The use of instrumented gait analysis in interdisciplinary interventions for children with cerebral palsy

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Thesis & papers

SDU **☆**

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- I Rasmussen HM, Nielsen DB, Pedersen NW, Overgaard S, Holsgaard-Larsen A. Gait Deviation Index, Gait Profile Score and Gait Variable Score in children with spastic cerebral palsy: Intra-rater reliability and agreement across two repeated sessions. **Gait & Posture. 2015;42(2):133-7.**
- IIa Rasmussen HM, Pedersen NW, Overgaard S, Hansen LK, Dunkhase-Heinl U, Petkov Y, Engell V, Baker R, and Holsgaard-Larsen A. The use of instrumented gait analysis for individually tailored interdisciplinary interventions in children with cerebral palsy: a randomised controlled trial protocol. BMC Pediatrics. 2015;15(1):202.
- IIb Rasmussen HM, Pedersen NW, Overgaard S, Hansen LK, Dunkhase-Heinl U, Petkov Y, Engell V and Holsgaard-Larsen A. The use of instrumented gait analysis for individually tailored interdisciplinary interventions in children with cerebral palsy: a randomised controlled trial.

[Re-submitted to Dev Med Child Neurol, Feb 2018].

III Rasmussen HM, Svensson J, Christensen MT, Pedersen NW, Overgaard S, Holsgaard-Larsen A. Threshold values of ankle dorsiflexion and gross motor function in 60 children with cerebral palsy – a cross-sectional study

[Acta Orthop, 2018 Mar 28:1-6 Epub ahead of print].



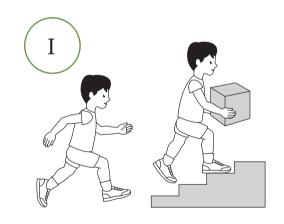
Content

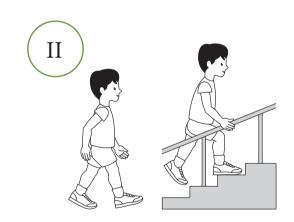
Introduction
Methods
Results
Conclusion
Perspectives



Population

Children with spastic cerebral palsy GMFCS level I and II





60% of childen with CP Rodby-Bousquet & Hägglund (2012)

Rosenbaum PL at al (2008) www.canchild.ca







The Danish Cerebral Palsy Follow-up Program (CPOP)

National clinical quality database & Follow-up program

Standardized examinations

Gross motor function

Muscle tone
Passive range of motion
Orthotics and assistive devices



www.cpguiden.dk

Rasmussen et al (2016)





Planning of interventions

Local teams

Interdisciplinary consultations

Examinations

Gross motor function

Gait pattern

Interventions

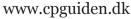
Rasmussen (2016)















Gait analysis

- Movements (kinematic)
- Forces (kinetics)

Gage (1994)

- Diagnose and monitor progress

Baker (2016)



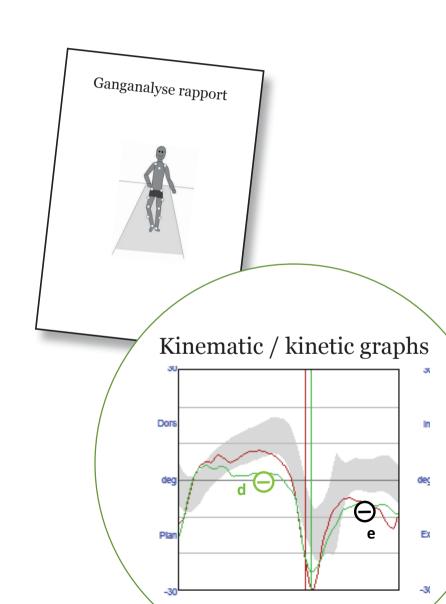




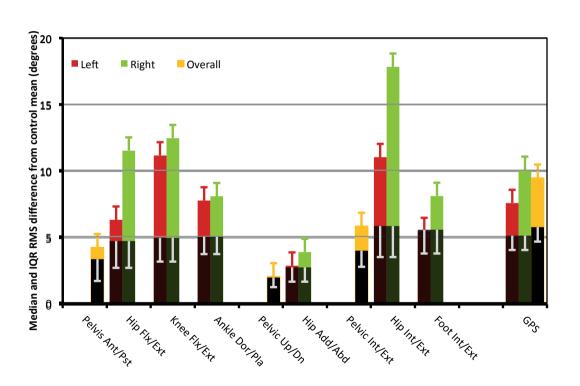
Clinical practise

Impairment focused interpretation (Baker 2009)

