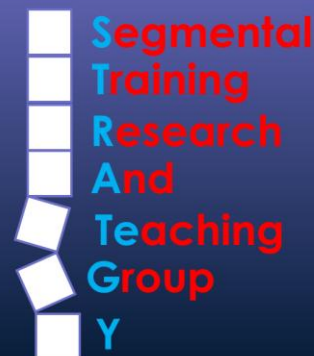


# STRATEGY Newsletter

March 2014



## Research

Research is currently based in five centres in USA (2), UK, Denmark and Hong Kong. A short summary of the status at the individual centres is outlined below:

### 1. **Hartford, Connecticut**

Research Team:

PI's: Sandy Saavedra, MS, PT, PhD; Adam Goodworth, MS, PhD;

Doctoral Student (visiting scholar from Brazil): Carolina Da Costa MS, PT

Master's Student in Neuroscience: Kerian Duncan

Clinical Specialist: Danni Bellows PT, MHS

DPT student research teams:

*DOTS Team:* Sarah Berkowitz, Stephanie Curcio, Nicole Kelleher, Chelsea Medeiros, Danielle Smith

*SIT with CP Team:* Ryan Carew, Andrea Kaminski, Sara Lefkowitz, Andres Mazo, Leah Raitt

Undergraduate research assistant: Samara Jerrick

**Study 1.1** Title: '*Sensory Contributions to Typical and Atypical Development of Trunk Control.*'

Goal: to identify sensory reliance and sensory reweighting for postural control in typical infants longitudinally, from 1-8 months of age and children with moderate-to-severe cerebral palsy (GMFCS 3-5).

Status: We just received 3 years funding from the National Institute of Health to complete this project. We will hire a postdoc to assist with data collection, data reduction and analysis. Interviews will begin Fall 2014 for the 2 year long position.

**Study 1.2** Title: '*Normalization of the Segmental Assessment of Trunk Control (SATCo) in Typical Infants.*'

Goal: to determine normalised standards for typical development of segmented trunk control.

Status: We received a Seed grant to cover the costs of collecting these data. Human Subjects approval is still pending. We have refined and practiced our protocols on pilot babies and hope to begin data collection no later than April 1st.

**Study 1.3** Title: *'Parental sensitivity and responsiveness to their infant's segmental level of trunk control.'*

Goal: to determine if parents automatically adjust their support as infants gain segmental control of the trunk.

Status: See Normalization study above.

**Study 1.4** Title: *'Repeatability and validity of magnetic tracking for head position using TrakSTAR magnetic tracking.'*

Goal: to evaluate the repeatability and validity of head CoM and kinematics of TrakSTAR magnetic tracking compared to Optotrack optical tracking.

Status: Currently on hold

**Study 1.5** Title *'Effectiveness of segmental training on trunk control in children with moderate-to-severe motor impairment: a case series'*

Goal: To examine outcome measures in a case series of Targeted Training for 11 children with neuromotor deficits.

Status: Sandy's Stability in Trunk with Cerebral Palsy (SITwithCP) research group has taken on the task of analysing these data and preparing the manuscript for publication. Students are currently taking reliability tests for scoring SATCo and GMFM. Groups of two students will score GMFM, SATCo and SAROMM data from video/chart review for each participant in this longitudinal data set. These will be combined with EMG/kinematic results for the manuscript we hope to submit by October 2014.

**Study 1.6** Title: *'Non-linear analysis of the segmental contributions to trunk control in children with moderate to severe cerebral palsy'*

Goal: to calculate approximate entropy, correlation dimension and lyapunov exponent, and conduct a surrogate analysis of postural sway data as measured by head or trunk movement and examine stability with different levels of trunk support.

Status: Carol is working on the analysis. She has met with her advisory committee three times and continues to make progress on the data analysis.

**Study 1.7** Title: '*Segmental sensorimotor control of trunk posture in adolescent idiopathic scoliosis.*'

Goal: to use engineering-based systems identification to characterize sensorimotor integration for trunk control in adolescents with and without scoliosis. This pilot study will be the first attempt at quantifying sensory contributions, active and passive stiffness, reflexes and neural time delays in the trunk posture system in adolescents with idiopathic scoliosis. Our second goal is to determine if abnormalities in sensorimotor integration are specific to certain regions of spinal curvature.

Status: This small exploratory study was recently funded by the Scoliosis Research Society. Adam Goodworth will lead a DPT student team focused on this project during 2014-2015.

## **2. Eugene, Oregon**

Principal investigators: Dr. Marjorie Woollacott. Dr. Sandra Saavedra.

Collaborators: Jaya Rachwani PPT, PhD candidate. Victor Santamaria, PPT. PhD candidate. Dr. Pablo Morales, PT. PhD.

