PhD thesis

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

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November 2017

9. Summary

English summary

The majority of ambulatory children with cerebral palsy experience an altered gait pattern or other walking difficulties and are dependent on healthcare interventions throughout their childhood. In the Nordic countries, a surveillance program and associated database, called the Cerebral Palsy follow-Up Program (CPUP) are used to ensure timely and consistent examinations. The interventions offered to children with cerebral palsy are based upon clinical examinations and standardised measures of overall gross motor function and functional mobility. However, the gait pattern, i.e. the manner of walking used by the child is not evaluated. This can be done with 3-dimensional instrumented gait analysis (gait analysis).

Gait analysis has been used in clinical practice and research for more than thirty years and is widely recognised as the 'gold standard' measure of gait in children with cerebral palsy. However, the potential added benefits of using gait analysis on gait, walking and patient-reported outcomes in the decision-making associated with interdisciplinary interventions to address impairments in gait have not been investigated. Thus, the overall aim of this thesis was to study the use of gait analysis in individually defined interdisciplinary interventions on gait, walking and patient-reported outcomes in children with cerebral palsy.

The starting point for the thesis was the investigation of intra-rater reliability and agreement of gait summary measures across two repeated sessions (later to be used in the randomised controlled trial). The study showed that the summary measures: the Gait Deviation Index and Gait Profile Score have excellent reliability and acceptable agreement. However, a large variability in some of the Gait Variable Scores was documented.

Having established documentation for the reliability and agreement of the Gait Deviation Index (primary outcome measure), a randomised controlled trial investigating the effectiveness of interdisciplinary interventions based on the use of gait analysis versus 'usual care' was conducted. A total of 60 children aged 5 to 8 years with spastic cerebral palsy at Gross Motor Function Classification System (GMFCS) levels I or II were randomised to the experimental or control group. No significant or clinically relevant between-group differences in the change scores of the primary outcome (Gait Deviation Index) or secondary outcome measures (1-min walk test, Pediatric Evaluation of Disability Inventory, The Pediatric Quality of Life Inventory Cerebral Palsy Module and The Pediatric Outcome Data Collection Instrument) were found at 26 weeks or 52 weeks follow-up. Showing that the addition of gait analysis in a case-mix of children with cerebral palsy at GMFCS levels I and II at an early age does not improve gait function, gross motor function and patient-reported outcome measures of disability and quality of life more than 'usual care' (without gait analysis).

Lastly, using a mechanistic approach to the data from the baseline assessment of the participants in the randomised controlled trial, we investigated the potential relationship between passive range of motion and passive traffic light categories used by the CPUP versus gait summary measures from the instruments' gait analysis, gross motor function and patient-reported outcome measures. We found that in our study sample, the range of motion in ankle dorsiflexion and the traffic light categories were correlated with measures of gait that are specific to movement in the ankle and not with measures of overall gait function, walking or gross motor capacity or performance.

In conclusion, the results of this thesis do not support the use of gait analysis in the decision-making of interdisciplinary intervention in a case-mix of children with cerebral palsy at GMFCS levels I and II, at an early age. Studies investigating which children with cerebral palsy could benefit from the use of gait analysis in clinical practice are warranted.

Danish summary - Dansk resume

De fleste gående børn med cerebral parese oplever at de bevæger anderledes and andre børn, og de vil ofte være afhængige af sundheds tilbud gennem hele deres barndom. I Danmark og de øvrige nordiske lande anvendes et opfølgningsprogram og en tilhørende database, kaldet CPOP – Opfølgningsprogram for Cerebral Parese (CPUP på svensk).

De overordnede mål med CPOP er at forbedre kvaliteten af sundhedstilbuddene til børn og unge med cerebral parese og begrænse udviklingen af sekundære følger hos det enkelte barn. Dette sker bl.a. ved at alle børn med cerebral parese tilbydes ensartede undersøgelser gennem hele barndommen. De tværfaglige indsatser til børn med cerebral parese, planlægges på baggrund af kliniske undersøgelser og standardiserede målemetoder til at vurdere grovmotorik og gang. Men barnets gangmønster evalueres ikke, hvilket kan gøres med 3-dimensionel klinisk ganganalyse.

Ganganalyse har været anvendt i klinisk praksis og forskning til børn med cerebral parese i mere end tredive år og er anerkendt som et 'guld standard' til vurdering af bevægelser under gang (gangmønstret) hos børn med cerebral parese. De mulige fordele ved at bruge ganganalyse i beslutninger om tværfaglige indsatser er ikke tidligere undersøgt. Det overordnede formål med afhandlingen er at undersøge effekterne af at anvende ganganalyse i individuelt tilpassede tværfaglige indsatser på ændringer i gangfunktionen hos børn med cerebral parese.

Første studie undersøgte pålidelighed og overensstemmelse for tre målemetoder, der beregner en samlet score for afvigelser i barnets bevægelserne under gang (Gait deviation Index, Gait Profile Score og Gait Variable Score). Resultaterne viste at de to overordnede score (Gait Deviation Index og Gait Profile Score) har en god pålidelighed og acceptabel overensstemmelse, mens en stor variation for nogle af Gait Variable Scores blev dokumenteret.

Herefter blev der gennemført et lodtrækningsstudie, hvor anvendelse ganganalyse i de tværfaglige tilbud til børn og unge med cerebral parese blev sammenlignet med det nuværende tilbud, hvor ganganalyse ikke tilbydes rutinemæssigt til alle børn. I studiet blev 60 børn med spastisk cerebral parese og gangfunktion uden hjælpemidler (GMFCS niveau I eller II) i alderen 5 til 8 år, tilfældigt fordelt mellem de to grupper. Ingen signifikante eller kliniske relevante forskelle blev dokumenteret imellem ændringerne i de to grupper ved 26 uger eller 52 ugers opfølgning. Resultaterne viser at brugen af ganganalyse til alle børn med cerebral parese og gangfunktion uden hjælpemidler (GMFCS niveau I og II) i en tidlig alder, ikke forbedrer gangmønstret eller deltagernes oplevelse af funktionsnedsættelen og livskvalitet.

Resultaterne i afhandlingen understøtter ikke brugen af ganganalyse i beslutninger om tværfaglige indsatser til alle børn med cerebral parese på GMFCS niveau I og II i en tidlig alder. Der er behov for forskningsprojekter, der fokuserer på hvilke grupper af børn med cerebral parese, der kan drage fordel af at ganganalyse anvendes.