

# Science Infos

## Paralysie Cérébrale

N°22- AVRIL 2016



### ***La Fondation Motrice vient de lancer son appel projets 2016/2017 sous la forme de 2 appels à projets distincts***

- un spécifique dans le champ de la rééducation motrice ou cognitive pour les personnes atteintes de PC
- un ouvert sur la paralysie cérébrale en général.

Quatre associations partenaires soutiennent ces appels à projets : la SESEP (Société d'Etudes et de Soins pour les Enfants Paralysés et Polymalformés), le CDI (Cercle de Documentation et d'Information pour la Rééducation des Infirmes Moteurs Cérébraux), la FFAIMC (Fédération Française des Associations IMC) et ENVOLUDIA.

Les lettres d'intention proposant les projets dont le Conseil Scientifique de la Fondation évaluera notamment la qualité scientifique et l'originalité sont attendues pour le 29 juin prochain.

Plus d'informations sur [www.lafondationmotrice.org](http://www.lafondationmotrice.org)

## Manifestations et congrès

## Publications scientifiques

### Epidémiologie

#### ✚ Prévalence- Incidence

Trends in the prevalence of cerebral palsy in children born between 1988 and 2007 in Okinawa, Japan.

#### ✚ Facteurs de risque – Causes

Asymptomatic congenital cytomegalovirus infection with neurological sequelae: A retrospective study using umbilical cord.

Cerebral palsy: causes, pathways, and the role of genetic variants.

Cerebral Palsy in 1-12 Year Old Children in Southern Iran.

Onset Factors in Cerebral Palsy: A Systematic Review.

Population impact of preterm birth and low birth weight on developmental disabilities in US children.

Sex differences in cerebral palsy on neuromotor outcome: a critical review.

#### ✚ •Génétique

Association Between Osteopontin Gene Polymorphisms and Cerebral Palsy in a Chinese population.

Cerebral palsy: phenotypes and risk factors in term singletons born small for gestational age.

Clinically relevant copy number variations detected in cerebral palsy.

Genes determining the severity of cerebral palsy: the role of single nucleotide polymorphisms on amount and structure of apolipoprotein E.

The importance of de novo mutations for pediatric neurological disease-It is not all in utero or birth trauma

### Lésions - Prévention des lésions

#### ✚ Données fondamentales

Abbreviated exposure to hypoxia is sufficient to induce CNS dysmyelination, modulate spinal motor neuron composition, and impair motor development in neonatal mice.

Plasticity in the Neonatal Brain following Hypoxic-Ischaemic Injury.

Prenatal ischemia deteriorates white matter, brain organization, and function: implications for prematurity and cerebral palsy.

#### ✚ Données cliniques

Cortical morphometry and IQ in VLBW children without cerebral palsy born in 2003-2007.

Melatonin for women in pregnancy for neuroprotection of the fetus.

Neonatal Magnesium Levels Between 24 and 48 Hours of Life and Outcomes for Epilepsy and Motor Impairment in Premature Infants.

Progress in Neonatal Neurology with a Focus on Neuroimaging in the Preterm Infant.

Passive Immunization against Congenital Cytomegalovirus Infection: Current State of Knowledge.

Robot-assisted C7 nerve root transfer from the contralateral healthy side: A preliminary cadaver study

What we learned about the role of antenatal magnesium sulfate for the prevention of cerebral palsy.

## Detection - Diagnostic

### + Données cliniques

Frequency Analysis and Feature Reduction Method For Prediction of Cerebral Palsy in Young Infants.  
Knee jerk responses in infants at high risk for cerebral palsy: an observational EMG study.  
Motor and cognitive outcome after specific early lesions of the brain – a systematic review.  
Prognostic significance of neurological signs in high-risk infants - a systematic review.  
Use of biochemical tests of placental function for improving pregnancy outcome.

## Motricité - Mobilité - Posture

A descriptive analysis of the upper limb patterns during gait in individuals with cerebral palsy.  
An investigation of the factors affecting handwriting articulation of school aged children with cerebral palsy based on the international classification of functioning, disability and health.  
Anticipatory control and spatial cognition in locomotion and navigation through typical development and in cerebral palsy.  
Clinical tools designed to assess motor abilities in children with cerebral palsy.  
Description of Primary and Secondary Impairments in Young Children With Cerebral Palsy.  
Differences in proprioceptive senses between children with diplegic and children with hemiplegic cerebral palsy.  
Differential item functioning in the Patient Reported Outcomes Measurement Information System Pediatric Short Forms in a sample of children and adolescents with cerebral palsy.  
Estimating the Mechanical Behavior of the Knee Joint During Crouch Gait: Implications for Real-Time Motor Control of Robotic Knee Orthoses.  
Developmental Dysplasia of Spastic Hip in Children with Cerebral Palsy in Southern India.  
Feasibility of using a large amplitude movement therapy to improve ambulatory function in children with cerebral palsy.  
Functional classifications for cerebral palsy: correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCs).  
Gait evolution in a family with hereditary spastic paraplegia.  
Gait pattern recognition in cerebral palsy patients using neural network Modelling.  
Hand Function in Young Children with Cerebral Palsy: Current Practice and Parent-Reported Benefits.  
Impact of a short walking exercise on gait kinematics in children with cerebral palsy who walk in a crouch gait.  
Kinematic upper limb evaluation of children and adolescents with cerebral palsy: a systematic review of the literature.  
Longitudinal association between gross motor capacity and neuromusculoskeletal function in children and youth with cerebral palsy.  
Mastery motivation: a way of understanding therapy outcomes for children with unilateral cerebral palsy.  
Medial gastrocnemius muscle volume in ambulant children with unilateral and bilateral cerebral palsy aged 2 to 9 years.  
Motion analysis of the upper extremity in children with unilateral cerebral palsy--an assessment of six daily tasks.  
Muscle synergy analysis in children with cerebral palsy.  
Neglect-like characteristics of developmental disregard in children with cerebral palsy revealed by event related potentials.  
Outcome measures evaluating hand function in children with bilateral cerebral palsy: a systematic review.  
Perspectives on classification of selected childhood neurodisabilities based on a review of literature.  
Postural variability and sensorimotor development in infancy.  
Predicting Missing Marker Trajectories in Human Motion Data Using Marker Intercorrelations.  
Prospective pilots of routine data capture by paediatricians in clinics and validation of the Disabilities Complexity Scale  
Relationship Between Central Hypotonia and Motor Development in Infants Attending a High-Risk Neonatal Neurology Clinic.  
Sit-to-stand movement changes in preschool-aged children with spastic diplegia following one neurodevelopmental treatment session--a pilot study.  
The Intra- and Inter-Rater Reliability of an Instrumented Spasticity Assessment in Children with Cerebral

Palsy.

The Manual Ability Classification System: A Scoping Review.

The mechanics of activated semitendinosus are not representative of the pathological knee joint condition of children with cerebral palsy.

Validation of Inter-Subject Training for Hidden Markov Models Applied to Gait Phase Detection in Children with Cerebral Palsy.

Validity of semi-quantitative scale for brain MRI in unilateral cerebral palsy due to periventricular white matter lesions: Relationship with hand sensorimotor function and structural connectivity.

## Traitement - Rééducation motrice et cognitive

The use of instrumented gait analysis for individually tailored interdisciplinary interventions in children with cerebral palsy: a randomised controlled trial protocol

What is the evidence for managing tone in young children with, or at risk of developing, cerebral palsy: a systematic review

### Pharmacologie Efficacite Tolérance

Effects of botulinum toxin A and/or bimanual task-oriented therapy on upper extremity activities in unilateral Cerebral Palsy: a clinical trial.

Effects of Botulinum Toxin-A and Goal-Directed Physiotherapy in Children with Cerebral Palsy GMFCS Levels I & II.

Intrathecal baclofen for treating spasticity in children with cerebral palsy.

Literature Review and Comparison of Two Statistical Methods to Evaluate the Effect of Botulinum Toxin Treatment on Gait in Children with Cerebral Palsy.

Onabotulinumtoxin A Treatment of Drooling in Children with Cerebral Palsy: A Prospective, Longitudinal Open-Label Study.

Should botulinum toxin A injections be repeated in children with cerebral palsy? A systematic review

### Chirurgie

Acetabular and femoral remodeling after varus derotational osteotomy in cerebral palsy: the effect of age and Gross Motor Function Classification Level.

C5 nerve palsy after posterior reconstruction surgery: predictive risk factors of the incidence and critical range of correction for kyphosis.

Comparative effects of multilevel muscle tendon surgery, osteotomies, and dorsal rhizotomy on functional and gait outcome measures for children with cerebral palsy.

Clinical relevance of echocardiogram in patients with cerebral palsy undergoing posterior spinal fusion.

Comparison of single event vs multiple event soft tissue surgeries in the lower extremities with cerebral palsy.

Distal femoral derotational osteotomy with external fixation for correction of excessive femoral anteversion in patients with cerebral palsy.

Does Spinal Fusion and Scoliosis Correction Improve Activity and Participation for Children With GMFCS level 4 and 5 Cerebral Palsy?

Does the GMFCS level influence the improvement in knee range of motion after rectus femoris transfer in cerebral palsy?

Dynamic motor control is associated with treatment outcomes for children with cerebral palsy.

Proximal Femoral Varus Derotation Osteotomy in Children with Cerebral Palsy: The Effect of Age, Gross Motor Function Classification System Level, and Surgeon Volume on Surgical Success.

Sudden falls as a persistent complication of selective dorsal rhizotomy surgery in children with bilateral spasticity: report of 3 cases.

The Effects of Selective Dorsal Rhizotomy on Balance and Symmetry of Gait in Children with Cerebral Palsy.

The role of arthrodesis of the wrist in spastic disorders.

Unplanned Hospital Readmissions and Reoperations After Pediatric Spinal Fusion Surgery.

Unusual entrapment of deep peroneal nerve after femoral distal extension osteotomy.

### Réadaptation fonctionnelle

Action observation in infancy: implications for neuro-rehabilitation.

Comparative Effectiveness Research and Children With Cerebral Palsy: Identifying a Conceptual Framework and Specifying Measures.

Daily Intervention for Young Children With Cerebral Palsy in GMFCS Level V: A Case Series.

Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants  
Effect of parent-delivered action observation therapy on upper limb function in unilateral cerebral palsy: a randomized controlled trial.  
Effects of strength training program on hip extensors and knee extensors strength of lower limb in children with spastic diplegic cerebral palsy.  
Effectiveness of Constraint induced movement therapy as compared to bimanual therapy in Upper motor function outcome in child with hemiplegic Cerebral palsy.  
Effectiveness of motor interventions in infants with cerebral palsy: a systematic review.  
Effects of self-control and instructor-control feedback on motor learning in individuals with cerebral palsy.  
Feasibility of using a large amplitude movement therapy to improve ambulatory function in children with cerebral palsy.  
GAME (Goals - Activity - Motor Enrichment): protocol of a single blind randomised controlled trial of motor training, parent education and environmental enrichment for infants at high risk of cerebral palsy.  
Intervention for an Adolescent With Cerebral Palsy During Period of Accelerated Growth.  
Multiple Treatments of Pediatric Constraint-Induced Movement Therapy (pCIMT): A Clinical Cohort Study.  
Practical Recommendations for Robot-Assisted Treadmill Therapy (Lokomat) in Children with Cerebral Palsy: Indications, Goal Setting, and Clinical Implementation within the WHO-ICF Framework.  
Standing Programs to Promote Hip Flexibility in Children With Spastic Diplegic Cerebral Palsy.  
Three Case Reports of Successful Vibration Therapy of the Plantar Fascia for Spasticity Due to Cerebral Palsy-Like Syndrome, Fetal-Type Minamata Disease

### **Orthèses**

Comparison of 2 Orthotic Approaches in Children With Cerebral Palsy.  
Effects of different seating equipment on postural control and upper extremity function in children with cerebral palsy.  
Effect of Knee Orthoses on Hamstring Contracture in Children With Cerebral Palsy: Multiple Single-Subject Study

### **Stimulation cérébrale - Stimulation neurosensorielle**

Brain stimulation and constraint for perinatal stroke hemiparesis: The PLASTIC CHAMPS Trial.  
Effects of neuromuscular electrical stimulation on the wrist and finger flexor spasticity and hand functions in cerebral palsy.  
Extracorporeal shockwave therapy (ESWT) benefits in spastic children with cerebral palsy (CP).  
Transcranial direct current stimulation during treadmill training in children with cerebral palsy: a randomized controlled double-blind clinical trial.

### **Réalité virtuelle - Jeux video**

A Virtual Environment to Improve the Detection of Oral-Facial Malfunction in Children with Cerebral Palsy.  
Martín-Ruiz ML, Máximo-Bocanegra N, Luna-Oliva L  
Navigation of a Virtual Exercise Environment with Microsoft Kinect by People Post-stroke or with Cerebral Palsy.

### **Thérapie cellulaire Médecine régénérative**

Stem cell therapy for cerebral palsy.  
Human allogeneic ABO/Rh-identical umbilical cord blood cells in the treatment of juvenile patients with cerebral palsy.

### **Exosquelette**

A Trunk Support System to Identify Posture Control Mechanisms in Populations Lacking Independent Sitting.

### **Autres methodes**

Efficacy and safety of acupuncture in children: an overview of systematic reviews.  
fMRI assessment of neuroplasticity in youths with neurodevelopmental-associated motor disorders after piano training.

## Langage -parole-communication

Communication changes experienced by adults with cerebral palsy as they age.

Development and reliability of the Functional Communication Classification System for children with cerebral palsy.

Dysarthria in Adults With Cerebral Palsy: Clinical Presentation and Impacts on Communication.

Social media experiences of adolescents and young adults with cerebral palsy who use augmentative and alternative communication.

Spoken language comprehension of phrases, simple and compound-active sentences in non-speaking children with severe cerebral palsy.

## Autres Troubles /Troubles concomitants

A combined surveillance program and quality register improves management of childhood disability.

### + Troubles de la croissance

Growth characteristics in cerebral palsy subtypes: a comparative assessment.

### + Troubles respiratoires

Community-Acquired Pneumonia Hospitalization among Children with Neurologic Disorders.

### + Troubles cardiovasculaires

Associations of sedentary behaviour, physical activity, blood pressure and anthropometric measures with cardiorespiratory fitness in children with cerebral palsy.

### + Nutrition – Troubles nutritionnels

Aspiration Pneumonia in Children with Cerebral Palsy after Videofluoroscopic Swallowing Study.

Association between gross motor function and nutritional status in children with cerebral palsy: a cross-sectional study from Colombia.

The nutritional state of children and adolescents with cerebral palsy is associated with oral motor dysfunction and social conditions: a cross sectional study.

### + Troubles gastrologiques

Duodenal Emphysema Complicated with Superior Mesenteric Artery Syndrome in a Patient with Cerebral Paralysis: A Case Report.

Sphère bucco-dentaire

Development of a new instrument for determining the level of chewing function in children.

Impact of oral diseases and disorders on oral-health-related quality of life of children with cerebral palsy.

Orthodontic management of a patient with cerebral palsy: six years follow-up.

Submandibular Duct Re-routing for Drooling in Neurologically Impaired Children.

The Comparison of Malocclusion Prevalence Between Children with Cerebral Palsy and Healthy Children.

### + Troubles de la vision

Measurement of visual ability in children with cerebral palsy: a systematic review.

### + Troubles du sommeil

Sleep positioning systems for children with cerebral palsy.

## Qualité de vie et rapport au monde

Social Attitudes toward Cerebral Palsy and Potential Uses in Medical Education Based on the Analysis of Motion Pictures.

## **Qualité de vie**

Caregiver-reported health-related quality of life of children with cerebral palsy and their families and its association with gross motor function: A South Indian study.

## **Vie quotidienne**

A grounded theory of Internet and social media use by young people who use augmentative and alternative communication (AAC).

## **Activité physique - Sport**

Barriers and facilitators of sports in children with physical disabilities: a mixed-method study.

Evaluation of a Physical Activity Intervention for Adults With Brain Impairment: A Controlled Clinical Trial.

Quantification of Physical Activity and Sedentary Time in Adults with Cerebral Palsy.

## **Prise en charge et Accompagnement**

Fatigue in the mothers of children with cerebral palsy.

Improving allied health professionals' research implementation behaviours for children with cerebral palsy: protocol for a before-after study.

Medical service use in children with cerebral palsy: The role of child and family factors characteristics.

Parents' perceptions of the services provided to children with cerebral palsy in the transition from preschool rehabilitation to school-based services

## **Domotique - Nouvelles technologies – Matériel médical**

A comparative study: use of a Brain-computer Interface (BCI) device by people with cerebral palsy in interaction with computers.

Lessons learned from studying the functional impact of adaptive seating interventions for children with cerebral palsy.

Two Seating Systems' Effects on an Adolescent With Cerebral Palsy and Severe Scoliosis.

# Manifestations et congrès

## Mars 2016

### Journées de la SOFOP

23-25 Mars 2016

Toulouse, France

<http://www.sofop-les-seminaires.org/fr/>

### 44emes entretiens de Médecine Physique et de Réadaptation

23-25 Mars 2016

Montpellier, France

<http://empr.fr/EventPortal/Information/EMPR2016/ACCUEIL.aspx>

## Avril 2016

### 20th European Congress of Physical and Rehabilitation Medicine (ESPRM)

23-28 Avril 2016

Lisbonne, Portugal

<http://www.esprm2016.com/en/>

## Mai 2016

### Congrès SFERHE - Société Francophone d'Etude et de Recherche sur les Handicaps de l'Enfance

Mouvements involontaires de l'enfant

23 - 24 Mai 2016

Bordeaux, France,

<http://www.tmsevents.fr/congres/2016/sferhe/>

## Juin 2016

### International Conference on Cerebral Palsy and Other Childhood-onset Disabilities

#### Joint meeting

5Th International Conference of Cerebral palsy (ICPC°

28th Annual Meeting of the European Academy of Childhood Disability (EACD)

1 st Biennial meeting of the International Alliance of Academies of Childhood Disability (IAACD)

1-4 Juin 2016

Suède, Stockholm

<http://eacd2016.org/>

## Septembre 2016

### 6th International Conference on Clinical Neonatology

22-24 Spetembre 2016

Turin, Italie

<https://www.eiseverywhere.com/ehome/105597/234360/>

## Octobre 2016

### 31ème Congrès de la Société française de Médecine Physique et de réadaptation (SOFMER)

13-15 Octobre 2016

Saint Etienne, France

<http://saint-etienne.sofmer2016.com/>



### Méthodologie de la recherche

Le profil de veille a été mis en place sur Pubmed avec le mot clé "Cerebral Palsy" pour des publications majoritairement en français ou en anglais, avec abstract.

**Free article** indique le lien vers les articles dont le texte intégral est librement disponible

## Epidémiologie

### ⬇️Prévalence- Incidence

#### **Trends in the prevalence of cerebral palsy in children born between 1988 and 2007 in Okinawa, Japan.**

Touyama M, Touyama J, Toyokawa S, Kobayashi Y.

*Brain Dev.* 2016 Apr 9. pii: S0387-7604(16)30024-9. doi:10.1016/j.braindev.2016.03.007. [Epub ahead of print]

AIM: This study aimed to describe trends in CP prevalence among children born between 1988 and 2007 in Okinawa, Japan.

METHOD: This study was conducted during two time periods, Period I (from 1988 to 1997) and Period II (from 1998 to 2007), using data from the local CP registration system. We assessed cerebral palsy gestational age and birth weight specific trends in prevalence and analyzed these with Poisson regression analysis.

RESULTS: Overall crude CP prevalence was 1.88 per 1000 live births. Approximately 70% of children with CP were born preterm or with low birth weight (LBW). Overall CP prevalence increased in Period I and decreased significantly in Period II ( $P<0.05$ ). Additionally, CP prevalence among children born with a birth weight between 1000 and 1999g increased in Period I and decreased significantly in Period II ( $P<0.05$ ). A significant decrease was found among the children born between 1995 and 2007 with a gestational age between 28 and 31 weeks ( $P<0.01$ ).

CONCLUSIONS: There was a decrease in CP prevalence from 1998 to 2007, especially among LBW children and preterm infants. The high CP proportions among LBW and preterm infants are unique features of the population of Okinawa, Japan.

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PMID: 27072917 [PubMed - as supplied by publisher]

### ⬇️Facteurs de risque – Causes

#### **Asymptomatic congenital cytomegalovirus infection with neurological sequelae: A retrospective study using umbilical cord.**

Uematsu M, Haginoya K, Kikuchi A, Hino-Fukuyo N, Ishii K, Shiihara T, Kato M, Kamei a, Kure S.

*Brain Dev.* 2016 Apr 8. pii: S0387-7604(16)30023-7. doi:10.1016/j.braindev.2016.03.006. [Epub ahead of print]

BACKGROUND: Congenital cytomegalovirus (CMV) infection causes various neurological sequelae. However, most infected infants are asymptomatic at birth, and retrospective diagnosis is difficult beyond the neonatal period.

OBJECTIVE: This study aimed to investigate the aspects of neurological sequelae associated with asymptomatic congenital CMV infection.

METHODS: We retrospectively analyzed 182 patients who were suspected of having asymptomatic congenital CMV infection with neurological symptoms in Japan. Congenital CMV infection was diagnosed by quantitative polymerase chain reaction amplification of CMV from dried umbilical cord DNA.

RESULTS: Fifty-nine patients (32.4%) who tested positive for CMV were confirmed as having congenital CMV infection. Among 54 congenital CMV patients, major neurological symptoms included intellectual disability ( $n=51$ , 94.4%), hearing impairment ( $n=36$ , 66.7%) and cerebral palsy ( $n=21$ , 38.9%), while microcephaly ( $n=16$ , 29.6%) and epilepsy ( $n=14$ , 25.9%) were less common. In a brain magnetic resonance imaging (MRI) study, cortical dysplasia was observed in 27 CMV-positive patients (50.0%), and all patients (100%) had cerebral white matter (WM) abnormality. Intracranial calcification was detected by CT in 16 (48.5%) of 33 CMV-positive patients. Cerebral palsy, cortical dysplasia and a WM abnormality with a diffuse pattern were associated with marked intellectual disability.

Science Infos Paralysie Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 9 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

CONCLUSIONS: Brain MRI investigations are important for making a diagnosis and formulating an intellectual prognosis. Analysis of umbilical cord tissue represents a unique and useful way to retrospectively diagnose congenital CMV infection.

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### **Cerebral palsy: causes, pathways, and the role of genetic variants.**

MacLennan AH, Thompson SC, Gecz J.

*Am J Obstet Gynecol.* 2015 Dec;213(6):779-88. doi: 10.1016/j.ajog.2015.05.034. Epub 2015 May 21.

Cerebral palsy (CP) is heterogeneous with different clinical types, comorbidities, brain imaging patterns, causes, and now also heterogeneous underlying genetic variants. Few are solely due to severe hypoxia or ischemia at birth. This common myth has held back research in causation. The cost of litigation has devastating effects on maternity services with unnecessarily high cesarean delivery rates and subsequent maternal morbidity and mortality. CP rates have remained the same for 50 years despite a 6-fold increase in cesarean birth. Epidemiological studies have shown that the origins of most CP are prior to labor. Increased risk is associated with preterm delivery, congenital malformations, intrauterine infection, fetal growth restriction, multiple pregnancy, and placental abnormalities. Hypoxia at birth may be primary or secondary to preexisting pathology and international criteria help to separate the few cases of CP due to acute intrapartum hypoxia. Until recently, 1-2% of CP (mostly familial) had been linked to causative mutations. Recent genetic studies of sporadic CP cases using new-generation exome sequencing show that 14% of cases have likely causative single-gene mutations and up to 31% have clinically relevant copy number variations. The genetic variants are heterogeneous and require function investigations to prove causation. Whole genome sequencing, fine scale copy number variant investigations, and gene expression studies may extend the percentage of cases with a genetic pathway. Clinical risk factors could act as triggers for CP where there is genetic susceptibility. These new findings should refocus research about the causes of these complex and varied neurodevelopmental disorders.

