Standers:

What does the research say?

Welcome

January 18, 2018

Presenter: Lori Potts, PT

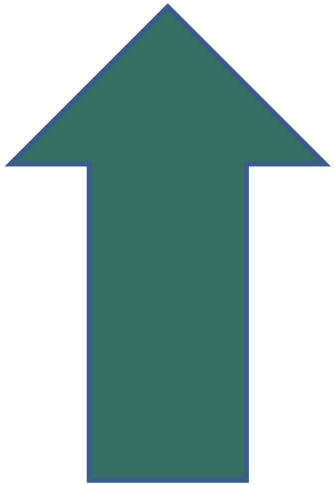
Benefits of standing

Bone & joint
Bowel & bladder
Breathing
Blood
Brain

What does the research say?

Levels of Evidence

1. Systematic Review
2. Randomized Controlled Trial (RCT)
3. Cohort Study
4. Case-Control Study, Case-Series
5. Mechanism-based Reasoning



"The Oxford 2011 Levels of Evidence" www.cebm.net

Systematic Literature Review

Collects and critically evaluates multiple research studies.

Rich, NC (2005)

Randomized controlled trial (RCT)

The subjects are randomly allocated to each study group.

Rich, NC (2005)

Glickman L, 2010

Systematic Literature Review (Jan 1980 – Oct 2009)
112 studies identified; 39 studies met criteria

Increase BMD
Decrease tone
Improve ROM

Reference

Paleg G, 2013

BMD	5 days/week, 60-90 minutes/day
Hip Stability	60 minutes/day in 30º to 60º total hip abduction
ROM- hip, knee, ankle	45-60 minutes/day
Spasticity	30-45 minutes/day

Reference

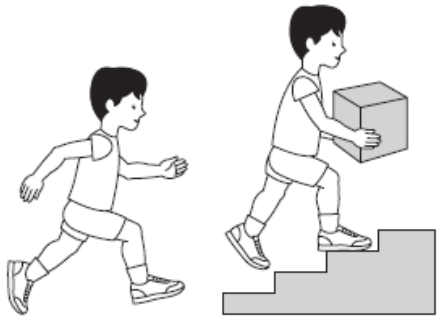
Gross Motor Function Classification System

Level I	walks without limitations
Level II	walks with limitations
Level III	walks using a hand-held mobility device
Level IV	self-mobility with limitations; may use powered mobility
Level V	transported in a manual wheelchair

Palisano R, et al (1997) Reference
Palisano R, et al (2008) Reference

GMFCS

I



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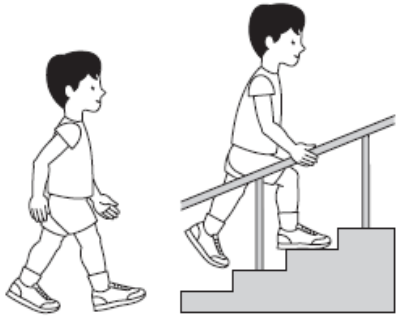

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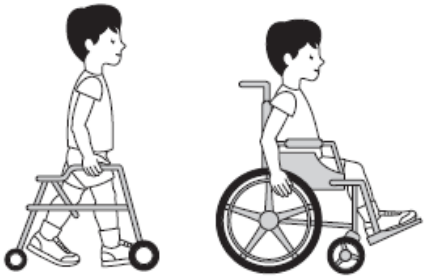
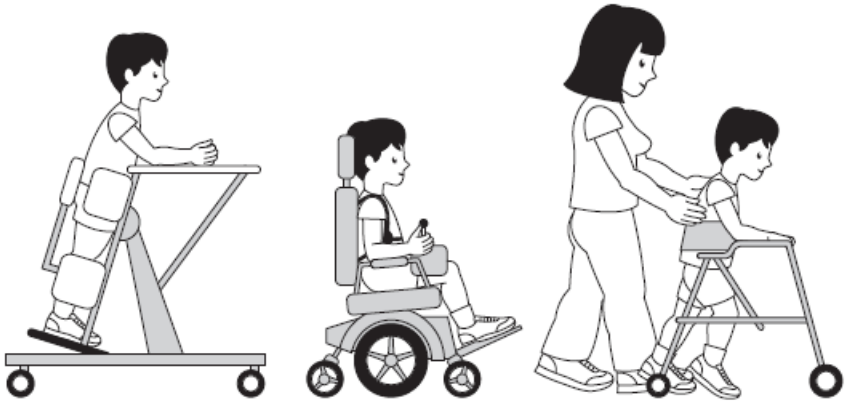


