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# Spina Bifida – management towards optimal standing and walking

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# Muscle Function Class

## MFC I-V

	I: Sacral	II: Low Lumbar	III: Mid-lumbar	IV: High Lumbar	V: High Lumbar/ Thoracic
	'Low' lesion			'High' lesion	
Muscle Strength grade 1-5, 1= no trace of contraction, 5=normal strength	Weakness of intrinsic foot muscles  Plantarflexion: 4-5	Plantar flexion $\leq$ 3, fair or less  Knee flexion $\geq$ 3, Hip extension and/or hip abduction $\geq$ 2- 3	Hip flexion 4-5  Knee extension 4- 5 good-to-normal  Knee flexion $\leq$ 3, fair or less  Trace of hip extension, hip abduction	No knee extension  No hip adduction  Hip flexion $\leq$ 2, poor or less  Pelvic elevation 2-3, fair or poor	No muscle activity in the lower limbs  No pelvic elevation

# Realistic prognosis of ambulation

- Level of motor paresis
- Analysis of additional ambulation-related factors
  - Contractures
  - Spasticity
  - Balance problems
  - Generalized muscle hypotonia



# Orthotics vocabulary

Categories of orthoses → reference to the anatomical segments and joints they encompass

- FO foot orthosis
- AFO ankle-foot orthosis
- KAFO knee-ankle-foot orthosis
- HKAFO hip-knee-ankle-foot orthosis
- THKAFO trunk-hip-knee-ankle-foot orthosis

(ISO 8449-3 : 1989)

# Orthosis types



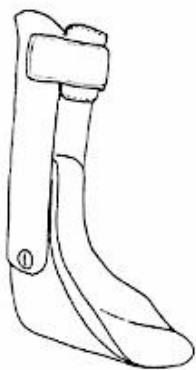
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AFO