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[Free Article](#)

PMID: 26003063 [PubMed - indexed for MEDLINE]

### **Cerebral Palsy in 1-12 Year Old Children in Southern Iran.**

Inaloo S, Katibeh P, Ghasemof M.

*Iran J Child Neurol.* 2016 Winter;10(1):35-41.

OBJECTIVE: Cerebral palsy (CP) is a non-progressive CNS disorder due to an insult to the growing brain, usually occurring in the first two years of life. During the recent years, its etiology has been changed; perinatal and postnatal insults are not considered as its main causes in developed countries any more. The aim of this study was to evaluate the causes of CP in children in southern Iran.

MATERIALS & METHODS: Overall, 200 children with CP aged 1-12 yr old referring to Pediatric Neurology Clinic affiliated to Shiraz University of Medical Sciences, Shiraz, Iran between 2012 and 2013 were enrolled. In addition, 200 healthy age and sex-matched children were considered as the control group. Exclusion criteria were isolated movement disorders with no other evidence of CP, progressive neurologic disorders, metabolic disorders, and incomplete or uncertain past history. After collecting the data on pregnancy period, prenatal history and past medical problems, they were analyzed with appropriate statistical methods.

RESULTS: Maternal age, medical problems during pregnancy period, route of delivery, head circumference at birth, neonatal admission, neonatal jaundice, and prematurity were the main risk factors for CP.

DISCUSSION: The distribution of risk factors of CP is different from that of developed countries in our region. Pre- and peri-natal etiologies are still among the common causes of CP in Iran.

[Free PMC Article](#)

PMCID: PMC4815485

PMID: 27057186 [PubMed]

### **Onset Factors in Cerebral Palsy: A Systematic Review.**

van Lieshout P, Candundo H, Martino R, Shin S, Barakat-Haddad C.

Science Infos Paralysie Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 10 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

*Neurotoxicology. 2016 Apr 1. pii: S0161-813X(16)30043-2. doi: 10.1016/j.neuro.2016.03.021. [Epub ahead of print]*

Studies have noted several factors associated with the occurrence of Cerebral Palsy (CP), yet considerable uncertainty remains about modifiable factors related to disease onset. A systematic review was performed to identify existing systematic reviews and primary studies pertaining to targeted factors associated with the onset of CP. The following databases were searched: MEDLINE, MEDLINE In Process, EMBASE, PsycINFO, Scopus, Web of Science, Cochrane Database of Systematic Reviews, CINAHL, ProQuest Dissertations & Theses, Hugu Navigator, AARP

Ageline. Variations of MeSH and keyword search terms were used. Critical appraisal was conducted on selected articles. Data extraction targeted reported factors, risk estimates, and 95% confidence intervals (CI). Findings identified two systematic reviews and three meta-analyses, as well as 83 studies of case control, cohort, and cross-sectional methodological designs. Selected studies indicated that lower gestational age was associated with the onset of CP. Medical diagnoses for the mother, in particular chorioamnionitis, was found to be positively associated with onset of CP. Preeclampsia was reported to be either inconclusive or positively associated with CP onset. Low birth weight predominantly indicated a positive association with the onset of CP, while male gender showed mixed findings. The combination of male gender with pre-term or low birth weight was also found to be positively associated with CP. Evidence was identified in the literature pertaining to specific factors relating to the onset of CP, in particular showing positive associations with lower gestational age and low birth weight.

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PMID: 27045882 [PubMed - as supplied by publisher]

### **Population impact of preterm birth and low birth weight on developmental disabilities in US children.**

Schieve LA, Tian LH, Rankin K, Kogan MD, Yeargin-Allsopp M, Visser S, Rosenberg D.

*Ann Epidemiol. 2016 Mar 22. pii: S1047-2797(16)30068-0. doi: 10.1016/j.annepidem.2016.02.012. [Epub ahead of print]*

**PURPOSE:** Although previous studies demonstrate associations between adverse perinatal outcomes and developmental disabilities (DDs), study of population impacts is limited.

**METHODS:** We computed relative risks adjusted (aRRs) for sociodemographic factors and component and summary population attributable fractions (PAFs) for associations between very low birth weight (VLBW, all preterm births), moderately low birth weight (MLBW) + Preterm, MLBW at term, and normal birth weight (NBW) + Preterm and seven DDs (cerebral palsy [CP], autism spectrum disorder [ASD], intellectual disability [ID], behavioral-conduct disorders, attention-deficit-hyperactivity disorder [ADHD], learning disability [LD], and other developmental delay) among children aged 3-17 years in the 2011-2012 National Survey of Children's Health.

**RESULTS:** VLBW-Preterm, MLBW-Preterm and NBW-Preterm were strongly to moderately associated with CP (aRRs: 43.5, 10.1, and 2.2, respectively; all significant) and also associated with ID, ASD, LD, and other developmental delay (aRR ranges: VLBW-Preterm 2.8-5.3; MLBW-Preterm 1.9-2.8; and NBW-Preterm 1.6-2.3). Summary PAFs for preterm birth and/or LBW were 55% for CP, 10%-20% for ASD, ID, LD, and other developmental delay, and less than 5% for ADHD and behavioral-conduct disorders. Findings were similar whether we assessed DDs as independent outcomes or within mutually exclusive categories accounting for DD co-occurrence.

**CONCLUSIONS:** Preterm birth has a sizable impact on child neurodevelopment. However, relative associations and population impacts vary widely by DD type.

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PMID: 27085382 [PubMed - as supplied by publisher]

### **Sex differences in cerebral palsy on neuromotor outcome: a critical review.**

Romeo DM, Sini F, Brogna C, Albamonte E, Ricci D, Mercuri E.

*Dev Med Child Neurol. 2016 Apr 21. doi: 10.1111/dmcn.13137. [Epub ahead of print]*

Sex differences have been reported in children with cerebral palsy (CP), with males having a higher risk of developing CP, but it is not entirely clear whether sex may also affect the severity of motor impairment. The aim of the present study was to critically review the existing literature on sex influence on neuromotor outcome in children with CP. The published papers confirm that CP occurs more frequently in males than in females. Within different types of CP or individual level of impairment, however, there was limited evidence that sex also had an effect on their performance.

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PMID: 27098195 [PubMed - as supplied by publisher]

**Association Between Osteopontin Gene Polymorphisms and Cerebral Palsy in a Chinese population.**

Shang Q, Zhou C, Liu D, Li W, Chen M, Xu Y, Wang F, Bi D, Zhang X, Zhao X, Wang L, Zhu C, Xing Q.  
*Neuromolecular Med.* 2016 Apr 25. [Epub ahead of print]

Cerebral palsy (CP) is a neurological disorder affecting movement and posture that develops as a complication of prenatal, perinatal, and postnatal brain injury. Such non-progressive brain injury is often accompanied by neonatal encephalopathy and inflammation. The widely expressed soluble cytokine osteopontin (OPN) plays an important role in inflammation and neurological protection. Therefore, it is of great interest to study the relationship between CP and genetic variants of OPN. To explore the genetic association between OPN gene single nucleotide polymorphisms (SNPs) and CP in the Chinese Han population, five SNPs (rs2853744, rs2853749, rs11728697, rs4754, and rs1126616) were genotyped among 715 CP patients and 658 healthy controls using the MassArray platform. Statistical analysis was performed using the online SHEsis program, and Bonferroni correction was applied as necessary. We found an association between rs1126616 and global CP (corrected allelic  $P = 0.0006$  and genotypic  $P = 0.0011$  after Bonferroni correction). The other SNPs were not statistically associated with CP or any of its subgroups. By testing a relatively large sample size, our study demonstrates that the OPN gene SNP rs1126616 is statistically associated with CP. We suspect that the OPN gene might be a susceptibility factor for CP.

PMID: 27114095 [PubMed - as supplied by publisher]

**Cerebral palsy: phenotypes and risk factors in term singletons born small for gestational age.**

Freire G, Shevell M, Oskoui M.

*Eur J Paediatr Neurol.* 2015 Mar;19(2):218-25. doi: 10.1016/j.ejpn.2014.12.005. Epub 2014 Dec 17.

**BACKGROUND AND OBJECTIVES:** Children born small for gestational age (SGA) are at increased risk of developing cerebral palsy (CP). The pathophysiology behind this association remains unclear. We compare the clinical profile of children with CP born SGA to other children with CP. We hypothesize that differences noted will support antenatal causes of CP in children born SGA.

**METHODS:** We conducted a retrospective cohort study of term singletons with CP, extracting data from the Canadian Cerebral Palsy Registry. SGA was determined as birth weight for gestational age and sex below the tenth percentile.

**RESULTS:** Mothers of children with CP born SGA were more likely to be of African-American ethnicity (RR 2.54, 95% CI 1.20-5.39), have intrauterine infections (RR 2.22, 95% CI 1.09-4.50) and have gestational hypertension (RR 1.78, 95% CI 1.06-3.00). Children with CP born SGA had smaller head circumferences at birth ( $p < 0.001$ ) and higher frequencies of emergency cesarean-section (RR 1.53, 95% CI 1.22-1.92), birth asphyxia (RR 1.53, 95% CI 1.0-2.32), and placental abnormalities (RR 1.45, 95% CI 1.00-2.10). Children with CP born SGA had greater fine motor (RR 1.46, 95% CI 1.02-2.11), gross motor (RR 1.53, 95% CI 1.12-2.10) and communication impairment (RR 1.24, 95% CI 1.10-1.40), and a higher frequency of cognitive impairment (RR 1.33, 95% CI 1.06-1.69).

**CONCLUSION:** Children with CP born SGA have different clinical factors and phenotypic profiles than other children with CP. These differences support the hypothesis of antenatal and perinatal causes of CP in children born SGA. Future case control studies would be desired to further define this causal pathway.

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PMID: 25596065 [PubMed - indexed for MEDLINE]

**Clinically relevant copy number variations detected in cerebral palsy.**

Oskoui M, Gazzellone MJ, Thiruvahindrapuram B, Zarrei M, Andersen J, Wei J, Wang Z, Wintle RF, Marshall CR, Cohn RD, Weksberg R, Stavropoulos DJ, Fehlings D, Shevell MI, Scherer SW.

*Nat Commun.* 2015 Aug 3;6:7949. doi: 10.1038/ncomms8949.

Cerebral palsy (CP) represents a group of non-progressive clinically heterogeneous disorders that are characterized by motor impairment and early age of onset, frequently accompanied by co-morbidities. The cause of CP has historically been attributed to environmental stressors resulting in brain damage. While genetic risk factors are also implicated, guidelines for diagnostic assessment of CP do not recommend for routine genetic testing. Given Numerous reports of aetiologic copy number variations (CNVs) in other neurodevelopmental disorders, we used microarrays to genotype a

population-based prospective cohort of children with CP and their parents. Here we identify de novo CNVs in 8/115 (7.0%) CP patients (~1% rate in controls). In four children, large chromosomal abnormalities deemed likely pathogenic were found, and they were significantly more likely to have severe neuromotor impairments than those CP subjects without such alterations. Overall, the CNV data would have impacted our diagnosis or classification of CP in 11/115 (9.6%) families.

[Free PMC Article](#)

PMCID: PMC4532872

PMID: 26236009 [PubMed - indexed for MEDLINE]

### **Genes determining the severity of cerebral palsy: the role of single nucleotide polymorphisms on the amount and structure of apolipoprotein E.**

Lien E, Andersen G, Bao Y, Gordish-Dressman H, Skranes JS, Blackman JA, Vik T.

*Acta Paediatr.* 2015 Jul;104(7):701-6. doi: 10.1111/apa.12983. Epub 2015 Mar 27.

AIM: Apolipoprotein E (apoE) influences repair and other processes in the brain, and the apoE4 variant is a risk factor for Alzheimer's disease and for prolonged recovery following traumatic brain injury. We previously reported that specific single nucleotide polymorphisms in the APOE or TOMM40 genes affecting the structure and production of apoE were associated with epilepsy, more impaired hand function and gastrostomy tube feeding in children with cerebral palsy (CP). This study explored how various combinations of the same polymorphisms may affect these clinical manifestations.

METHODS: Successful DNA analyses of APOE and TOMM40 were carried out on 227 children. The CP Register of Norway provided details of gross and fine motor function, epilepsy and gastrostomy tube feeding. Possible associations between these clinical manifestations and various combinations of the APOE $\epsilon$ 2,  $\epsilon$ 3 or  $\epsilon$ 4 alleles and of the rs59007384 polymorphism in the TOMM40 gene were explored.

RESULTS: Epilepsy, impaired fine motor function and gastrostomy tube feeding were less common in children carrying the combination of rs59007384 GG and APOE $\epsilon$ 2 or  $\epsilon$ 3 than in children with other combinations.

CONCLUSION: Our findings suggest that specific combinations of genes influence the structure and production of apoE differently and affect the clinical manifestations of CP.

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PMCID: PMC4474769 [Available on 2016-07-01]

PMID: 25703783 [PubMed - indexed for MEDLINE]

### **The importance of de novo mutations for pediatric neurological disease-It is not all in utero or birth trauma.**

Erickson RP.

*Mutat Res Rev Mutat Res.* 2016 Jan-Mar;767:42-58. doi: 10.1016/j.mrrev.2015.12.002. Epub 2016 Jan 4.

The advent of next generation sequencing (NGS, which consists of massively parallel sequencing to perform TGS (total genome sequencing) or WES (whole exome sequencing)) has abundantly discovered many causative mutations in patients with pediatric neurological disease. A surprisingly high number of these are de novo mutations which have not been inherited from either parent. For epilepsy, autism spectrum disorders, and neuromotor disorders, including cerebral palsy, initial estimates put the frequency of causative de novo mutations at about 15% and about 10% of these are somatic. There are some shared mutated genes between these three classes of disease. Studies of copy number variation by comparative genomic hybridization (CGH) preceded the NGS approaches but they also detect de novo variation which is especially important for ASDs. There are interesting differences between the mutated genes detected by CGS and NGS. In summary, de novo mutations cause a very significant proportion of pediatric neurological disease.

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PMID: 27036065 [PubMed - in process]

## **Lésions Prévention des lésions**

### **+ Données fondamentales**

**Abbreviated exposure to hypoxia is sufficient to induce CNS dysmyelination, modulate spinal motor neuron composition, and impair motor development in neonatal mice.**

Watzlawik JO, Kahoud RJ, O'Toole RJ, White KA, Ogden AR, Painter MM, Wootla B, Papke LM, Denic A, Weimer JM, Carey WA, Rodriguez M.

*PLoS One.* 2015 May 28;10(5):e0128007. doi: 10.1371/journal.pone.0128007.eCollection 2015.

Neonatal white matter injury (nWMI) is an increasingly common cause of cerebral palsy that results predominantly from hypoxic injury to progenitor cells including those of the oligodendrocyte lineage. Existing mouse models of nWMI utilize prolonged periods of hypoxia during the neonatal period, require complex cross-fostering and exhibit poor growth and high mortality rates. Abnormal CNS myelin composition serves as the major explanation for persistent neuro-motor deficits. Here we developed a simplified model of nWMI with low mortality rates and improved growth without cross-fostering. Neonatal mice are exposed to low oxygen from postnatal day (P) 3 to P7, which roughly corresponds to the period of human brain development between gestational weeks 32 and 36. CNS hypomyelination is detectable for 2-3 weeks post injury and strongly correlates with levels of body and brain weight loss. Immediately following hypoxia treatment, cell death was evident in multiple brain regions, most notably in superficial and deep cortical layers as well as the subventricular zone progenitor compartment. PDGF $\alpha$ R, Nkx2.2, and Olig2 positive oligodendrocyte progenitor cell were significantly reduced until postnatal day 27. In addition to CNS dysmyelination we identified a novel pathological marker for adult hypoxic animals that strongly correlates with life-long neuro-motor deficits. Mice reared under hypoxia reveal an abnormal spinal neuron composition with increased small and medium diameter axons and decreased large diameter axons in thoracic lateral and anterior funiculi. Differences were particularly pronounced in white matter motor tracts left and right of the anterior median fissure. Our findings suggest that 4 days of exposure to hypoxia are sufficient to induce experimental nWMI in CD1 mice, thus providing a model to test new therapeutics. Pathological hallmarks of this model include early cell death, decreased OPCs and hypomyelination in early postnatal life, followed by dysmyelination, abnormal spinal neuron composition, and neuro-motor deficits in adulthood.

[Free PMC Article](#)

PMCID: PMC4447462

PMID: 26020269 [PubMed - indexed for MEDLINE]

**Plasticity in the Neonatal Brain following Hypoxic-Ischaemic Injury.**

Rocha-Ferreira E, Hristova M.

*Neural Plast.* 2016;2016:4901014. doi: 10.1155/2016/4901014. Epub 2016 Mar 7.

Hypoxic-ischaemic damage to the developing brain is a leading cause of child death, with high mortality and morbidity, including cerebral palsy, epilepsy, and cognitive disabilities. The developmental stage of the brain and the severity of the insult influence the selective regional vulnerability and the subsequent clinical manifestations. The increased susceptibility to hypoxia-ischaemia (HI) of periventricular white matter in preterm infants predisposes the immature brain to motor, cognitive, and sensory deficits, with cognitive impairment associated with earlier gestational age. In term infants HI causes selective damage to sensorimotor cortex, basal ganglia, thalamus, and brain stem. Even though the immature brain is more malleable to external stimuli compared to the adult one, a hypoxic-ischaemic event to the neonate interrupts the shaping of central motor pathways and can affect normal developmental plasticity through altering neurotransmission, changes in cellular signalling, neural connectivity and function, wrong targeted innervation, and interruption of developmental apoptosis. Models of neonatal HI demonstrate three morphologically different types of cell death, that is, apoptosis, necrosis, and autophagy, which crosstalk and can exist as a continuum in the same cell. In the present review we discuss the mechanisms of HI injury to the immature brain and the way they affect plasticity.

PMCID: PMC4800097

PMID: 27047695 [PubMed - in process]

**Prenatal ischemia deteriorates white matter, brain organization, and function: implications for prematurity and cerebral palsy.**

Coq JO, Delcour M, Massicotte VS, Baud O, Barbe MF.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:7-11. doi: 10.1111/dmcn.13040.

Cerebral palsy (CP) describes a group of neurodevelopmental disorders of posture and movement that are frequently associated with sensory, behavioral, and cognitive impairments. The clinical picture of CP has changed with improved neonatal care over the past few decades, resulting in higher survival rates of infants born very preterm. Children born preterm seem particularly vulnerable to perinatal hypoxia-ischemia insults at birth. Animal models of CP are crucial for elucidating underlying mechanisms and for development of strategies of neuroprotection and remediation. Most animal models of CP are based on hypoxia-ischemia around the time of birth. In this review, we focus on alterations of brain organization and functions, especially sensorimotor changes, induced by prenatal ischemia in rodents and rabbits, and relate these alterations to neurodevelopmental disorders found in preterm children. We also discuss recent literature that addresses the relationship between neural and myelin plasticity, as well as possible contributions of white matter injury to the emergence of brain dysfunctions induced by prenatal ischemia.

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PMCID: PMC4817365 [Available on 2017-03-01]

PMID: 27027601 [PubMed - in process]

## **Données cliniques**

### **Cortical morphometry and IQ in VLBW children without cerebral palsy born in 2003-2007.**

Sølsnes AE, Grunewaldt KH, Bjuland KJ, Stavnes EM, Bastholm IA, Aanes S, Østgård HF, Håberg A, Løhaugen GC, Skranes J, Rimol LM.

*Neuroimage Clin.* 2015 Apr 14;8:193-201. doi: 10.1016/j.nicl.2015.04.004. eCollection 2015.

Children born prematurely with very low birth weight (VLBW: bw  $\leq$  1500 g) have an increased risk of preterm perinatal brain injury, which may subsequently alter the maturation of the brain, including the cerebral cortex. The aim of study was to assess cortical thickness and surface area in VLBW children compared with term-born controls, and to investigate possible relationships between cortical morphology and Full IQ. In this cross-sectional study, 37 VLBW and 104 term children born between the years 2003-2007 were assessed cognitively at 5-10 years of age, using age appropriate Wechsler tests. The FreeSurfer software was used to obtain estimates of cortical thickness and surface area based on T1-weighted MRI images at 1.5 Tesla. The VLBW children had smaller cortical surface area bilaterally in the frontal, temporal, and parietal lobes. A thicker cortex in the frontal and occipital regions and a thinner cortex in posterior parietal areas were observed in the VLBW group. There were significant differences in Full IQ between groups (VLBW M = 98, SD = 9.71; controls M = 108, SD = 13.57;  $p < 0.001$ ). There was a positive relationship between IQ and surface area in both groups, albeit significant only in the larger control group. In the VLBW group, reduced IQ was associated with frontal cortical thickening and temporo-parietal thinning. We conclude that cortical deviations are evident in childhood even in VLBW children born in 2003-2007 who have received state of the art medical treatment in the perinatal period and who did not present with focal brain injuries on neonatal ultrasonography. The cortical deviations were associated with reduced cognitive functioning.

#### **[Free PMC Article](#)**

PMCID: PMC4473819

PMID: 26106543 [PubMed - indexed for MEDLINE]

### **Melatonin for women in pregnancy for neuroprotection of the fetus.**

Wilkinson D, Shepherd E, Wallace EM.

*Cochrane Database Syst Rev.* 2016 Mar 29;3:CD010527. doi: 10.1002/14651858.CD010527.pub2.

**BACKGROUND:** Melatonin is an antioxidant with anti-inflammatory and anti-apoptotic effects. Animal studies have supported a fetal neuroprotective role for melatonin when administered maternally. It is important to assess whether melatonin, given to the mother, can reduce the risk of neurosensory disabilities (including cerebral palsy) and death, associated with fetal brain injury, for the preterm or term compromised fetus.

**OBJECTIVES:** To assess the effects of melatonin when used for neuroprotection of the fetus.

**SEARCH METHODS:** We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (31 January 2016).

**SELECTION CRITERIA:** We planned to include randomised controlled trials and quasi-randomised controlled trials comparing melatonin given to women in pregnancy (regardless of the route, timing, dose and duration of administration) for fetal neuroprotection with placebo, no treatment, or with an alternative agent aimed at providing fetal neuroprotection. We also planned to include comparisons of different regimens for administration of melatonin.

DATA COLLECTION AND ANALYSIS: Two review authors planned to independently assess trial eligibility, trial quality and extract the data.

MAIN RESULTS: We found no randomised trials for inclusion in this review. One study is ongoing.

AUTHORS' CONCLUSIONS: As we did not identify any randomised trials for inclusion in this review, we are unable to comment on implications for practice at this stage. Although evidence from animal studies has supported a fetal neuroprotective role for melatonin when administered to the mother during pregnancy, no trials assessing melatonin for fetal neuroprotection in pregnant women have been completed to date. However, there is currently one ongoing randomised controlled trial (with an estimated enrolment target of 60 pregnant women) which examines the dose of melatonin, administered to women at risk of imminent very preterm birth (less than 28 weeks' gestation) required to reduce brain damage in the white matter of the babies that were born very preterm. Further high-quality research is needed and research efforts should be directed towards trials comparing melatonin with either no intervention (no treatment or placebo), or with alternative agents aimed at providing fetal neuroprotection (such as magnesium sulphate for the very preterm infant). Such trials should evaluate maternal and infant short- and longer-term outcomes (including neurosensory disabilities such as cerebral palsy), and consider the costs of care.

PMID: 27022888 [PubMed - in process]

### **Neonatal Magnesium Levels Between 24 and 48 Hours of Life and Outcomes for Epilepsy and Motor Impairment in Premature Infants.**

Ostrander B, Bardsley T, Korgenski EK, Greene T, Bonkowsky JL.