- History
- Orientation: Gait indices
- Video
- Evidence and interpretation
- Kinematic / kinetic graphs
- Physical examination
- Patient reported outcome measures







Research: Gait indices

Gait Deviation Index Schwartz (2008)

Gait Profile Score
Baker (2009)



Gait Variable Score Movement Analysis Profile

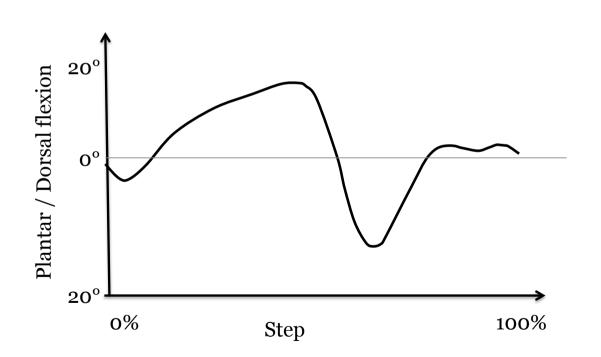




Research: Gait indices

Gait Deviation Index Schwartz (2008)

Gait Profile Score
Baker (2009)



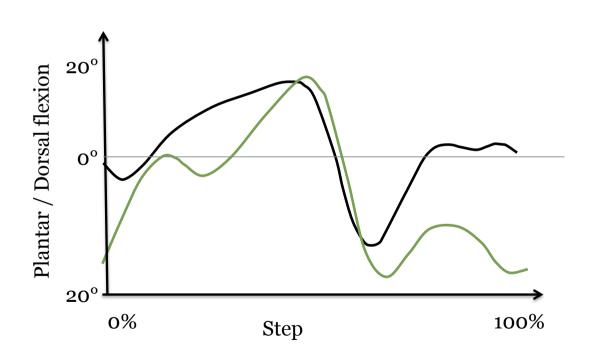




Research: Gait indices

Gait Deviation Index Schwartz (2008)

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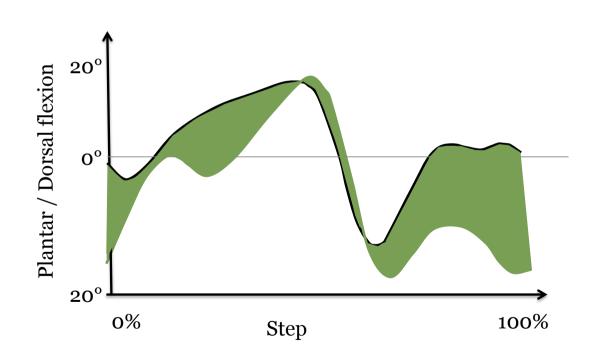




Research: Gait indices

Gait Deviation Index Schwartz (2008)

Gait Profile Score
Baker (2009)







Gait analysis



- 40-70% Changes in treatment plans

Lofterod (2007), Cook (2003), Kay (2000), Deluca (1997)

- 77-97% Compliance

Wren TA (2013), Lofterod (2007), Wren TA (2005)

- Effectiveness of interventions

Franki (2014), Van den Broeck (2010), Wren (2013)





Motivation for the study

Combining the CPOP with the use of gait analysis







Study aim

Study aim

This study aimed to determine if individually tailored interdisciplinary interventions with gait analysis lead to greater improvements than individually tailored interdisciplinary intervention without gait analysis in overall gait pathology, walking performance and patient-reported outcome measures of function, disability and health-related quality of life.