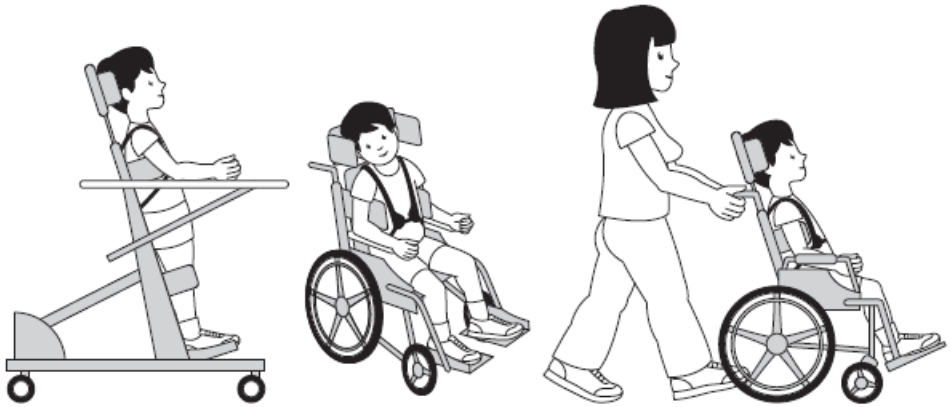
www.canchild.ca

GMFCS

IV



V



What does the research say?

Tone

Joint ROM

BMD

Hip Stability

Tremblay F, 1990

22 children with CP (Experimental n=12)(Control n=10)
30 min prolonged stretch to gastroc soleus in stander

Decrease in spasticity remained for 35 minutes after cessation of stretch

Reference

Salem Y, 2010

6 children with spastic CP (GMFCS Levels II and III)
45 min/d, 3 times/wk in prone stander, 9 sessions

Improved stride length, gait speed, stride time, stance phase time, double support time, muscle tone, and peak dorsiflexion angle during midstance.

Abstract

What does the research say?

Tone

Joint ROM

BMD

Hip Stability

Gibson S, 2009

5 non-ambulatory children with CP (ages 6 – 9 years)
1 h, 5 days per week, for 6 weeks

Hamstrings lengthened with standing
Caregivers reported improved ease of transfers/ADLs

Abstract

Gough M, 2012

Review:

Muscle deformity (joint contractures) in children with spastic CP

may be due to the impairment of muscle growth and subsequent altered muscle adaptation

Reference

What does the research say?

Tone

Joint ROM

BMD

Hip Stability

Mergler S, 2009

Systematic Literature Review
Fractures and low BMD
Children with severe CP (GMFCS IV and V)
32 studies identified; 5 studies met criteria

77% of children with moderate to severe CP present with low BMD in the femur.

Mergler S, 2009

Cohort Studies

A population of subjects is observed over time and compared to another group.

Prospective OR
Retrospective

Rich, NC (2005)

Uddenfeldt W, 2013

Retrospective Cohort, 536 children, 9-year data span

GMFCS

Levels I-III had similar fracture incidence as typical peers

Levels IV-V had stunted growth; increased risk of fractures

Reference

Uddenfeldt, 2013

Retrospective Cohort, 536 children, 9-year data span

Children at GMFCS levels IV and V who used standers had **four-fold reduction in fractures.**

Reference

Meta-Analysis

uses statistical methods to analyze multiple studies.

