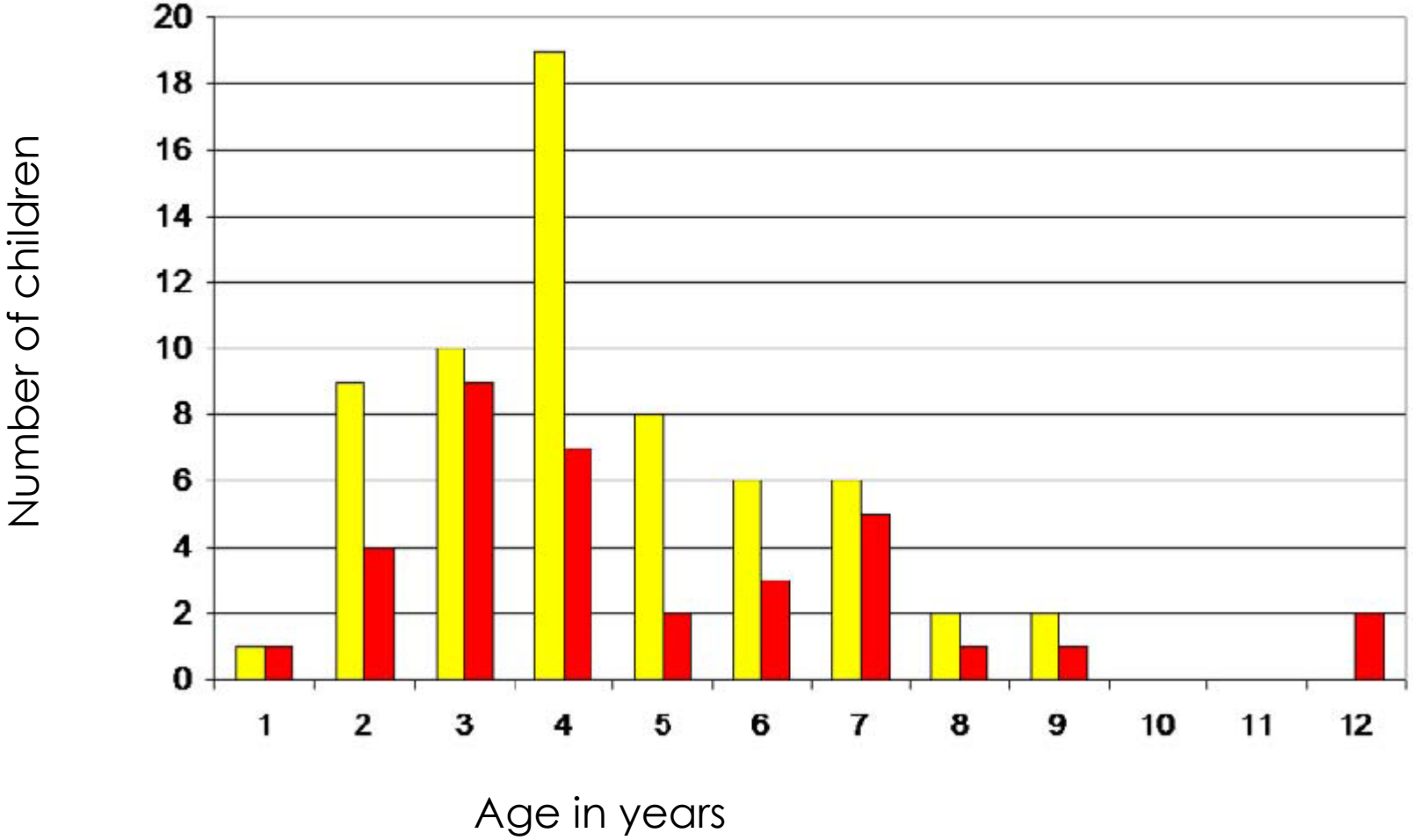
- Children using all 3 supports before hip subluxation maintained significantly more hip integrity than other groups ($p<0.05$)

Hägglund et al., 2005

- Participants: 206 children with CP, without recurrent hip dislocations
- Only 3 developed dislocation: One not a surgical candidate and died soon after, one who moved into the area and one who refused to participate in program
- Results:
  - The number of children with severe contractures was reduced 70%
  - Severe scoliosis was reduced 60%

Number of children related to age (years) at first registration of MP above 33% (yellow) and 40% (red).



