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FRANK

Development of gait in children : Research and therapy

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Normal or typical development

§ Importance of locomotion?


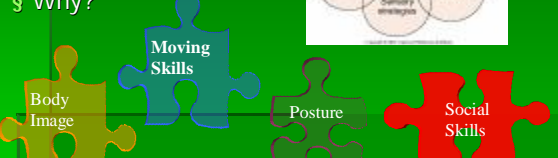
- Locomotion makes that development can occur
- Perception
- Cognitive
- Communication
- ...



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§ What is locomotion?
§ What's organization?
§ What's function?
§ Why?

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- § Development = organization of function
- § Function = having the possibilities
- § Having possibilities = be able to adapt
 - § Gravity (stability - balance)
 - § Communication (express - talk - ...)

= organization of function to create possibilities by movement
 - patterns and behavior
 = to be able to adapt to the needs

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Function: which - how - why?

= to be able to adapt to the context:

- survive
- gravity
- sensation
- motivation
- communication

= variability - choice - dynamics are necessary

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Study normal development

Vertical development

= milestones

Evaluate functional progression

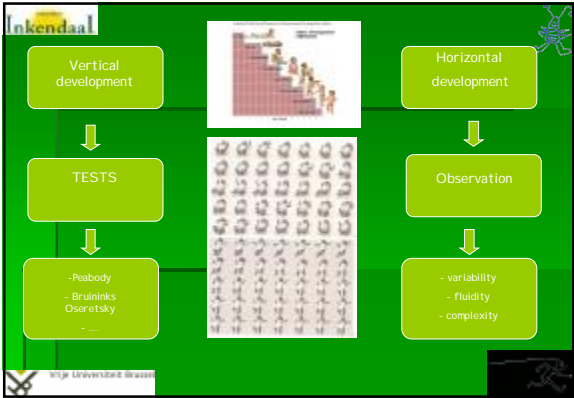
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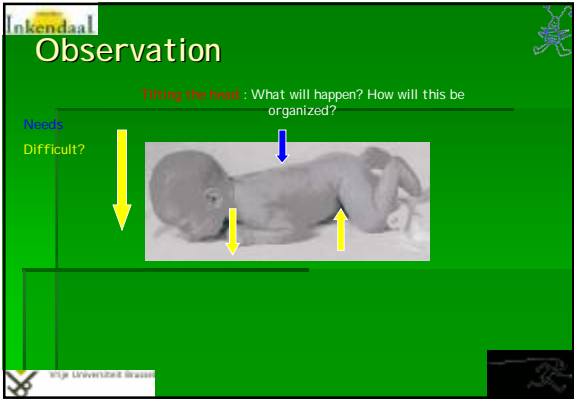
Horizontal development