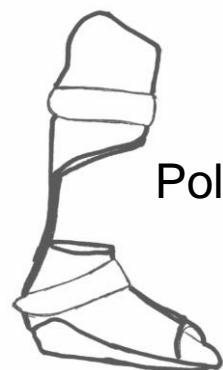


Solid

Overlapping



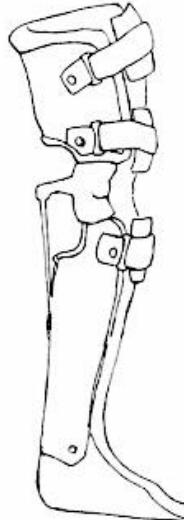
Polycentric



KAFO

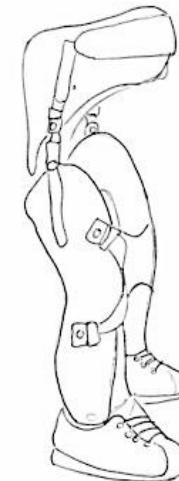


Freely-  
articulating

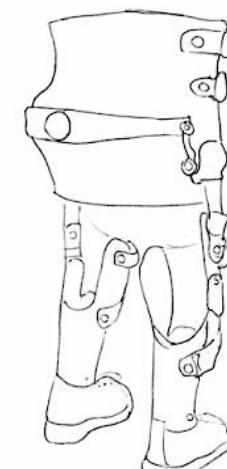


Locked

HKAFO



3-D



Reciprocal

# MFC I



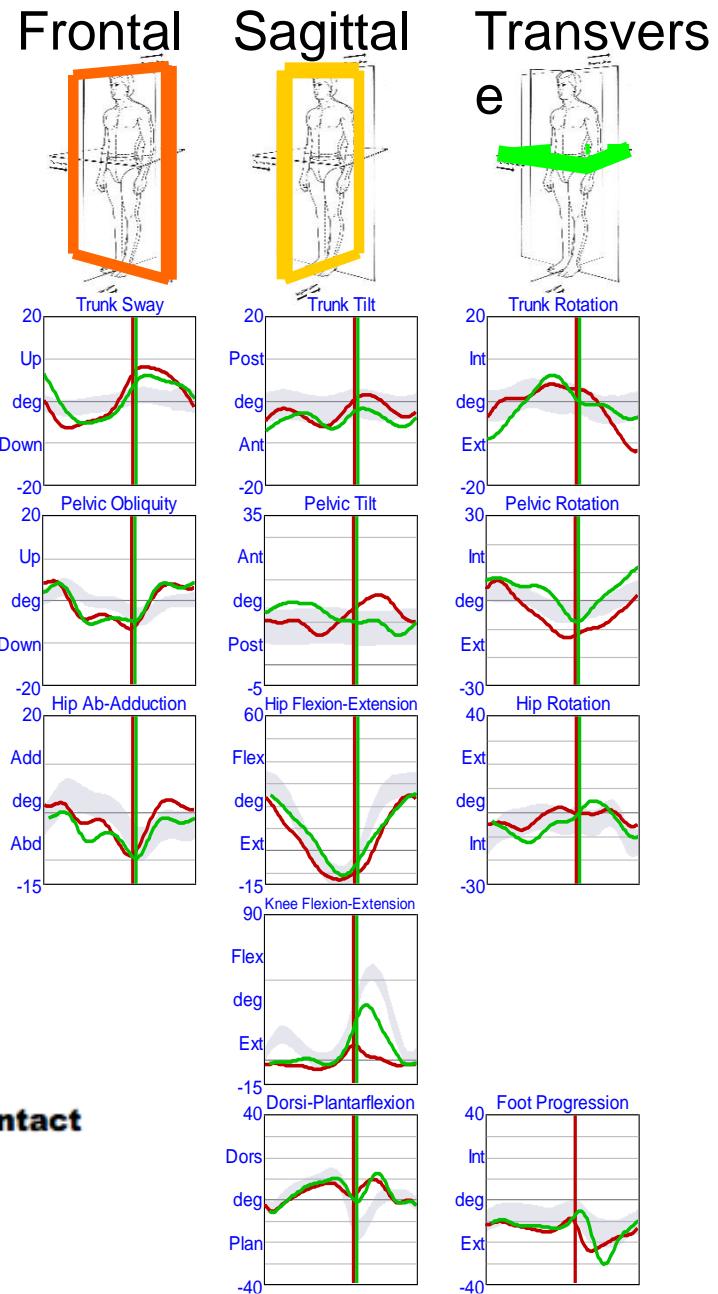
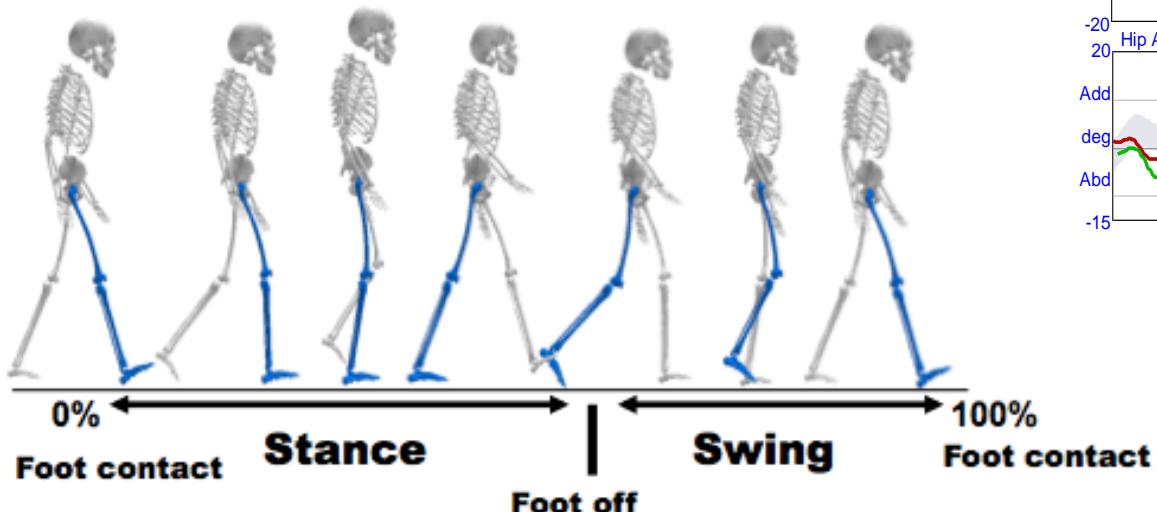
- Weakness of intrinsic foot muscles and flexor hallucis longus
- Expected ambulation:

