Cerebral Palsy: Maximizing Function and Planning for the Future

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Lecture Outline
- Describing the population of children with CP
- Framework for understanding function
- Capacity and Performance
- Outcome Measures
- Reviewing the Current Literature
- New Technologies
- Transition Planning
- Looking Forward

Learner Objectives
- Discuss frameworks for understanding function
- Understand the importance of both capacity and performance
- List outcome measures available in the clinical setting
- Understand how to search for new technologies online
Definition of Cerebral Palsy

- Classic definition: ‘a disorder of movement and posture due to a defect or lesion in the immature brain,’ Bax 1964

- Modified definition: ‘an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development,’ Mutch 1992

Cardinal Features

- Neuromotor control problem that affects movement and posture
- Non-progressive (static encephalopathy)
  - Symptoms change over time
- Injury or anomaly is present early

Definition

- “Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and/or by a seizure disorder.”
  - International Workshop on Definition and Classification of Cerebral Palsy, 2004

Terms to Review

<table>
<thead>
<tr>
<th>Type</th>
<th>Site</th>
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<tbody>
<tr>
<td>Spastic</td>
<td>Quadriplegia/Tetra</td>
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<tr>
<td>Dyskinetic</td>
<td>Triplegia</td>
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<tr>
<td>dystonia</td>
<td>Hemiplegia</td>
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<tr>
<td>athetosis</td>
<td>Monoplegia</td>
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<tr>
<td>chorea</td>
<td>Diplegia</td>
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<tr>
<td>Ataxic</td>
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<tr>
<td>Hypotonic</td>
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<tr>
<td>Mixed</td>
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Spasticity

- Increased tone
- Rate dependent
- Associated with limitations in range of motion
- Can lead to joint contractures
- Measured by the Modified Ashworth Scale
  - 0=no increase, 1=slight increase at end range, 2=catch and resistance through less than ½ of range, 3=increase through most of range, 4=marked increase in tone making movement difficult, 5=rigidity

Other Types

- Dystonia
  - sustained muscle contractions that result in twisting movements or abnormal postures
  - predominately trunk and proximal limbs
- Athetosis
  - slow writhing movements
  - distal extremities
- Chorea
  - abrupt, rapid, brief, irregular movements
  - face and extremities

GMFCS Level

- Based on self-initiated movement (emphasizing mobility)

Prevalence/Incidence of Cerebral Palsy

- 3.3 (CI 3.1-3.7) per 1,000 among 8 year olds in 2006
  - 56% were able to walk independently (Kirby et al. Prevalence and functioning of children with cerebral palsy in four areas of the United States in 2006: A report from the Autism and Developmental Disabilities Monitoring Network. Research in Developmental Disabilities vol 32, #2 March 2011, pp 462-469.)
Severity and Life Expectancy

- Up to 80% have impairments beyond their motor control
- Seizures in up to 40%
- 80% some speech impairment
- Limited visual acuity in 75%
- Despite increasing severity, life expectancy is improving
  - 15 yo with tube feeds and can’t lift head = 13 additional years
  - 15 yo walks unaided 51-55 additional years (Strauss, Brooks, Rosebloom, Shavelle, Life expectancy in cerebral palsy an update. 2008 V 50 #7)

Thinking about Function

- International Classification of Functioning, Health and Disability (ICF)
- Social Ecological Model
- Life Course Model

ICF

- Levels of functioning
  - Body
  - Person
  - Person in community
- Disability: umbrella term
  - Impairment
  - Activity limitation
  - Participation restriction
- The neutral term functioning refers to body functions, activities and participation
- Disability as interaction between the person and their environment
  - Contextual factors (personal and environmental)

Activity & Participation in ICF-CY*

- Learning and Applying Knowledge
- General Tasks and Demands
  - Self-regulation
- Communication
- Mobility
- Self Care
- Domestic Life
- Interpersonal Interactions and Relationships
- Major Life Areas
  - Play
- Community, Social and Civic Life