**2.1 Rachwani J, Santamaria V, Saavedra SL, Wood S, Porter F, Woollacott MH (2013). Segmental Trunk Control Acquisition and Reaching in Typically Developing Infants. *Exp Brain Res*, 228 (1), 131-139.**

The aim of this recently published paper was to study how the thoracic and pelvic supports impacted the arm and head - trunk kinematics during a reach-to-grasp task in an immature central nervous system. This was a cross sectional study developed in a sample of infants aged from 4 to 6 months.

### **2.2 Healthy young adults and trunk support during a reach-to-grasp task.**

In this ongoing project, we are studying the biomechanics of trunk, head and arm during a reaching task. Also, arm and bilateral electromyographic patterns of trunk muscles are being analyzed in order to thoroughly understand how the central nervous system of healthy individuals would deal with the imposed trunk constraints during reaching.

Data have been collected, analyzed and are being written up for publication.

### **2.3 Longitudinal study during development of motor control of arm, trunk and head in infants.**

The principal purpose of this ongoing project is to analyze the influence of pelvic and thoracic levels of support during the neuromaturation of arm and head-trunk control in a sample of infants from 3 to 8 months of age. The main components being analyzed are kinematics of posture and reaching together with the EMG muscle patterns of arm and back during the development of head control, sitting and motor control of the arm in infants.

Data have been collected and are currently being analyzed.

### **2.4 Trunk support and motor control of arm, trunk and head in children diagnosed with Cerebral Palsy.**

The principal purpose of this ongoing cross-sectional study is to analyze how three different levels of support, pelvic, thoracic and axillae, would impact head-trunk-arm kinematics during a reach. Additionally, the muscle patterns of activation at these three different levels of support are being studied for understanding of the activation of neuromuscular patterns in moderate to severely involved children with CP unable to maintain a sitting position or sit by themselves.

We are currently collecting data for this project.

### **2.5. Eye tracking system and trunk support**

In this novel project done on moderate to severe CP, we are exploring the interaction between the visuomotor ability, posture and arm movements during a reach-to-grasp task at different levels of support. Additionally, we are analyzing the ocular and head control while the subject follows specific targets in space at different levels of support.

We are currently collecting data for this project.

## **3. Copenhagen**

### **Research Team:**

PI's: Derek Curtis MS, PT, PhD stud, Dr. Sandy Saavedra, MS, PT, PhD; Dr. Marjorie Woollacott

Master's Students in Health Science: Lisbeth Hansen BSc PT and Katrine Erharden BSc PT

BSc students in Physical Therapy: Silje Vindheim Jørgensen and Isa-Nora Carlsen (SALLCo study) and Lina Kristine Sollie, Elisabeth Lothe Eltvik og Marie Gry Richardy (SATCo translation)

### **Study 3.1 'Repeatability of the SATCo test in children with Cerebral Palsy'**

This is Lisbeth Hansen and Katrine Erharden's Masters project. The SATCo test will be repeatability tested on 30 children with CP intra- and interday and intra and inter-tester. The study will also investigate the degree of agreement between video scoring and 'live' tester scoring. The protocol requires participants to be SATCo-tested twice on the same day by 2 testers and twice again later in the same week. SATCo will be scored by the tester and video scored by experts (at The Movement Centre). The test-retest will include 6 children from each of the 5 GMFCS categories.

Status: This project has ethical approval and data collection has started.

### **Study 3.2 'The effect of trunk control on gait in children with Cerebral Palsy'**

This study will be looking at the effect of trunk control on gait kinematics and kinetics in children with CP GMFCS I and II. Ethical approval has been obtained and data collection has been started. The study will use data from Lisbeth Hansen and Katrine Erharden's Masters project plus instrumented gait analysis.

**Study 3.3 'SALLCo test - Development of test score sheet and instructions'** Physical therapy students Silje Vindheim Jørgensen and Isa-Nora Carlsen have started this study. The SALLCo test has been developed and used by Dr. Butler and The Movement Centre for a number of years but has not been formally described and published. The scoring sheet and manual are currently being written in close cooperation with Dr Butler and The Movement Centre and when finished, the test will be performed and video recorded for 10-15 children with motor control issues in the lower extremities. The test videos will be scored independently from the test manual by 4-6 scorers to determine the repeatability.

### **Study 3.4 'Danish translation of the SATCo test'**

Lina Kristine Sollie, Elisabeth Lothe Eltvik og Marie Gry Richardy have translated the SATCo test to Danish. The back translation has been approved by Dr. Butler and the translation is now available on the Movement Centre website. There are plans to make the test available on the website for the Danish Association of Physiotherapists.

### **Study 3.5 'Effect of Targeted Training on gross motor function in children with CP'**

An RCT including 28 children with CP GMFCSIII-V. Intervention is TT, 5 times a week for 6 months and control is treatment as usual.

Status: Data collection is completed and data is now being processed ready for publication.

### **Study 3.6 'Normative values for posture and sway for typically developing children in unsupported sitting'.**

A study of 20 children documenting repeatability and normal values for sway in an unsupported seated position using a 3D trunk model with levels corresponding to the SATCo levels.

Status: Submitted to Gait and Posture in March 2014, awaiting decision.