Protocol article:

Rasmussen HM, edersen NW, Overgaard S, Hansen LK, Dunkhase-Heinl U, Petkov Y, Engell V, Baker R, Holsgaard-Larsen, A BMC Pediatrics (2015)

Rasmussen et al. BMC Pediatrics (2015) 15:202 DOI 10.1186/s12887-015-0520-7 **BMC** Pediatrics STUDY PROTOCO The use of instrumented gait analysis for individually tailored interdisciplinary interventions in children with cerebral palsy: a randomised controlled trial protocol Helle Mätzke Rasmussen ^{1,2}, Niels Wisbech Pedersen ^{1,2}, Søren Overgaard ^{1,2}, Lars Kjaersgaard Hansen Helie Matzie Basmussen ", inies Wispech Federsen", Søren Uvergaard ", Lars njaersgaard marben , Ulrike Dunkhase-Heini^{ns, Y}anko Petkov⁶, Vilhelm Engell¹², Richard Baker² and Anders Holsgaard-Larsen¹² Background: Children with cerebral palsy (CP) often have an altered gait. Orthopsedic surgen backgroung: Anoten win ceebral pasy (Lr) often have an affere gar. Lythopseoic surgery, spastiony management physical therapy and orthotics are used to improve the gait. Interventions are individually tailored and are yorka Inerapy and ormotics are used to improve the gait, interventions are individually tailored and a anned on the basis of clinical examinations and standardised measurements to assess walking (care as usual). These or the pass of chieful examinators and satisfactors in the gait that reflect underlying neuro-musculosk wewey, these measurements do not describe features in the gait that reflect underlying neuro-musculosk rowever, mele neasuremens on not describe reatures in me gait trial reflect underlying neuro-musculoseeral impairments. This can be done with 3-dimensional instrumented gait analysis (GAI, The aim of this study is to test the Physichesis that improvements in gait following individually tailored internentions when IGA is used are supe Methods/Design: A prospective, single blind, randomised, parallel group study will be co Methods/Ubsight: A prospective, single blind, randomised, parallel group study will be conducted. Children aged 5 to 8 years with spastic CP, classified at Gross Motor Function Classification System levels I on II, will be included. The Anguous are тумычныму смилес инеговыратыту инегуенциов разес оп the use of кла. many outcome is gait measured by the Gait Deviation Index Secondary outcome measures The durinance (internance) and parent-responsed uncomes or functional mountly frequence evaluation of your mentory), health-related quality of life (The Pediatric Quality of Life Inventory) Cerebral Palsy Module) and The may pure meases quality or the time remains, subsity or the inventury seterior ratio mounted after this, pain and participation (The Pediatric Outcome Data Collection Instrument). The primary endpoint for erall health, pain and participation (The Pediatric Outcome Uata Collection Instrument). The primary enopoint for sessing the outcome of the two interventions will be 52 weeks after start of intervention. A follow up will also be assessing one outcome on the two interventions will be set weeks and some on interventions of the patient-reported outcomes. Discussion: To our knowledge, this is the first randomised controlled trial comparing the effects of an individually Discussion: To our incomedge, rus is the first fandomised controlled that companing the effects of all introducing tailored interdisciplinary intervention based on the use of IGA versus 'care as usual' in children with CP. Consequen Trial registration: Trial registration: ClinicalTrials.gov NCT02160457. Registered June 2, 2014. Keywords: Gait analysis, Cerebral Palsy, Gait Deviation Index, Study protocol