Rich, NC (2005)

Kim S, 2017

Meta-Analysis
Effect of WB exercise on BMD for children with CP
118 studies identified; 3 studies met criteria

Weight bearing exercise has a significant effect on improving BMD of the femur in children with CP.

Reference

Case Control Study

Two groups of subjects (the case and the control) are exposed to different interventions to determine which group achieves a better outcome.

Rich, NC (2005)

Damcott M, 2013

Non-ambulatory children with CP
Passive standers (n = 4)
Dynamic standers (n = 5)

30 min/d, 5 d/wk for 15 months

Watanabe L. (2010)

Damcott M, 2013

Children in dynamic standers showed significant increases in BMD and BMC and maintained increases longer.

Abstract

Case Series

A group (series) of case reports on subjects with a pre-identified problem who are given similar treatment.

Subjects are observed for an outcome of interest. No control group is involved.

Rich, NC (2005)

Kecskemethy H, 2008

Non-ambulatory youth with CP (ages 6 – 21 years)
GMFCS Level V (n = 19)
GMFCS Level IV (n = 1)
Measured weight bearing during 30 min standing sessions

There is wide variance in the actual weight borne while in passive standers.

Reference

What does the research say?

Tone

Joint ROM

BMD

Hip Stability

Mayson T, 2011

Many children with cerebral palsy of GMFCS Levels IV-V have a normal hip at infancy that progresses to significant displacement and eventual dislocation.

www.childdevelopment.ca
Sunny Hill Health Centre For Children
British Columbia Ministry of Children and Family Development

Soo B, 2006

Cohort Study, 323 children

Mean duration follow up was 11 years 8 months

Incidence of hip displacement

GMFCS Level I = 0%

GMFCS Level V = 90%

Abstract

Hägglund G, 2007

Cohort Study, 212 children
Followed from birth until 9-16 years of age

For children with severe limitations,

the risk of dislocation is highest between 2-5 years.
Occurs predominantly with spastic/dyskinetic CP.