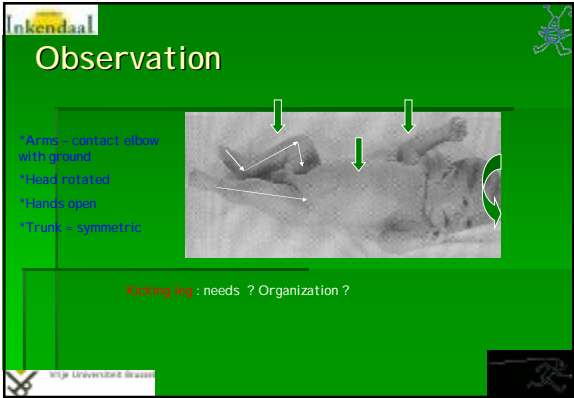
= sequences of movement

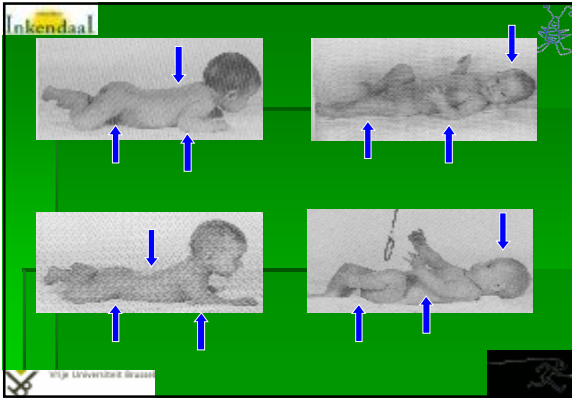
quality of movement

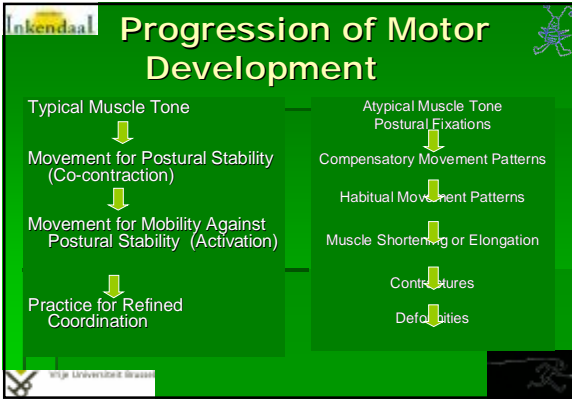
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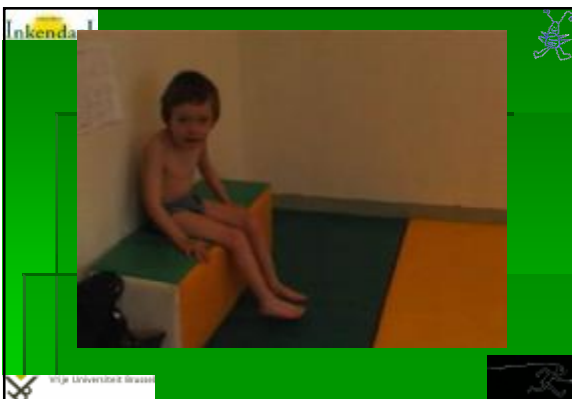


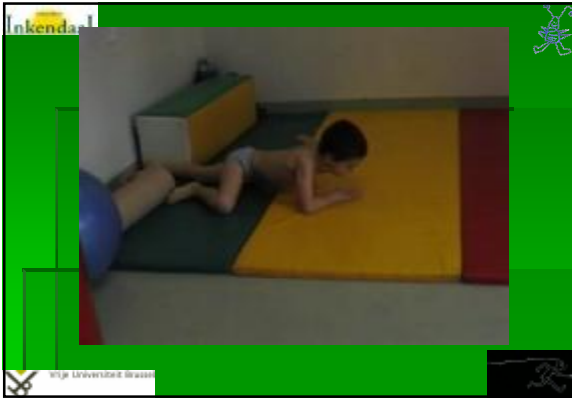












**Research postural control:
Influence of a stable trunk on
gait in children with cerebral
palsy**

**Development of
postural control**

Is the base on which movements can be organized

Posture : function is holding against gravity
to keep balance during initiation of a movement

Functional approach:

1. Function to coordinate posture and movement
2. Function to coordinate different segments of the body
3. Anticipation
4. Adaptation

Motor control

- § Characterized by:
 - § Internal Constrains
 - § Musculoskeletal development
 - § Maturation of the CNS
 - § Specification of the task
 - § Environment

Two functional principles

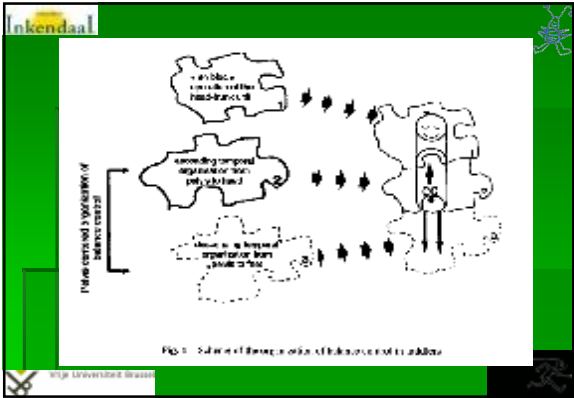
- § Stable reference frame from which the equilibrium control is based
- § Gradual mastery of de degrees of freedom of the various body joints