*Pediatr Neurol.* 2016 Mar 3. pii: S0887-8994(15)30232-0. doi: 10.1016/j.pediatrneurol.2016.02.012. [Epub ahead of print]

OBJECTIVE: Elevated rates of epilepsy and motor impairments including cerebral palsy are observed in children who were born prematurely. Maternal antenatal magnesium supplementation has been associated with decreased rates of cerebral palsy in infants born prematurely. Our objective was to determine whether the neonatal serum magnesium level between 24 and 48 hours after birth is associated with better long-term neurodevelopmental outcomes (epilepsy, motor impairment) in premature infants.

METHODS: We performed a retrospective cohort analysis in infants born less than 37-weeks gestation over a ten-year period. Prenatal, perinatal, and postnatal clinical and demographic information was collected. Crude and adjusted odds ratios were estimated under generalized linear models with generalized estimating equations to examine the association of the neonatal serum magnesium level between 24 and 48 hours after birth with the risk of epilepsy and/or motor impairment (spasticity; hypotonia; cerebral palsy).

RESULTS: The final cohort included 5461 infants born less than 37-weeks gestation from 2002 to 2011. The adjusted relative risk ratio for the combined outcomes of epilepsy and/or motor impairment, controlling for gestational age, current age, maternal magnesium supplementation, maternal steroid administration, five-minute Apgar score, neonatal infection, need for vasopressor use, and birth weight and with serum magnesium level as the main independent variable, was 0.85 (P = 0.24). Stratified analyses by gestational age less than 32 or greater than 32 weeks were not significantly associated with adverse neurodevelopmental outcome (risk ratio = 0.79 and 1.2, P = 0.12 and 0.49, respectively). A multivariate analysis for the risk of motor impairment alone had a risk ratio of 0.94 (P = 0.72).

CONCLUSION: This study demonstrates that the neonatal magnesium level between 24 and 48 hours of life in premature infants is not significantly associated with the risk for developing epilepsy or motor impairment.

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PMID: 27025188 [PubMed - as supplied by publisher]

### **Progress in Neonatal Neurology with a Focus on Neuroimaging in the Preterm Infant.**

de Vries LS, Benders MJ, Groenendaal F.

*Neuropediatrics.* 2015 Aug;46(4):234-41. doi: 10.1055/s-0035-1554102. Epub 2015 Jun 29.

*Comment in Neuropediatrics.* 2015 Aug;46(4):233.

There have been tremendous changes in the methods used to evaluate brain injury in the preterm infant in the past 30 years. In particular, major improvements have been made in how we use neuroimaging techniques and now magnetic resonance imaging (MRI) is used more often and considered complementary to routine and sequential cranial ultrasound. The focus has shifted from severe lesions such as large intraventricular and parenchymal hemorrhages and cystic periventricular leukomalacia to assessing and understanding the etiology of more subtle noncystic white matter injury, punctate hemorrhage, and cerebellar lesions. The more severe lesions that dominated the early period

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of preterm neonatal brain imaging occur less frequently but are still associated with major disabilities, such as, cerebral palsy, while subtle white matter injury and cerebellar lesions are more often associated with cognitive and behavioral problems, which have become the most prevalent issues among the survivors of extremely preterm birth.

Georg Thieme Verlag KG Stuttgart · New York.

PMID: 26121069 [PubMed - indexed for MEDLINE]

### **Passive Immunization against Congenital Cytomegalovirus Infection: Current State of Knowledge.**

Jückstock J(1), Rothenburger M, Friese K, Traunmüller F.

*Pharmacology.* 2015;95(5-6):209-17. doi: 10.1159/000381626. Epub 2015 Apr 25.

Primary infection with the human cytomegalovirus (CMV) occurs in 1-4% of pregnancies. The rates of maternal-fetal CMV transmissions are around 25, 36, 41, and 66%, for infections occurring in the peri-conceptional weeks, first, second, and third trimester of pregnancy, respectively. On the other hand, the severity of fetal organ damage and dysfunction diminishes with increasing gestational age. Congenitally CMV-infected newborns may have Neurosensory impairments like mental retardation, cerebral palsy, epilepsy, progressive hearing loss or visual defects, or even may have a fatal outcome. In in-vitro experiments, CMV specific neutralizing IgG antibodies - which are abundant in CMV specific hyperimmune globulin (HIG) products - inhibited the entry of the virus into target cells and hampered viral cell-to-cell spread. This article provides a brief overview on the epidemiology and diagnostic tools in congenital CMV infection. It also concisely summarizes the currently available study results on the safety and effectiveness of HIG treatment. Accordingly, in clinical studies HIG administration to expectant mothers following primary CMV infection (prophylactic use) was shown to lower the risk of maternal-fetal transmission of CMV compared to untreated controls. HIG was also able to ameliorate the disease sequelae in evidently infected fetuses (therapeutic use), as demonstrated by the regression or even resolution of sonographic pathologies including placental inflammation.

#### [Free Article](#)

PMID: 25924667 [PubMed - indexed for MEDLINE]

### **Robot-assisted C7 nerve root transfer from the contralateral healthy side: A preliminary cadaver study.**

Jiang S, Ichihara S, Prunières G, Peterson B, Facca S, Xu WD, Liverneaux P

*Hand Surg Rehabil.* 2016 Apr;35(2):95-9. doi: 10.1016/j.hansur.2015.12.008. Epub 2016 Apr 5.

Patients with cerebral palsy and spastic hemiplegia may have extremely poor upper extremity function. Unfortunately, many current therapies and treatments for patients with spastic hemiplegia offer very limited improvements. One innovative technique for treating these patients is the use a contralateral C7 nerve root transfer to neurotize the C7 nerve root in the affected limb. This may result not only in less spasticity in the affected limb, but also improved control and motor function vis-a-vis the new connection to the normal cerebral hemisphere. However, contralateral C7 transfers can require large incisions and long nerve grafts. The aim of this study was to test the feasibility of a contralateral C7 nerve root transfer procedure with the use of a prevertebral minimally invasive robot-assisted technique. In a cadaver, both sides of the C7 root were dissected. The right recipient C7 root was resected as proximally as possible, while the left donor C7 root was resected as distally as possible. With the use of the da Vinci (®) SI surgical robot (Intuitive Surgical™, Sunnyvale, CA, USA), we were able to eliminate the large incision and use a much shorter nerve graft when

performing contralateral C7 nerve transfer.

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PMID: 27117122 [PubMed - in process]

### **What we learned about the role of antenatal magnesium sulfate for the prevention of cerebral palsy.**

Rouse DJ, Hirtz D; Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network.

*Semin Perinatol.* 2016 Apr 22. pii: S0146-0005(16)00015-X. doi: 10.1053/j.semperi.2016.03.007. [Epub ahead of print]

Based on the convincing case control study of Nelson and Grether which suggested that the administration of magnesium sulfate to mothers prior to early preterm birth might protect their offspring from cerebral palsy, and a pilot study by John Hauth et al. at the University of Alabama at Birmingham, the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network, with co-funding from the

National Institute of Neurologic Disorders and Stroke embarked on the Beneficial Effects of Antenatal Magnesium (BEAM) Trial in 1997.

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PMID: 27117179 [PubMed - as supplied by publisher]

## Detection - Diagnostic

### +Données cliniques

#### **Frequency Analysis and Feature Reduction Method For Prediction of Cerebral Palsy in Young Infants.**

Rahmati H, Martens H, Aamo OM, Stavadahl O, Stoen R, Adde L.

*IEEE Trans Neural Syst Rehabil Eng.* 2016 Mar 8. [Epub ahead of print]

The aim of this paper is to achieve a model for prediction of cerebral palsy based on motion data of young infants. The prediction is formulated as a classification problem to assign each of the infants to one of the healthy or with cerebral palsy groups. Unlike formerly proposed features that are mostly defined in the time domain, this study proposes a set of features derived from frequency analysis of infants' motions. Since cerebral palsy affects the variability of the motions, and frequency analysis is an intuitive way of studying variability, suggested features are suitable and consistent with the nature of the condition. In the current application, a wellknown problem, few subjects and many features, was initially encountered. In such a case, most classifiers get trapped in a sub-optimal model and, consequently, fail to provide sufficient prediction accuracy. To solve this problem, a feature selection method that determines features with significant predictive ability is proposed. The feature selection method decreases the risk of false discovery and, therefore, the prediction model is more likely to be valid and generalizable for future use. A detailed study is performed on the proposed features and the feature selection method: the classification results confirm their applicability. Achieved sensitivity of 86%, specificity of 92% and accuracy of 91% are comparable with state of the art clinical and expert-based methods for predicting cerebral palsy.

PMID: 27046852 [PubMed - as supplied by publisher]

#### **Knee jerk responses in infants at high risk for cerebral palsy: an observational EMG study.**

Hamer EG, Dijkstra LJ, Hooijsma SJ, Zijdewind I, Hadders-Algra M

*Pediatr Res.* 2016 Apr 20. doi: 10.1038/pr.2016.99. [Epub ahead of print]

**BACKGROUND:** Following our clinical observation of tonic responses in response to the knee jerk in infants at very high risk for cerebral palsy (VHR infants), we systematically studied tonic responses, clonus and reflex irradiation. We questioned i) whether these responses occurred more often in VHR infants than in typically developing (TD) infants, and ii) whether they were associated with abnormal general movement quality.

**METHODS:** 24 VHR and 26 TD infants were assessed around 3 months corrected age. Surface electromyograms of leg, trunk, neck and arm muscles were recorded while eliciting the knee jerk. All assessments were video-recorded.

**RESULTS:** VHR infants more often than TD infants showed tonic responses in the ipsilateral quadriceps and hamstring (Mann-Whitney U;  $p=0.0005$  and  $p=0.0009$ ), clonus (Chi-square;  $p=0.0005$ ) and phasic responses in the contralateral quadriceps and hamstring (Mann-Whitney U;  $p=0.002$  and  $p=0.0003$ , respectively). Widespread reflex irradiation occurred in VHR and TD infants. Definitely abnormal general movements and stiff movements were associated with tonic responses (Mann-Whitney U;  $p=0.0005$ ,  $p=0.007$ , respectively) and clonus (Mann-Whitney U;  $p=0.003$  and  $p=0.0005$ ) in the ipsilateral quadriceps. **CONCLUSION:** Similar to clonus, tonic responses may be regarded as a marker of a loss of supraspinal control. Reflex irradiation primarily is a neurodevelopmental phenomenon of early ontogeny. *Pediatric Research* (2016); doi:10.1038/pr.2016.99.

PMID: 27096750 [PubMed - as supplied by publisher]

#### **Motor and cognitive outcome after specific early lesions of the brain – a systematic review.**

Hielkema T, Hadders-Algra M.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:46-52. doi: 10.1111/dmcn.13047.

The aim of this systematic review was to study motor and cognitive outcome in infants with severe early brain lesions and to evaluate effects of side of the lesion, sex, and social economic status on outcome. A literature search was

performed using the databases Pubmed and Embase. Included studies involved infants with either cystic periventricular leukomalacia (cPVL), preterm, or term stroke (i.e. parenchymal lesion of the brain). Outcome was expressed as cerebral palsy (CP) and intellectual disability (mental retardation). Median prevalence rates of CP after cPVL, preterm, and term stroke were 86%, 71%, and 29% respectively; of intellectual disability 50%, 27%, and 33%. Most infants with cPVL developed bilateral CP, those with term stroke unilateral CP, whereas after preterm stroke bilateral and unilateral CP occurred equally often. Information on the effects of sex and social economic status on outcome after specific brain lesions was very limited. Our findings show that the risk for CP is high after cPVL, moderate after preterm stroke, and lowest after term stroke. The risk for intellectual disability after an early brain lesion is lower than that for CP. Predicting outcome at individual level remains difficult; new imaging techniques may improve predicting developmental trajectories.

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PMID: 27027607 [PubMed - in process]

### **Prognostic significance of neurological signs in high-risk infants - a systematic review.**

Hamer EG, Hadders-Algra M.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:53-60. doi: 10.1111/dmcn.13051.

The aim of this paper was to systematically review the literature on the significance of specific neurological signs in infancy, in particular in infants at risk for developmental problems such as cerebral palsy (CP). A literature search was performed using the databases PubMed, Embase, Web of Science, and AMED. Papers on infantile reactions ('primitive reflexes') and postural reactions were included if data were available allowing for calculation of sensitivity, specificity, or positive and negative predictive value for CP or atypical developmental outcome. Our search identified 23 articles on 20 different neurological signs. Properties of six neurological signs were reported in at least three different papers. The data indicated that, in early infancy, an absent Moro or plantar grasp response may be predictive for adverse developmental outcome. After early infancy, persistence of the Moro response and asymmetric tonic neck reflex was clinically significant. Prediction of a delayed emergence of the parachute reaction increases with age. Abnormal performances on the pull-to-sit manoeuvre and vertical suspension test have predictive significance throughout infancy. The neurological signs reviewed have some predictive value in infants at risk. For most of the signs, criteria for abnormality and significance are age-dependent.

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PMID: 27027608 [PubMed - in process]

### **Use of biochemical tests of placental function for improving pregnancy outcome.**

Heazell AE, Whitworth M, Duley L, Thornton JG.

*Cochrane Database Syst Rev.* 2015 Nov 25;11:CD011202. doi: 10.1002/14651858.CD011202.pub2.

**BACKGROUND:** The placenta has an essential role in determining the outcome of pregnancy. Consequently, biochemical measurement of placentally-derived factors has been suggested as a means to improve fetal and maternal outcome of pregnancy.

**OBJECTIVES:** To assess whether clinicians' knowledge of the results of biochemical tests of placental function is associated with improvement in fetal or maternal outcome of pregnancy.

**SEARCH METHODS:** We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (31 July 2015) and reference lists of retrieved studies.

**SELECTION CRITERIA:** Randomised, cluster-randomised or quasi-randomised controlled trials assessing the merits of the use of biochemical tests of placental function to improve pregnancy outcome. Studies were eligible if they compared women who had placental function tests and the results were available to their clinicians with women who either did not have the tests, or the tests were done but the results were not available to the clinicians. The placental function tests were any biochemical test of placental function carried out using the woman's maternal biofluid, either alone or in combination with other placental function test/s.

**DATA COLLECTION AND ANALYSIS:** Two review authors independently assessed trials for inclusion, extracted data and assessed trial quality. Authors of published trials were contacted for further information.

**MAIN RESULTS:** Three trials were included, two quasi-randomised controlled trials and one randomised controlled trial. One trial was deemed to be at low risk of bias while the other two were at high risk of bias. Different biochemical  
[Science Infos Paralysie Cérébrale](#), avril 2016, [FONDATION MOTRICE](#) 67 rue Vergniaud 75013 Paris - tel +33 19 1 45 54 03 03 contact: [Christine Doumergue](mailto:Christine.Doumergue@lafondationmotrice.org) [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

analytes were measured - oestrogen was measured in one trial and the other two measured human placental lactogen (hPL). One trial did not contribute outcome data, therefore, the results of this review are based on two trials with 740 participants. There was no evidence of a difference in the incidence of death of a baby (risk ratio (RR) 0.88, 95% confidence interval (CI) 0.36 to 2.13, two trials, 740 participants (very low quality evidence)) or the frequency of a small-for-gestational-age infant (RR 0.44, 95% CI 0.16 to 1.19, one trial, 118 participants (low quality evidence)). In terms of this review's secondary outcomes, there was no evidence of a clear difference between women who had biochemical tests of placental function compared with standard antenatal care for the incidence of stillbirth (RR 0.56, 95% CI 0.16 to 1.88, two trials, 740 participants (very low quality evidence)) or neonatal death (RR 1.62, 95% CI 0.39 to 6.74, two trials, 740 participants, very low quality evidence) although the directions of any potential effect were in opposing directions. There was no evidence of a difference between groups in elective delivery (RR 0.98, 95% CI 0.84 to 1.14, two trials, 740 participants (low quality evidence)), caesarean section (one trial, RR 0.48, 95% CI 0.15 to 1.52, one trial, 118 participants (low quality evidence)), change in anxiety score (mean difference -2.40, 95% CI -4.78 to -0.02, one trial, 118 participants), admissions to neonatal intensive care (RR 0.32, 95% CI 0.03 to 3.01, one trial, 118 participants), and preterm birth before 37 weeks' gestation (RR 2.90, 95% CI 0.12 to 69.81, one trial, 118 participants). One trial (118 participants) reported that there were no cases of serious neonatal morbidity. Maternal death was not reported. A number of this review's secondary outcomes relating to the baby were not reported in the included studies, namely: umbilical artery pH < 7.0, neonatal intensive care for more than seven days, very preterm birth (< 32 weeks' gestation), need for ventilation, organ failure, fetal abnormality, neurodevelopment in childhood (cerebral palsy, neurodevelopmental delay). Similarly, a number of this review's maternal secondary outcomes were not reported in the included studies (admission to intensive care, high dependency unit admission, hospital admission for > seven days, pre-eclampsia, eclampsia, and women's perception of care).

**AUTHORS' CONCLUSIONS:** There is insufficient evidence to support the use of biochemical tests of placental function to reduce perinatal mortality or increase identification of small-for-gestational-age infants. However, we were only able to include data from two studies that measured oestrogens and hPL. The quality of the evidence was low or very low. Two of the trials were performed in the 1970s on women with a variety of antenatal complications and this evidence cannot be generalised to women at low-risk of complications or groups of women with specific pregnancy complications (e.g. fetal growth restriction). Furthermore, outcomes described in the 1970s may not reflect what would be expected at present. For example, neonatal mortality rates have fallen substantially, such that an infant delivered at 28 weeks would have a greater chance of survival were those studies repeated; this may affect the primary outcome of the meta-analysis. With data from just two studies (740 women), this review is underpowered to detect a difference in the incidence of death of a baby or the frequency of a small-for-gestational-age infant as these have a background incidence of approximately 0.75% and 10% of pregnancies respectively. Similarly, this review is underpowered to detect differences between serious and/or rare adverse events such as severe neonatal morbidity. Two of the three included studies were quasi-randomised, with significant risk of bias from group allocation. Additionally, there may be performance bias as in one of the two studies contributing data, participants receiving standard care did not have venepuncture, so clinicians treating participants could identify which arm of the study they were in. Future studies should consider more robust randomisation methods and concealment of group allocation and should be adequately powered to detect differences in rare adverse events. The studies identified in this review examined two different analytes: oestrogens and hPL. There are many other placental products that could be employed as surrogates of placental function, including: placental growth factor (PlGF), human chorionic gonadotrophin (hCG), plasma protein A (PAPP-A), placental protein 13 (PP-13), pregnancy-specific glycoproteins and progesterone metabolites and further studies should be encouraged to investigate these other placental products. Future randomised controlled trials should test analytes identified as having the best predictive reliability for placental dysfunction leading to small-for-gestational-age infants and perinatal mortality.

PMID: 26602956 [PubMed - indexed for MEDLINE]

## Motricité - Mobilité – Posture

### **A descriptive analysis of the upper limb patterns during gait in individuals with cerebral palsy.**

Bonnefoy-Mazure A, Sagawa Y Jr, Lascombes P, De Coulon G, Armand S.

*Res Dev Disabil.* 2014 Nov;35(11):2756-65. doi: 10.1016/j.ridd.2014.07.013. Epub 2014 Jul 31.

Patients with cerebral palsy (CP) are characterized by a large diversity of gait deviations; thus, lower limb movements during gait have been well-analyzed in the literature. However, the question of upper limb movements and, more

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particularly, arm movements during gait has received less attention for CP patients as a function of the disease type (Hemiplegic, HE or Diplegic, DI). Thus, the aim of this study was to investigate upper limb movements for a large group of CP patients; we used a retrospective search, including upper limb kinematic parameters and 92 CP patients (42 females and 50 males, mean±standard deviation (SD); age: 15.2±6.7 years). The diagnoses consisted of 48 HE and 44 DI. A control group of 15 subjects (7 females and 8 males, age: 18.4±8.4 years) was included in the study to provide normal gait data. For the DI patients and CG, 88 arms and 30 arms were analyzed, respectively. For the HE patients, 48 affected arms and 48 non-affected arms were analyzed. The kinematic parameters selected and analyzed were shoulder elevation angles; elbow flexion angles; thorax tilt and obliquity angles; hand vertical and anterior-posterior movements; and arm angles. Several gait parameters were also analyzed, such as the gait profile score (GPS) and normalized speed. Statistical analyses were performed to compare CG with the affected and non-affected upper limbs of HE patients and with the two upper limbs of DI patients. The results show that HE and DI patients adopt abnormal upper limb movements. However, DI patients have greater shoulder, elbow, thorax and arm angle movements compared with HE patients. However, HE patients adopt different movements between their affected and non-affected arms. Thus, the patients used their upper limbs to optimize their gait more where gait deviations were more important. These observations confirm that the upper limbs must be integrated into rehabilitation programs to improve inter-limb coordination.

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PMID: 25084472 [PubMed - indexed for MEDLINE]

### **An investigation of the factors affecting handwriting articulation of school aged children with cerebral palsy based on the international classification of functioning, disability and health.**

Kim HY.

*J Phys Ther Sci.* 2016 Jan;28(2):347-50. doi: 10.1589/jpts.28.347. Epub 2016 Feb 29.

[Purpose] This study was designed to identify factors influencing handwriting articulation based on the international classification of functioning, disability and health (ICF) and to recommend effective evaluation and intervention strategies to improve the handwriting of children with cerebral palsy.

[Subjects] The subjects were 96 elementary school children with cerebral palsy and the study was conducted from 04/07/2011 to 29/08/2011. [Methods] Factors related to handwriting articulation were investigated based on the ICF model.

[Results] Wrist lateral deviation, upper-extremity speed of body function and education of personal factor were significantly associated with handwriting articulation.

[Conclusion] Efforts to manage and improve the handwriting articulation of children with cerebral palsy should focus on wrist lateral deviation, upper-extremity speed, and education.

#### **[Free PMC Article](#)**

PMCID: PMC4792971

PMID: 27065517 [PubMed]

### **Anticipatory control and spatial cognition in locomotion and navigation through typical development and in cerebral palsy.**

Belmonti V, Cioni G, Berthoz A.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:22-7. doi: 10.1111/dmcn.13044.

Behavioural evidence, summarized in this narrative review, supports a developmental model of locomotor control based on increasing neural integration of spatial reference frames. Two consistent adult locomotor behaviours are head stabilization and head anticipation: the head is stabilized to gravity and leads walking direction. This cephalocaudal orienting organization aligns gaze and vestibula with a reference frame centred on the upcoming walking direction, allowing anticipatory control on body kinematics, but is not fully developed until adolescence. Walking trajectories and those of hand movements share many aspects, including power laws coupling velocity to curvature, and minimized spatial variability. In fact, the adult brain can code trajectory geometry in an allocentric reference frame, irrespective of the end effector, regulating body kinematics thereafter. Locomotor trajectory formation, like head anticipation, matures in early adolescence, indicating common neurocomputational substrates. These late-developing control mechanisms can be distinguished from biomechanical problems in children with cerebral palsy (CP). Children's performance on a novel navigation test, the Magic Carpet, indicates that typical navigation development consists of the increasing integration of egocentric and allocentric reference frames. In CP, [Science Infos Paralysie Cérébrale](#), avril 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 21 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org](#)

right-brain impairment seems to reduce navigation performance due to a maladaptive left-brain sequential egocentric strategy. Spatial integration should be considered more in rehabilitation.

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PMID: 27027604 [PubMed - in process]

### **Clinical tools designed to assess motor abilities in children with cerebral palsy.**

Pavão SL, Silva FP, Dusing SC, Rocha NA.

*Dev Neurorehabil.* 2016 Mar 28;1-11. [Epub ahead of print]

**OBJECTIVE:** This systematic review aimed to list the tools used by rehabilitation professionals to test motor abilities in children with cerebral palsy (CP), to determine if these tools have psychometric properties specifically measured for CP, and to identify the main characteristics of these tools.