Community ambulation. Ability to keep up with peers when walking outdoors

**Orthoses:** Insoles, FO



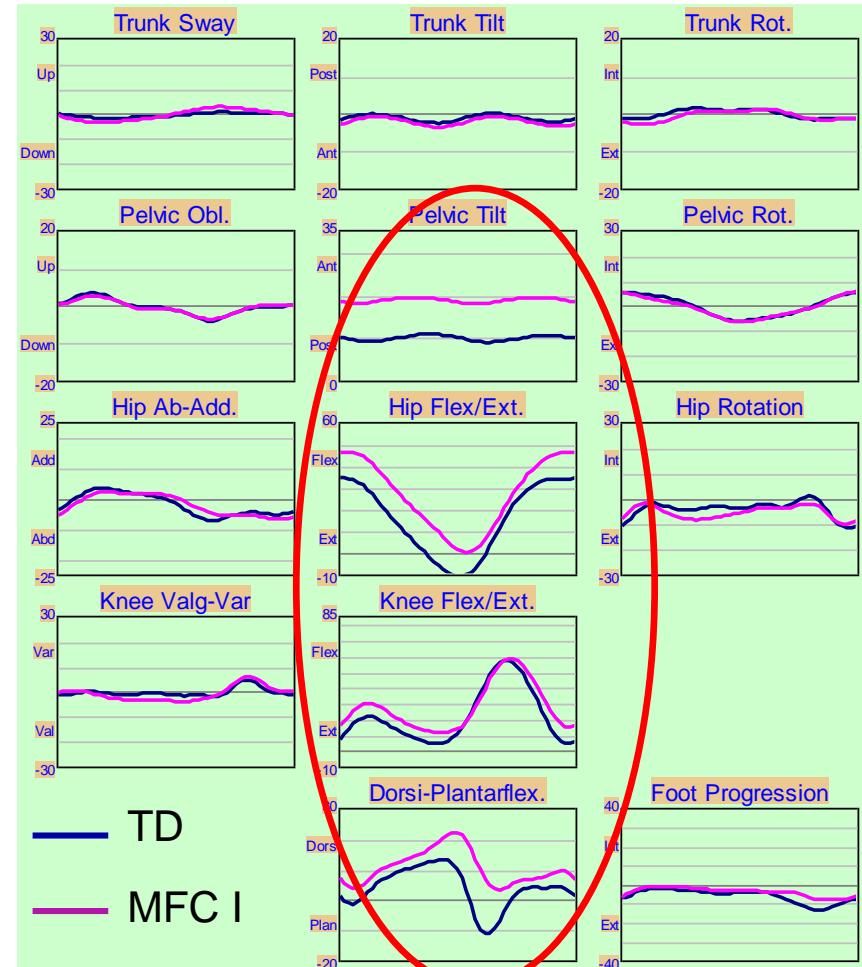
# Gait analysis



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# MFC II

- Main problem: Plantarflexion weakness

Expected ambulation

- Community ambulation with need of orthoses.
- No walking aid.
- Wheelchair use only for long distances outdoors