Bronfenbrenner’s Ecology Systems Theory

- Context of the systems of relationships that form the child’s environment
- Also known as the bio-ecological systems theory
- Microsystem - layer closest to the child with which the child has direct contact (Beck 2000)
- Mesosystem - connection between structures in the child’s microsystem (connection between parents and teachers)
- Exosystem - larger social system in which the child doesn’t function directly (community based family supports)
- Macrosystem - cultural values, customs, has a trickle down effect
- Chronosystem - dimension of time

CDC
From Life Course to Life Course Health Development

- Life-course models – are concerned with patterns and pathways that link individual development and social change
  - Built on Lifespan models (connect the dots) and Life Stage models (periods of psychological development)
- Life Course Health Development (LCHD) models-
  - Connect the dots
  - Describe the pathways or health trajectories
  - Address the biopsychosocial mechanisms that determine or influence health trajectories
  - Builds on social ecology model

2004 National Research Council and Institute of Medicine Report


“Children’s health is the extent to which individual children or groups of children are able or enabled to
(a) develop and realize their potential,
(b) satisfy their needs, and
(c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments.”

Multiple, Interacting Influences

A new model of children’s health and its influences

The way health and development occur is not random, but is affected by the prior patterns of adaption. They can be represented as in a kaleidoscope, where what happens in future twists is determined by earlier configurations.

Source: Children’s Health, Nation’s Health, IOM report, 2004

The Evolving Health Care System (Neal Halfon)

The First Era (Yesterday)
- Focused on acute and infectious disease
- Germ Theory
- Short time frames
- Medical Care
- Insurance-based financing
- Reducing Deaths

The Second Era (Today)
- Increasing focus on chronic disease
- Multiple Risk Factors
- Longer time frames
- Chronic Disease Mgmt & Prevention
- Pre-paid benefits
- Prolonging Disability free Life

The Third Era (Tomorrow)
- Increasing focus on achieving optimal health
- Complex Systems - Life Course Pathways
- Lifespan/ generational
- Investing in population-based prevention
- Producing Optimal Health for All
Optimizing Health Development

Addressing the factors shaping health development trajectories over the lifespan

Measuring Capacity

- What the child can do in a standardized environment
- Gross Motor Function Measure-66 (GMFM-66)

The GMFM is a standardized observational instrument designed and validated to measure change in gross motor function over time in children with cerebral palsy. The scoring key is meant to be a general guideline. However, most of the items have specific descriptors for each score. It is imperative that the guidelines contained in the manual be used for scoring each item.

SCORING KEY

- 0 = does not initiate
- 1 = initiates
- 2 = partially completes
- 3 = completes
- NT = Not tested [used for the GMAE scoring]

GMFM Scoring

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>GMFM RAW SUMMARY SCORE</th>
<th>GOAL AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Lying &amp; Rolling</td>
<td>Total Dimension A = 51 x 100 = %</td>
<td>A.</td>
</tr>
<tr>
<td>B. Sitting</td>
<td>Total Dimension B = 60 x 100 = %</td>
<td>B.</td>
</tr>
<tr>
<td>C. Crawling &amp; Kneeling</td>
<td>Total Dimension C = 42 x 100 = %</td>
<td>C.</td>
</tr>
<tr>
<td>D. Standing</td>
<td>Total Dimension D = 39 x 100 = %</td>
<td>D.</td>
</tr>
<tr>
<td>E. Walking, Running &amp; Jumping</td>
<td>Total Dimension E = 72 x 100 = %</td>
<td>E.</td>
</tr>
</tbody>
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TOTAL SCORE = \( \frac{\% A + \% B + \% C + \% D + \% E}{\text{Total # of Dimensions}} \)

GOAL TOTAL SCORE = Sum of % scores for each dimension identified as a goal area / # of Goal areas

Capacity and Performance

- Capacity
  - What a person can do
- Performance
  - What the person actually does
I. Handles objects easily and successfully. At most, limitations in the ease of performing manual tasks requiring speed and accuracy. However, any limitations in manual abilities do not restrict independence in daily activities.

II. Handles most objects but with somewhat reduced quality and/or speed of achievement. Certain activities may be avoided or be achieved with some difficulty; alternative ways of performance might be used but manual abilities do not usually restrict independence in daily activities.