Reference

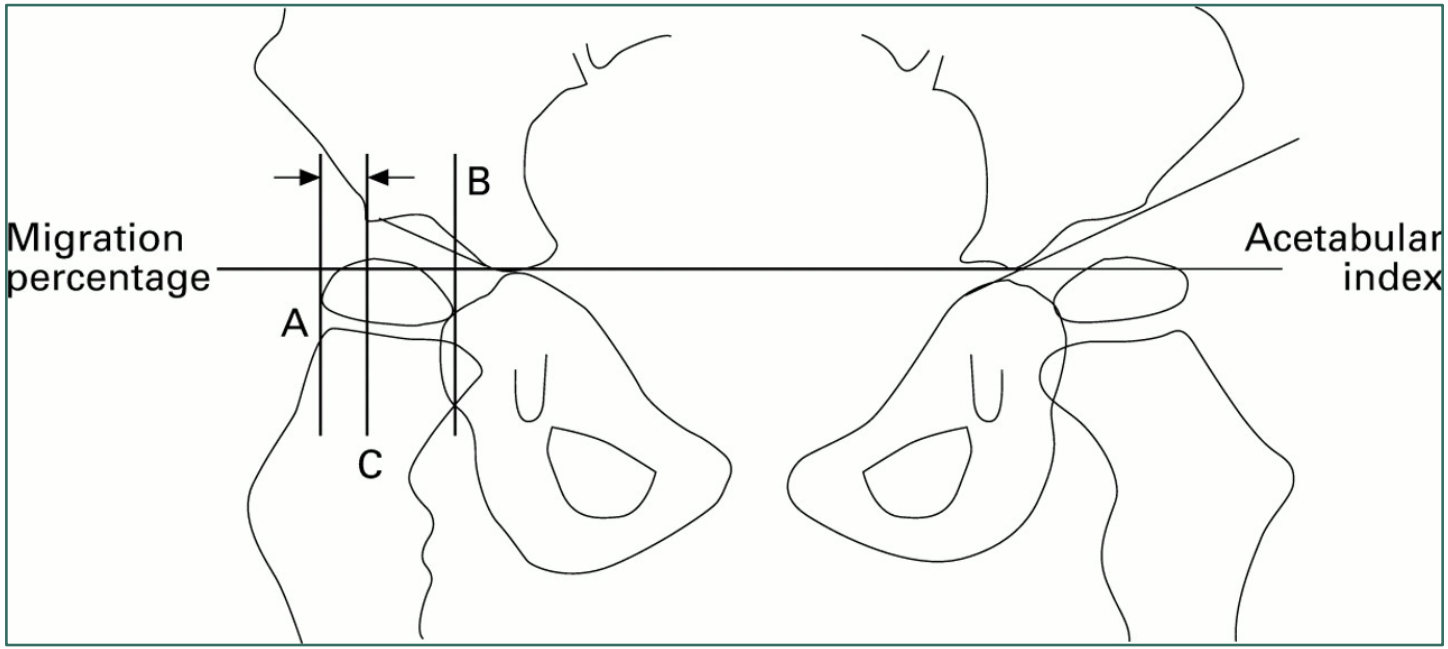
Hägglund G, 2005/2014

Sweden
258 children born between 1992 and 1997
431 children born between 1998 and 2007

The risk of developing a dislocated hip in the whole population of children with CP has been estimated to be between 15% and 20%.

Reference | Abstract

Measurement of migration percentage and acetabular index.



MP

Migration percentage = (AC × 100)/AB.

Migration percentage = AC/AB x 100

David Scrutton, and Gillian Baird Arch Dis Child 1997;76:381-384

ADC

Robin J, 2009

Migration Percentage

>15%	dysplasia
>30%	subluxation
>100%	dislocation

Reference

Hermanson M, 2015/2017

145 children followed for five years (from first x-ray)
Mean age at initial pelvic radiograph = 3.5 years
- Group 1 = developed hip displacement
- Group 2 = did not develop hip displacement

Which factors are predictors of developing MP > 40% within 5 years of the first x-ray?

Abstract
Reference

Hermanson M, 2015/2017

MP (migration percentage)
HSA (head-shaft angle)
GMFCS Level
were significantly associated with an MP >40%.

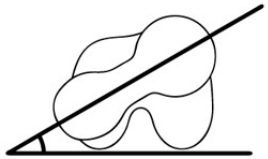
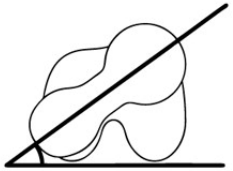
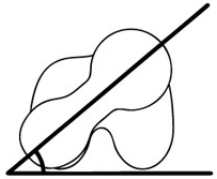
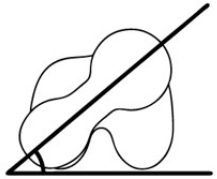
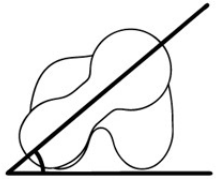
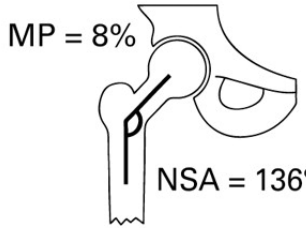
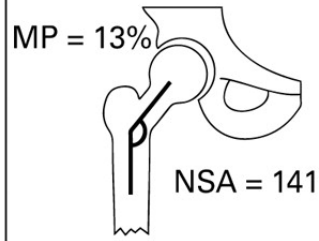
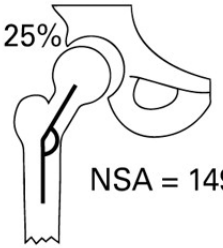
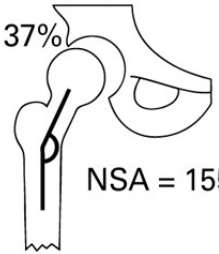
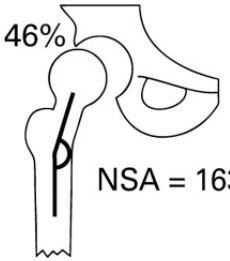
Abstract | Reference