Article IIb - resubmitted





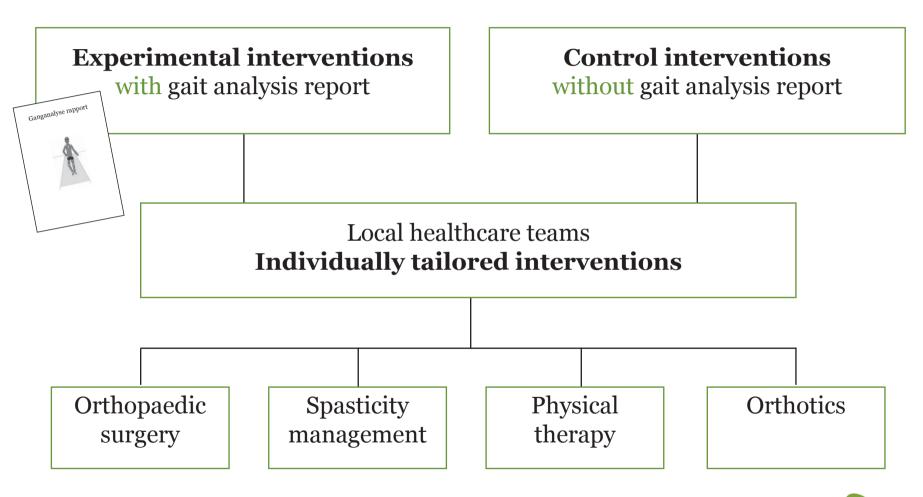
Outcomes

- Overall gait pathology
- Walking performance
- Function & disability
- Health-related quality of life

	Study II	
Instrumented gait analysis		
Gait Deviation Index (primary outcome)	X	
1-minute walk	X	
Patient reported outcome measures		
Pediatric Evaluation of Disability Inventory Mobility scale	X	
Pediatric Outcome Data Collection Instrument	X	
The Pediatric Quality of Life Inventory Cerebral Palsy Module	X	