III. Handles objects with difficulty; needs help to prepare and/or modify activities. The performance is slow and achieved with limited success regarding quality and quantity. Activities are performed independently if they have been set up or adapted.

IV. Handles a limited selection of easily managed objects in adapted situations. Performs parts of activities with effort and with limited success. Requires continuous support and assistance and/or adapted equipment, for even partial achievement of the activity.

V. Does not handle objects and has severely limited ability to perform even simple actions. Requires total assistance.
The Current Literature for Maximizing Function for Children with CP

Longitudinal study of motor performance and its relation to motor capacity in children with cerebral palsy

- Van Eck M, Dallmeijer AJ, Voorman JM, Becher JG
- Aim: To track motor performance longitudinally with motor capacity

Methods

- Motor performance: captured in the Motor portion of the Vineland Adaptive Behavior Scales (parent interview with 20 items for gross motor skills)
- Motor capacity: GMFM 66
- Measured Annually on 104 children for 3 years
  - GMFCS 1: 49
  - GMFCS 2: 15
  - GMFCS 3: 10
  - GMFCS 4: 12
  - GMFCS 5: 18

GENERAL HEADINGS FOR EACH LEVEL

LEVEL I - Walks without Limitations
LEVEL II - Walks with Limitations
LEVEL III - Walks Using a Hand-Held Mobility Device
LEVEL IV - Self-Mobility with Limitations; May Use Powered Mobility
LEVEL V - Transported in a Manual Wheelchair
Results and Discussion

- Regression Analysis shows that a 4% increase in motor capacity is needed for a 1% increase in motor performance
- GMFCS level 1 - performed near their capacity and made progress
- Bigger gaps between performance and capacity for children in the GMFCS levels 4 & 5

Correlates of decline in gross motor capacity in adolescents with cerebral palsy in GMFCS levels III to V: an exploratory study

- Barlett DJ, Hanna SE, Avery L, Stevenson RD, Galuppi B.
- Aim: Correlate clinical characteristics with decline in motor capacity as measured by the GMFM-66

Methods

- GMFCS level III n=51
- GMFCS level IV n=47
- GMFCS level V n=37
- Measured and correlated range of motion, spinal alignment, pain and other characteristics with GMFM-66
Results and Discussion

- Capacity declines over time (first time point was recorded from a previous study)
- Drop in Motor Capacity associated with
  - Limitations in ROM
  - Spinal malalignment
- Increases in mid-arm circumference, triceps skin folds and circumference to knee height ratio were associated with less decline

Probability of walking, wheeled mobility, and assisted mobility in children and adolescents with cerebral palsy

- Authors: Palisano R, Hanna S, Rosenbaum P, and Tieman B

- Aim of Study: determine how the probability of walking, wheeled mobility, and assisted walking changes with different environmental settings and age

Changes in mobility over time and differing environments

- Study methods
  - Design: longitudinal descriptive study, random sampling of larger group
  - Subjects:
    - 642 children with CP receiving services through regional rehabilitation center in Ontario
    - Stratified by GMFCS and age
  - Data:
    - GMFCS
    - Usual method of mobility

Changes in mobility over time and differing environments

- Procedure:
  - Questionnaire completed by parents every 6 months (<6 years) and 12 months (age 6 and >)
    - Typical method of mobility
    - Different settings: home, school/work, outdoors
  - PT classified GMFCS at first data point

- Data analysis:
  - Mixed-effects analyses used to model probability of mobility method as a function of age
Changes in mobility over time and differing environments

- **Results**
  - GMFCS levels I and V varied little by age and environment
  - Across GMFCS levels consistency very high for home setting and low in school setting
  - GMFCS II probability of walking outdoors and at school increases with age
  - GMFCS III probability of walking in all 3 settings is 50% at age 18

**Discussion**

- Method of mobility is influenced by age and setting
- Limitation is all reports are parent reports even in school setting where they are not present
- GMFCS I and II typically walk long-term in all settings
- Results of study may help with long-term planning for child and family