**METHOD:** Web of Science, PEDro, PubMed/MEDLINE, Science Direct, and SciELO databases were searched to identify the tools. PubMed/MEDLINE was then searched to identify the studies assessing those tools' psychometric properties. The agreement-based standards for the selection of health measurement tools and the Terwee criteria were used to assess the quality and the results of each included study, respectively.

**RESULTS:** Eighteen tools were identified. The psychometric properties of many of the tools used with children with CP have not been evaluated for this population.

**CONCLUSION:** The psychometric properties evaluated often have a poor methodological quality of measurement. Overall, we suggest the tools with most empirical support to evaluate children with CP.

PMID: 27019351 [PubMed - as supplied by publisher]

### **Description of Primary and Secondary Impairments in Young Children With Cerebral Palsy.**

Jeffries L, Fiss A, McCoy SW, Bartlett DJ.

*Pediatr Phys Ther.* 2016 Spring;28(1):7-14. doi: 10.1097/PEP.000000000000221.

**PURPOSE:** We describe primary and secondary impairments in young children with cerebral palsy (CP); report differences in impairments on the basis of Gross Motor Function Classification System (GMFCS), age, and sex; and examine the extent that individual impairments account for the construct of primary and secondary impairments.

**METHODS:** Participants included 429 children with CP (242 [56%] male; 1½ to 5 years) representing all GMFCS levels. Reliable assessors collected primary and secondary impairment data using clinical measures. Analyses included descriptive statistics, comparisons among GMFCS, age, and sex, and factor analysis.

**RESULTS:** Young children with CP present with primary and secondary impairments. Significant differences in impairments occur among some GMFCS levels and age groups but not sex groups. Postural stability contributed most to primary impairments and strength to secondary impairments.

**CONCLUSION:** Young children with CP across GMFCS levels may have already developed secondary impairments that should be addressed within therapy services.

PMID: 27088676 [PubMed - in process]

### **Differences in proprioceptive senses between children with diplegic and children with hemiplegic cerebral palsy.**

Ryu HJ, Song GB

*J Phys Ther Sci.* 2016 Jan;28(2):658-60. doi: 10.1589/jpts.28.658. Epub 2016 Feb 29.

[Purpose] In the present study, in order to examine the differences in proprioceptive senses between children with diplegic CP and children with hemiplegic CP, neck reposition errors were measured.

[Subjects and Methods] Head reposition senses were measured after neck flexion, extension, and left-right rotation, using head repositioning accuracy tests. These tests were done with 12 children with diplegic CP and nine children with hemiplegic CP.

[Results] The results indicated that children with diplegic CP had poorer head repositioning senses after movements in all directions compared to children with hemiplegic CP.

[Conclusion] The results indicated that children with diplegic CP had poorer head repositioning senses after movements in all directions as compared to children with hemiplegic CP.

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PMCID: PMC4793028

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PMID: 27065559 [PubMed]

**Differential item functioning in the Patient Reported Outcomes Measurement Information System Pediatric Short Forms in a sample of children and adolescents with cerebral palsy.**

Coster WJ, Ni P, Slavin MD, Kisala PA, Nandakumar R, Mulcahey MJ, Tulskey DS, Jette AM.  
*Dev Med Child Neurol.* 2016 Apr 21. doi: 10.1111/dmcn.13138. [Epub ahead of print]

**AIM:** The present study examined the Patient Reported Outcomes Measurement Information System (PROMIS) Mobility, Fatigue, and Pain Interference Short Forms (SFs) in children and adolescents with cerebral palsy (CP) for the presence of differential item functioning (DIF) relative to the original calibration sample.

**METHOD:** Using the Graded Response Model we compared item parameter estimates generated from a sample of 303 children and adolescents with CP (175 males, 128 females; mean age 15y 5mo) to parameter estimates from the PROMIS calibration sample, which served as the reference group. DIF was assessed in a two-step process using the item response theory-likelihood ratio-differential item functioning detection procedure.

**RESULTS:** Significant DIF was identified for four of eight items in the PROMIS Mobility SF, for two of eight items in the Pain Interference Scale, and for one item out of 10 on the Fatigue Scale. Impact of DIF on total score estimation was notable for Mobility and Pain Interference, but not for Fatigue.

**INTERPRETATION:** Results suggest differences in the responses of adolescents with CP to some items on the PROMIS Mobility and Pain Interference SFs. Cognitive interviews about the PROMIS items with adolescents with varying degrees of mobility limitations would provide better understanding of how they are interpreting and selecting responses to the PROMIS items and thus help guide selection of the most appropriate way to address this issue.

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PMID: 27098277 [PubMed - as supplied by publisher]

**Estimating the Mechanical Behavior of the Knee Joint During Crouch Gait: Implications for Real-Time Motor Control of Robotic Knee Orthoses.**

Lerner Z, Damiano D, Bulea T.

*IEEE Trans Neural Syst Rehabil Eng.* 2016 Apr 14. [Epub ahead of print]

Individuals with cerebral palsy frequently exhibit crouch gait, a pathological walking pattern characterized by excessive knee flexion. Knowledge of the knee joint moment during crouch gait is necessary for the design and control of assistive devices used for treatment. Our goal was to 1) develop statistical models to estimate knee joint moment extrema and dynamic stiffness during crouch gait, and 2) use the models to estimate the instantaneous joint moment during weight-acceptance. We retrospectively computed knee moments from 10 children with crouch gait and used stepwise linear regression to develop statistical models describing the knee moment features. The models explained at least 90% of the response value variability: peak moment in early (99%) and late (90%) stance, and dynamic stiffness of weight-acceptance flexion (94%) and extension (98%). We estimated knee extensor moment profiles from the predicted dynamic stiffness and instantaneous knee angle. This approach captured the timing and shape of the computed moment (root-mean-squared error: 2.64 Nm); including the predicted early-stance peak moment as a correction factor improved model performance (root-mean-squared error: 1.37 Nm). Our strategy provides a practical, accurate method to estimate the knee moment during crouch gait, and could be used for real-time, adaptive control of robotic orthoses.

PMID: 27101612 [PubMed - as supplied by publisher]

**Developmental Dysplasia of Spastic Hip in Children with Cerebral Palsy in Southern India.**

Vykuntaraju KN, Manohar V, Lakshman RR, Ramaswamy P.

*Indian Pediatr.* 2016 Mar 3;53(3):259-60.

We studied the proportion of developmental dysplasia of spastic hip in children with cerebral palsy. Children with cerebral palsy aged 2-12 years were enrolled. Migration percentage was measured on pelvic radiographs. Hip dysplasia was seen in 15 (12.7%) children.

PMID: 27029696 [PubMed - in process]

**Feasibility of using a large amplitude movement therapy to improve ambulatory function in children with cerebral palsy.**

Science Infos Paralysie Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 23 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

Hickman R, Dufek JS, Lee SP, Blahovec A, Kuiken A, Riggins H, McClellan JR.  
*Physiother Theory Pract.* 2015;31(6):382-9. doi: 10.3109/09593985.2015.1011295. Epub 2015 Jul 8.

Cerebral palsy (CP) is the most common cause of motor disability among children. Limited evidence exists regarding the efficacy of traditional rehabilitation strategies on improving ambulatory function in this population. The purpose of the study was to investigate the feasibility and short-term effects of a novel large amplitude movement therapy on ambulatory functions in children with CP. Temporal-spatial gait characteristics were examined before and after a single intervention session, replicated over five children. Five children with CP ( $7.0 \pm 1.0$  years); Gross Motor Function Classification System Levels I-II, participated. Baseline gait parameters were obtained as the participant walked across an instrumented walkway at self-selected and fast speeds. Children then participated in a 20-30 min intervention focused on making body and limb movements as large as possible with gait assessment repeated immediately. All children tolerated testing and therapy with no adverse effects. Outcomes after one intervention included: significantly greater stride velocity; reduced double support time; and greater stride length after training for three of the five participants. Results for this pilot study suggested that the large amplitude movement therapy was feasible for children with CP. There is a need for a larger scale study to determine if the protocol can be effective at an appropriate clinical dose.

PMID: 26154826 [PubMed - indexed for MEDLINE]

**Functional classifications for cerebral palsy: correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCS).**

Compagnone E, Maniglio J, Camposeo S, Vespino T, Losito L, De Rinaldis M, Gennaro L, Trabacca A.  
*Res Dev Disabil.* 2014 Nov;35(11):2651-7. doi: 10.1016/j.ridd.2014.07.005. Epub 2014 Jul 23.

This study aimed to investigate a possible correlation between the gross motor function classification system-expanded and revised (GMFCS-E&R), the manual abilities classification system (MACS) and the communication function classification system (CFCS) functional levels in children with cerebral palsy (CP) by CP subtype. It was also geared to verify whether there is a correlation between these classification systems and intellectual functioning (IQ) and parental socio-economic status (SES). A total of 87 children (47 males and 40 females, age range 4-18 years, mean age  $8.9 \pm 4.2$ ) were included in the study. A strong correlation was found between the three classifications: Level V of the GMFCS-E&R corresponds to Level V of the MACS ( $r_s=0.67$ ,  $p=0.001$ ); the same relationship was found for the CFCS and the MACS ( $r_s=0.73$ ,  $p<0.001$ ) and for the GMFCS-E&R and the CFCS ( $r_s=0.61$ ,  $p=0.001$ ). The correlations between the IQ and the global functional disability profile were strong or moderate (GMFCS and IQ:  $r_s=0.66$ ,  $p=0.001$ ; MACS and IQ:  $r_s=0.58$ ,  $p=0.001$ ; CFCS and MACS:  $r_s=0.65$ ,  $p=0.001$ ). The Kruskal-Wallis test was used to determine if there were differences between the GMFCS-E&R, the CFCS and the MACS by CP type. CP types showed different scores for the IQ level (Chi-square=8.59,  $df=2$ ,  $p=0.014$ ), the GMFCS-E&R (Chi-square=36.46,  $df=2$ ,  $p<0.001$ ), the CFCS (Chi-square=12.87,  $df=2$ ,  $p=0.002$ ), and the MACS Level (Chi-square=13.96,  $df=2$ ,  $p<0.001$ ) but no significant differences emerged for the SES (Chi-square=1.19,  $df=2$ ,  $p=0.554$ ). This study shows how the three functional classifications (GMFCS-E&R, CFCS and MACS) complement each other to provide a better description of the functional profile of CP. The systematic evaluation of the IQ can provide useful information about a possible future outcome for every functional level. The SES does not appear to affect functional profiles.

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PMID: 25062096 [PubMed - indexed for MEDLINE]

**Gait evolution in a family with hereditary spastic paraplegia.**

Armand S, Turcot K, Bonnefoy-Mazure A, Lascombes P, De Coulon G.  
*Eur J Paediatr Neurol.* 2015 Jan;19(1):87-92. doi: 10.1016/j.ejpn.2014.08.001. Epub 2014 Aug 30.

BACKGROUND: The degree of disability in patients with hereditary spastic paraplegia has been reported variable even in members of the same family (same gene mutation). Moreover, it has been established that patients with hereditary spastic paraplegia should be treated differently from cerebral palsy patients due to the progressive nature of this disease. However, the gait evolution of hereditary spastic paraplegia showing onset symptoms at an early age has been described as stable. Therefore, this study aims to evaluate the walking ability and the influence of treatments on gait evolution in a family with hereditary spastic paraplegia.



**METHODS:** Clinical gait analyses were performed in six hereditary spastic paraplegia patients from the same family with a follow-up of 4-15 years.

**RESULTS:** Based on the gait deviation index, results showed a large variation of walking ability in these patients and no statistical difference between the first and last examination. In fact, three patients have improved their gait (from childhood to adolescence) whereas three patients worsened their gait.

**CONCLUSIONS:** Gait alterations in a family with hereditary spastic paraplegia are heterogeneous. Gait evolution in hereditary spastic paraplegia with early symptoms had a tendency to improve gait until adolescence with adapted treatments and to decline in the adulthood.

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PMID: 25218933 [PubMed - indexed for MEDLINE]

### **Gait pattern recognition in cerebral palsy patients using neural network Modelling.**

Muhammad J, Gibbs S, Abboud R, Anand S, Wang W.

*J Ayub Med Coll Abbottabad. 2015 Oct-Dec;27(4):754-8.*

**BACKGROUND:** Interpretation of gait data obtained from modern 3D gait analysis is a challenging and time consuming task. The aim of this study was to create neural network models which can recognise the gait patterns from pre- and post-treatment and the normal ones. Neural network is a method which works on the principle of learning from experience and then uses the obtained knowledge to predict the unknowns.

**METHODS:** Twenty-eight patients with cerebral palsy were recruited as subjects whose gait was analysed in pre and post-treatment. A group of twenty-six normal subjects also participated in this study as control group. All subjects' gait was analysed using Vicon Nexus to obtain the gait parameters and kinetic and kinematic parameters of hip, knee and ankle joints in three planes of both limbs. The gait data was used as input to create neural network models. A total of approximately 300 trials were split into 70% and 30% to train and test the models, respectively. Different models were built using different parameters. The gait modes were categorised as three patterns, i.e., normal, pre- and post-treatments.

**RESULTS:** The results showed that the models using all parameters or using the joint angles and moments could predict the gait patterns with approximately 95% accuracy. Some of the models e.g., the models using joint power and moments, had lower rate in recognition of gait patterns with approximately 70-90% successful ratio.

**CONCLUSION:** Neural network models can be used in clinical practice to recognise the gait pattern for cerebral palsy patients.

PMID: 27004315 [PubMed - indexed for MEDLINE]

### **Hand Function in Young Children with Cerebral Palsy: Current Practice and Parent-Reported Benefits.**

Klevberg GL, Østensjø S, Elkjær S, Kjekken I, Jahnsen RB.

*Phys Occup Ther Pediatr. 2016 Apr 11:1-16. [Epub ahead of print]*

**AIMS:** To (1) describe characteristics of current interventions to improve hand function in young children with Cerebral Palsy (CP), and explore factors associated with (2) increased likelihood of hand and ADL training and (3) child benefits of training.

**METHODS:** A cross-sectional design was used with parent-reported data and data from the Norwegian CP Follow-up Program (CPOP). A total of 102 children (53% of the cohort of newly recruited children in the CPOP, mean age: 30.3 months, SD: 12.1) were included. Hand function was classified according to the Mini-Manual Ability Classification System (Mini-MACS). Data were analyzed with descriptive statistics, cross-tables and direct multiple logistic regressions.

**RESULTS:** The majority of the children performed training of hand skills and ADL. Parents reported high amounts of training, and training was commonly integrated in everyday activities. Both parents (OR = 5.6,  $p < .011$ ) and OTs (OR = 6.2,  $p < .002$ ) reported more hand training for children at Mini-MACS levels II-III compared to level I. Parents reported larger child benefits when training was organized as a combination of training sessions and practice within everyday activities (OR = 7.090,  $p = .011$ ).

**CONCLUSIONS:** Parents reported that the children's everyday activities were utilized as opportunities for training, hence describing the intensity of therapy merely by counting minutes or number of sessions seems insufficient.

PMID: 27065199 [PubMed - as supplied by publisher]

### **Impact of a short walking exercise on gait kinematics in children with cerebral palsy who walk in a crouch gait.**

Parent A, Raison M, Pouliot-Laforte A, Marois P, Maltais DB, Ballaz L.

*Clin Biomech (Bristol, Avon)*. 2016 Mar 14;34:18-21. doi: 10.1016/j.clinbiomech.2016.03.003. [Epub ahead of print]

**BACKGROUND:** Crouch gait results in an increase of the joint stress due to an excessive knee flexion. Daily walking exercises, even when performed at a self-selected speed, may result in a decrease of the extensor muscle strength which could lead to a more severe crouch gait pattern. The aim of this study was to assess the impact of a short walking exercise on gait kinematics in children with cerebral palsy who walk with a crouch gait.

**METHODS:** Seven children with cerebral palsy who walk with a crouch gait were asked to walk for 6min at a self-selected speed. The spatio-temporal and kinematic measures, as well as the center of mass position were compared before and after the exercise.

**FINDINGS:** There was no significant difference between walking speed before and after the walking exercise. Knee flexion and the maximal ankle dorsiflexion increased after the walking exercise. The vertical position of the center of mass decreased. No significant difference was found at the hip.

**INTERPRETATION:** Children with cerebral palsy who walk with a crouch gait were more crouched after a 6-min walking exercise performed at their self-selected speed. These gait modifications could be due to fatigue of the extensor muscle groups. This study highlighted that a short walking exercise, corresponding to daily mobility, results in gait pattern modifications. Since therapies in children with cerebral palsy aim to improve motor function in everyday life situations, it could be relevant to evaluate gait adaptation after a few minutes of walking exercise.

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PMID: 27038653 [PubMed - as supplied by publisher]

### **Kinematic upper limb evaluation of children and adolescents with cerebral palsy: a systematic review of the literature.**

Franco de Moura RC, Almeida CS, Dumont AJ, Lazzari RD, Lopes JB, Duarte NA, Braun LF, Oliveira CS

*J Phys Ther Sci*. 2016 Jan;28(2):695-700. doi: 10.1589/jpts.28.695. Epub 2016 Feb 29.

[Purpose] The aim of the present study was to perform a review of the literature on objective measures of upper limb movements in children and adolescents with cerebral palsy and describe the methods used to investigate upper limb kinematics in this population. [Materials and Methods] An extensive database search was performed using the keywords kinematics, upper limb, and cerebral palsy. A total of 146 papers were identified, but only five met the inclusion criteria.

[Results] No consensus was found regarding the data collection, processing, and analysis procedures or reporting of the results. [Conclusion] Standardization of the protocol for 3D upper limb movement analysis will provide the foundation for comparable, reproducible results and eventually facilitate the planning of treatment interventions.

[Free PMC Article](#)

PMCID: PMC4793036

PMID: 27065566 [PubMed]

### **Longitudinal association between gross motor capacity and neuromusculoskeletal function in children and youth with cerebral palsy.**

Vos RC, Becher JG, Voorman JM, Gorter JW, van Eck M, van Meeteren J, Smits DW, Twisk JW, Dallmeijer AJ; PERRIN+ Study Group.

*Arch Phys Med Rehabil*. 2016 Apr 13. pii: S0003-9993(16)30048-X. doi: 10.1016/j.apmr.2016.03.012. [Epub ahead of print]

**OBJECTIVE:** To examine associations over longitudinal measurements between neuromusculoskeletal function and gross motor capacity in children and youth with Cerebral Palsy (CP).

**DESIGN:** A prospective cohort study **SETTING:** Rehabilitation departments of university medical centers and rehabilitations centers in The Netherlands **PARTICIPANTS:** 148 children (5-9 years) and 179 youth (11-20 years) with CP, GMFCS I(n=180), II(n=44), III(n=36), IV(n=34) and V(n=33).

**INTERVENTIONS:** not applicable **OUTCOME MEASURES:** Gross motor capacity was assessed with the Gross Motor Function Measure (GMFM-66) over a period of 2-4 years in different age cohorts. Neuromusculoskeletal function included selective motor control (SMC), muscle strength, spasticity and range of motion (ROM) of the lower extremities.

Science Infos Paralysie Cérébrale , avril 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 26 1 45 54 03 03 contact: Christine Doumergue \[cdoumergue@lafondationmotrice.org\]\(mailto:cdoumergue@lafondationmotrice.org\)](#)

RESULTS: Multi-level analyses showed that SMC was significantly associated with gross motor capacity in children and youth with CP, showing higher values and a more favourable course in those with better SMC. Strength was only associated to gross motor capacity in youth. Reduced ROM of hip (children) and knee extension (youth) and spasticity of the hip adductors (youth) were additionally - but more weakly- associated with lower values and a less favourable course of gross motor capacity.

CONCLUSIONS: Results indicate that children and youth with more severely impaired SMC and youth with reduced muscle strength have a less favourable course of gross motor capacity, while spasticity and reduced ROM are less determinative.

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### **Mastery motivation: a way of understanding therapy outcomes for children with unilateral cerebral palsy.**

Miller L, Ziviani J, Ware RS, Boyd RN.

*Disabil Rehabil.* 2015;37(16):1439-45. doi: 10.3109/09638288.2014.964375. Epub 2014 Sep 26.

PURPOSE: To investigate the impact of mastery motivation on occupational performance outcomes immediately following upper limb (UL) training and 6 months post-intervention for school-aged children with unilateral cerebral palsy.

METHOD: This prediction study was a post-hoc analysis of a matched pairs randomized comparison trial (COMBiT Trial Registration: ACTRN12613000181707). The Canadian Occupational Performance Measure (COPM) was administered at baseline, 13 and 26 weeks post-intervention. Parents completed the Dimensions of Mastery Questionnaire (DMQ), Parenting Scale and a demographic questionnaire. Children's UL capacity and performance was assessed using the Melbourne Assessment of Unilateral UL Function and assisting hand assessment (AHA). Regression models were fitted using generalized estimating equations to baseline, 13 and 26 week measurements.

RESULTS: Forty-six children (7.78 years SD 2.27 years, 31 males, Manual Ability Classification System I = 23, II = 23) participated. Higher levels of bimanual performance (AHA:  $\beta = 0.03$ ,  $p < 0.001$ ), greater object-oriented persistence (DMQ:  $\beta = 0.31$ ,  $p = 0.05$ ), and treatment group allocation (Standard Care:  $\beta = 0.24$ ,  $p = 0.01$ ) were positively associated with COPM performance scores post-intervention.

CONCLUSIONS: Children's bimanual performance and persistence with object-oriented tasks significantly impact occupational performance outcomes following UL training. Predetermining children's mastery motivation along with bimanual ability may assist in tailoring of intervention strategies and models of service delivery to improve effectiveness. Implications for Rehabilitation Children's object persistence and bimanual performance both impact upper limb training outcomes Working with children's motivational predispositions may optimize engagement and therapy outcomes. Supporting positive parenting styles may enhance a child's mastery motivation and persistence with difficult tasks.

PMID: 25259559 [PubMed - indexed for MEDLINE]

### **Medial gastrocnemius muscle volume in ambulant children with unilateral and bilateral cerebral palsy aged 2 to 9 years.**

Barber LA, Read F, Lovatt Stern J, Lichtwark G, Boyd RN.

*Dev Med Child Neurol.* 2016 Apr 21. doi: 10.1111/dmcn.13132. [Epub ahead of print]

AIM: Calf muscle growth in children with unilateral cerebral palsy (UCP) and bilateral cerebral palsy (BCP) is unknown. This cross-sectional study examines the medial gastrocnemius growth rates of ambulatory children with UCP and BCP compared with children with typical development (CTD), aged 2 to 9 years.

METHOD: Fifty children with UCP (mean age 66mo [SD 18], 29 males, Gross Motor Function Classification System [GMFCS] I=32, II=18), 50 children with BCP (age 64mo [SD 19], 31 males, GMFCS I=21, II=29), and 78 CTD (age 64mo [SD 16], 40 males) participated in the study. The medial gastrocnemius muscle volume was measured at rest using a validated freehand three-dimensional (3D) ultrasound method.

RESULTS: Normalized medial gastrocnemius muscle growth rate was significantly less in the children with UCP (0.001 mL/kg/mo) compared with the BCP (0.015 mL/kg/mo,  $p=0.001$ ) and CTD (0.014 mL/kg/mo,  $p<0.001$ ) groups. Normalized medial gastrocnemius muscle growth rate was the same in the BCP and CTD groups ( $p=0.77$ ).

INTERPRETATION: The normalized growth rate of the medial gastrocnemius muscle in children aged 2 to 9 years with UCP is significantly lower compared with children with BCP and CTD. The growth rate differences in the children with  
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UCP compared with BCP raises questions about the underlying mechanisms that lead to reduced growth in each cerebral palsy (CP) group and potential differences in muscle recovery response in UCP and BCP following treatment.

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### **Motion analysis of the upper extremity in children with unilateral cerebral palsy--an assessment of six daily tasks.**

Klotz MC, van Drongelen S, Rettig O, Wenger P, Gantz S, Dreher T, Wolf SI.