### **Study 3.7 'The Central role of trunk control in gross motor function and activity in children with severe cerebral palsy'**

GMFM, PEDI and SATCo data from 92 referrals to the Movement Centre in the UK have been analysed to determine the relationship between trunk control, gross motor function and functional mobility in children with CP.

Status: Article for submission to Developmental Medicine and Childhood Neurology is currently being drafted.

### **4. The Movement Centre / Manchester Metropolitan University, UK**

Research Team:

Supervisory Team: Penny Butler PhD, FCSP, Ian Loram PhD, Paul Holmes PhD, John Darby PhD, Pauline Holbrook BA, MCSP, Richard Major FIPEM, CEng.

PhD student: Maria Sanchez PT, MSc.

1. Maria Sanchez has now commenced her PhD studies at Manchester Metropolitan University. The aims of her study are to: Develop a system – a clinical tool - that will allow objective measurement of a child's condition and enable quantification of change.
2. To show change achieved through Targeted Training
  - Within a single session
  - Over a period of sessions

The approach of this project is to: (i) evaluate the existing video-based system of analysis; (ii) develop a quantitative, manually operated video-based system for use in the clinic, (iii) validate the quantitative video-based system using a Vicon marker based system (iv) apply both the quantitative video and Vicon system to evidence change achieved through Targeted Training (v) develop an approach and specification for increased automation of video-based analysis (vi) through preliminary work and pilot data, support applications for funding to resource development of a more automated system of video analysis for clinical use (vii) produce and provide training for clinicians in cerebral palsy in all systems developed during the project.

### **5. Hong Kong**

Research Team:

PI: Tamis Pin PhD, MSc, PT

Collaborators: Dr Hon-Ming Cheung, M.B., B.S, FHKAM (Paediatrics), FHKC (Paediatrics); Mrs Sandra Lee, PDPT

Study: 'Psychometric study on Segmental Assessment of Trunk Control in preterm infants from 4 to 12 months corrected age'

Tamis is currently looking at the psychometric properties of the SATCo on preterm and full-term infants in a pilot longitudinal study from 4 to 12 months of (corrected) age. In this study, Tamis will collaborate with the Associate Consultant (Dr Cheung) and Senior Physiotherapist (Mrs Lee) in the preterm follow-up clinic in one of the teaching hospitals, Prince of Wales Hospital, in Hong Kong. Penny Butler will also be involved in the reliability side of this study. It is now waiting for research funding approval from the Department of

Rehabilitation Sciences, Hong Kong Polytechnic University and the ethics approval from the Hospital.

## Clinical services and development

### **1. Targeted Training in Oswestry, UK**

The Movement Centre continues to provide Targeted Training on a routine clinical basis for children with problems of movement control around 50 children receiving services at any one time.

Outcome measures are:

- Range of joint movement (limbs and trunk)
- SATCo
- Functional goals (specific and timed)
- PEDI (at start and end of a (9) month course of TT)
- GMFM (at start and end of a (9) month course of TT)
- Edinburgh Visual Gait Score (for children able to walk independently) (at start and end of a (9) month course of TT)
- Chailey Levels of Ability (at start and end of a (9) month course of TT)

These outcome measures are reported on our website (see below).

### **2. Targeted Training in Hartford, CT, USA**

There are currently 4 children in the Hartford area who are in the process of being set up for Targeted Training. Danni Bellows and Sandy Saavedra will be supervising the training. We will aim to produce case studies for publication and promotion of TT in the USA.

Device measurements have been completed for all 4 children. There has been a lengthy delay determining cost and ability to import ORLAU standers from the UK. Insurance authorization requests have finally been submitted for these 4 children. We are waiting for insurer responses. A 5<sup>th</sup> child is coming for evaluation next week and might be added to the group.

Outcome measures are:

- SAROMM (spinal alignment and range of motion measure)
- GMFM
- SATCo
- HAT (hypertonicity assessment tool)
- BAS (Barry Albright Dystonia Scale if the HAT indicates dystonia)
- CVI screening test (visual function)
- anthropometrics
- Functional goals or Goal Attainment scale

### **3. Targeted Training in Copenhagen, Denmark**

There are currently 3 children in a course of TT in Copenhagen, two at Kirkebækskolen and one at Geelsgårdskolen. DC is supervising the training. The aim at both schools is to produce case studies for publication and promotion of TT in Denmark. Outcome measures at Kirkebækskolen are:

- Range of joint movement (limbs and trunk)
- SATCo.
- Functional goals (specific and timed)
- PEDI (at start and end of a (9) month course of TT)
- GMFM (at start and end of a (9) month course of TT)

The two children started their course of training in September 2013.

Outcome measures at Geelsgårdskolen are:

- PEDI (at start and end of a (9) month course of TT)
- GMFM (at start and end of a (9) month course of TT)
- Functional goals (specific and timed)

This child children started their course of training in September 2013.

We are using TT equipment loaned from The Movement Centre in Oswestry.

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