Participation Outcomes in a Randomized Trial of 2 Models of Upper-Limb Rehabilitation for Children with Congenital Hemiplegia

- Sakzewski L, Ziviani J, Abbott DF, Macdonell RA, Jackson GD, and Boyd RN

- **Aim:** to determine if CIMT is more effective than bimanual training to improve performance and participation

CIMT vs Bimanual Training

- **Design:** single blind, randomized trial
- **Population**
  - Children with congenital hemiplegia
  - 52% boys, mean age 10.2 years
  - Matched for age, sex, side of hemiplegia, UE function
CIMT vs Bimanual Training

- **Intervention**
  - Therapy 6 hours/day for 10 days
  - “circus themed” camps with PT and OT’s
  - Program focused on fine motor activities, functional goals, mealtimes
  - Individual goals using COPM addressed 15 minutes/day
  - CIMT group: custom glove worn, removed only 15 minutes/day

CIMT vs Bimanual Training

- **Outcome measures at 3 and 26 weeks**
  - **COPM**
    - Child selected 3-5 goals and rated on perceived performance and satisfaction
    - Parents selected goals in children <8 years old
  - **LIFE-H** measures life habits in different environments
  - **CAPE** measures participation in formal and informal activities (leisure and recreation)
  - **School Function Assessment (SFA)** measures performance in functional tasks needed in school setting

CIMT vs Bimanual Training

- **Results**
  - No difference between groups on baseline measures
  - Significant improvement in COPM performance and satisfaction at each follow-up
  - No difference between groups on COPM
  - 66% in each group made significant change in COPM
  - **LIFE-H** no difference between groups
  - Both groups significantly improved in personal care at 26 weeks

CIMT vs Bimanual Training

- **CAPE** no difference between groups and no difference over time
- Sex differences noted
  - Boys had better outcomes for intensity of physical activities
  - Girls had better outcomes in self-improvement activities

- **School Functional Assessment**: no significant difference between groups or over time
CIMT vs Bimanual Training

- Clinical Relevance
  - Improvements seen only in goals established by patients or parents (COPM)
  - No significant difference between 2 techniques
  - No improvement in participation in different environments
  - Outcome measures may not have been sensitive enough to pick up small changes

- Focus on interventions that directly impact participation including barriers may be necessary

Occupational Therapy Home Programs for Cerebral Palsy: Double Blinded, Randomized, Controlled Trial

- Authors: Novak I, Cusick A, and Lannin N

- Aim of study: to determine the effectiveness of a home occupational therapy program in children with cerebral palsy

OT Home Program

- Study Methods:
  - Design: randomized, double-blind, controlled
  - Subjects: 36 with cerebral palsy
    - average age 7.75 years
    - 69% boys
    - GMFCS: I (47%), II (14%), III (16%), IV (7%), V (16%)
    - MAC: I (47%), II (25%), III (6%), IV (14%), V (8%)

OT Home Program

- Methods (cont)
  - Randomization: no OT home program, OT home program for 4 weeks, OT home program 8 weeks
  - Home program:
    - Set family and child goals in collaboration with therapist
    - Therapeutic activities selected supporting goals
    - Home visits and progress updates
    - Parents determined frequency/duration of treatment sessions
OT Home Program

Outcome measures:
- Primary: COPM performance and satisfaction scores at 8 weeks
- Secondary: COPM at 4 weeks, GAS, QUEST, CAPE

Statistical analysis:
- Differences across 3 groups using regression analysis
- Group means using independent t-tests

Results:
- COMP-P and COMP-S scores significantly improved in OTHP groups
  - No differences between OTHP groups
- GAS: OTHP groups had significantly higher t-scores
  - No differences between OTHP groups
- QUEST: OTHP groups had significantly higher scores at 8 weeks (not at 4 weeks)
  - No differences between OTHP groups
- CAPE: no significant difference between groups

Discussion:
- Positive response from families, all refused to stop at 4 weeks
- Goal directed therapy critical
- Outcome measures focused on individual goals critical
- Satisfaction of program may lead to greater adherence to program
- Longer period was required to impact quality of skills

Single-Event Multilevel Surgery in Children with Spastic Diplegia

Thomason P, Baker R, Graham HK et al.