*Res Dev Disabil.* 2014 Nov;35(11):2950-7. doi: 10.1016/j.ridd.2014.07.021. Epub 2014 Aug 9.

Restrictions in range of motion of the upper extremity are common in patients with unilateral cerebral palsy (CP). The purpose of this study was to investigate movement deviations of the upper extremity in children with unilateral CP by means of 3D motion capture as well as by the use of easy to use scores and questionnaires (MACS, MRC, MAS, ABILHAND-Kids). 16 children with a spastic, unilateral CP were included and compared to a group of 17 typically developing adolescents (TD). The movement time and range of motion (ROM) of six uni- and bimanual daily tasks were compared and correlated with the scores and questionnaires. Movement times increased significantly with involvement according to MACS in all tasks. The restrictions in ROM were pronounced in the forearm. As a compensatory mechanism the children of the MACS 2 and 3 groups showed increased trunk movement. Furthermore, there was a positive correlation between the MACS and the ABILHAND-Kids Questionnaire. In contrast to previous studies, which reported a correlation between the restrictions in ROM and the MACS, this study showed no consistent correlation between the restrictions in ROM neither with the MACS nor with the ABILHAND-Kids. While the MACS and the ABILHAND-Kids function as a simple rating tool for clinical use, the detailed analysis of different daily tasks using 3-D-motion capture provides more detailed information about the movement deviations and spatiotemporal parameters.

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### **Muscle synergy analysis in children with cerebral palsy.**

Tang L, Li F, Cao S, Zhang X, Wu D, Chen X.

*J Neural Eng.* 2015 Aug;12(4):046017. doi: 10.1088/1741-2560/12/4/046017. Epub 2015 Jun 10.

**OBJECTIVE:** To explore the mechanism of lower extremity dysfunction of cerebral palsy (CP) children through muscle synergy analysis.

**APPROACH:** Twelve CP children were involved in this study, ten adults (AD) and eight typically developed (TD) children were recruited as a control group. Surface electromyographic (sEMG) signals were collected bilaterally from eight lower limb muscles of the subjects during forward walking at a comfortable speed. A nonnegative matrix factorization algorithm was used to extract muscle synergies. In view of muscle synergy differences in number, structure and symmetry, a model named synergy comprehensive assessment (SCA) was proposed to quantify the abnormality of muscle synergies.

**MAIN RESULTS:** There existed larger variations between the muscle synergies of the CP group and the AD group in contrast with the TD group. Fewer mature synergies were recruited in the CP group, and many abnormal synergies specific to the CP group appeared. Specifically, CP children were found to recruit muscle synergies with a larger difference in structure and symmetry between two legs of one subject and different subjects. The proposed SCA scale demonstrated its great potential to quantitatively assess the lower-limb motor dysfunction of CP children. SCA scores of the CP group ( $57.00 \pm 16.78$ ) were found to be significantly less ( $p < 0.01$ ) than that of the control group (AD group:  $95.74 \pm 2.04$ ; TD group:  $84.19 \pm 11.76$ ).

**SIGNIFICANCE:** The innovative quantitative results of this study can help us to better understand muscle synergy abnormality in CP children, which is related to their motor dysfunction and even the physiological change in their nervous system.

PMID: 26061115 [PubMed - indexed for MEDLINE]

### **Neglect-like characteristics of developmental disregard in children with cerebral palsy revealed by event related potentials.**

Zielinski IM, Steenbergen B, Baas CM, Aarts PB, Jongsma ML.

*BMC Neurol.* 2014 Nov 30;14:221. doi: 10.1186/s12883-014-0221-0.

**BACKGROUND:** Children with unilateral Cerebral Palsy (CP) often show diminished awareness of the remaining capacity of their affected upper limb. This phenomenon is known as Developmental Disregard (DD). DD has been explained by operant conditioning. Alternatively, DD can be described as a developmental delay resulting from a lack of use of the affected hand during crucial developmental periods. We hypothesize that this delay is associated with a general delay in executive functions (EF) related to motor behavior, also known as motor EFs.

**METHODS:** Twenty-four children with unilateral CP participated in this cross-sectional study, twelve of them diagnosed with DD. To test motor EFs, a modified go/nogo task was presented in which cues followed by go- or nogo-stimuli appeared at either the left or right side of a screen. Children had to press a button with the hand corresponding to the side of stimulus presentation. Apart from response accuracy, Event-Related Potentials (ERPs) extracted from the ongoing EEG were used to register covert cognitive processes. ERP N1, P2, N2, and P3 components elicited by cue-, go-, and nogo-stimuli were further analyzed to differentiate between different covert cognitive processes.

**RESULTS:** Children with DD made more errors. With respect to the ERPs, the P3 component to go-stimuli was enhanced in children with DD. This enhancement was related to age, such that younger children with DD showed stronger enhancements. In addition, in DD the N1 component to cue- and go-stimuli was decreased.

**CONCLUSIONS:** The behavioral results show that children with DD experience difficulties when performing the task. The finding of an enhanced P3 component to go-stimuli suggests that these difficulties are due to increased mental effort preceding movement. As age in DD mediated this enhancement, it seems that this increased mental effort is related to a developmental delay. The additional finding of a decreased N1 component in DD furthermore suggests a general diminished visuo-spatial attention. This effect reveals that DD might be a neuropsychological phenomenon similar to post-stroke neglect syndrome that does not resolve during development. These findings suggest that therapies aimed at reducing neglect could be a promising addition to existing therapies for DD.

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PMCID: PMC4258290

PMID: 25433482 [PubMed - indexed for MEDLINE]

### **Outcome measures evaluating hand function in children with bilateral cerebral palsy: a systematic review.**

Elvrum AG, Saether R, Riphagen II, Vik T.

*Dev Med Child Neurol.* 2016 Apr 28. doi: 10.1111/dmcn.13119. [Epub ahead of print]

**AIM:** To review outcome measures used to evaluate hand function, with emphasis on manual capacity and performance, in children with bilateral cerebral palsy (CP), to describe the content and measurement properties of such measures, and to investigate the quality of the studies that have examined these properties.

**METHOD:** Embase, MEDLINE, PubMed, and CINAHL were searched. The COSMIN-criteria (COnsensus-based Standards for the selection of health Measurement INstruments) were used to assess the quality of studies and the Terwee criteria were used to assess the result of the studies.

**RESULTS:** Five hand function measures were identified from 16 papers. The strongest level of evidence for aspects of validity and reliability was found for the Melbourne Assessment 2, assessing unimanual capacity, and for the questionnaire ABILHAND-Kids, assessing perceived manual ability in daily activities. However, evidence for the responsiveness of these measures is missing.

**INTERPRETATION:** Further high-quality studies providing evidence for responsiveness, as well as for additional aspects of validity and reliability of the Melbourne Assessment 2 and the ABILHAND-Kids, are needed. Furthermore, there is a need to develop appropriate outcome measures evaluating how children with bilateral CP use their hands when handling objects in bimanual tasks.

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### **Perspectives on classification of selected childhood neurodisabilities based on a review of literature.**

Jeevanantham D, Bartlett D.

*Dev Neurorehabil.* 2016 Apr 8:1-13. [Epub ahead of print]

**PURPOSE:** Classifying children with heterogeneous health conditions is challenging. The purposes of this perspective are to explore the prevailing classifications in children with the three selected neurodisabilities using the underlying framework of ICF/ICF-CY, explore the utility of the identified classifications, and make recommendations aimed at improving classifications.

**METHODS:** A literature search on six databases and Google was conducted. Articles published between the years 2000 and 2013 were included if they provided information on classification of cerebral palsy (CP), and/or developmental coordination disorder (DCD) and/or autism spectrum disorders (ASD).

**RESULTS:** Children with DCD and ASD are classified using combinations of multiple measures. The classifications in CP meet more of the proposed criteria for utility than those in DCD and ASD.

**CONCLUSION:** None of the existing classifications addressed all the criteria. The heterogeneity associated with the selected neurodisabilities poses major challenges. Further work is required to establish improved classifications.

PMID: 27057781 [PubMed - as supplied by publisher]

### **Postural variability and sensorimotor development in infancy.**

Dusing SC.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:17-21. doi: 10.1111/dmcn.13045.

Infants develop skills through a coupling between their sensory and motor systems. Newborn infants must interpret sensory information and use it to modify movements and organize the postural control system based on the task demands. This paper starts with a brief review of evidence on the use of sensory information in the first months of life, and describes the importance of movement variability and postural control in infancy. This introduction is followed by a review of the evidence for the interactions between the sensory, motor, and postural control systems in typically development infants. The paper highlights the ability of young infants to use sensory information to modify motor behaviors and learn from their experiences. Last, the paper highlights evidence of atypical use of sensory, motor, and postural control in the first months of life in infants who were born preterm, with neonatal brain injury or later diagnosed with cerebral palsy (CP).

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### **Predicting Missing Marker Trajectories in Human Motion Data Using Marker Intercorrelations.**

Gløersen Ø, Federolf P.

*PLoS One.* 2016 Mar 31;11(3):e0152616. doi: 10.1371/journal.pone.0152616. eCollection 2016.

Missing information in motion capture data caused by occlusion or detachment of markers is a common problem that is difficult to avoid entirely. The aim of this study was to develop and test an algorithm for reconstruction of corrupted marker trajectories in datasets representing human gait. The reconstruction was facilitated using information of marker inter-correlations obtained from a principal component analysis, combined with a novel weighting procedure. The method was completely data-driven, and did not require any training data. We tested the algorithm on datasets with movement patterns that can be considered both well suited (healthy subject walking on a treadmill) and less suited (transitioning from walking to running and the gait of a subject with cerebral palsy) to reconstruct. Specifically, we created 50 copies of each dataset, and corrupted them with gaps in multiple markers at random temporal and spatial positions. Reconstruction errors, quantified by the average Euclidian distance between predicted and measured marker positions, was  $\leq 3$  mm for the well suited dataset, even when there were gaps in up to 70% of all time frames. For the less suited datasets, median reconstruction errors were in the range 5-6 mm. However, a few reconstructions had substantially larger errors (up to 29 mm). Our results suggest that the proposed algorithm is a viable alternative both to conventional gap-filling algorithms and state-of-the-art reconstruction algorithms developed for motion capture systems. The strengths of the proposed algorithm are that it can fill gaps anywhere in the dataset, and that the gaps can be considerably longer than when using conventional interpolation techniques. Limitations are that it does not enforce musculoskeletal constraints, and that the reconstruction accuracy declines if applied to datasets with less predictable movement patterns.

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PMID: 27031243 [PubMed - in process]

### **Prospective pilots of routine data capture by paediatricians in clinics and validation of the Disabilities Complexity Scale.**

Horridge KA, McGarry K, Williams J, Whitlingum G; British Academy of Childhood Disability.

*Dev Med Child Neurol.* 2016 Mar 26. doi: 10.1111/dmcn.13101. [Epub ahead of print]

**AIMS:** To pilot prospective data collection by paediatricians at the point of care across England using a defined terminology set; demonstrate feasibility of data collection and utility of data outputs; and confirm that counting the number of needs per child is valid for quantifying complexity.

**METHOD:** Paediatricians in 16 hospital and community settings collected and anonymized data. Participants completed a survey regarding the process. Data were analysed using R version 3.1.2.

**RESULTS:** Overall, 8117 needs captured from 1224 consultations were recorded. Sixteen clinicians responded positively about the process and utility of data collection. The sum of needs varied significantly ( $p < 0.01$ ) by level of gross motor function ascertained using the Gross Motor Function Classification System for children with cerebral palsy; epilepsy severity as defined by level of expertise required to manage it; and by severity of intellectual disability.

**INTERPRETATION:** Prospective data collection at the point of clinical care proved possible without disrupting clinics, even for those with the most complex needs, and took the least time when done electronically. Counting the number of needs was easy to do, and quantified complexity in a way that informed clinical care for individuals and related directly to validated scales of functioning. Data outputs could inform more appropriate design and commissioning of quality services.

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### **Relationship Between Central Hypotonia and Motor Development in Infants Attending a High-Risk Neonatal Neurology Clinic.**

Segal I, Peylan T, Sucre J, Levi L, Bassan H.

*Pediatr Phys Ther.* 2016 Mar 29. [Epub ahead of print]

**PURPOSE:** To study the relationship between central hypotonia and motor development, and to determine the relative contribution of nuchal, truncal, and appendicular hypotonia domains to motor development.

**METHODS:** Appendicular, nuchal, and truncal tones of high-risk infants were assessed, as was their psychomotor developmental index (PDI). Infants with peripheral hypotonia were excluded.

**RESULTS:** We included 164 infants (mean age  $9.6 \pm 4$  months), 36 with normal tone in all 3 domains and 128 with central hypotonia. Twenty-six of the latter had hypotonia in 1 domain and 102 had multiple combinations of 3 domains. Hypotonia domains were distributed as follows: truncal ( $n = 115$ ), appendicular ( $n = 93$ ), and nuchal ( $n = 70$ ). Each domain was significantly associated with PDI scores ( $P < .001$ ) but not with a later diagnosis of cerebral palsy. On linear regression, nuchal hypotonia had the strongest contribution to PDI scores ( $\beta = -0.6$  [nuchal],  $-0.45$  [appendicular], and  $-0.4$  [truncal],  $P < .001$ ).

**CONCLUSIONS:** Central hypotonia, especially nuchal tone, is associated with lowered motor development scores.

PMID: 27027244 [PubMed - as supplied by publisher]

### **Sit-to-stand movement changes in preschool-aged children with spastic diplegia following one neurodevelopmental treatment session--a pilot study.**

Yonetsu R, Iwata A, Surya J, Unase K, Shimizu J.

*Disabil Rehabil.* 2015;37(18):1643-50. doi: 10.3109/09638288.2014.972592. Epub 2014 Oct 20.

**PURPOSE:** This study was designed to provide a better understanding of how a single neurodevelopmental treatment (NDT) session affects sit-to-stand (STS) movements in children with cerebral palsy (CP).

**METHODS:** Eight children with spastic diplegia and five typically developing children, aged 4-6 years, participated in this study. The CP participants performed STS movements immediately before and after a 40-min NDT session. Using a three-dimensional, four-camera analysis system, angular movements involving the hip, knee and ankle joints of the participants were obtained.

**RESULTS:** During forward tilt of the trunk, the maximum and final angles after the NDT session significantly decreased compared with those before the session ( $p < 0.05$ ,  $p < 0.01$ ). Moreover, the final hip flexion after the session also significantly decreased compared with that before the session ( $p < 0.01$ ). On the other hand, the initial, maximum and final ankle dorsiflexion angles after the session were significantly greater ( $p < 0.05$ ,  $p < 0.01$  and  $p < 0.05$ , respectively) than before the session.

**CONCLUSIONS:** These findings suggest that a single NDT session enables children with CP to stand from a seated position without using some atypical movement patterns.

**IMPLICATIONS FOR REHABILITATION:** Preschool-aged children with spastic diplegia, with limited ability to independently transfer from a sitting position, and dependent on a wheelchair for mobility experience obstacles to  
[Science Infos Paralyse Cérébrale](#), avril 2016, [FONDATION MOTRICE](#) 67 rue Vergniaud 75013 Paris - tel +33 31 1 45 54 03 03 contact: [Christine Doumergue](mailto:Christine.Doumergue@lafondationmotrice.org) [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

enhanced activities of daily life and social participation. A single neurodevelopmental treatment session would enable children with spastic diplegia to perform sit-to-stand movements more efficiently, with selective muscle control. Understanding how a single neurodevelopmental treatment session affects sit-to-stand movements in children with spastic diplegia is invaluable for therapists planning more efficient therapeutic programs and may enable children with spastic diplegia to develop improved mobility.

PMID: 25327772 [PubMed - indexed for MEDLINE]

### **The Intra- and Inter-Rater Reliability of an Instrumented Spasticity Assessment in Children with Cerebral Palsy.**

Schless SH, Desloovere K, Aertbeliën E, Molenaers G, Huenaerts C, Bar-On L.

*PLoS One.* 2015 Jul 2;10(7):e0131011. doi: 10.1371/journal.pone.0131011. eCollection 2015.

**AIM:** Despite the impact of spasticity, there is a lack of objective, clinically reliable and valid tools for its assessment. This study aims to evaluate the reliability of various performance- and spasticity-related parameters collected with a manually controlled instrumented spasticity assessment in four lower limb muscles in children with cerebral palsy (CP).

**METHOD:** The lateral gastrocnemius, medial hamstrings, rectus femoris and hip adductors of 12 children with spastic CP (12.8 years,  $\pm 4.13$  years, bilateral/unilateral involvement  $n=7/5$ ) were passively stretched in the sagittal plane at incremental velocities. Muscle activity, joint motion, and torque were synchronously recorded using electromyography, inertial sensors, and a force/torque load-cell. Reliability was assessed on three levels: (1) intra- and (2) inter-rater within session, and (3) intra-rater between session.

**RESULTS:** Parameters were found to be reliable in all three analyses, with 90% containing intra-class correlation coefficients  $>0.6$ , and 70% of standard error of measurement values  $<20\%$  of the mean values. The most reliable analysis was intra-rater within session, followed by intra-rater between session, and then inter-rater within session. The Addis evaluation had a slightly lower level of reliability than that of the other muscles.

**CONCLUSIONS:** Limited intrinsic/extrinsic errors were introduced by repeated stretch repetitions. The parameters were more reliable when the same rater, rather than different raters performed the evaluation. Standardisation and training should be further improved to reduce extrinsic error when different raters perform the measurement. Errors were also muscle specific, or related to the measurement set-up. They need to be accounted for, in particular when assessing pre-post interventions or longitudinal follow-up. The parameters of the instrumented spasticity assessment demonstrate a wide range of applications for both research and clinical environments in the quantification of spasticity.

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PMCID: PMC4489837

PMID: 26134673 [PubMed - indexed for MEDLINE]

### **The Manual Ability Classification System: A Scoping Review.**

Jeevanantham D, Dyszuk E, Bartlett D.

*Pediatr Phys Ther.* 2015 Fall;27(3):236-41. doi: 10.1097/PEP.000000000000151.

*Comment in Pediatr Phys Ther.* 2015 Fall;27(3):242.

**PURPOSE:** To examine the use of the Manual Ability Classification System (MACS) and to identify gaps in the literature by conducting a thorough search of existing publications from 2006 to March 2013.

**METHODS:** An extensive literature search included 15 databases, using the search terms "Manual Ability Classification System" or "MACS" to retrieve relevant abstracts.

**RESULTS:** A total of 161 articles were identified for final inclusion. The review identified literature that supports the reliability, validity, and stability of the MACS.

**CONCLUSIONS:** The MACS could be considered as a standard classification for children with cerebral palsy on the basis of manual abilities. The MACS can be reliably used for children between 4 and 18 years and adults between 18 and 24 years. The use of the MACS is expected to increase; further work is required to explore the use of the MACS in clinical practice.

PMID: 26020598 [PubMed - indexed for MEDLINE]

### **The mechanics of activated semitendinosus are not representative of the pathological knee joint condition of children with cerebral palsy.**

*J Electromyogr Kinesiol.* 2016 Apr 20;28:130-136. doi: 10.1016/j.jelekin.2016.04.002. [Epub ahead of print]

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Ateş F, Temelli Y, Yucesoy CA.

Characteristic cerebral palsy effects in the knee include a restricted joint range of motion and forcefully kept joint in a flexed position. To show whether the mechanics of activated spastic semitendinosus muscle are contributing to these effects, we tested the hypothesis that the muscle's joint range of force exertion is narrow and force production capacity in flexed positions is high. The

isometric semitendinosus forces of children with cerebral palsy (n=7, mean (SD)=7years (8months), GMFCS levels III-IV, 12 limbs tested) were measured intra-operatively as a function of knee angle, from flexion (120°) to full extension (0°). Peak force measured in the most flexed position was considered as the benchmark. However, peak force (mean (SD)=112.4N (54.3N)) was measured either at intermediate or even full knee extension (three limbs) indicating no narrow joint range of force exertion. Lack of high force production capacity in flexed knee positions (e.g., at 120° negligible or below 22% of the peak force) was shown except for one limb. Therefore, our hypothesis was rejected for a vast majority of the limbs. These findings and those reported for spastic gracilis agree, indicating that the patients' pathological joint condition must rely on a more complex mechanism than the mechanics of individual spastic muscles.

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PMID: 27128957 [PubMed - as supplied by publisher]

### **Validation of Inter-Subject Training for Hidden Markov Models Applied to Gait Phase Detection in Children with Cerebral Palsy.**

Taborri J, Scalona E, Palermo E, Rossi S, Cappa P.

*Sensors (Basel)*. 2015 Sep 23;15(9):24514-29. doi: 10.3390/s150924514.

Gait-phase recognition is a necessary functionality to drive robotic rehabilitation devices for lower limbs. Hidden Markov Models (HMMs) represent a viable solution, but they need subject-specific training, making data processing very time-consuming. Here, we validated an inter-subject procedure to avoid the intra-subject one in two, four and six gait-phase models in pediatric subjects. The inter-subject procedure consists in the identification of a standardized parameter set to adapt the model to measurements. We tested the inter-subject procedure both on scalar and distributed classifiers. Ten healthy children and ten hemiplegic children, each equipped with two Inertial Measurement Units placed on shank and foot, were recruited. The sagittal component of angular velocity was recorded by gyroscopes while subjects performed four walking trials on a treadmill. The goodness of classifiers was evaluated with the Receiver Operating Characteristic. The results provided a goodness from good to optimum for all examined classifiers ( $0 < G < 0.6$ ), with the best performance for the distributed classifier in two-phase recognition ( $G = 0.02$ ). Differences were found among gait partitioning models, while no differences were found between training procedures with the exception of the shank classifier. Our results raise the possibility of avoiding subject-specific training in HMM for gait-phase recognition and its implementation to control exoskeletons for the pediatric population.

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PMCID: PMC4610555

PMID: 26404309 [PubMed - indexed for MEDLINE]

### **Validity of semi-quantitative scale for brain MRI in unilateral cerebral palsy due to periventricular white matter lesions: Relationship with hand sensorimotor function and structural connectivity.**

Fiori S, Guzzetta A, Pannek K, Ware RS, Rossi G, Klingels K, Feys H, Coulthard A, Cioni G(2), Rose S, Boyd RN.

*Neuroimage Clin*. 2015 Apr 9;8:104-9. doi: 10.1016/j.nicl.2015.04.005. eCollection2015.

AIM: To provide first evidence of construct validity of a semi-quantitative scale for brain structural MRI (sqMRI scale) in children with unilateral cerebral palsy (UCP) secondary to periventricular white matter (PWM) lesions, by examining the relationship with hand sensorimotor function and whole brain structural connectivity.

METHODS: Cross-sectional study of 50 children with UCP due to PWM lesions using 3 T (MRI), diffusion MRI and assessment of hand sensorimotor function. We explored the relationship of lobar, hemispheric and global scores on the sqMRI scale, with fractional anisotropy (FA), as a measure of brain white matter microstructure, and with hand sensorimotor measures (Assisting Hand Assessment, AHA; Jebsen-Taylor Test for Hand Function, JTTHF; Melbourne Assessment of Unilateral Upper Limb Function, MUUL; stereognosis; 2-point discrimination).

**RESULTS:** Lobar and hemispheric scores on the sqMRI scale contralateral to the clinical side of hemiplegia correlated with sensorimotor paretic hand function measures and FA of a number of brain structural connections, including connections of brain areas involved in motor control (postcentral, precentral and paracentral gyri in the parietal lobe). More severe lesions correlated with lower sensorimotor performance, with the posterior limb of internal capsule score being the strongest contributor to impaired hand function.

**CONCLUSION:** The sqMRI scale demonstrates first evidence of construct validity against impaired motor and sensory function measures and brain structural connectivity in a cohort of children with UCP due to PWM lesions. More severe lesions correlated with poorer paretic hand sensorimotor function and impaired structural connectivity in the hemisphere contralateral to the clinical side of hemiplegia. The quantitative structural MRI scoring may be a useful clinical tool for studying brain structure-function relationships but requires further validation in other populations of CP.