Robin J, 2008

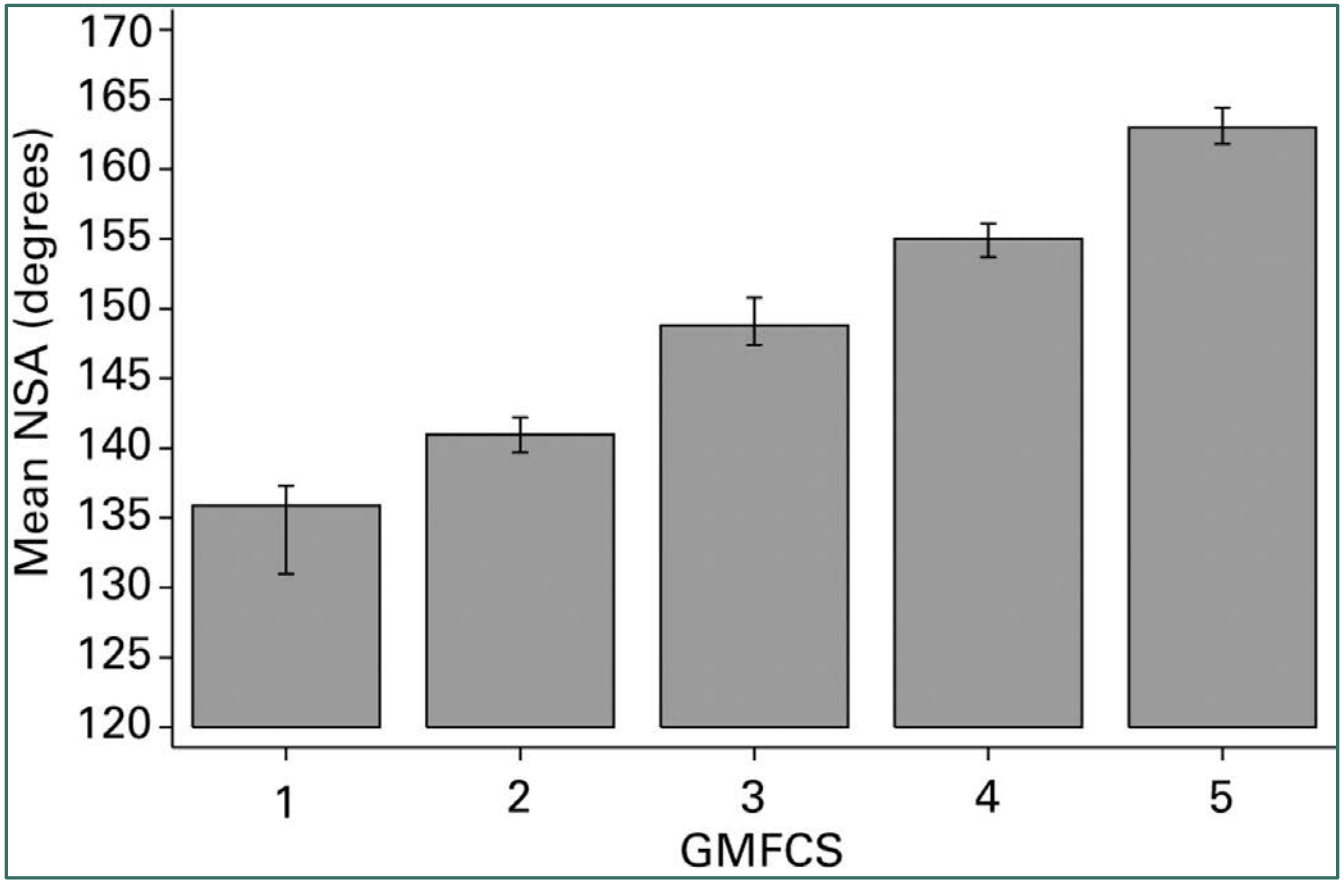
292 children with CP
Clinical measurement of FNA (femoral neck anteversion)
X-ray evaluation of NSA (neck-shaft angle)

Children with CP have increased FNA and NSA. Both deformities are related to displacement of the hip.