Aim
- Evaluate the benefits of a multilevel surgery in children with CP
Single-Event Multilevel Surgery

- Design: randomized, controlled trial comparing multilevel surgery with physical therapy alone

- Population
  - 19 children, ages 6-12 years
  - GMFCS level II or III
  - Exclusion: dystonia, SDR, ITB, prior ortho surgery, hip migration >25%

Single-Event Multilevel Surgery

- Methods
  - Multilevel surgery defined as 1 surgical procedure performed at 2 different anatomic levels on both sides of body and includes soft tissue and bone
  - Surgery group
    - PT 1st 12 weeks to regain lost function
    - PT 2nd 12 weeks, 3x/week to improve ROM, balance, strength, function
  - Control group
    - Progressive resistance training matched in intensity to surgery group

Single-Event Multilevel Surgery

- Outcome measures
  - 3 dimensional gait analysis
    - Gait profile score (GPS)
    - Gillette Gait Index (GGI)
  - GMFM-66
  - Functional mobility scale (FMS)
  - Child Health Questionnaire (CHQ)

Single-Event Multilevel Surgery

- Results
  - 11 patients in surgical group, 8 patients in control group
  - 85 procedures performed, mean of 8 procedures/patient
Single-Event Multilevel Surgery

- 12 month follow-up
  - Median GPS improvement 34% in surgical group, mild deterioration in control group
  - Mean GGI with significant improvement (57%) in surgical group only
  - No change in GMFM
  - Improvement in CHG-PF50 in control group

- 24 month follow-up, non-randomized phase
  - Significant improvement in GMFM (5%)
  - Significant improvement in CHQ-PF50

Single-Event Multilevel Surgery

- Clinical relevance
  - Change of 10% in GGI considered clinically relevant
  - Improvement of GMFM of 4.9% is better than seen in SDR studies
  - Gait parameters improved at 12 months but GMFM and Functional Mobility Scale improved only at 24 months
  - No analysis of relationship between surgical procedures and outcomes due to small sample size

- Clinical relevance (cont)
  - No standard surgical recommendations based on gait analysis may lead to difficulty with generalizing results to other centers and surgeons
Developing and validating the Communication Function Classification System for Individuals with Cerebral Palsy

- Mary Jo Cooley Hidecker, et al.
- Developmental Medicine and Child Neurology 2011, 53: 704-710

**Objective**: To create and validate a communication function classification system
- To complement existing measures for gross motor (GMFCS) and fine motor (MACS)

**Methods**
- An expert group got together to create the measure with the following categories
  - Sender skills
  - Receiver skills
  - Pace
  - Partner familiarity
  - Age-appropriateness
  - Use of augmentative devices or assistive communication

**Results**
- Good reliability between professionals but only moderate between professionals and parents.
- Parents rate their children’s abilities higher
- Level I: Sends and receives with familiar and unfamiliar partners effectively and efficiently
- Level II: Sends and receives with familiar and unfamiliar partners but may need extra time
- Level III: Sends and receives with familiar partners effectively but not with unfamiliar partners
- Level IV: Inconsistently sends and/or receives even with familiar partners
- Level V: Seldom effectively sends and receives even with familiar partners
Conclusion

- The classification augments existing tools and doesn’t require a formal assessment.

- Important to the Rehab Doc because it will likely go through refinement and become part of the tools we use to classify children with CP.

New Technologies

- “My child understands everything but can’t talk”
- Brave new world of apps
- Communication opportunities earlier and more often
- Taps into the issue of capacity
A Quick Internet Search

Transition Planning

- Increasingly important
- Increased survivability
- Severity of children aging up
- Stressed health care system
- Stressed homes and communities
- Known decrement in health care access and health outcomes after aging-out

ChoiceBoard Creator

It is the perfect app for creating customizable choice boards for the unique needs of individuals with communication challenges. It reinforces correct choice by expanding the selected image as well as playing the customized auditory rewards.
California Example