Larnert, 2014

- Children at GMFCS levels III-V (N = 353)
- Children at GMFCS V have a significantly higher risk of hip displacement compared with children at GMFCS III-IV.
- The risk is highest at 2-3 years of age.
- The results support a surveillance program including radiographic hip examinations as soon as the diagnosis of severe CP is suspected.

Bouwhuis, 2014

- Surgical procedures in hip(sub)luxations in severe CP (GMFCS IV and V)
- 15 studies
- The mean MP at follow-up ranged from 6 to 29%
- The percentage of patients reporting pain decreased from 81% preoperatively to 5% at follow-up
- 25% had complications such as osteoarthritis, ulcers or fractures
- Conclusions: There is insufficient evidence for the effectiveness of soft tissue surgery to stabilize the hip, in children with severe cerebral palsy (GMFCS 4 and 5) aimed to prevent luxation of the hip. Varus derotational osteotomy (VDRO) can be a beneficial procedure in children with severe CP and a painful hipluxation

Hägglund's approach

- Early orthopedic surgery (between ages 4-6)
- Spasticity management
- Visits every 6 months by entire team
- Equipment adjusted every 6 months
- Every child has a 24-hour postural management program, including sitting, standing, and lying positions and activities delivered at home, school, and in the community

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Optimal dosage

- Hip biomechanics (60 minutes/day in 15-30 degrees of total bilateral hip abduction, based on Oxford Levels 2-5 evidence)

QUESTIONS/DISCUSSION ABOUT HIPS

Picolini Maneuver

- Place the child in supine
- Straighten hips and knees as much as possible
- Rotate the femur (internal/external) as you slowly abduct it
- Learn to feel when the joint feels "stable"
- Now match this in the stander

Precautions

- Keep airway open
- Stop at 30 degrees hip abduction
- Stop at boney or soft tissue end feel (moderate resistance)
- Stop if child grimaces or vocalizes pain/discomfort

Choose footplates that are adjustable in 3 planes

- Match hindfoot, midfoot, and forefoot to tibia/fibula
- Adjust dorsi/plantar flexion to meet your goals/needs
- Adjust for leg length discrepancy to assure equal and full loading on each side

Postural management

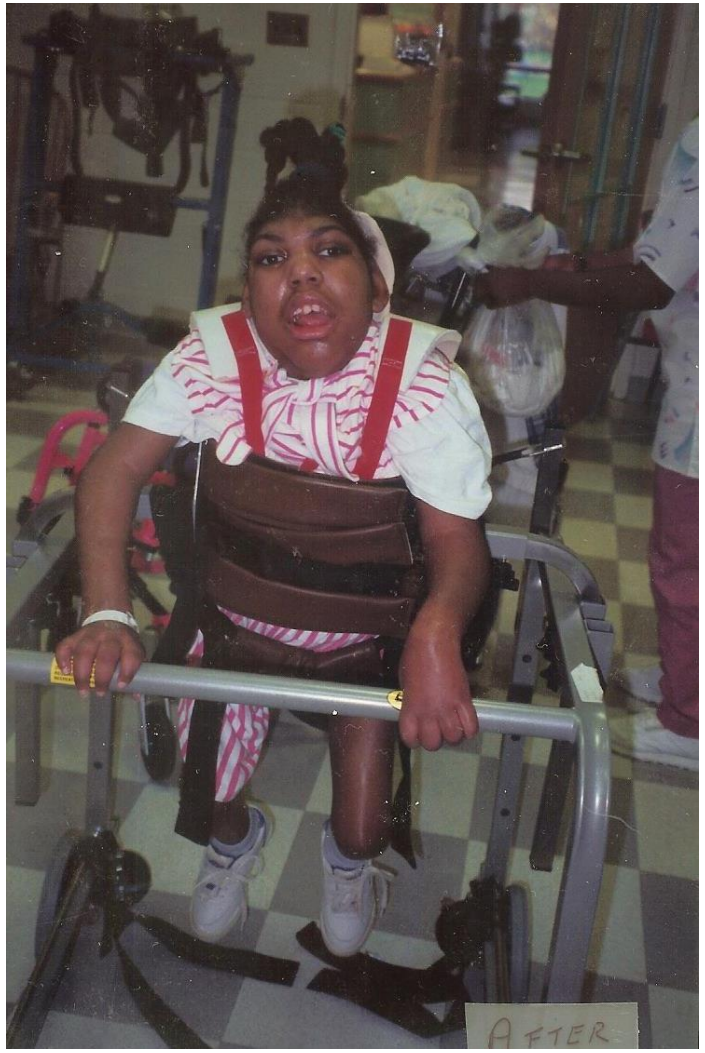
- Sitting
- Standing (in abduction)
- Lying
- Activity
- YOU NEED ALL 4!!!