**Orthoses:** Initially free-articulated KAFO, thereafter AFO



Freely-articulating KAFO

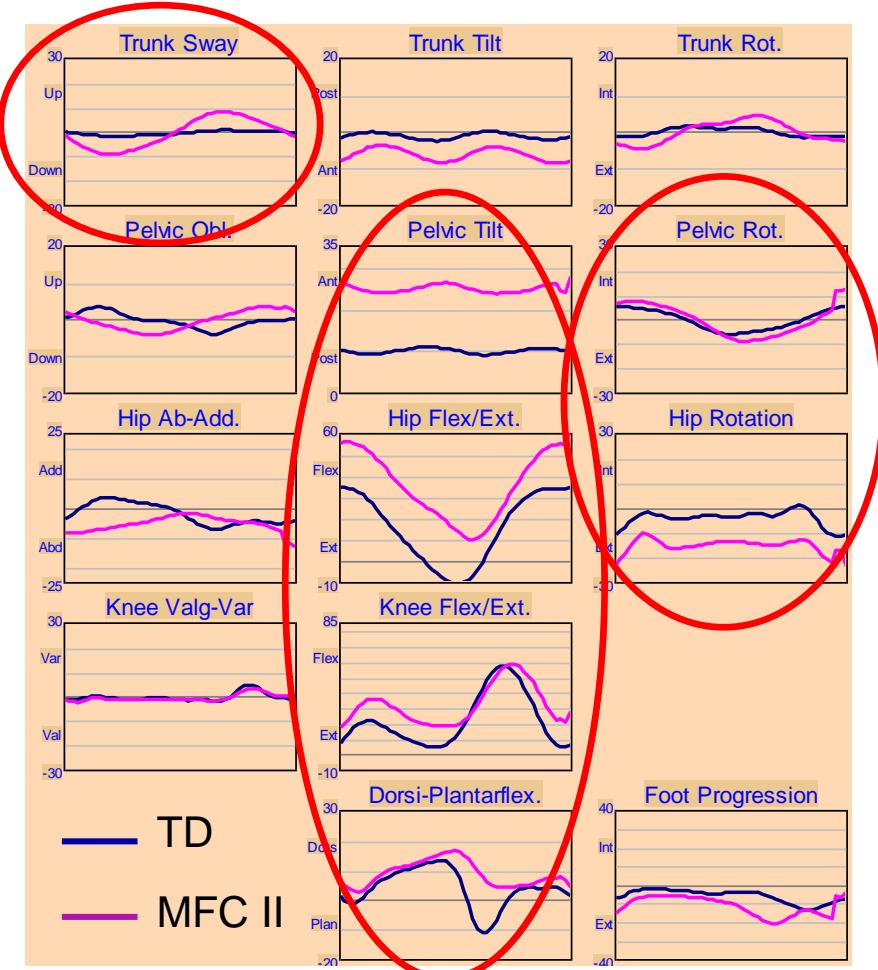


AFO (solid/overlap)



AFO (polycentric)

# Ex. MFC II with AFOs, 11.7 years

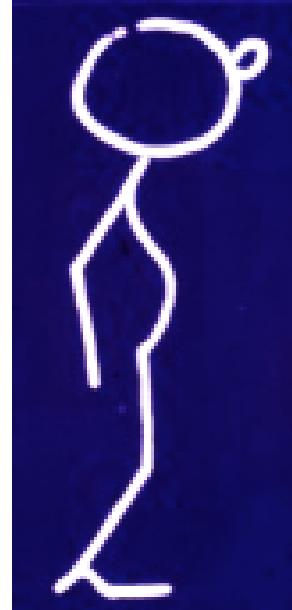


# MFC III

- No below-knee muscle strength
- Weakness of hip extensors, hip abductors

Expected ambulation:

- Household ambulation with orthoses, sometimes walking aids
- Wheelchair use only outdoors, and for long distances indoors