- In Home Supportive Services for Individuals with CP (co-authors Bob Newcomer and Taewoon Kang)
- Pays for personal assistances services
- Linked data
  - California Department of Health Care Services
  - Department of Social Services
  - Department of Developmental Services

Medicaid Costs for Individuals with CP and all other IHSS recipients

Planning for the Future

- What happens today affects tomorrow
- Goals for maximizing function and quality of life - inclusive living in the least restrictive environment
- Optimizing health for children with cerebral palsy
  (a) develop and realize their potential,
  (b) satisfy their needs,
  (c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments

Percent Distributions of IHSS Recipients, 2005

Mean Monthly Expenditures
Clinical Care

- Address co-morbid issues - seizures, visual impairment, swallowing dysfunction...
- Pick effective strategies for improving health and function
- Address issues early and pre-emptively
- Take advantage of existing technologies

Research

- Provide an evidence base
- Advance prevention strategies
- Advance treatment options
- Study population level changes

Teaching

- Focus on function - outcomes on the continuum
- Consider the child in context of their environment
- Respect for desires of the child and family
- Attention to capacity and performance

Advocacy

- Raise your voice for children
- Focus on the needs of the population
- Pay attention to fiscal cuts
Controlled study of the effects of continuous intrathecal baclofen infusion in non-ambulant children with cerebral palsy.

Barbara N. Vlaski, Katerina M. Department of Pediatric, The Pediatric Hospital, Karolinska University Hospital, Stockholm, Sweden.

Abstract

AIM: To measure changes in children with severe spastic cerebral palsy (CP) after continuous intrathecal baclofen (ITB) infusion over 18 months and to compare the results with those of a comparison group awaiting treatment.

METHOD: Thirty-eight children with severe spastic CP considered suitable for ITB were assessed when first seen, just before insertion of an intrathecal pump, and 6 months and 18 months later. Eighteen children waited around 6 months for a pump (group 1: nine males, nine females, mean age 5.9 years, range 3.0-9.2 years, mean 11.2 years, range 0.9-18.3 years, mean 11.2 years, range 0.9-18.3 years, mean 11.2 years, range 0.9-18.3 years). This baseline period was used as a control for comparison with the first and second 6-month periods after the pump for the remaining 20 children (group 2: 11 males, nine females; mean age 5.9 years, range 3.0-10.2 years, mean 11.2 years, range 0.9-18.3 years, mean 11.2 years, range 0.9-18.3 years). The mean outcome measure was the Pediatric Evaluation of Disability Inventory (PEDi), other assessments were of function, ease of care, quality of life, and costs of equipment.

RESULTS: No significant change was found in the Pediatric Evaluation of Disability Inventory (PEDi) between group 1 while awaiting treatment and group 2 in the two periods after pump insertion, nor in the Lifestyle Assessment Questionnaire or the cost of new equipment. Significant changes were found in group 2 in the first 6 months according to the modified Ashworth scale (Differences between mean values for groups 1.7 standard error 0.98, p=0.005), Penn State score (3.3, 0.27, p=0.001), mean joint range of movement (3.9, 2.8, p=0.05), and Caregiver Questionnaire (0.6.7, 6.1, p=0.01), and in the second 6 months for the Modified Ashworth Scale score (0.6.2, 0.10, p=0.001).

INTERPRETATION: ITB in children with severe spastic CP over the first 18 months improves their quality of life in terms of comfort and ease of care. It has less effect on function, participation in society, or the overall cost of new equipment.


Comment in


Bimanual training and constraint-induced movement therapy in children with hemiplegic cerebral palsy: a randomized trial.

Gordon AH, Young SC, Haislip ES, Stavrakopoulos N, Hata C, Swan C, Foppa M, Iannotti A, Charidee S. Teachers College, Columbia University, New York, NY 10027, USA. agh07@columbia.edu

Abstract

BACKGROUND: Constraint-induced movement therapy (CIMT) promotes hand function using intensive unimanual practice along with restraint of the non-affected hand. CIMT has not been compared with a treatment with equivalent dosing frequency and intensity in children with cerebral palsy (CP).