Take-home messages

- Know the evidence basis for interventions
- Position hips in abduction and external rotation
- Stand for 1 hour/day
- Increase activity and participation
- Now:
  - Join me for a discussion of what best practices should be for standing
  - Help me with decision tree for choosing a stander

Paleg, G. (1996) Using standing aids as tools for nonweight-bearing treatments. ADVANCE for Physical Therapists 28, 17.

Gained 1 degrees per week of hip and knee extension after 20 min 3-5x/wk



STANDING IMPROVES ROM

- Hips, knees, and ankles
- Level 2-5 evidence
- Moderate evidence

CLINICAL RECOMMENDATIONS

- Standing daily for 60 minutes in 15-30 degrees of total bilateral hip abduction may improve hip biomechanics.

WHAT DID WE LEARN?

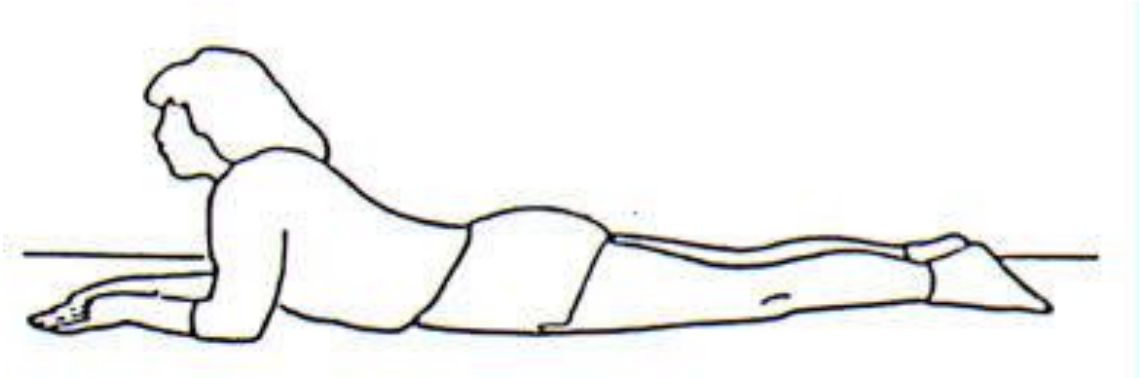
- Dislocated hips, scoliosis and contractures are preventable in kids with CP GMFCS level 4 and 5 (non-ambulatory)
- Daily standing is part of this prevention program

CONTRAINDICATIONS?

- There was no evidence that supported standing would be contraindicated if the participants had one or both subluxed or dislocated hips.

PRONE VS. SUPINE

- Prone may be better for hip ROM
- Supine may be better for knee contractures
- Maybe children with Level III and IV CP need more prone (not upright, but flatter prone)



GRAVITY

Angle matters!

Choose prone when…..

- Child has fair head control
- Adults are comfortable loading this way
- Hip flexors are tight
- You want child to practice extension
- Surface does not overstimulate flexion
- You will not need to access child's respiratory system and/or abdomen quickly

GRAVITY

Angle matters!

Choose supine when…..

- Poor or no head control
- Adults are comfortable loading this way
- 2 or more adults are needed for transfer
- Hamstrings are tight
- You want child to practice flexion
- Surface does not overstimulate extension
- You may need to access child's respiratory system and/or abdomen quickly

Area of Body	Concern	Clinical Recommendation	Device
Head Control	User cannot clear airway in prone	Try neck collar/support	Supine Stander
	User has intermittent control and this is a goal of standing		Prone Stander
	No concerns		Any type

Area of Body	Concern	Clinical Recommendation	Device
Trunk/Spine	User has tendency to hyperextend trunk	If you wish to block this	Supine Stander
		If contact on the back increases extension	Prone Stander
	User has tendency to flex trunk	If you wish to block this	Prone Stander
		If contact on the chest/stomach increases flexion	Supine Stander
	User has scoliosis/kyphosis/lordosis	You can choose to accommodate this or try to gently over time stretch back muscles	Sling Stander and other types