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PMCID: PMC4473818

PMID: 26106533 [PubMed - indexed for MEDLINE]

## Traitement - Rééducation motrice et cognitive

### **The use of instrumented gait analysis for individually tailored interdisciplinary interventions in children with cerebral palsy: a randomised controlled trial protocol.**

Rasmussen HM, Pedersen NW, Overgaard S, Hansen LK, Dunkhase-Heinl U, Petkov Y, Engell V, Baker R, Holsgaard-Larsen A

*BMC Pediatr.* 2015 Dec 7;15:202. doi: 10.1186/s12887-015-0520-7.

**BACKGROUND:** Children with cerebral palsy (CP) often have an altered gait. Orthopaedic surgery, spasticity management, physical therapy and orthotics are used to improve the gait. Interventions are individually tailored and are planned on the basis of clinical examinations and standardised measurements to assess walking ('care as usual'). However, these measurements do not describe features in the gait that reflect underlying neuro-musculoskeletal impairments. This can be done with 3-dimensional instrumented gait analysis (IGA). The aim of this study is to test the hypothesis that improvements in gait following individually tailored interventions when IGA is used are superior to those following 'care as usual'.

**METHODS/DESIGN:** 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 or II, will be included. The interventions under investigation are: 1) individually tailored interdisciplinary interventions based on the use of IGA, and 2) 'care as usual'. The primary outcome is gait measured by the Gait Deviation Index. Secondary outcome measures are: walking performance (1-min walk test) and patient-reported outcomes of functional mobility (Pediatric Evaluation of Disability Inventory), health-related quality of life (The Pediatric Quality of Life Inventory Cerebral Palsy Module) and overall health, pain and participation (The Pediatric Outcome Data Collection Instrument). The primary endpoint for assessing the outcome of the two interventions will be 52 weeks after start of intervention. A follow up will also be performed at 26 weeks; however, exclusively for the patient-reported outcomes.

**DISCUSSION:** To our knowledge, this is the first randomised controlled trial comparing the effects of an individually tailored interdisciplinary intervention based on the use of IGA versus 'care as usual' in children with CP. Consequently, the study will provide novel evidence for the use of IGA.

**TRIAL REGISTRATION:** ClinicalTrials.gov NCT02160457 . Registered June 2, 2014.

[Free PMC Article](#)

PMCID: PMC4671214

PMID: 26643822 [PubMed - indexed for MEDLINE]

### **What is the evidence for managing tone in young children with, or at risk of developing, cerebral palsy: a systematic review.**

Ward R, Reynolds JE, Bear N, Elliott C, Valentine J.

*Disabil Rehabil.* 2016 Mar 30:1-12. [Epub ahead of print]

**BACKGROUND AND OBJECTIVES:** To conduct a systematic review of the evidence for the management of tone in infants 0-24 months of age, with or at risk of developing cerebral palsy.

Science Infos Paralysie Cérébrale , avril 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 34 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

**METHOD:** This review was conducted and reported following the Preferred Reporting Items for Systematic Reviews and Meta-analyses Statement. The Cochrane Central Register of Controlled Trials, Embase, MEDLINE, CINAHL Plus and PsycINFO databases were systematically searched for relevant articles. Inclusion criteria were: children aged 0-24 months, identified as at risk of, or having cerebral palsy;  $\geq 25\%$  of participants  $\leq 24$  months, and included a standardized assessment of tone. Only peer reviewed journal articles were considered. Eligible studies were coded using the Oxford Levels of Evidence. Methodological quality was assessed using the PEDro scale for randomized controlled trials and the checklist for assessing the quality of quantitative studies of Kmet, Cook and Lee for non-randomized control trials.

**RESULTS:** A total of 4838 studies were identified. After removing duplicates and unrelated studies, a total of 56 full text studies were reviewed. A total of five studies met inclusion criteria, two of which were RCTs, two pre-/post-test designs and one retrospective case audit. Interventions included BoNT-A, Oral Baclofen, Neurofacilitation of Developmental Reaction and Neurodevelopmental Therapy. The quality of evidence ranged from limited to moderate.

**CONCLUSION:** The management of tone in infants and young children is not well described, with a dearth of high-level evidence to support intervention in the 0-24 month age-range. This is in contrast to a recent review completed by Novak et al. (2013) who report high levels of evidence of interventions for children with cerebral palsy, over 2 years of age. Implications for Rehabilitation High level of evidence to support clinical decision making for the management of tone in young children 0-24 months is not available. The lack of available evidence in the management of tone of young children underpins service delivery and intervention and impacts on patient outcomes. In the absence of clear research evidence, the systematic application of sensitive outcome measures is required to confirm treatment effects and generate new evidence. Hypertonia should not be managed in isolation. Consideration needs to be given to all components of the

ICF-CY.

PMID: 27027325 [PubMed - as supplied by publisher]

### **Pharmacologie Efficacite Tolérance**

#### **Effects of botulinum toxin A and/or bimanual task-oriented therapy on upper extremity activities in unilateral Cerebral Palsy: a clinical trial.**

Speth L, Janssen-Potten Y, Rameckers E, Defesche A, Winkens B, Becher J, Smeets R, Vles H.

*BMC Neurol.* 2015 Aug 19;15:143. doi: 10.1186/s12883-015-0404-3.

**BACKGROUND:** This study reports on the effects of botulinum toxin A (BoNT-A) injections in the upper extremity (UE) in children with unilateral Cerebral Palsy (uCP) combined with bimanual task-oriented therapy (BITT) or either treatment modality performed separately. Bimanual activities were measured with the Assisting Hand Assessment (AHA), the ABILHand-Kids questionnaire (AK), the Observational Skills Assessment Score (OSAS). Goal achievement was measured with Goal Attainment Scaling (GAS), using blind video assessment, and the Canadian Occupational Performance Measure (COPM).

**METHODS:** Thirty-five children, mean age 7.14 years (SD 2.63), 11 Manual Ability Classification Score (MACS) I, 15 MACS II and 9 MACS III, participated. The trial started with four study groups: BoNT-A-only (n = 5), BITT-only (n = 11), BoNT-A + BITT (n = 13), and control (n = 6). Twenty-two children were randomised, 13 children received their parents' preferred treatment: BoNT-A + BITT or BITT-only. Three comparisons were analysed: BITT (BoNT-A + BITT and BITT-only; n = 24) versus no BITT (BoNT-A-only and control; n = 11), BoNT-A (BoNT-A-only and BoNT-A + BITT; n = 18) versus no BoNT-A (BITT-only and control; n = 17), and the additional effect of BoNT-A (BoNT-A + BITT versus BITT-only). Follow-up time: 24 weeks.

**RESULTS:** No significant differences between the groups were found on the AHA. The amount of use of both hands on the OSAS was significantly better in the BoNT-A group in the beading and sandwich-making task. The BoNT-A group also showed significant improvement in the quality scores of the OSAS: the wrist position during grasping and holding, especially in the younger children. The BITT group improved significantly on the AK and significantly more on the performance and satisfaction scores of the COPM at 12 and 24 weeks regarding several goals. BoNT-A showed a significant negative effect at 12 and 24 weeks in the most important goal. BITT, more than BoNT-A + BITT, showed positive effects on the GAS score at 12 (significant), 18 and 24 weeks.

**CONCLUSIONS:** BoNT-A has a positive effect on quality of movement and amount of use of the affected UE during the 3 months' working time. BoNT-A has no additional effect on bimanual performance and goal achievement. BITT has a positive effect on goal achievement and bimanual performance, even up to 6 weeks after therapy had stopped.

TRIAL REGISTRATION: Current Controlled Trials ISRCTN69541857.

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PMCID: PMC4544795

PMID: 26286662 [PubMed - indexed for MEDLINE]

### **Effects of Botulinum Toxin-A and Goal-Directed Physiotherapy in Children with Cerebral Palsy GMFCS Levels I & II.**

Löwing K, Thews K, Haglund-Åkerlind Y, Gutierrez-Farewik EM.

*Phys Occup Ther Pediatr.* 2016 Apr 8:1-15. [Epub ahead of print]

**AIMS:** To evaluate short and long-term effects of botulinum toxin-A combined with goal-directed physiotherapy in children with cerebral palsy (CP).

**METHOD:** A consecutive selection of 40 children, ages 4-12 years, diagnosed with unilateral or bilateral CP, and classified in GMFCS levels I-II. During the 24 months, 9 children received one BoNT-A injection, 10 children two injections, 11 children three injections, and 10 children received four injections. 3D gait analysis, goal-attainment scaling, and body function assessments were performed before and at 3, 12, and 24 months after initial injections.

**RESULTS:** A significant but clinically small long-term improvement in gait was observed. Plantarflexor spasticity was reduced after three months and remained stable, while passive ankle dorsiflexion increased after 3 months but decreased slightly after 12 months. Goal-attainment gradually increased, reached the highest levels at 12 months, and levels were maintained at 24 months.

**CONCLUSION:** The treatments' positive effect on spasticity reduction was identified, but did not relate to improvement in gait or goal-attainment. No long-term positive change in passive ankle dorsiflexion was observed. Goal attainment was achieved in all except four children. The clinical significance of the improved gait is unclear. Further studies are recommended to identify predictors for positive treatment outcome.

PMID: 27058177 [PubMed - as supplied by publisher]

### **Intrathecal baclofen for treating spasticity in children with cerebral palsy.**

Hasnat MJ, Rice JE.

*Cochrane Database Syst Rev.* 2015 Nov 13;11:CD004552. doi: 10.1002/14651858.CD004552.pub2.

**BACKGROUND:** Cerebral palsy is a disorder of movement and posture arising from a non-progressive lesion in the developing brain. Spasticity, a disorder of increased muscle tone, is the most common motor difficulty and is associated with activity limitation to varying degrees in mobility and self care. Oral baclofen, a gamma-aminobutyric acid (GABA) agonist, has been used in oral form to treat spasticity for some time, but it has a variable effect on spasticity and the dose is limited by the unwanted effect of excessive sedation. Intrathecal baclofen produces higher local concentrations in cerebrospinal fluid at a fraction of the equivalent oral dose and avoids this excessive sedation.

**OBJECTIVES:** To determine whether intrathecal baclofen is an effective treatment for spasticity in children with cerebral palsy.

**SEARCH METHODS:** We searched the CENTRAL, MEDLINE, EMBASE and CINAHL databases, handsearched recent conference proceedings, and communicated with researchers in the field and pharmaceutical and drug delivery system companies.

**SELECTION CRITERIA:** We included studies which compared the effect of intrathecal baclofen treatment on spasticity, gross motor function or other areas of function with controls.

**DATA COLLECTION AND ANALYSIS:** Two authors selected studies, two authors extracted data and two authors assessed the methodological quality of included studies.

**MAIN RESULTS:** Six studies met the inclusion criteria. The data obtained were unsuitable for the conduct of a meta-analysis; we have completed a qualitative summary. All studies were found to have high or unclear risk of bias in some aspects of their methodology. Five of the six studies reported data collected in the randomised controlled phase of the study. A sixth study did not report sufficient results to determine the effect of intrathecal baclofen versus placebo. Of these five studies, four were conducted using lumbar puncture or other short-term means of delivering intrathecal baclofen. One study assessed the effectiveness of implantable intrathecal baclofen pumps over six months. The four short-term studies demonstrated that intrathecal baclofen therapy reduces spasticity in children with cerebral palsy. However, two of these studies utilised inappropriate techniques for statistical analysis of results. The single longer-term study demonstrated minimal reduction in spasticity with the use of intrathecal baclofen therapy. One of the short-term studies and the longer term study showed improvement in comfort and ease of care. The longer term study found a small improvement in gross motor function and also in some domains of health-related quality of life. Some

[Science Infos Paralysie Cérébrale](#), avril 2016, [FONDATION MOTRICE](#) 67 rue Vergniaud 75013 Paris - tel +33 36 1 45 54 03 03 contact: [Christine Doumergue](mailto:Christine.Doumergue@lafondationmotrice.org) [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

caution is required in interpreting the findings of the all the studies in the review due to methodological issues. In particular, there was a high risk of bias in the methodology of the longer term study due to the lack of placebo use in the control group and the absence of blinding to the intervention after randomisation for both participants and investigators.

**AUTHORS' CONCLUSIONS:** There is some limited short-term evidence that intrathecal baclofen is an effective therapy for reducing spasticity in children with cerebral palsy. The effect of intrathecal baclofen on long-term spasticity outcomes is less certain. The validity of the evidence for the effectiveness of intrathecal baclofen in treating spasticity in children with cerebral palsy from the studies in the review is constrained by the small sample sizes of the studies and methodological issues in some studies. Spasticity is a impairment in the domain of body structure and function. Consideration must also be given to the broader context in determining whether intrathecal baclofen therapy is effective. The aim of therapy may be, for example, to improve gross motor function, to increase participation at a social role level, to improve comfort, to improve the ease of care by others or to improve the overall quality of life of the individual. Intrathecal baclofen may improve gross motor function in children with cerebral palsy, but more reliable evidence is needed to determine this. There is some evidence that intrathecal baclofen improves ease of care and the comfort and quality of life of the individuals receiving it, but again small sample sizes and methodological issues in the studies mean that these results should be interpreted with caution. Further evidence of the effectiveness of intrathecal baclofen for treating spasticity, increasing gross motor function and improving comfort, ease of care and quality of life is needed from other investigators in order to validate these results. The short duration of the controlled studies included in this review did not allow for the exploration of questions regarding whether the subsequent need for orthopaedic surgery in children receiving intrathecal baclofen therapy is altered, or the safety and the economic implications of intrathecal baclofen treatment when long-term therapy is administered via an implanted device. Controlled studies are not the most appropriate study design to address these questions, cohort studies may be more appropriate.  
PMID: 26563961 [PubMed - indexed for MEDLINE]

### **Literature Review and Comparison of Two Statistical Methods to Evaluate the Effect of Botulinum Toxin Treatment on Gait in Children with Cerebral Palsy.**

Nieuwenhuys A, Papageorgiou E, Pataky T, De Laet T, Molenaers G, Desloovere K.

*PLoS One.* 2016 Mar 31;11(3):e0152697. doi: 10.1371/journal.pone.0152697. eCollection 2016.

**AIM:** This study aimed at comparing two statistical approaches to analyze the effect of Botulinum Toxin A (BTX-A) treatment on gait in children with a diagnosis of spastic cerebral palsy (CP), based on three-dimensional gait analysis (3DGA) data. Through a literature review, the available expert knowledge on gait changes after BTX-A treatment in children with CP is summarized.

**METHODS:** Part 1-Intervention studies on BTX-A treatment in children with CP between 4-18 years that used 3DGA data as an outcome measure and were written in English, were identified through a broad systematic literature search. Reported kinematic and kinetic gait features were extracted from the identified studies. Part 2-A retrospective sample of 53 children with CP ( $6.1 \pm 2.3$  years, GMFCS I-III) received 3DGA before and after multilevel BTX-A injections. The effect of BTX-A on gait was interpreted by comparing the results of paired samples t-tests on the kinematic gait features that were identified from literature to the results of statistical parametric mapping analysis on the kinematic waveforms of the lower limb joints.

**RESULTS:** Part 1-53 kinematic and 33 kinetic features were described in literature. Overall, there is no consensus on which features should be evaluated after BTX-A treatment as 49 features were reported only once or twice. Part 2-Post-BTX-A, both statistical approaches found increased ankle dorsiflexion throughout the gait cycle. Statistical parametric mapping analyses additionally found increased knee extension during terminal stance. In turn, feature analyses found increased outtoeing during stance after BTX-A.

**CONCLUSION:** This study confirms that BTX-A injections are a valuable treatment option to improve gait function in children with CP. However, different statistical approaches may lead to different interpretations of treatment outcome. We suggest that a clear, definite hypothesis should be stated a priori and a commensurate statistical approach should accompany this hypothesis.

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PMID: 27030973 [PubMed - in process]

## **Onabotulinumtoxin A Treatment of Drooling in Children with Cerebral Palsy: A Prospective, Longitudinal Open-Label Study.**

Møller E, Pedersen SA, Vinicoff PG, Bardow A, Lykkeaa J, Svendsen P, Bakke M.  
*Toxins (Basel)*. 2015 Jun 30;7(7):2481-93. doi: 10.3390/toxins7072481.

The aim of this prospective open-label study was to treat disabling drooling in children with cerebral palsy (CP) with onabotulinumtoxin A (A/Ona, Botox®) into submandibular and parotid glands and find the lowest effective dosage and least invasive method. A/Ona was injected in 14 children, Mean age 9 years, SD 3 years, under ultrasonic guidance in six successive Series, with at least six months between injections. Doses and gland involvement increased from Series A to F (units (U) per submandibular/parotid gland: A, 10/0; B, 15/0; C, 20/0; D, 20/20; E, 30/20; and F, 30/30). The effect was assessed 2, 4, 8, 12, and 20 weeks after A/Ona (drooling problems (VAS), impact (0-7), treatment effect (0-5), unstimulated whole saliva (UWS) flow and composition)) and analyzed by two-way NOVA. The effect was unchanged-moderate in A to moderate-marked in F. Changes in all parameters were significant in E and F, but with swallowing problems  $\leq 5$  weeks in 3 of 28 treatments. F had largest VAS and UWS reduction (64% and 49%). We recommend: Start with dose D A/Ona (both submandibular and parotid glands and a total of 80 U) and increase to E and eventually F (total 120 U) without sufficient response.

### **Free PMC Article**

PMCID: PMC4516924

PMID: 26134257 [PubMed - indexed for MEDLINE]

## **Should botulinum toxin A injections be repeated in children with cerebral palsy? A systematic review.**

Kahraman A, Seyhan K, Değer Ü, Kutlutürk S, Mutlu A.

*Dev Med Child Neurol*. 2016 Apr 22. doi: 10.1111/dmcn.13135. [Epub ahead of print]

**AIM:** The aim of this study was to determine the effects of repeat botulinum toxin A (BoNT-A) injections in children with spastic cerebral palsy (CP) on the basis of a best evidence synthesis.

**METHOD:** This study included 13 original articles after searching the literature to retrieve information. We used the critical review form produced by McMaster University to determine the methodological quality of the studies, and then confirmed the levels of evidence from Sackett. The studies were also evaluated using the International Classification of Function, Disability and Health - Children and Youth Version (ICF-CY).

**RESULTS:** A total of 893 children with spastic CP who had been administered repeat BoNT-A injections were evaluated. The evidence level was II in four of the thirteen studies, III in four studies, and IV in five studies. The McMaster review form score was 14 in two studies, 13 in four studies, and 12 in seven studies. The results showed that repeat BoNT-A may be a safe and an effective approach. The first two injections/one repeat especially relieve spasticity and improve fine and gross motor activities.

**INTERPRETATION:** Future studies to investigate the effectiveness of repeat BoNT-A in children with spastic CP may be planned within the framework of the ICF-CY to include well-designed randomized controlled trials and those conducted on larger homogenous groups.

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PMID: 27103334 [PubMed - as supplied by publisher]

## **Chirurgie**

### **Acetabular and femoral remodeling after varus derotational osteotomy in cerebral palsy: the effect of age and Gross Motor Function Classification Level.**

Shore BJ, Powell D, Miller PE, Matheny TH, Snyder BD.

*J Pediatr Orthop B*. 2016 Apr 22. [Epub ahead of print]

This study investigated the degree of acetabular and femoral remodeling after isolated varus derotation osteotomy (VDRO) in children with cerebral palsy. This retrospective review investigated 56 children (103 hips) who underwent VDROs for spastic hip displacement between 1994 and 2007. The average age of the patients at surgery was 7.7 years and the follow-up duration was 7.8 years (range 5-11 years). The acetabular index showed a significant linear decrease ( $P < 0.001$ ), with children of less than 6 years showing the greatest correction ( $P < 0.001$ ). VDRO without pelvic osteotomy does result in a mild improvement in acetabular dysplasia over time, with greater rates of correction found in children of less than 6 years old. LEVEL OF EVIDENCE: Therapeutic Study - Level IV.

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PMID: 27111554 [PubMed - as supplied by publisher]

**C5 nerve palsy after posterior reconstruction surgery: predictive risk factors of the incidence and critical range of correction for kyphosis.**

Kurakawa T, Miyamoto H(2), Kaneyama S(3), Sumi M(3), Uno K(4).

*Eur Spine J.* 2016 Apr 7. [Epub ahead of print]

**PURPOSE:** It has been reported that the incidence of post-operative segmental nerve palsy, such as C5 palsy, is higher in posterior reconstruction surgery than in conventional laminoplasty. Correction of kyphosis may be related to such a complication. The aim of this study was to elucidate the risk factors of the incidence of post-operative C5 palsy, and the critical range of sagittal realignment in posterior instrumentation surgery.

**METHODS:** Eighty-eight patients (mean age 64.0 years) were involved. The types of the disease were; 33 spondylosis with kyphosis, 27 rheumatoid arthritis, 17 athetoid cerebral palsy and 11 others. The patients were divided into two groups; Group P: patients with post-operative C5 palsy, and Group NP: patients without C5 palsy. The correction angle of kyphosis, and pre-operative diameter of C4/5 foramen on CT were evaluated between the two groups. Multivariate logistic regression analysis was used to determine the critical range of realignment and the risk factors affecting the incidence of post-operative C5 palsy.

**RESULTS:** Seventeen (19.3 %) of the 88 patients developed C5 palsy. The correction angle of kyphosis in Group P (15.7°) was significantly larger than that in Group NP (4.5°). In Group P, pre-operative diameters of intervertebral foramen at C4/5 (3.2 mm) were significantly smaller than those in Group NP (4.1 mm). The multivariate analysis demonstrated that the risk factors were the correction angle and pre-operative diameter of the C4/5 intervertebral foramen. The logistic regression model showed a correction angle exceeding 20° was critical for developing the palsy when C4/5 foraminal diameter reaches 4.1 mm, and there is a higher risk when the C4/5 foraminal diameter is less than 2.7 mm regardless of any correction.

**CONCLUSIONS:** This study has indicated the risk factors of post-operative C5 palsy and the critical range of realignment of the cervical spine after posterior instrumented surgery.

PMID: 27055443 [PubMed - as supplied by publisher]

**Comparative effects of multilevel muscle tendon surgery, osteotomies, and dorsal rhizotomy on functional and gait outcome measures for children with cerebral palsy.**

Feger MA, Lunsford CD, Sauer LD, Novicoff W, Abel MF.

*PM R.* 2015 May;7(5):485-93. doi: 10.1016/j.pmrj.2014.11.002. Epub 2014 Nov 20.

**OBJECTIVE:** To compare the impact of common surgical interventions (selective dorsal rhizotomy, muscle-tendon surgery, and osteotomies) for patients with cerebral palsy (CP) on Gross Motor Function Measure and temporal, kinematic, and kinetic gait variables as assessed via 3-dimensional motion analysis.

**DESIGN:** Retrospective cohort study.

**SETTING:** Motion analyses laboratory.

**PARTICIPANTS:** Ninety-four patients with CP, 56 of whom underwent surgery (37, muscle-tendon surgery; 11, osteotomy; and 8, selective dorsal rhizotomy) and 38 of whom did not have surgery; the patients were ages 4-18 years, with a Gross Motor Function Classification System classification of I, II, or III.

**INTERVENTIONS:** Single-event, multilevel muscle tendon surgery, selective dorsal rhizotomy, and osteotomy.

**MAIN OUTCOME MEASURES:** Change scores (postintervention - preintervention) in Gross Motor Function Measure and temporal, kinematic, and kinetic gait variables.