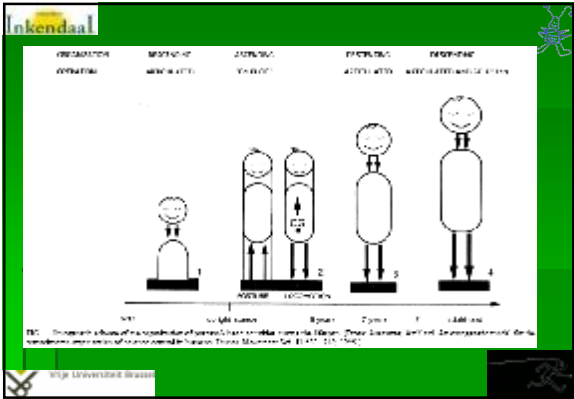
Choice of the stabilized anatomical segment of reference depends on:

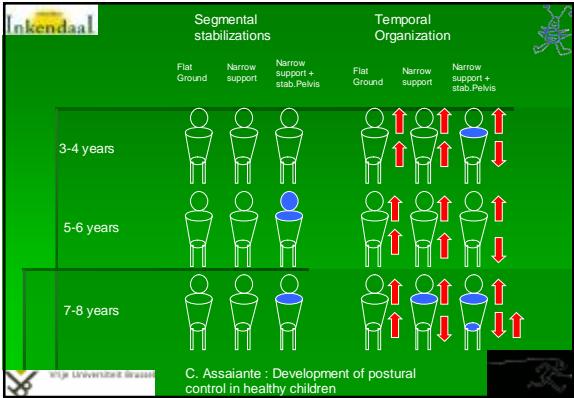
- a. Dynamic constraints
- b. Environment
- c. Characteristics of each developmental period.

Two modes of control

- § « en bloc » strategy
 - § Minimizing the number of degrees of freedom
- § « articulated » strategy
 - § Controlling independently a couple of consecutive anatomical segments and requires the mastery of the degrees of freedom of the corresponding joint








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Egocentric to exocentric spatial orientation




TUMUC 2: Photograph of the 18-month-old child (see also TUMUC 1) who is sitting on a stool. The child is looking forward (egocentric) in the left photograph and to the side (exocentric) in the right photograph. The child is sitting on a stool and looking at the camera in the left photograph. In the right photograph, the child is looking to the side, away from the camera.

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Periventricular Leucomalacia

- Spastic diplegia
- GMFCS I or II
- Premature
- Walks Independently



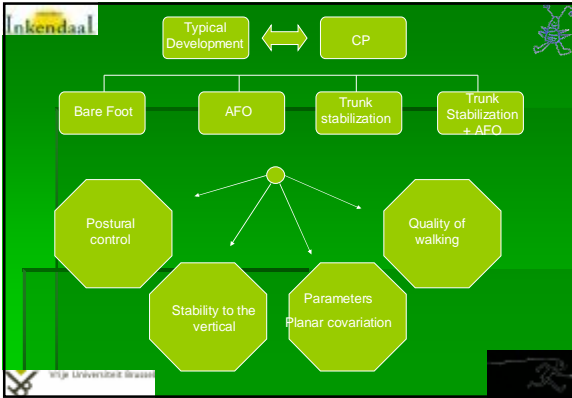
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Does a good postural control has influence on gait?

- § What means trunk control?
 - § = stability (to the vertical) by pitch and roll
- § What means quality of walking?
 - § = parameters like step length, walking velocity, step width, ...
 - § = planar covariation (inter segmental coordination)

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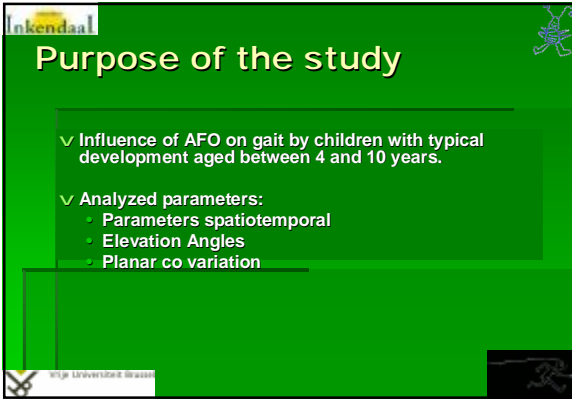
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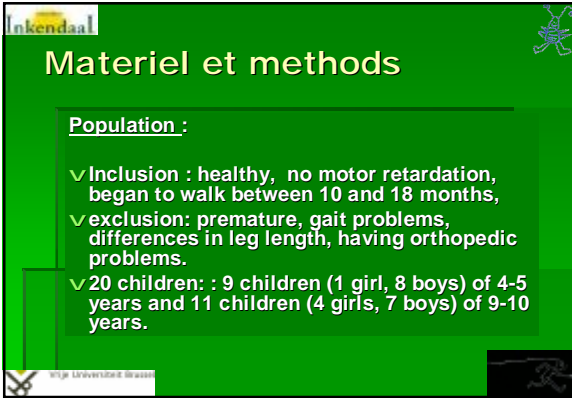
Influence of ankle foot orthosis on gait by children with a typical development.