OBJECTIVES: The authors report a randomized trial comparing CIMT and a bimanual intervention (hand-arm intensive bimanual therapy; HABIT) that maintains the intensity of practice associated with CIMT but where children are engaged in functional bimanual tasks.

METHODS: A total of 42 participants with hemiplegic CP between the ages of 3.5 and 10 years (matched for age and hand function) were randomized to receive 60 hours of CIMT or an equivalent dosage of functional bimanual training (HABIT) conducted in day-care environments. A physical therapist blinded to treatment allocation tested hand function before and after treatment. The primary outcomes were changes in Jebsen Taylor Test of Hand Function (JTHF) and Assistance Hand Assessment (AHAD) scores. Secondary measures included the Dadi Alimentation Scale (DAS).

RESULTS: Both the CIMT and HABT groups demonstrated comparable improvement from the pretreatment to immediate posttest in the JTHF and AHAD (P = .001), which were maintained at 6 months. GARS, however, revealed greater progress toward goals for the HABT group (P < .0001) with continued improvement across last sessions for both groups (P < .0001).

CONCLUSIONS: Both CIMT and bimanual training lead to similar improvements in hand function. A potential benefit of bimanual training is that participants may improve more on self-determined goals.

PMID: 22720024 [PubMed - indexed for MEDLINE]

Intensive Voice Treatment (LSVT LOUD) for Children with Spastic Cerebral Palsy and Dysarthria.

Tos-Ca, Bosen CA. National Center for Voice and Speech, Denver, CO.

Abstract

PURPOSE: The purpose of this study was to examine the effects of an intensive voice treatment (LSVT LOUD) for children with spastic cerebral palsy (CP) and dysarthria.

METHOD: A non-concurrent multiple baseline single-subject design with replication across five children with spastic CP was used. Auditory-perceptual analysis of speech, acoustic measures of vocal functioning, and perceptual ratings of parents of participants were obtained from baseline, post-treatment, and 6-week follow-up recordings sessions.

RESULTS: Listeners consistently preferred the speech samples taken immediately post-treatment over those taken during the baseline phase for most perceptual characteristics rated in this study. Changes in acoustic measures of vocal functioning were not consistent across participants and occurred more frequently for maximum performance tasks as opposed to speech. Although parents of the tested participants reported an improved perception of vocal loudness immediately following treatment, maintenance of changes at 6-week follow-up varied across the participants. No changes were observed in the 53% participant who did not receive treatment.

CONCLUSIONS: These findings provide some preliminary observations that the children with spastic CP in this study not only tolerated intensive voice treatment but also showed improvement on selected aspects of vocal functioning. These outcomes warrant further research through Phase 2 treatment studies.

PMID: 22536277 [PubMed - as supplied by publisher]
Treadmill interventions with partial body weight support in children under six years of age at risk of neuromotor delay.


Abstract

BACKGROUND: Delayed motor development may occur in children with Down syndrome, cerebral palsy or children born preterm, in whom turn may be the first opportunity to explore the environment. Neuropsychological and early intervention literature suggests that task-specific training facilitates motor development. Treadmill intervention is a good example of biocomforter task-specific training.

OBJECTIVES: To assess the effectiveness of treadmill intervention on locomotor motor development in pre-ambulatory infants and children under the age of 6 years who are at risk of neuromotor delay.

METHODS: In March 2011 we enrolled CENTRAL (The Cochrane Library, Issue 1, 2011), MEDLINE (1948 to March Week 2, 2011), EMBASE (1980 to Week 11, 2011), PsycINFO (1987 to current), CINAHL (1987 to current), Science Citation Index (1993 to 2011), PEDro until 1 March 2011, CDSR (1980 to 18 March 2011) and LILACS (until March 2011). We also searched ICTRP, ClinicalTrials.gov, mRCT and CenterWatch.

RESULTS: We included randomised controlled trials, quasi-randomised controlled trials and controlled clinical trials that evaluated the effect of treadmill intervention in children under six years of age with delays in gait development or the attainment of independent walking or who were at risk of neuromotor delay.