**RESULTS:** No statistically significant differences in change scores were found between groups in the Gross Motor Function Measure, velocity, or stride length measures after the observation period. The selective dorsal rhizotomy group had greater improvements in knee extension when compared with the nonsurgical group and greater hip and knee total range of motion during the gait cycle when compared with nonsurgical group and the muscle-tendon surgery and osteotomy cohorts. Lastly, the muscle-tendon surgery group had greater improvements in total knee range of motion compared with the nonsurgical group.

**CONCLUSIONS:** Patients who undergo selective dorsal rhizotomy and, to a lesser extent, muscle tendon procedures demonstrate greater improvements in kinematic gait variables compared with nonsurgical interventions in patients with spasticity resulting from CP.

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PMID: 25460211 [PubMed - indexed for MEDLINE]

**Clinical relevance of echocardiogram in patients with cerebral palsy undergoing posterior spinal fusion.**

DiCindio S, Arai L, McCulloch M, Sadacharam K, Shah SA, Gabos P, Dabney K, Theroux MC.

*Paediatr Anaesth.* 2015 Aug;25(8):840-5. doi: 10.1111/pan.12676. Epub 2015 May 9.

BACKGROUND: Spinal deformity is one of the secondary musculoskeletal problems that occur with cerebral palsy (CP). Of the co morbidities associated with CP and spinal deformity, cardiac function is of theoretical concern.

OBJECTIVE: The goal of our study was to determine the clinical relevance of routine preoperative cardiology evaluation via echocardiogram for patients with CP presenting for posterior spine fusion (PSF) surgery.

METHODS: A retrospective chart review was performed of CP patients presenting for scoliosis surgery. The data collected for each patient included: age, sex, height, weight, Cobb angle, and medical history. All patients had a preoperative cardiac evaluation.

RESULTS: Seventy-two patients were included. The mean age was  $13.6 \pm 3.4$  years. Left ventricular systolic function was normal in all patients; the mean shortening fraction was  $39.3 \pm 6.2\%$ . No patient had more than mild insufficiency of either the semilunar or atrioventricular valve. One patient was diagnosed with aortic root dilation as well as aortic valve insufficiency. All patients had PSF surgery without changes in anesthetic or surgical plans, and no patient experienced complications attributable to a cardiac origin.

CONCLUSION: The results suggest that routine preoperative cardiology evaluation via echocardiogram for children with CP in the absence of clinical history or physical examination findings suggestive of cardiac disease is not necessary.

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PMID: 25958933 [PubMed - indexed for MEDLINE]

**Comparison of single event vs multiple event soft tissue surgeries in the lower extremities with cerebral palsy.**

Mahmudov V, Gunay H, Kucuk L, Coskunol E, Calis Atamaz F.

*J Orthop.* 2015 Nov 14;12(Suppl 2):S171-5. doi: 10.1016/j.jor.2015.10.017. eCollection 2015.

In children with spasticity of multiple muscle groups, the need for repeat surgical interventions increases with advancing age. AIM: The present study aimed to investigate retrospectively whether there are any clinical and functional differences between single-event multilevel surgeries and multiple surgical events at a single level.

METHOD: The medical records of 109 patients with cerebral palsy (CP) were used. The patients, who met the inclusion and exclusion criteria, were assigned into following 4 groups based on the surgical procedures. The Gross Motor Function measure-88 (GMFCS) and Functional Independence Measure for Children (WeeFIM) were used for assessments.

RESULTS: When compared to groups, there was no significant difference. This study showed that both surgical techniques resulted in improvements in GMFCS and WeeFIM levels.

PMCID: PMC4796575 [Available on 2016-12-01]

PMID: 27047219 [PubMed]

**Distal femoral derotational osteotomy with external fixation for correction of excessive femoral anteversion in patients with cerebral palsy.**

Skiak E, Karakasli A, Basci O, Satoglu IS, Ertem F, Havitcioglu H.

*J Pediatr Orthop B.* 2015 Sep;24(5):425-32. doi: 10.1097/BPB.000000000000168.

Patients with cerebral palsy (CP) disorder often develop rotational hip deformity. Increasing deformities impair already diminished walking abilities; femoral osteotomies are often performed to maintain and improve walking abilities. Fixation of osteotomies with condylar plates has been used

successfully, but does not often enable immediate postoperative full weight-bearing. To avoid considerable postoperative rehabilitation deficit and additional bone loss because of inactivity, a postoperative treatment with full weight-bearing, is therefore, desirable. Self-tapping Schanz screws with a unilateral external fixator crossing the knee joint providing stronger anchoring in osteopenic bone might fulfill these demands. A retrospective study was carried out on 27 ambulatory CP patients, mean age 17.5 years (range 9-22 years); 11 patients with bilateral severe intoeing deformities underwent a supracondylar femoral osteotomy between September 2008 and April 2012. All patients were allowed to bear their full weight postoperatively. The aim of this study was to describe the technique, the results of this technique, to evaluate the time required for bone healing, and the type of complications associated with a distal

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derotational femoral osteotomy fixed with a uniaxial external fixator crossing the knee joint. A total of 27 patients were studied [mean weight 48.8 kg (range 29.8-75 kg)]. The mean preoperative rotation included internal rotation of 69° and external rotation of 17°. All patients were evaluated clinically and radiographically for a minimum of 1 year after surgery. There was a significant decrease in the mean medial rotation from 69° to 32° (P=0.00034). The lateral rotation increased significantly from preoperative 17° to postoperative 45° (P=0.0011). The femoral anteversion decreased significantly from a mean of 55° preoperatively to a mean 17° postoperatively (P=0.030). All patients, except one, achieved solid fusion uneventfully. One patient was a 16-year-old female who had sustained a knee flexion contracture of 30° because of a delay in the physiotherapy program. One 13-year-old female patient with a bilateral osteotomy had a nondisplaced fracture in her right femur after a direct trauma 2 weeks after removal of an external fixator, and was treated by a cast. Another 17-year-old male patient developed a nonunion because of loosening of two pins and achieved solid union after revision by dynamic compression plate plating. Besides four cases with superficial pin-tract infection, no other complications were documented. Minimally invasive supracondylar femoral derotational osteotomy fixed with a unilateral external fixators crossing the knee joint is a reliable procedure in CP patients. Most patients can be treated with early postoperative full weight-bearing. However, removal of the knee joint crossing fixator should be performed as early as possible to achieve a full range of motion.

PMID: 25794115 [PubMed - indexed for MEDLINE]

### **Does Spinal Fusion and Scoliosis Correction Improve Activity and Participation for Children With GMFCS level 4 and 5 Cerebral Palsy?**

Sewell MD, Wallace C, Malagelada F, Gibson A, Noordeen H, Tucker S, Molloy S, Lehovskiy J.  
*Medicine (Baltimore)*. 2015 Dec;94(49):e1907. doi: 10.1097/MD.0000000000001907.

Spinal fusion is used to treat scoliosis in children with cerebral palsy (CP). Following intervention, the WHO considers activity and participation should be assessed to guide intervention and assess the effects. This study assesses whether spinal fusion for scoliosis improves activity and participation for children with severe CP. Retrospective cohort study of 70 children (39M:31F) with GMFCS level 4/5 CP and significant scoliosis. Thirty-six underwent observational and/or brace treatment as the sole treatment for their scoliosis, and 34 underwent surgery. Children in the operative group were older and had worse scoliosis than those in the observational group. Questionnaire and radiographic data were recorded over a 2-year period. The ASKp was used to measure activity and participation. In the observational group, Cobb angle and pelvic obliquity increased from 51 (40-90) and 10 (0-30) to 70 (43-111) and 14 (0-37). Mean ASKp decreased from 16.3 (1-38) to 14.2 (1-36). In the operative group, Cobb angle and pelvic obliquity decreased from 81 (50-131) and 14 (1-35) to 38 (10-76) and 9 (0-24). Mean ASKp increased from 10.5 (0-29) to 15.9 (3-38). Spinal-related pain correlated most with change in activity and participation in both groups. There was no difference in mobility, GMFCS level, feeding or communication in either group before and after treatment. In children with significant scoliosis and CP classified within GMFCS levels 4 and 5, spinal fusion was associated with an improvement in activity and participation, whereas nonoperative treatment was associated with a small reduction. Pain should be carefully assessed to guide intervention.

#### [Free Article](#)

PMID: 26656322 [PubMed - indexed for MEDLINE]

### **Does the GMFCS level influence the improvement in knee range of motion after rectus femoris transfer in cerebral palsy?**

Blumetti FC, Morais Filho MC, Kawamura CM, Cardoso MO, Neves DL, Fujino MH, Lopes JA.  
*J Pediatr Orthop B*. 2015 Sep;24(5):433-9. doi: 10.1097/BPB.000000000000184.

The aim of this study was to evaluate the influence of the Gross Motor Function Classification System (GMFCS) on the outcomes of rectus femoris transfer (RFT) for patients with cerebral palsy and stiff knee gait. We performed a retrospective review of patients seen at our gait laboratory from 1996 to 2013. Inclusion criteria were (i) spastic diplegic cerebral palsy, (ii) GMFCS levels I-III, (iii) reduced peak knee flexion in swing (PKFSw<55°), and (iv) patients who underwent orthopedic surgery with preoperative and postoperative gait analysis. Patients were divided into two groups according to whether they received a concurrent RFT or not at the time of surgery: non-RFT group (185 knees) and RFT group (123 knees). The primary outcome was the overall knee range of motion (KROM) derived from gait kinematics. The secondary outcomes were the PKFSw and the time of peak knee flexion in swing (tPKFSw). We observed a statistically significant improvement in KROM only for patients in the RFT group (P<0.001). However, PKFSw and tPKFSw improved in both groups after surgery (P<0.001 for all analyses). In the RFT group, the improvement

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in KROM was observed only for patients classified as GMFCS levels I and II. In the non-RFT group, no improvement in KROM was observed in any GMFCS level. In this study, patients at GMFCS levels I and II were more likely to benefit from the RFT procedure.

PMID: 25856277 [PubMed - indexed for MEDLINE]

### **Dynamic motor control is associated with treatment outcomes for children with cerebral palsy.**

Schwartz MH, Rozumalski A, Steele KM.

*Dev Med Child Neurol.* 2016 Apr 21. doi: 10.1111/dmcn.13126. [Epub ahead of print]

AIM: To estimate the impact of dynamic motor control on treatment outcomes in children with cerebral palsy.

METHOD: We used multiple regression on a retrospective cohort of 473 ambulatory children with cerebral palsy who underwent conservative treatment, single-level orthopaedic surgery, single-event multi-level orthopaedic surgery, or selective dorsal rhizotomy. Outcomes included gait pattern, gait speed, energy cost of walking, and the Pediatric Outcomes Data Collection Instrument. Explanatory variables considered were pre-treatment levels of each outcome, treatment group, prior treatment, age, and dynamic motor control computed from surface electromyography using synergy analysis. Effect sizes were estimated from the adjusted response.

RESULTS: Pre-treatment levels had effect sizes 2 to 13 times larger than the next largest variable. Individuals with milder pre-treatment involvement had smaller gains or actual declines. Dynamic motor control was significant in all domains except energy cost. The effect size of dynamic motor control was second only to pre-treatment level, and was substantially larger than the effect size of treatment group for outcomes where both were significant (gait pattern 2:1, gait speed 4:1). The effect of dynamic motor control was independent of treatment group.

INTERPRETATION: Dynamic motor control is an important factor in treatment outcomes. Better dynamic motor control is associated with better outcomes, regardless of treatment.

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PMID: 27097830 [PubMed - as supplied by publisher]

### **Proximal Femoral Varus Derotation Osteotomy in Children with Cerebral Palsy: The Effect of Age, Gross Motor Function Classification System Level, and Surgeon Volume on Surgical Success.**

Shore BJ, Zurakowski D, Dufreny C, Powell D, Matheney TH, Snyder BD

*J Bone Joint Surg Am.* 2015 Dec 16;97(24):2024-31. doi: 10.2106/JBJS.O.00505.

BACKGROUND: The purpose of this study was to evaluate mid-term results of proximal femoral varus derotation osteotomy (VDRO) in children with cerebral palsy and determine what effect age, Gross Motor Function Classification System (GMFCS) level, and surgeon volume had on surgical success.

METHODS: We analyzed a cohort of children with cerebral palsy who underwent VDRO for hip displacement at a tertiary-level pediatric hospital between 1994 and 2007. Age, sex, GMFCS level, preoperative radiographic parameters, previous botulinum toxin administration or soft-tissue release, adjunctive pelvic osteotomy, the performance of bilateral surgery at the index VDRO, and surgeon volume (the number of procedures performed) were recorded. Results were analyzed via univariate and multivariate analyses for association with the need for revision hip surgery. Kaplan-Meier survivorship curves were generated, determining the time from index surgery to failure (defined as the need for subsequent surgical procedures on the hip and/or pelvis, or a hip migration percentage of >50% at the time of final follow-up), and were further stratified according to osseous versus soft-tissue revision.

RESULTS: A total of 567 VDROs were performed in 320 children (mean age [and standard deviation], 8.2 ± 3.8 years). The mean follow-up was 8.3 years (range, three to eighteen years). Of the initial 320 patients, 117 (37%) were considered to have had failure. Multivariate Cox regression analysis confirmed that younger age at surgery ( $p < 0.001$ ), increased GMFCS level ( $p = 0.01$ ), and lower annual surgical hip volume ( $p = 0.02$ ) were significant independent predictors of any type of surgical revision. Furthermore, soft-tissue release at VDRO was protective against revision ( $p = 0.02$ ). Five-year survivorship analysis revealed a 92% success rate for children classified as GMFCS levels I and II compared with a 76% success rate for those of GMFCS level V ( $p < 0.01$ ).

CONCLUSIONS: This study demonstrated a 37% failure rate after VDRO in children with cerebral palsy. Older age, lower GMFCS level, and increased surgeon volume were strong predictors of surgical success.

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PMID: 26677236 [PubMed - indexed for MEDLINE]

### **Sudden falls as a persistent complication of selective dorsal rhizotomy surgery in children with bilateral spasticity: report of 3 cases.**

Grootveld LR, van Schie PE, Buizer AI(1), Jeroen Vermeulen R, van Ouwkerk WJ Strijers R, Becher JJ  
*J Neurosurg Pediatr.* 2016 Apr 22:1-4. [Epub ahead of print]

Selective dorsal rhizotomy (SDR) surgery is a well-established treatment for ambulatory children with bilateral spastic paresis and is performed to eliminate spasticity and improve walking. The objective of this case report is to describe sudden falls as a persistent complication of SDR. The authors report on 3 patients with bilateral spastic paresis, aged 12, 6, and 7 years at the time of surgery. The percentage of transected dorsal rootlets was around 40% at the L2-S1 levels. Sudden falls were reported with a frequency of several a day, continuing for years after SDR. The falls were often triggered by performing dual tasks as well as occurring in the transition from sitting to standing, during running, after strenuous exercise, or following a fright. Patients also had residual hyperesthesia and dysesthesia of the foot sole. The authors hypothesize that the sudden falls are caused by a muscle inhibition reflex of the muscles in the legs, as an abnormal reaction to a sensory stimulus that is perceived with increased intensity by a patient with hyperesthesia. A favorable effect of gabapentin medication supports this hypothesis.

PMID: 27104630 [PubMed - as supplied by publisher]

### **The Effects of Selective Dorsal Rhizotomy on Balance and Symmetry of Gait in Children with Cerebral Palsy.**

Rumberg F, Bakir MS, Taylor WR, Haberl H, Sarpong A, Sharankou I, Lebek S, Funk JF.

*PLoS One.* 2016 Apr 4;11(4):e0152930. doi: 10.1371/journal.pone.0152930. eCollection 2016.

**AIM:** Cerebral palsy (CP) is associated with dysfunction of the upper motor neuron and results in balance problems and asymmetry during locomotion. Selective dorsal rhizotomy (SDR) is a surgical procedure that results in reduced afferent neuromotor signals from the lower extremities with the aim of improving gait. Its influence on balance and symmetry has not been assessed. The aim of this prospective cohort study was to evaluate the impact of SDR on balance and symmetry during walking.

**METHODS:** 18 children (10 girls, 8 boys; age 6 years (y) 3 months (m), SD 1y 8m) with bilateral spastic CP and Gross Motor Function Classification System levels I to II underwent gait analysis before and 6 to 12 months after SDR. Results were compared to 11 typically developing children (TDC; 6 girls, 5 boys; age 6y 6m, SD 1y 11m). To analyse balance, sway velocity, radial displacement and frequency were calculated. Symmetry ratios were calculated for balance measures and spatio-temporal parameters during walking.

**RESULTS:** Most spatio-temporal parameters of gait, as well as all parameters of balance, improved significantly after SDR. Preoperative values of symmetry did not vary considerably between CP and TDC group and significant postoperative improvement did not occur.

**INTERPRETATION:** The reduction of afferent signalling through SDR improves gait by reducing balance problems rather than enhancing movement symmetry.

PMID: 27043310 [PubMed - in process]

### **The role of arthrodesis of the wrist in spastic disorders.**

Neuhaus V, Kadzielski JJ, Mudgal CS.

*J Hand Surg Eur Vol.* 2015 Jun;40(5):512-7. doi: 10.1177/1753193414530193. Epub 2014 Apr 1.

Comment in *J Hand Surg Eur Vol.* 2015 Jun;40(5):518-9.

We investigated the functional and radiographic outcome of wrist arthrodesis in 11 adults with spastic wrist deformities, carried out by one surgeon between 2003 and 2012. The underlying cause of spasticity was a cerebrovascular insult in five, traumatic brain injury in four, and cerebral palsy in two patients. A dorsal plate and local bone graft was used in all patients. The mean radiographic flexion deformity significantly improved from 67° pre-operatively to 4° of dorsal angulation post-operatively. Thumb-in-palm deformity was more pronounced in three patients after the operation. The functional House score improved in all patients an average of two levels (range 1-3). © The Author(s) 2014.

PMID: 24692187 [PubMed - indexed for MEDLINE]

### **Unplanned Hospital Readmissions and Reoperations After Pediatric Spinal Fusion Surgery.**

Jain A, Puvanesarajah V, Menga EN, Sponseller PD.

*Spine (Phila Pa 1976).* 2015 Jun 1;40(11):856-62. doi: 10.1097/BRS.0000000000000857.

**STUDY DESIGN:** Retrospective review.

**OBJECTIVE:** To investigate the rates and reasons for unplanned readmissions and reoperation after pediatric spinal fusion surgery at our institution and to identify risk factors by analyzing patient and surgical characteristics.

Unplanned readmission and reoperation were defined as unplanned events within 90 days of the index surgery.

**SUMMARY OF BACKGROUND DATA:** The rate of unplanned readmission and reoperation after pediatric spinal fusion surgery is not well established.

**METHODS:** Clinical records were reviewed for all children who underwent spinal fusion surgical procedures for spinal deformity correction performed by 1 surgeon from 2000 through 2013 at our institution. Inclusion criteria were age of 10 to 18 years at surgery, fusion spanning more than 5 vertebral levels, and 3 months of clinical or radiographical follow-up (1002 patients met these criteria). Univariate and multivariate logistic regression models were created. Statistical significance was set at a P value of less than 0.05 for all analyses.

**RESULTS:** The overall 90-day unplanned readmission and reoperation rates were 8.0% and 3.8%, respectively. The most common causes of readmission were wound dehiscence (1.8%), deep wound infection (1.5%), pulmonary complications (1%), and superficial wound infection (0.9%). Univariate analysis showed that readmission was significantly associated with a higher number of levels fused, greater estimated blood loss, longer length of stay, and certain diagnoses; reoperation was significantly associated with a higher number of levels fused and certain diagnoses. On multivariate analysis, only patient diagnosis was found to be significantly associated with readmission and reoperation; patients with congenital scoliosis, genetic or syndromic scoliosis, cerebral palsy, and other neuromuscular disorders had significantly higher rates.

**CONCLUSION:** Unplanned readmission rate after pediatric spinal fusion surgery was 8%, most commonly for wound dehiscence and deep and superficial infections. Increased intraoperative blood loss, higher number of levels fused, and certain diagnoses are risk factors for unplanned readmission.

**LEVEL OF EVIDENCE:** 4.

PMID: 26091156 [PubMed - indexed for MEDLINE]

### **Unusual entrapment of deep peroneal nerve after femoral distal extension osteotomy.**

Yıldırım E, Sarıkaya İA, İnan M.

*J Pediatr Orthop B.* 2015 Sep;24(5):440-3. doi: 10.1097/BPB.000000000000167.

The lateral exposure of the supracondylar femur includes the risk of damaging the neurovascular structures or tightening of the neurological structures within the popliteal fossa may occur as a complication of the osteotomy. Although different pathways of common peroneal nerve (CPN) have been reported throughout the literature, division of deep and superficial branches above the supracondylar femur level has not been reported. A 15-year-old boy with bilateral knee flexion contracture and spastic diplegic cerebral palsy underwent bilateral femoral distal extension osteotomy. The authors found an unusual higher division of CPN above the supracondylar femur level. This report is aimed at warning surgeons about the division of the CPN at a higher level and highlighting a need for a high-powered cadaveric research.

PMID: 25734569 [PubMed - indexed for MEDLINE]

### **Réadaptation fonctionnelle**

#### **Action observation in infancy: implications for neuro-rehabilitation.**

Burzi V, Tealdi G, Boyd RN, Guzzetta A.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:74-7. doi: 10.1111/dmcn.13048.

Action observation therapy has been found to be effective in improving hand motor function in both adults with stroke and children with unilateral cerebral palsy. We here propose a provocative hypothesis arguing that the same therapy might be effective in very early intervention in infants with unilateral or asymmetric brain damage, but through a different underlying mechanism. If the activation of motor networks induced in infancy by action observation enhances the excitability of the damaged sensorimotor cortex, it could also accelerate the maturation of the corticospinal tract and the adaptive shaping of the spinal motor circuits. This hypothesis should be explored carefully in prospective studies and, if confirmed, might support the use of action observation therapy at a much earlier time than experimented so far.

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PMID: 27027611 [PubMed - in process]

### **Comparative Effectiveness Research and Children With Cerebral Palsy: Identifying a Conceptual Framework and Specifying Measures.**

Gannotti ME, Law M, Bailes AF, O'Neil ME, Williams U, DiRezze B; Expert Panel.

*Pediatr Phys Ther.* 2016 Spring;28(1):58-69. doi: 10.1097/PEP.000000000000203

**PURPOSE:** A step toward advancing research about rehabilitation service associated with positive outcomes for children with cerebral palsy is consensus about a conceptual framework and measures.

**METHODS:** A Delphi process was used to establish consensus among clinicians and researchers in North America.

**RESULTS:** Directors of large pediatric rehabilitation centers, clinicians from large hospitals, and researchers with expertise in outcomes participated (N = 18). Andersen's model of health care utilization framed outcomes: consumer satisfaction, activity, participation, quality of life, and pain. Measures agreed upon included Participation and Environment Measure for Children and Youth,

Measure of Processes of Care, PEDI-CAT, KIDSCREEN-10, PROMIS Pediatric Pain Interference Scale, Visual Analog Scale for pain intensity, PROMIS Global Health Short Form, Family Environment Scale, Family Support Scale, and functional classification levels for gross motor, manual ability, and communication.

**CONCLUSIONS:** Universal forms for documenting service use are needed. Findings inform clinicians and researchers concerned with outcome assessment.

PMID: 27088688 [PubMed - in process]

### **Daily Intervention for Young Children With Cerebral Palsy in GMFCS Level V: A Case Series.**

Heathcock JC, Baranet K, Ferrante R, Hendershot S.

*Pediatr Phys Ther.* 2015 Fall;27(3):285-92. doi: 10.1097/PEP.000000000000149.

*Comment in Pediatr Phys Ther.* 2015 Fall;27(3):217.

**PURPOSE:** To describe a daily physical therapy (PT) intervention program and outcomes for 2 young children with spastic quadriplegia, Gross Motor Function Classification System (GMFCS) level V, and to evaluate the feasibility of using a daily program in an urban children's hospital outpatient setting.