**Orthoses:** HKAFO, KAFO, AFO with condylar support



HKAFO 3D hip joint



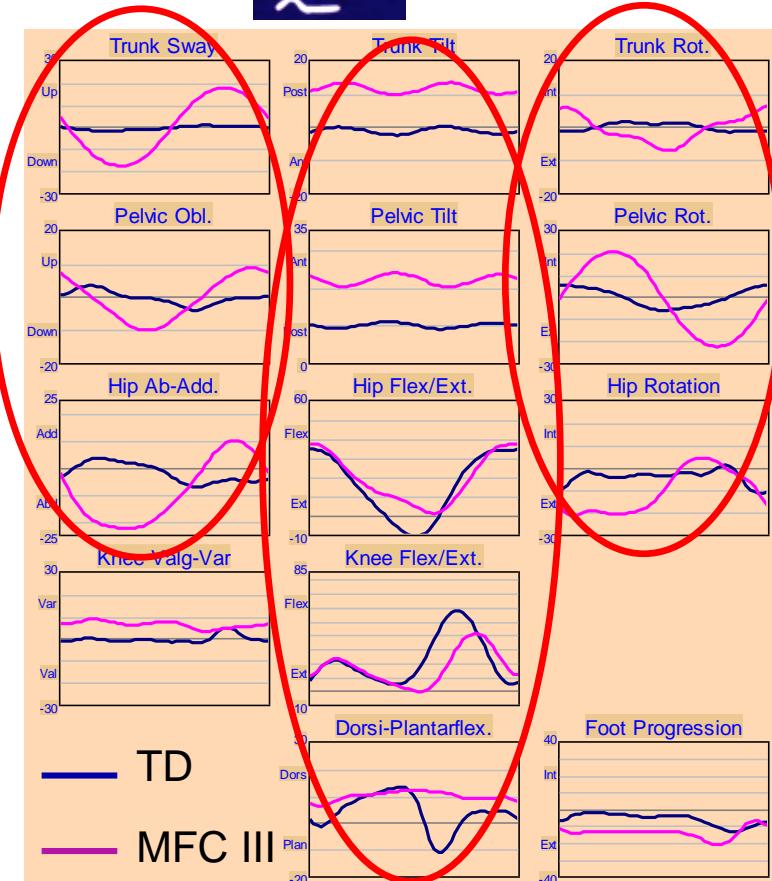
Freely-articulating KAFO



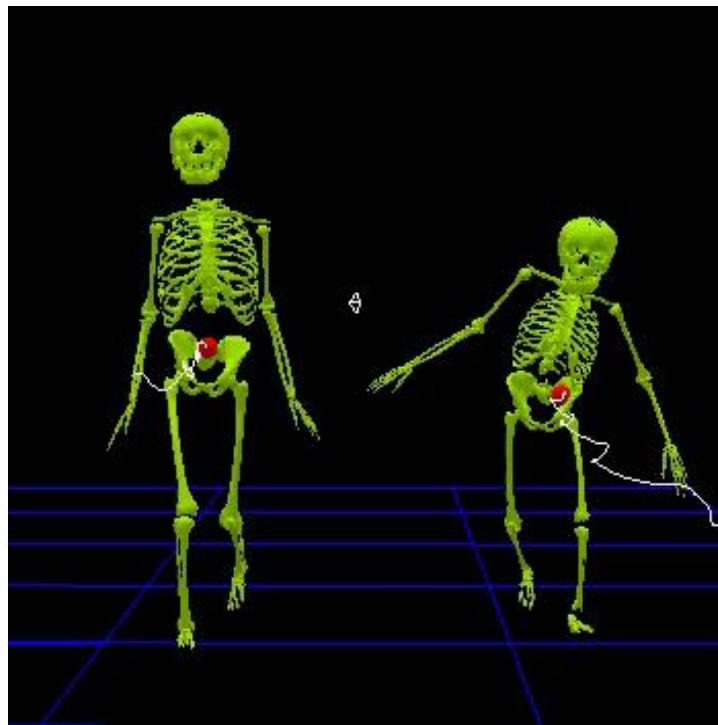
AFO with condylar support

# Ex. MFC III with KAFOs, 7.8 years

Hips contained

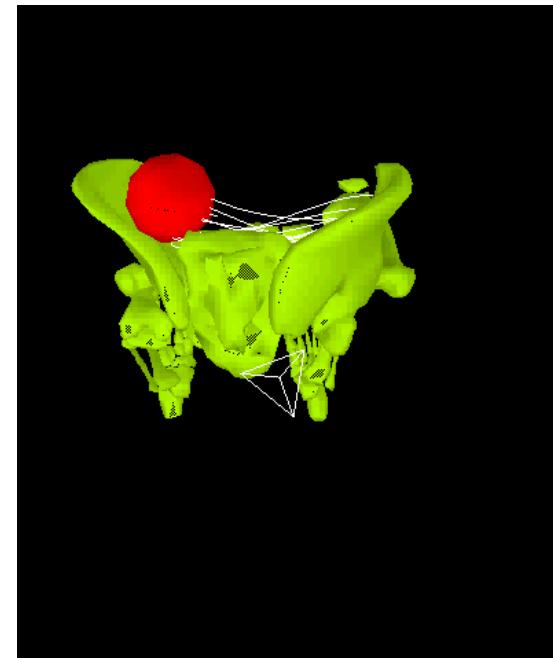


# Compensatory gait



TD

MFC III



*With stable hips*

MFC III

# MFC III

## Midlumbar



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### Keep the hips reduced!



- Modern hip surgery, without tendon transfers, combined with well-aligned orthoses
  - For children with potential walking capacity
    - Contained hips
    - Higher quality of life
- Danielsson et al 2008
- No walking aids
    - hands are free to be used for other things!