Area of Body	Concern	Clinical Recommendation	Device
Arms/Hands	User has use of upper extremities	You want to strengthen these muscles, strengthen accessory breathing muscles You want to encourage exploration and self-mobility You want person to be independent in use of stander	Self-Propelled Self-Propelled Sit-to-Stand w/swivel seat Sling Seat

Area	Concern	Clinical Recommendation	Device
Hips	User has tightness but full range	Ensure device can attain full hip extension	Prone Stander Self-Propelled Upright
		Some devices allow for hip hyperextand thus increased stretch	Sit-to-Stand Sling Seat
	User has loss of range flex/ext	Cannot attain full extension	Supine Stander
		You want to improve extension ROM	Prone Stander
		You want to improve flexion ROM	Sit-to-Stand Sling Seat
	User has tightness/spasticity in adductors	Place feet in 10-50 degrees (total) abduction	Check that model can accommodate this
	You want increased loading at the acetabulum	Place feet in 10-50 degrees (total) abduction	Check that model can accommodate this
	User has windswept deformity	You can choose to accommodate this or try to gently over time de-rotate pelvis and stretch hips/knees	Sling Seat

Area of Body	Concern	Clinical Recommendation	Device
Knees	User has tightness but full range	Ensure device can attain full hip extension and avoid pressure on kneecaps	Prone Stander Self-Propelled Upright
	User has loss of knee ext ROM	A knee contraction bracket is available	Special Order
		Partially stand person and increase stretch slowly over time	Sit-to-Stand Sling Seat
	Knees collapse upon loading	Try knee immobilizers	Supine Stander Prone Stander Self-Propelled Upright

Area of Body	Concern	Clinical Recommendation	Device
Ankles	You want to stretch heelcords	Add dorsiflexion or wedge	All types
	User has pronation/supination or int/ext rotational deformity	Order model with foot plates that adjust the way you need them to	All types

Area of Body	Clinical Recommendation	Device
All Areas	Make sure feet are fully loaded If you can move feet or slip a piece of paper under show, reposition	All types
	Be sure supports are where you want. In some models, as you raise and lower the user, the position of the supports change and you may get undesired results	
	For solid seat sit-to-stand models, consider a swivel seat to increase ease of transfers	
	Power lifts are available in some models	

Checklist

- Is it easy to load (goes flat, right height)
- Does it keep the kid in alignment with few supports/straps
- Can you get abduction?
- Can you get the legs fully loaded?
- Can the kid be active and participate?
- Will it be used?

Which kind of stander is best?

- Kecsemethy, 2008
  - Supine stander was better than sit to stand (model did not go fully upright and left knees wt bearing)
- Herman, 2007
  - More upright is better

Who Needs a Stander?

- GMFCS Levels 2-5 starting at 9 mos
- Level 2 and 3's may not need to stand from age 4 (onset of walking) until puberty unless ROM is an issue (crouch gait)
- GMFCS Level 4 and 5 need to stand daily for 60 min 5x/wk throughout their lives! (7 ½ hrs/wk for BMD)
- May be able to decrease dosage if child is more active (sit to stand transfers, gait trainer, bike, etc)

TAKE HOME MESSAGES

- Know the evidence basis of what you do.
- Stand in abduction.
- Stand for an hour a day.
- Get people active and increase participation.
- Join me for a discussion of what best practices should be for standing.
- Help me with decision tree for choosing a stander.

DOSAGE

- Bone Mineral Density (60-90 minutes/day based on Levels of evidence: 2-4)
- Hip Biomechanics (60 minutes/day in 30-60 degrees of total bilateral hip abduction based on Levels of evidence: 2-5)
- Range of Motion (45-60 minutes/day based on Level of evidence: 2)
- Spasticity (30-45 minutes/day based on Level of evidence: 2)

WHY DO OTS, SLPS AND CLASSROOM STAFF LOVE STANDERS?

- Improved head control
- Better hand function
- Easier eye contact
- More alert (limbic and reticular activating system stimulated)
- More peer interaction than in wheelchair (especially if stander is low)
- Less transfers with sit to stand models
- Self mobility with some children in mobile stander
- Others?????