DATA COLLECTION AND ANALYSIS: Four authors independently extracted the data using standardised forms. Outcome parameters were structured according to the “body functions” and “activity and participation” components of the International Classification of Functioning, Disability and Health. Children & Youth version (ICF-CY), which was developed by the World Health Organization.

MAIN RESULTS: We included five studies, which reported on treadmill intervention in 136 children. Of the 136 children, 73 were allocated to treadmill intervention groups, with the other children serving as controls. The studies varied in the type of population studied (children with Down syndrome, cerebral palsy or who were at risk for neuromotor delay), the type of comparison (for example, treadmill versus no intervention, high intensity treadmill versus low intensity), the time of evaluation (during the intervention or at various intervals after intervention), and the parameters assessed. Due to the diversity of the studies, we were only able to analyze data from three studies on meta-analyses and the following two outcomes: age of onset of independent walking and gross motor function. Evidence suggested that treadmill intervention could lead to earlier onset of independent walking when compared to no treadmill intervention; two studies, effect estimate 1.47, 95% confidence interval (CI) 1.27, 1.69), though these trials studied different populations and children with Down syndrome seemed to benefit while it was not clear if this was the case for children at high risk of neuromotor delays. Another two studies, both in children with Down syndrome, compared different types of treadmill interventions: one compared treadmill intervention with and without orthotics, while the other compared high versus low-intensity treadmill intervention. Both were inconsistent regarding the impact of different protocols on the age at which children started to walk. There is insufficient evidence to determine whether treadmill intervention improves gross motor function (two studies, effect estimate 0.86, 95% CI 0.64, 1.10) in the one study evaluating treadmill with and without orthotics, results suggested that adding orthotics might hinder gross motor progress (effect estimate -0.49, 95% CI: -1.64, 0.65). In one study, children with Down syndrome achieved the age of onset of assisted walking and reported those receiving the treadmill intervention were able to walk with assistance earlier than those who did not receive the intervention (effect estimate -1.02, 95% CI: -1.35, -0.68). Another study comparing high and low intensity treadmill was unable to conclude whether one was more effective than the other in helping children achieve independent walking at an earlier age (effect estimate -1.46, 95% CI: -2.26, -0.67). Step frequency was also increased in children with Down syndrome in another study and those who received high intensity therapy rather than low intensity treadmill training showed an increased number of alternating steps (effect estimate 11.05, 95% CI: 6.03, 16.07). Our other primary outcome, falls and injuries due to falls, was not measured in any of the included studies.

AUTHORS’ CONCLUSIONS: The current review provided only limited evidence of the efficacy of treadmill intervention in children up to six years of age. Few studies have assessed treadmill interventions in young children using an appropriate control group (which would be usual treatment or no treatment). The available evidence indicates that treadmill intervention may accelerate the development of independent walking in children with Down syndrome. Further research is needed to confirm this and should also address whether intensive treadmill intervention can accelerate walking onset in young children with cerebral palsy and high risk infants, and whether treadmill intervention has a general effect on gross motor development in the various subgroups of young children at risk for developmental delay.

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There is low level evidence to support the use of functional electrical stimulation to enhance function in the upper limb of children with neurological conditions.

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CLINICAL SCENARIO: There are a range of neurological conditions that affect upper limb function in children including: stroke, cerebral palsy, brain injury, brain tumour and spinal cord injury. These conditions impact a child’s ability to perform activities of daily living and participate independently in age appropriate occupations. Current upper limb rehabilitation interventions for children include, but are not limited to, constraint induced therapy, bimanual treatment, goal directed training, neuro-developmental therapy, functional retraining and reconditioning (Sakzewski, Ziviani & Boyd, 2009).

Functional electrical stimulation (FES) has been used widely in adult populations for upper limb retraining and is considered best practice for adults following stroke (National Stroke Foundation, 2010). Interestingly, FES is not routinely used in upper limb rehabilitation for children. There is however, emerging evidence to support the use of FES for children in the lower limb (Kang, Bang & Jung, 2007; Van der Linden, Haziewood, Hillman & Robb, 2008). We aimed to evaluate the evidence for FES to promote upper limb function in children with neurological conditions.