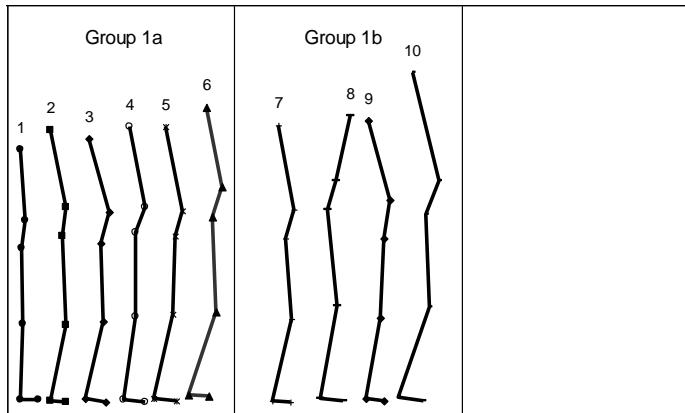
# Effect of Spasticity: Standing

MFC I

No spast

Ankle

Ankle + knee/hip

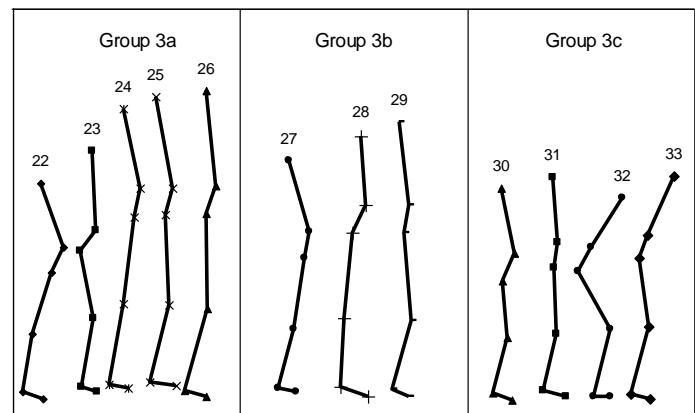


MFC III

No spast

Ankle

Ankle + knee/hip

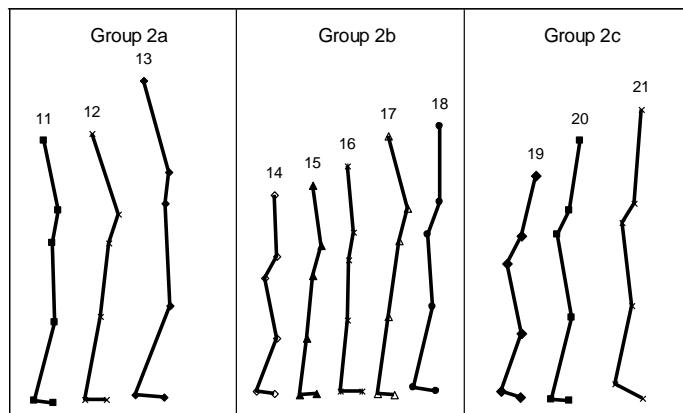


MFC II

No spast

Ankle

Ankle + knee+hip



# MFC IV

- Knee extensor weakness
- Remaining pelvic elevation

Expected ambulation: Household ambulation with orthoses and walking aids. Wheelchair use both in- and outdoors

**Orthoses:** HKAFO, locked knee joint



HKAFO (3-D hip joint)



Reciprocating gait orthosis (RGO)

# MFC V

- No muscle activity in the lower limbs
- No pelvic elevation



Expected ambulation: Non-functional ambulation

- Ambulation during therapy, in school, and for limited time at home
- Wheelchair is used for mobility

## Orthoses: THKAFO



Standing device



Swivel walker



Para walker



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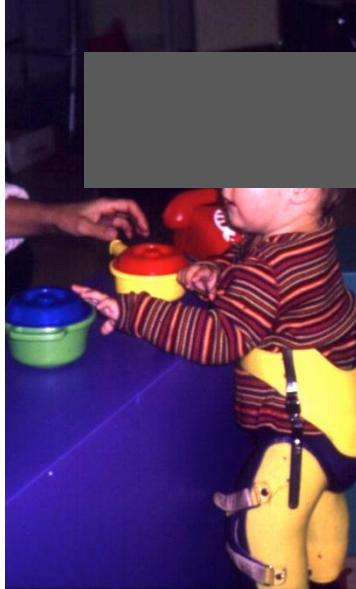
# Physiotherapy

- Orthosis timing
- Standing
- Walking
- Orthosis acceptance
- Orientation in space
- Avoiding muscle imbalance

# Standing and Walking



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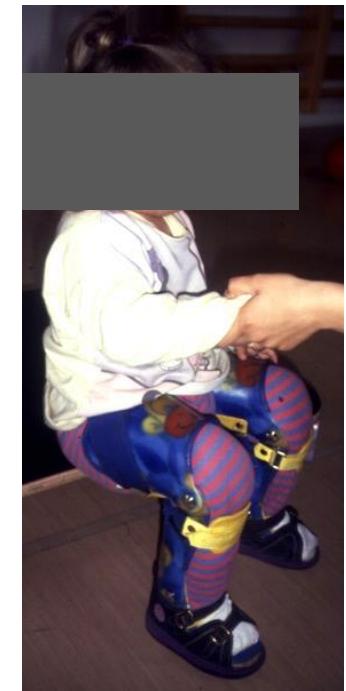
Side steps for pelvic elevation



# Orthosis acceptance and Orientation in space



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# Avoiding muscle imbalance



## Summary

- Characteristic similarities in muscle function classes
- Heterogeneity within and between groups
- Optimal gait achieved by body alignment
  - Contained hips
  - Prevention of deformities
  - Stable orthoses in frontal and transverse planes



Thanks for your attention