Reference

	GMFCS I	GMFCS II	GMFCS III	GMFCS IV	GMFCS V
FNA	 FNA = 30°	 FNA = 36°	 FNA = 40°	 FNA = 40°	 FNA = 40°
NSA + MP	 MP = 8% NSA = 136°	 MP = 13% NSA = 141°	 MP = 25% NSA = 149°	 MP = 37% NSA = 155°	 MP = 46% NSA = 163°

Robin J (2008)


Mean NSA (degrees)
170
165
160
155
150
145
140
135
130
125
120
1
2
3
4
5
GMFCS

Robin J (2008)

Robin J, 2008

“…Displacement of the hip in patients with CP can be explained…by the abnormal shape of the proximal femur, as a result of delayed walking, limited walking or inability to walk.”

Reference

Willoughby K, 2012

Weight bearing and functional movement may have a role in preventing secondary changes to the hip.

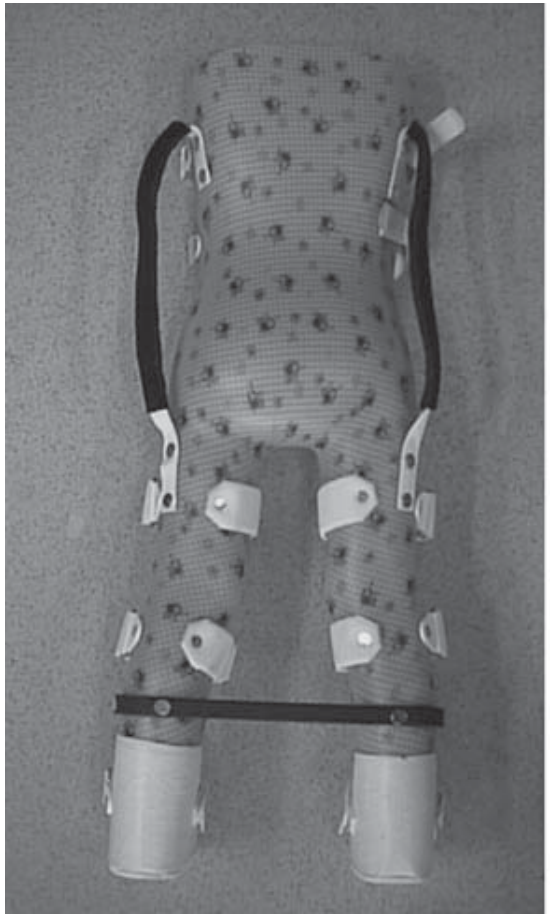
> "It may be the excessive anteversion and coxa valga that is partly responsible for the very high rates of hip displacement in children in GMFCS levels IV and V, rather than adductor spasticity."

Reference

Dalen Y, 2010

18 children, age 3-18 years
Severe cerebral palsy
Standing shell used 40 min/day

Reference



The Standing shell was developed in Sweden in the late 1980s.

Dalen Y, 2010

Non-dynamic WB in standing shell did not affect whole body BMD.

In children with spasticity, non-dynamic WB in standing shell worsened hip displacement.

Reference

Martinsson C, 2011

Purpose:
To study the effect of 1 year of daily, straddled weight-bearing on hip migration percentage (MP) and muscle length in children with cerebral palsy who were nonambulatory.

Reference

Martinsson C, 2011

97 children; all were non-ambulant, GMFCS III-V
Ages 2-6 years
Spastic, dyskinetic or mixed CP

Supported standing for 1.5 hours daily for one year.