Degelaen Marc, De Borre Ludo, Cheron Guy,
Leurs Françoise, Pelc Karine, Dan Bernard
Kerckhofs Erik, De Meirleir Linda









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Materiel et methods : Posterior Leaf-Springs



Fig. 1. Heuristic posterior leaf spring (PLSL)


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Children with typical development

Bare foot with AFO

4 – 5 years

9 – 10 years

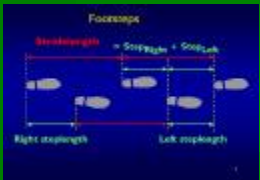


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Parameters spatiotemporal

- § Step length
- § Step width
- § Walking velocity
- § Cadence



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Elevation angles and planar co variation

Elevation angles

Borghese et al. (1996)
Cheron et al. (2001)

Planar Co variation

L'Ellipse

Roll (deg)
Pitch (deg)
Yaw (deg)

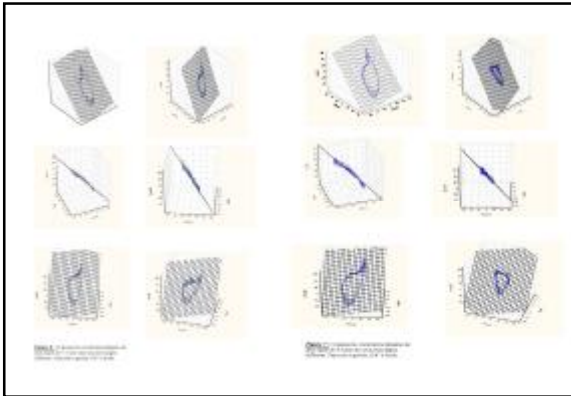
Results

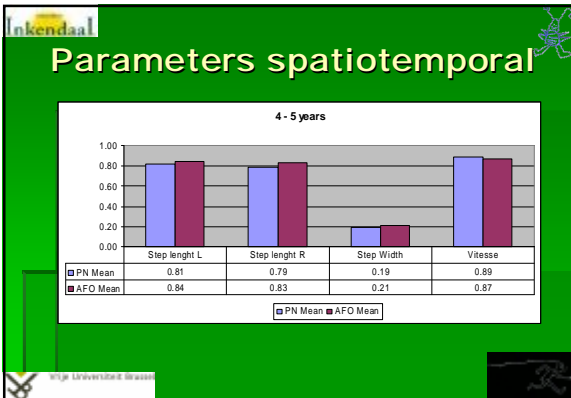
Elevation Angles

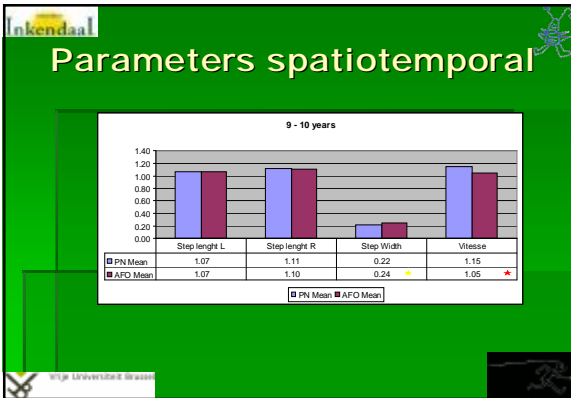
Bare Foot Ankle Foot orthese

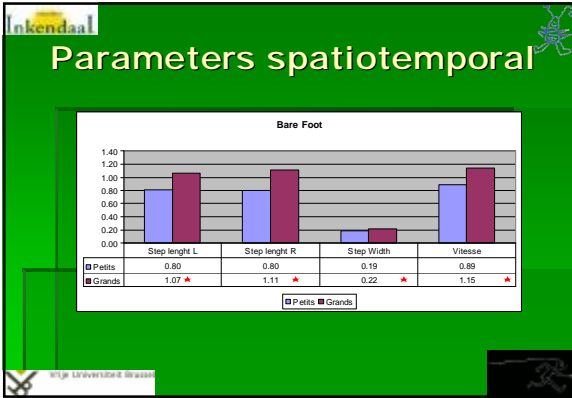
4 - 5

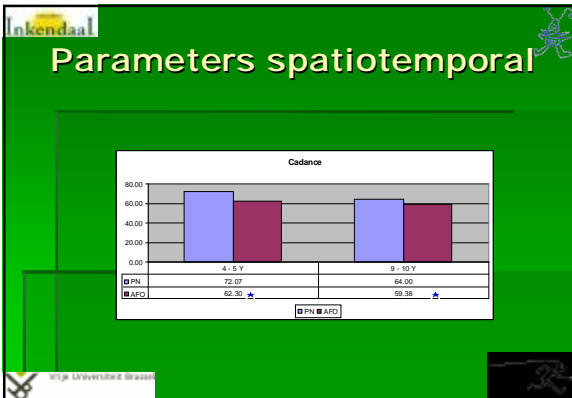
9 - 10

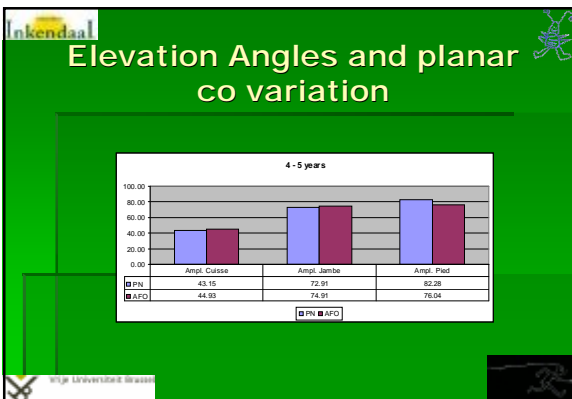


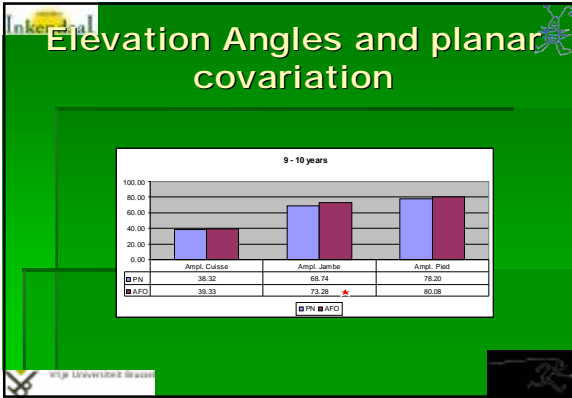


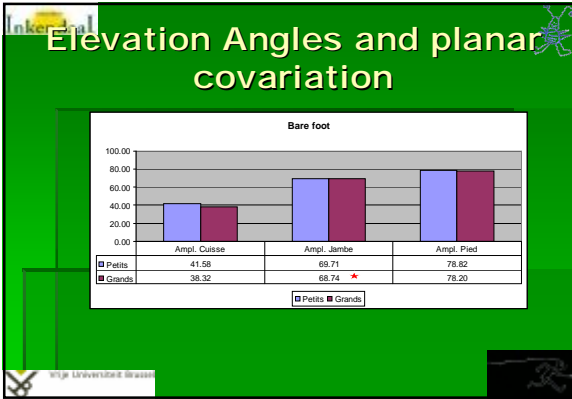


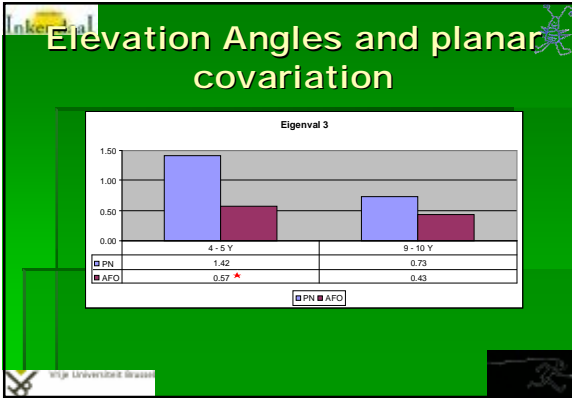















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Conclusion

- § Evolution of gait with age
- § Ankle foot orthosis change gait in children with typical development
- § Spatiotemporal parameters in children are changed
- § Ankle foot orthosis synchronize the movement between the shank and foot