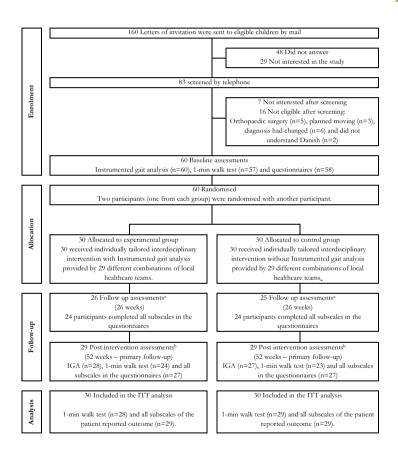
Interventions







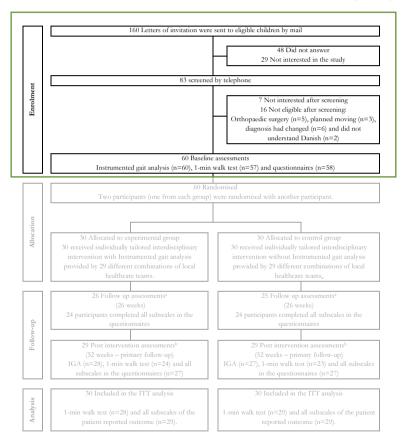
Flow chart

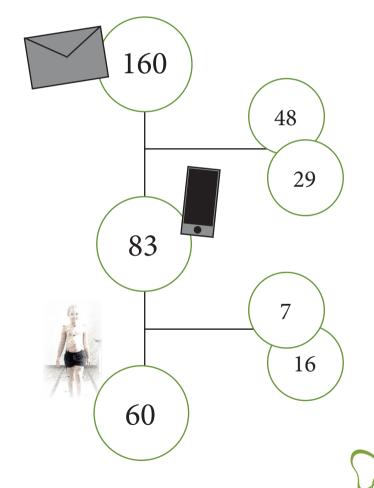






Flow chart: Enrollment

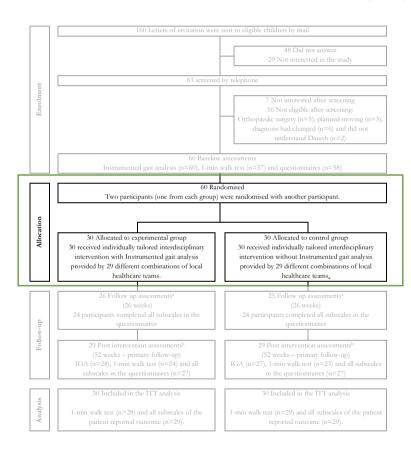




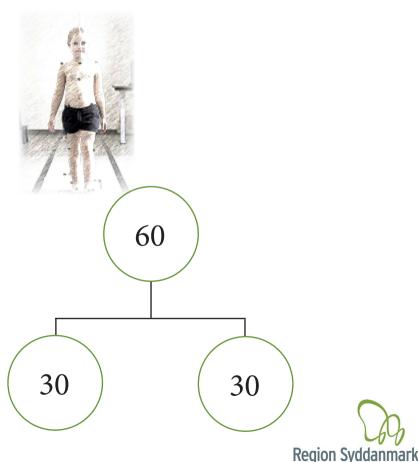
Region Syddanmark



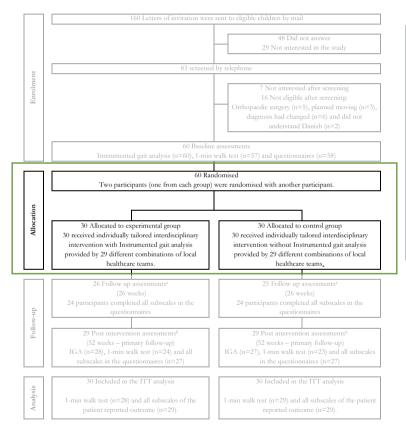
Flow chart: Allocation



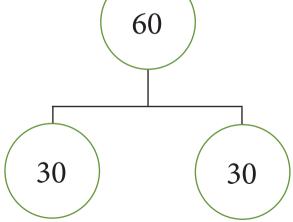




Flow chart: Allocation

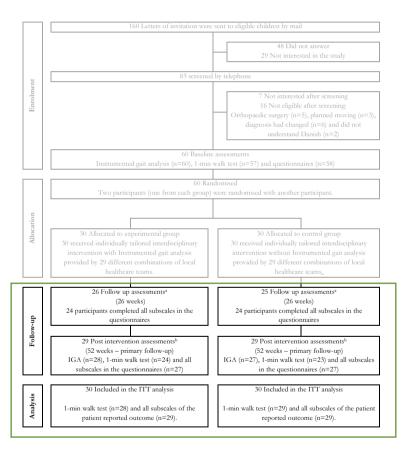


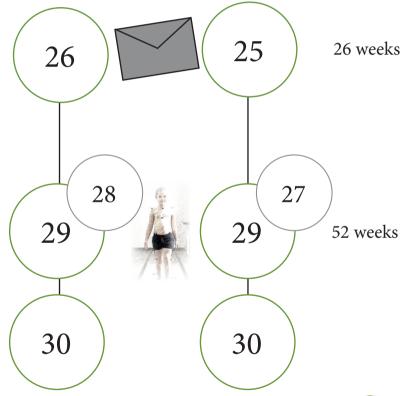
Participants	Study II-III	
Number, n	60	
Age, mean (SD)	6 y 10 m	(1 y 3 m)
Sex, girls/boys, n (%)	21/39	(35/65)
CP subtype, UL/BL, n (%)	43/17	(72/28)
GMFCS I / II, n (%)	42/18	(70/30)





Flow chart: Follow-up & analysis





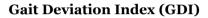




Between-group differences

In favor of **Control**

In favor of **Experimental**



1-minute walk test (metre)

PEDI, Functional skills

PEDI, Caregiver assistance

PedsQL, Daily Activities

PedsQL, School Activities

PedsQL, Movement and Balance

PedsQL, Pain and Hurt

PedsQL, Fatigue

PedsQL, Eating Activities

PedsQL, Speech and Communication

PODCI, Global functioning scale

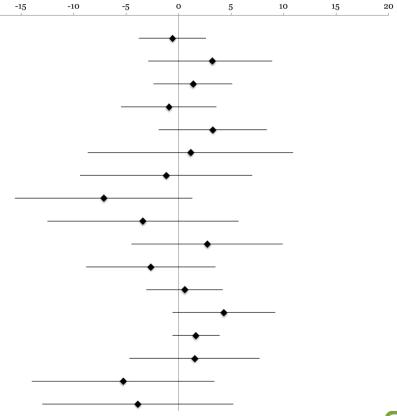
PODCI, Upper extremity function

PODCI, Transfer and basic mobility

PODCI, Sports and physical functioning

PODCI, Pain/Comfort Scale

PODCI, Happiness Scale







Applied interventions & compliance

Applied interventions	Exp	CON
Physiotherapy	24	24
Orthotics	8	12
Spasticity management	7	10
Orthopedic surgery	0	1