Reference

Martinsson C, 2011

Study Group N=14	SG 1 Post-hip surgery and abducted standing	N=3
	SG 2 Abducted standing only	N=11
Control Group N=83	CG 1 Post-hip surgery and standing	N=20
	CG 2 Standing only	N=63

Reference

Martinsson C, 2011

Straddled weight-bearing, 1 hour per day may

- **reduce the MP after adductor-iliopsoas-tenotomies OR**
- **prevent an MP increase…in children with CP who did not need surgery.**

Larger studies are needed to confirm the results. Reference

Gericke T, 2006

Postural management consensus statement

Integrated approach: equipment, activity, surgery

GMFCS Levels IV and V

- After birth (when possible): prone lying
- 6 months: supported sitting
- 12 months: supported standing

Reference

Mayson T, 2011 [Pountney T, 2009]

Integrated approach: postural management, orthoses, tone management, surgery.

Postural management equipment before 18 months of age for children with bilateral CP GMFCS Levels III, IV, V may help decrease incidence of hip pathology by age 5.

Reference | Abstract

Mayson T, 2011 [Pountney T, 2009]

If child cannot walk more than 10 steps by the age of 30 months and has MP >15%, positioning equipment should be used. Programs should include hip abduction.

Interventions may include

- Lying support (night use recommended)
- Seating system (six hours per day recommended)
- Standing support (one hour per day recommended)

Reference
Abstract

www.childdevelopment.ca

Clinical Tool - Focus on Hip Health
Positioning for Children GMFCS Levels IV-V:

Specific hip abduction recommendations

- After birth: supine lying with hip abduction, flexion, ER
- 5-6 months: supported sitting
- 9-10 months: supported standing
- 10+ months: supported walking

Reference

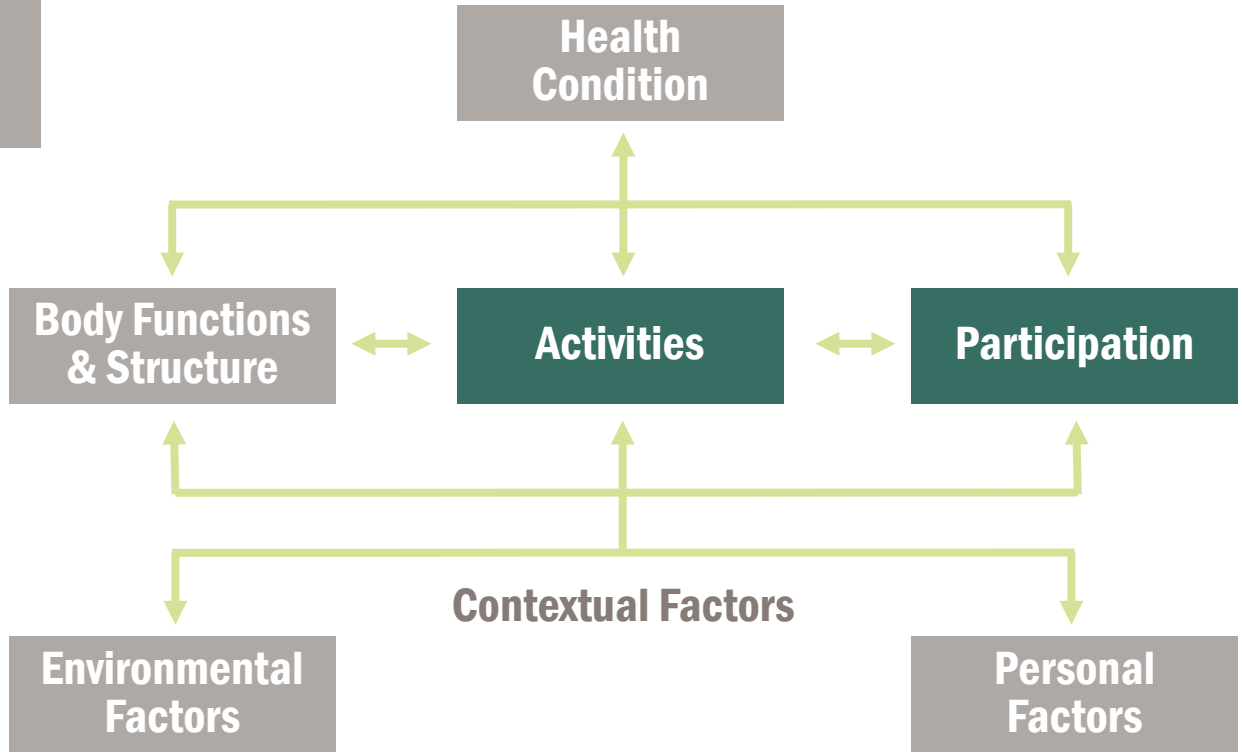
Gough M, 2009

An appraisal:

“We need to develop a means to implement a postural management programme for these children in a manner that does not adversely impact, but instead enhances, their environment and participation.”

Reference

The ICF



ICF E-Learning Tool/World Health Organization icf.ideaday.de

Standing and/or Walking

Is there a predictor of independent walking?

Begnoche D, 2016

Secondary data analysis of an observational cohort study

80 children with CP, ages 2 -6 years
GMFCS Levels II and III

Is there a predictor of independent walking?

Reference

Begnoche D, 2016

A sit to stand activity
was the only significant predictor of taking ≥ 3 steps independently.

This correctly identified a Walker or Non-walker 75% of the time.

Goodwin J, 2007

Young people's experience with standing frames

Attitudes – examples:

- **Understanding the benefit helps to endure discomfort of standing**
- **Standing can enable access to activity OR be limiting**
- **Peer interaction can be enhanced OR it can separate**
- **Specific standing opportunity may or may not be a choice**

Reference

Goodwin J, 2007

Young people's experience with standing frames

Challenges – examples:

- **Difficulty with transfer OR caregiver expertise**
- **Lack of control OR having control over position**
- **Design of frame for function and/or appearance**
- **Size of stander and space requirements**

Reference

Clinical Applications

Tone:

Reduced spasticity does not last a long time after standing session. Supported standing may be followed with an activity that would benefit from reduced tone (walking practice, hygiene/dressing care)

Clinical Applications

Joint ROM

Sustained standing (45-60 min) for passive stretch may show greater improvements. To increase stretch, consider hip extension position, use of knee immobilizers, use of dorsiflexion wedges.

Further research needed. Is development of joint contracture related to decreased muscle growth?

Clinical Applications

BMD

Supported standing can begin at 9-10 months old. Passive weight bearing to maintain BMD. Dynamic, active WB and muscle use to increase BMD. Incorporate sit-to-stand transfers to load/unload long bones. Assure that child is bearing weight through the legs; use minimum necessary postural supports and straps.

Clinical Applications

Hip stability

Aim for 30° to 60° total hip abduction for non-ambulatory children with spastic CP (15° to 30° per LE.)

Avoid 0° abduction position.

Remember:

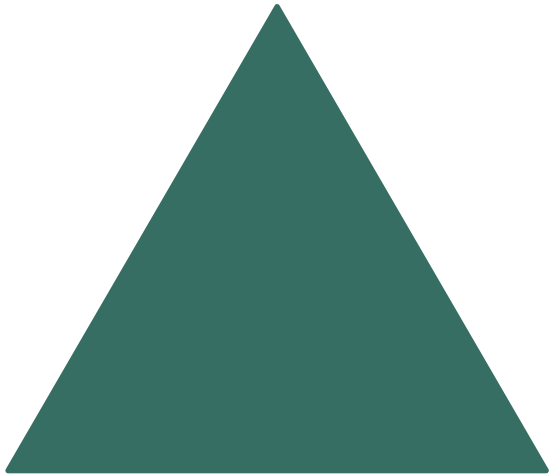
lack of walking before age five (with or without device) contributes to excessive femoral neck anteversion and hip shaft angle.

Clinical Tip:

An isoceles triangle has 60° in each angle.

For a quick estimate to achieve 30° abduction per hip, approximate the distance between the child's feet as equal to the child's inside leg length.

Meeting this requirement becomes more challenging as the child's height increases. (Note: for the total foot-to-foot distance, you'll want to add in the distance between-hips!)



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