 

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Influence of ankle foot orthosis on trunk movement by children with a typical development.



Degelaen Marc, De Borre Ludo, Cheron Guy, Leurs Françoise, Pelc Karine, Dan Bernard Kerckhofs Erik, De Meirleir Linda

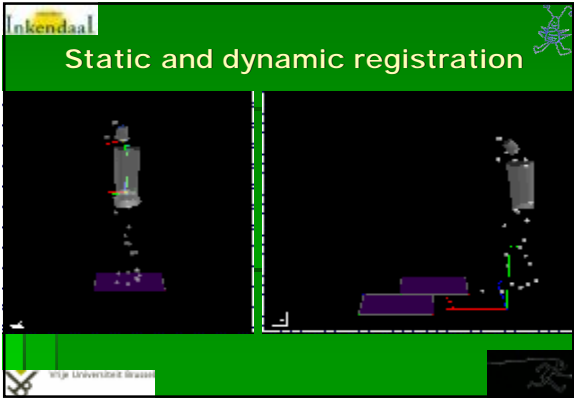
 

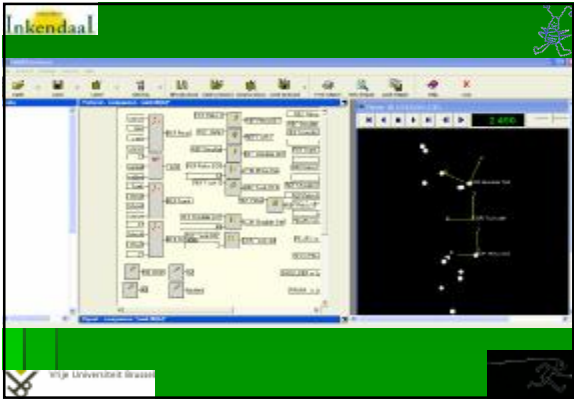
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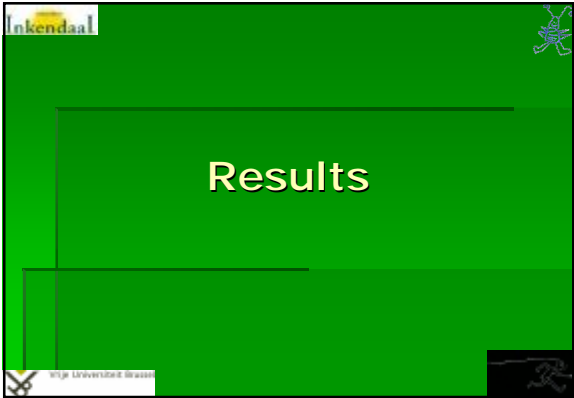
Purpose of the study

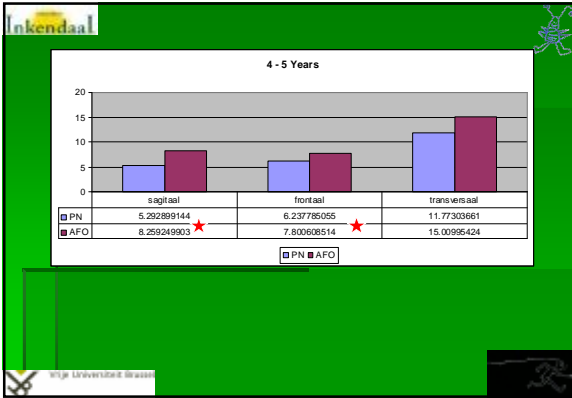
✓ Influence of AFO on trunk movements by children with typical development aged between 4 and 10 years.