n = 28/29, p = > 0.05





Applied interventions & compliance

Applied interventions	Exp	CON
Physiotherapy	24	24
Orthotics	8	12
Spasticity management	7	10
Orthopedic surgery	0	1

n = 28/29, p = > 0.05

Compliance	+ Rec + app	+ Rec
Physiotherapy	24	28
Orthotics	6	10
Spasticity management	5	14
Orthopedic surgery	0	1





Conclusion

Study aim

This study aimed to determine if individually tailored interdisciplinary interventions with gait analysis lead to greater improvements than individually tailored interdisciplinary intervention without gait analysis in overall gait pathology, walking performance and patient-reported outcome measures of function, disability and health-related quality of life.

Conclusion

This study could not confirm the hypothesis that improvement in the overall gait pathology, walking performance and patient-reported outcomes following individually tailored interventions when gait analysis is used are superior to those following 'usual care' in a case-mix of all children with cerebral palsy at GMFCS levels I and II, at an early age.



Perspectives

Study results - Gait analysis

Explorative data - analysis

Christina Esmann

Measure of processes of Care Gross Motor Function Measure (selected items)

Gait Analysis

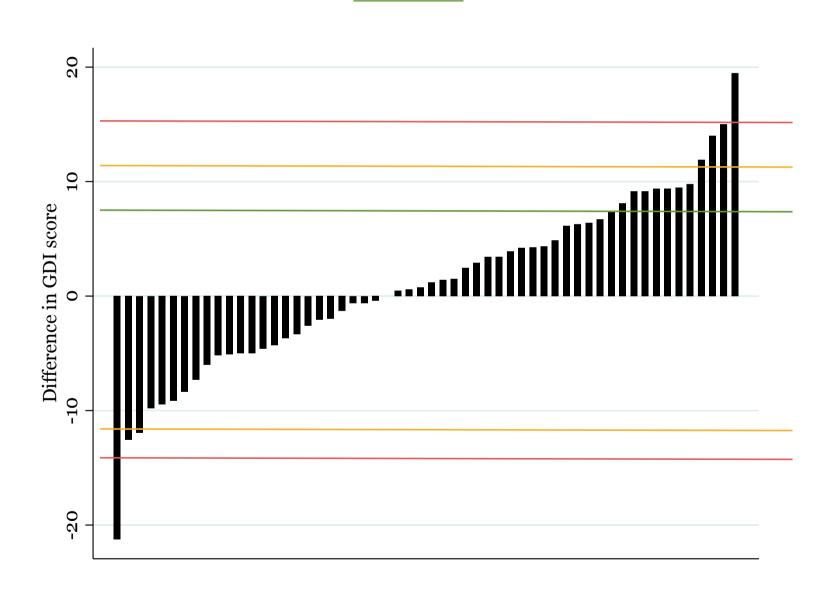
Validation of methods used for interpretation

Dissimination of recommendations
Aherence to recommendations



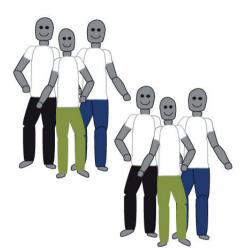


Change in participants



Thanks!

Participants and their parents
The local teams and helathcare professionals
Resarch assistants & collegues



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Region of Southern Denmark Research grant and PhD grant, The Physiotherapy Practice Foundation,
The Ludvig and Sara Elsass Foundation,
The Linex Foundation and
The Danish Physiotherapy Research Fund.