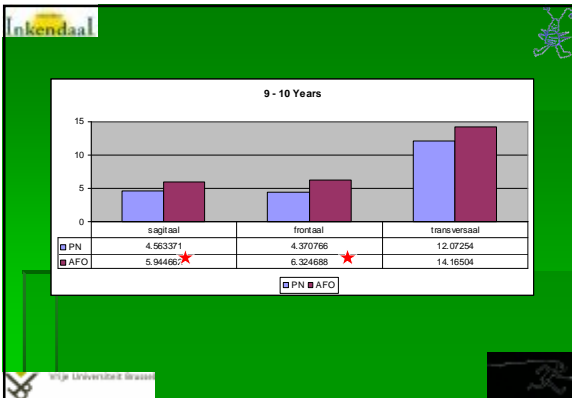
 

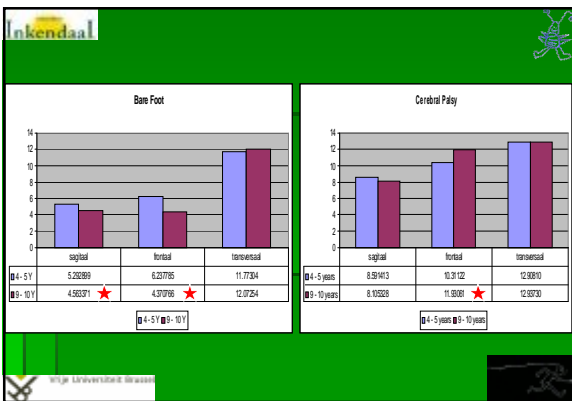


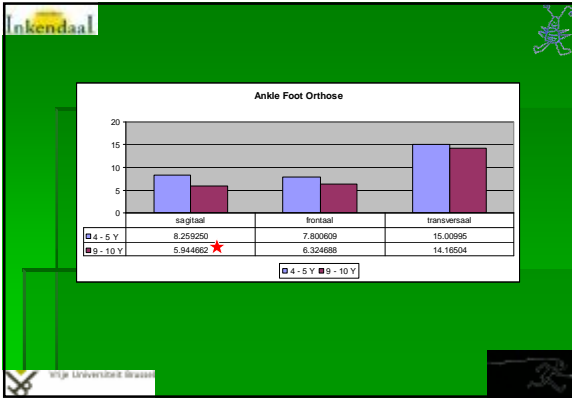


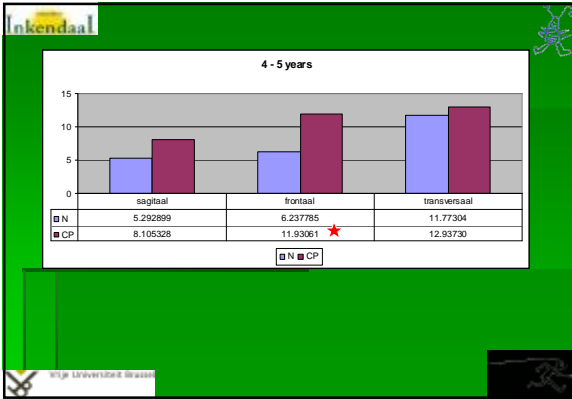


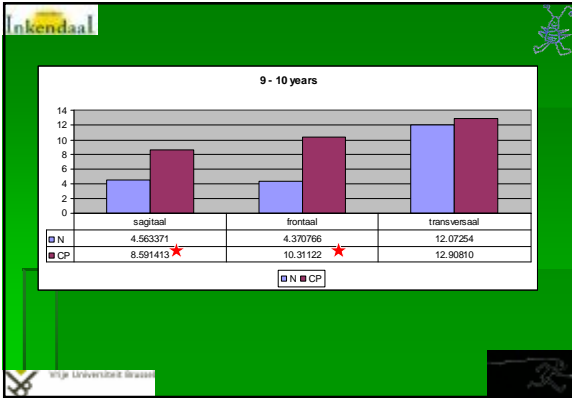
















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Conclusion



- § More variability in younger children _____
- § Use of AFO gives more compensations in the trunk
- § Most compensation are seen in the sagital and frontal plane
- § The older the CP children, the more they are different from the typical developing children


 


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§ With proper assessments and activities to minimize motor development problems the child can develop efficient skills in:



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Thanks