**SUMMARY OF KEY POINTS:** Two young children, GMFCS level V, received 2 hours of PT intervention based on motor learning principles 5 days a week for 4 consecutive weeks. Gross Motor Functional Measure (GMFM-66, GMFM-88) and the Bayley Scales of Infant Development, Third Edition, were used as pre- and postoutcome measures.

The daily, high intensity intervention was well tolerated. Improvements in motor function, language, and cognitive skills were found.

**STATEMENT OF CONCLUSION:** A daily PT program appears feasible and may improve overall development in young children with cerebral palsy in GMFCS level V.

PMID: 25974119 [PubMed - indexed for MEDLINE]

### **Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants**

Spittle A, Orton J, Anderson PJ, Boyd R, Doyle LW.

*Cochrane Database Syst Rev.* 2015 Nov 24;11:CD005495. doi: 10.1002/14651858.CD005495.pub4.

*Update of Cochrane Database Syst Rev.* 2012;12:CD005495.

**BACKGROUND:** Infants born preterm are at increased risk of developing cognitive and motor impairment compared with infants born at term. Early developmental interventions have been provided in the clinical setting with the aim of improving overall functional outcomes for these infants. Long-term benefits of these programmes remain unclear.

**OBJECTIVES:** Primary objective To compare the effectiveness of early developmental intervention programmes provided post hospital discharge to prevent motor or cognitive impairment in preterm (< 37 weeks) infants versus standard medical follow-up of preterm infants at infancy (zero to < three years), preschool age (three to < five years), school age (five to < 18 years) and adulthood ( $\geq$  18 years). Secondary objectives To perform subgroup analyses to determine the following. • Effects of gestational age, birth weight and brain injury (periventricular leukomalacia (PVL)/intraventricular haemorrhage (IVH)) on cognitive and motor outcomes when early intervention is compared with standard follow-up. Gestational age: < 28 weeks, 28 to < 32 weeks, 32 to < 37 weeks. Birth weight: < 1000 grams, 1000 to < 1500 grams, 1500 to < 2500 grams. ◦ Brain injury: absence or presence of grade III or grade IV IVH or cystic PVL

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(or both) or an abnormal ultrasound/magnetic resonance image (MRI) before initiation of the intervention. • Effects of interventions started during inpatient stay with a post-discharge component versus standard follow-up care. • Effects of interventions focused on the parent-infant relationship, infant development or both compared with standard follow-up care. To perform sensitivity analysis to identify the following. • Effects on motor and cognitive impairment when early developmental interventions are provided within high-quality randomised trials with low risk of bias for sequence generation, allocation concealment, blinding of outcome measures and selective reporting bias.

**SEARCH METHODS:** The search strategy of the Cochrane Neonatal Review Group was used to identify randomised and quasi-randomised controlled trials of early developmental interventions provided post hospital discharge. Two review authors independently searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE Advanced, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO and EMBASE (1966 to August 2015).

**SELECTION CRITERIA:** Studies included had to be randomised or quasi-randomised controlled trials of early developmental intervention programmes that began within the first 12 months of life for infants born before 37 weeks' gestational age. Interventions could commence on an inpatient basis but had to include a post-discharge component for inclusion in this review. Outcome measures were not prespecified, other than that they had to assess cognitive outcomes, motor outcomes or both. Rates of cerebral palsy were documented.

**DATA COLLECTION AND ANALYSIS:** Two independent review authors extracted and entered data. Cognitive and motor outcomes were pooled by four age groups: infancy (zero to < three years), preschool age (three to < five years), school age (five to < 18 years) and adulthood ( $\geq$  18 years). Meta-analysis using RevMan 5.1 was carried out to determine the effects of early developmental interventions at each age range. Subgroup analyses focused on gestational age, birth weight, brain injury, commencement of the intervention, focus of the intervention and study quality.

**MAIN RESULTS:** Twenty-five studies met the inclusion criteria (3615 randomly assigned participants). Only 12 of these studies were randomised controlled trials with appropriate allocation concealment. Variability was evident with regard to focus and intensity of the intervention, participant characteristics and length of follow-up. Meta-analysis led to the conclusion that intervention improved cognitive outcomes at infancy (developmental quotient (DQ): standardised mean difference (SMD) 0.32 standard deviations (SDs), 95% confidence interval (CI) 0.16 to 0.47; P value < 0.001; 16 studies; 2372 participants) and at preschool age (intelligence quotient (IQ); SMD 0.43 SDs, 95% CI 0.32 to 0.54; P value < 0.001; eight studies; 1436 participants). However, this effect was not sustained at school age (IQ: SMD 0.18 SDs, 95% CI -0.08 to 0.43; P value = 0.17; five studies; 1372 participants). Heterogeneity between studies for cognitive outcomes at infancy and at school age was significant. With regards to motor outcomes, meta-analysis of 12 studies showed a significant effect in favour of early developmental interventions at infancy only; however, this effect was small (motor scale DQ: SMD 0.10 SDs, 95% CI 0.01 to 0.19; P value = 0.03; 12 studies; 1895 participants). No effect was noted on the rate of cerebral palsy among survivors (risk ratio (RR) 0.82, 95% CI 0.52 to 1.27; seven studies; 985 participants). Little evidence showed a positive effect on motor outcomes in the long term, but only five included studies reported outcomes at preschool age (n = 3) or at school age (n = 2).

**AUTHORS' CONCLUSIONS:** Early intervention programmes for preterm infants have a positive influence on cognitive and motor outcomes during infancy, with cognitive benefits persisting into preschool age. A great deal of heterogeneity between studies was due to the variety of early developmental intervention programmes tested and to gestational ages of included preterm infants; thus, comparisons of intervention programmes were limited. Further research is needed to determine which early developmental interventions are most effective in improving cognitive and motor outcomes, and to discern the longer-term effects of these programmes.

PMID: 26597166 [PubMed - indexed for MEDLINE]

### **Effect of parent-delivered action observation therapy on upper limb function in unilateral cerebral palsy: a randomized controlled trial.**

Kirkpatrick E, Pearse J, James P, Basu A.

*Dev Med Child Neurol.* 2016 Mar 31. doi: 10.1111/dmcn.13109. [Epub ahead of print]

**AIM:** To determine whether home-based, parent-delivered therapy comprising action observation (AO) and repeated practice (RP) improves upper limb function more than RP alone in children with unilateral cerebral palsy (UCP).

**METHOD:** Design: single-blinded parallel-group randomized controlled trial with 1:1 allocation comparing AO+RP (intervention) with RP alone (control). Randomization: computer-generated, with allocation concealment by opaque sequentially-numbered envelopes.

**SETTING:** northern England, August 2011 to September 2013.

**PARTICIPANTS:** 70 children with UCP; mean age 5.6 years (SD 2.1), 31 female.

**INTERVENTION:** home-based activities were provided, tailored to interests and abilities.

**DURATION:** 15 minutes/day, 5 days/week for 3 months.

**ASSESSMENTS:** Assisting Hand Assessment (AHA; primary outcome measure), Melbourne Assessment 2 (MA2), and ABILHAND-Kids at baseline, 3 months, and 6 months.

**RESULTS:** Outcome data was available at 3 months for 28 children in the AO+RP group and 31 controls, and at 6 months for 26 and 28 children respectively. There were no between-group differences in AHA, MA2, or ABILHAND-Kids at 3 or 6 months versus baseline (all  $p>0.05$ ). Combined-group improvements ( $p<0.001$ ), observed in AHA and MA2 at 3 months, were maintained at 6 months. ABILHAND-Kids also showed improvement at 3 months ( $p=0.003$ ), maintained at 6 months.

**INTERPRETATION:** Parent-delivered RP (with or without AO) improves upper limb function and could supplement therapist input.

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PMID: 27038153 [PubMed - as supplied by publisher]

### **Effects of strength training program on hip extensors and knee extensors strength of lower limb in children with spastic diplegic cerebral palsy.**

Aye T, Thein S, Hlaing T.

*J Phys Ther Sci.* 2016 Jan;28(2):671-6. doi: 10.1589/jpts.28.671. Epub 2016 Feb 29.

[Purpose] The purpose of this study was to determine whether strength training programs for hip extensors and knee extensors improve gross motor function of children with cerebral palsy in Myanmar.

[Subjects and Methods] Forty children (25 boys and 15 girls, mean age:  $6.07 \pm 2.74$  years) from National Rehabilitation Hospital, Yangon, Myanmar, who had been diagnosed with spastic diplegic cerebral palsy, Gross Motor Classification System I and II participated in a 6-week strength training program (45 minutes per day, 3 days per week) on hip and knee extensors. Assessment was made, before and after intervention, of the amount of training weight in pounds, as well as Gross Motor Function Measure (GMFM) dimensions D (standing) and E (walking, running, jumping).

[Results] All scores had increased significantly after the strength-training program.

[Conclusion] A simple method of strength-training program for hip and knee extensors might lead to improved muscle strength and gross motor function in children with spastic diplegic cerebral palsy.

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PMCID: PMC4793031

PMID: 27065561 [PubMed]

### **Effectiveness of Constraint induced movement therapy as compared to bimanual therapy in Upper motor function outcome in child with hemiplegic Cerebral palsy.**

Zafer H, Amjad I, Malik AN, Shaukat E.

*Pak J Med Sci.* 2016 Jan-Feb;32(1):181-4. doi: 10.12669/pjms.321.8491.

**OBJECTIVE:** This study aims at determining the effectiveness of constraint induced movement therapy as compared to bimanual therapy for improving functional status in children with hemiplegic cerebral palsy.

**METHODS:** This study was a randomized control trial, children ( $n = 20$ ) with spastic hemiplegic cerebral palsy was randomly allocated to CIMT (constraint induced movement therapy) and BMT (bimanual therapy) group. The children with spastic hemiplegia, age between 1.5 and 12 year and having 10 degrees of wrist extension and 10 degrees of finger extension were included in study. Treatment regime was two hours of daily training six days a week for two weeks. Constraint was applied to CIMT group for six hours. The outcome tool QUEST was used for baseline and post treatment assessment.

**RESULT:** CIMT had superior outcome as compared to BMT in improving functional status ( $p=0.007$ ). On QUEST tool grasp and dissociated movements results were significant ( $p=0.005$ ) and ( $p=0.028$ ) respectively. Weight bearing and protective extension resulted in no significant outcome ( $p=0.080$ ) and ( $p=0.149$ ) respectively. Dissociated movements and grasp are significantly improved but there is no difference for weight bearing and protective extension in CIMT treated group as compared to BMT treated group.

CONCLUSION: CIMT approach is better in improving functional status of child with cerebral palsy as compared to BMT. Significant improvement in grasp and dissociated movement is noted in group of CIMT while there was no significant improvement in weight bearing and protective extension in CIMT group when compared to BMT. CIMT is considered the appropriate treatment approach for unilateral conditions while BMT for bilateral conditions.

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PMCID: PMC4795864

PMID: 27022371 [PubMed]

### **Effectiveness of motor interventions in infants with cerebral palsy: a systematic review.**

Morgan C, Darrah J Gordon AM, Harbourne R, Spittle A, Johnson R, Fetters L.

*Dev Med Child Neurol.* 2016 Mar 29. doi: 10.1111/dmcn.13105. [Epub ahead of print]

AIM: To systematically review the evidence on the effectiveness of motor interventions for infants from birth to 2 years with a diagnosis of cerebral palsy or at high risk of it.

METHOD: Relevant literature was identified by searching journal article databases (PubMed, Embase, CINAHL, Cochrane, Web of Knowledge, and PEDro). Selection criteria included infants between the ages of birth and 2 years diagnosed with, or at risk of, cerebral palsy who received early motor intervention.

RESULTS: Thirty-four studies met the inclusion criteria, including 10 randomized controlled trials. Studies varied in quality, interventions, and participant inclusion criteria. Neurodevelopmental therapy was the most common intervention investigated either as the experimental or control assignment. The two interventions that had a moderate to large effect on motor outcomes (Cohen's effect size >0.7) had the common themes of child-initiated movement, environment modification/enrichment, and task-specific training.

INTERPRETATION: The published evidence for early motor intervention is limited by the lack of high-quality trials. There is some promising evidence that early intervention incorporating child-initiated movement (based on motor-learning principles and task specificity), parental education, and environment modification have a positive effect on motor development. Further research is crucial.

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PMID: 27027732 [PubMed - as supplied by publisher]

### **Effects of self-control and instructor-control feedback on motor learning in individuals with cerebral palsy.**

Hemayattalab R.

*Res Dev Disabil.* 2014 Nov;35(11):2766-72. doi: 10.1016/j.ridd.2014.07.006. Epub 2014 Jul 31.

In this study we investigated the effects of "self-control and instructor-control feedback" on motor learning in individuals with cerebral palsy (CP). For this reason 22 boy students with CP type I (12.26±3.11 years of age) were chosen. They were put into self-control feedback, instructor-control feedback and control groups. All participants practiced dart throwing skill for 5 sessions (4 blocks of 5 trails each session). The self-control group received knowledge of results (KR) feedback for half of their trials whenever they wanted. The instructor-control group received KR feedback after half of both their good and bad trails. The control group received no feedback for any trails. The acquisition test was run immediately at the end of each practice session (the last block) and the retention and transfer tests were run 24h following the acquisition phase. Analyses of variance with repeated measures and Post hoc tests were used to analyze the data. According to the results of this study, individuals with CP have the ability of acquiring and retaining a new motor skill. Also, it was found that self-control feedback is effective than instructor-control feedback on learning of a motor task in individuals with CP as in the average population. These findings show that rules regarding feedback also apply to people afflicted with CP.

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PMID: 25086427 [PubMed - indexed for MEDLINE]

### **Feasibility of using a large amplitude movement therapy to improve ambulatory function in children with cerebral palsy.**

Hickman R, Dufek JS, Lee SP, Blahovec A, Kuiken A, Riggins H, McClellan JR.

*Physiother Theory Pract.* 2015;31(6):382-9. doi: 10.3109/09593985.2015.1011295. Epub 2015 Jul 8.

Cerebral palsy (CP) is the most common cause of motor disability among children. Limited evidence exists regarding the efficacy of traditional rehabilitation strategies on improving ambulatory function in this population. The purpose

Science Infos Paralysie Cérébrale , avril 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 48 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org](#)



of the study was to investigate the feasibility and short-term effects of a novel large amplitude movement therapy on ambulatory functions in children with CP. Temporal-spatial gait characteristics were examined before and after a single intervention session, replicated over five children. Five children with CP ( $7.0 \pm 1.0$  years); Gross Motor Function Classification System Levels I-II, participated. Baseline gait parameters were obtained as the participant walked across an instrumented walkway at self-selected and fast speeds. Children then participated in a 20-30 min intervention focused on making body and limb movements as large as possible with gait assessment repeated immediately. All children tolerated testing and therapy with no adverse effects. Outcomes after one intervention included: significantly greater stride velocity; reduced double support time; and greater stride length after training for three of the five participants. Results for this pilot study suggested that the large amplitude movement therapy was feasible for children with CP. There is a need for a larger scale study to determine if the protocol can be effective at an appropriate clinical dose.

PMID: 26154826 [PubMed - indexed for MEDLINE]

**GAME (Goals - Activity - Motor Enrichment): protocol of a single blind randomised controlled trial of motor training, parent education and environmental enrichment for infants at high risk of cerebral palsy.**

Morgan C, Novak I, Dale RC, Guzzetta A, Badawi N.

*BMC Neurol.* 2014 Oct 7;14:203. doi: 10.1186/s12883-014-0203-2.

**BACKGROUND:** Cerebral palsy is the most common physical disability of childhood and early detection is possible using evidence based assessments. Systematic reviews indicate early intervention trials rarely demonstrate efficacy for improving motor outcomes but environmental enrichment interventions appear promising. This study is built on a previous pilot study and has been designed to assess the effectiveness of a goal - oriented motor training and enrichment intervention programme, "GAME", on the motor outcomes of infants at very high risk of cerebral palsy (CP) compared with standard community based care.

**METHODS/DESIGN:** A two group, single blind randomised controlled trial ( $n = 30$ ) will be conducted. Eligible infants are those diagnosed with CP or designated "at high risk of CP" on the basis of the General Movements Assessment and/or abnormal neuroimaging. A physiotherapist and occupational therapist will deliver home-based GAME intervention at least fortnightly until the infant's first birthday. The intervention aims to optimize motor function and engage parents in developmental activities aimed at enriching the home learning environment. Primary endpoint measures will be taken 16 weeks after intervention commences with the secondary endpoint at 12 months and 24 months corrected age. The primary outcome measure will be the Peabody Developmental Motor Scale second edition. Secondary outcomes measures include the Gross Motor Function Measure, Bayley Scales of Infant and Toddler Development, Affordances in the Home Environment for Motor Development - Infant Scale, and the Canadian Occupational Performance Measure. Parent well-being will be monitored using the Depression Anxiety and Stress Scale.

**DISCUSSION:** This paper presents the background, design and intervention protocol of a randomised trial of a goal driven, motor learning approach with customised environmental interventions and parental education for young infants at high risk of cerebral palsy.

**TRIAL REGISTRATION:** This trial is registered on the Australian New Zealand Clinical Trial register: ACTRN12611000572965.

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PMCID: PMC4194357

PMID: 25287779 [PubMed - indexed for MEDLINE]

**Intervention for an Adolescent With Cerebral Palsy During Period of Accelerated Growth.**

Reubens R, Silkwood-Sherer DJ.

*Pediatr Phys Ther.* 2016 Spring;28(1):117-25. doi: 10.1097/PEP.0000000000000223.

**PURPOSE:** The purpose of this case report was to describe changes in body functions and structures, activities, and participation after a biweekly 10-week program of home physical therapy and hippotherapy using a weighted compressor belt.

**PARTICIPANT:** A 13-year-old boy with spastic diplegic cerebral palsy, Gross Motor Function Classification System level II, was referred because of accelerated growth and functional impairments that limited daily activities.

**OUTCOME MEASURES:** The Modified Ashworth Scale, passive range of motion, 1-Minute Walk Test, Timed Up and Down Stairs, Pediatric Balance Scale, Pediatric Evaluation of Disability Inventory Computer Adaptive Test, and Dimensions of Mastery Questionnaire 17 were examined at baseline, 5, and 10 weeks.

**OUTCOMES:** Data at 5 and 10 weeks demonstrated positive changes in passive range of motion, balance, strength, functional activities, and motivation, with additional improvements in endurance and speed after 10 weeks.

**CLINICAL IMPLICATIONS:** This report reveals enhanced body functions and structures and activities and improved participation and motivation.

PMID: 27088701 [PubMed - in process]

### **Multiple Treatments of Pediatric Constraint-Induced Movement Therapy (pCIMT): A Clinical Cohort Study.**

DeLuca SC, Ramey SL, Trucks MR, Wallace DA.

*Am J Occup Ther.* 2015 Nov-Dec;69(6):6906180010p1-9. doi: 10.5014/ajot.2015.019323.

Pediatric constraint-induced movement therapy (pCIMT) is one of the most efficacious treatments for children with cerebral palsy (CP). Distinctive components of pCIMT include constraint of the less impaired upper extremity (UE), high-intensity therapy for the more impaired UE ( $\geq 3$  hr/day, many days per week, for multiple weeks), use of shaping techniques combined with repetitive task practice, and bimanual transfer. A critical issue is whether multiple treatments of pCIMT produce additional benefit. In a clinical cohort (mean age = 31 mo) of 28 children with asymmetrical CP whose parents sought multiple pCIMT treatments, the children gained a mean of 13.2 (standard deviation [SD] = 4.2) new functional skills after Treatment 1; Treatment 2 produced a mean of 7.3 (SD = 4.7) new skills; and Treatment 3, 6.5 (SD = 4.2). These findings support the conclusion that multiple pCIMT treatments can produce clinically important functional gains for children with hemiparetic CP.

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PMCID: PMC4643376

PMID: 26565094 [PubMed - indexed for MEDLINE]

### **Practical Recommendations for Robot-Assisted Treadmill Therapy (Lokomat) in Children with Cerebral Palsy: Indications, Goal Setting, and Clinical Implementation within the WHO-ICF Framework.**

Tabea Aurich (-Schuler), Warken B, Graser JV, Ulrich T, Borggraefe I, Heinen F, Meyer-Heim A, van Hedel HJ, Schroeder AS

*Neuropediatrics.* 2015 Aug;46(4):248-60. doi: 10.1055/s-0035-1550150. Epub 2015 May 26.

Active participation and the highest level of independence during daily living are primary goals in Neurorehabilitation. Therefore, standing and walking are key factors in many rehabilitation programs. Despite inconclusive evidence considering the best application and efficacy of robotic tools in the field of pediatric neurorehabilitation, robotic technologies have been implemented to complement conventional therapies in recent years. A group of experienced therapists and physicians joined in an "expert panel." They compared their clinical application protocols, discussed recurring open questions, and developed experience-based recommendations for robot-assisted treadmill therapy (exemplified by the Lokomat, Hocoma, Volketswil, Switzerland) with a focus on children with cerebral palsy. Specific indications and therapeutic goals were defined considering the severity of motor impairments and the International Classification of Functioning, Disability and Health framework (ICF). After five meetings, consensus was found and recommendations for the implementation of robot-assisted treadmill therapy including postsurgery rehabilitation were proposed. This article aims to provide a comprehensive overview on therapeutical applications in a fast developing field of medicine, where scientific evidence is still scarce. These recommendations can help physicians and therapists to plan the child's individual therapy protocol of robot-assisted treadmill therapy.

Georg Thieme Verlag KG Stuttgart · New York.

PMID: 26011438 [PubMed - indexed for MEDLINE]

### **Standing Programs to Promote Hip Flexibility in Children With Spastic Diplegic Cerebral Palsy.**

Macias-Merlo L, Bagur-Calafat C, Girabent-Farrés M, Stuberg WA.

*Pediatr Phys Ther.* 2015 Fall;27(3):243-9. doi: 10.1097/PEP.000000000000150.

*Comment in Pediatr Phys Ther.* 2015 Fall;27(3):249.

**PURPOSE:** To investigate the effects of a standing program on the range of motion (ROM) of hip abduction in children with spastic diplegic cerebral palsy.

**METHODS:** The participants were 13 children, Gross Motor Functional Classification System level III, who received physical therapy and a daily standing program using a custom-fabricated stander from 12 to 14 months of age to the age of 5 years. Hip abduction ROM was goniometrically assessed at baseline and at 5 years.

**RESULTS:** Baseline hip abduction was 42° at baseline and 43° at 5 years.

**CONCLUSIONS:** This small difference was not clinically significant, but did demonstrate that it was possible to maintain hip abduction ROM in the spastic adductor muscles of children with cerebral palsy with a daily standing program during the children's first 5 years of development.

PMID: 26020594 [PubMed - indexed for MEDLINE]

### **Three Case Reports of Successful Vibration Therapy of the Plantar Fascia for Spasticity Due to Cerebral Palsy-Like Syndrome, Fetal-Type Minamata Disease.**

Usuki F, Tohyama S.

*Medicine (Baltimore).* 2016 Apr;95(15):e3385. doi: 10.1097/MD.0000000000003385.

Fetal-type Minamata disease is caused by the exposure to high concentrations of methylmercury in the fetal period and shows cerebral palsy-like clinical features. Relief of spasticity is a major task of rehabilitation to improve their activities of daily living. Here we report the effect of long-term vibration therapy on bilateral lower-limb spasticity in 3 patients with fetal-type Minamata disease. We used a simple, inexpensive, and noninvasive approach with hand-held vibration massagers, which were applied to the plantar fascia at 90 Hz for 15 minutes. The effect was observed soon after the first treatment and resulted in better performance of the repetitive facilitation. Vibration therapy for 1 year improved Modified Ashworth Scale for the ankle flexors in 2 cases. The labored gait improved and gait speed increased in another case. Continued vibration therapy for another 1 year further improved Modified Ashworth Scale score and range of motion of ankle dorsiflexion in 1 case. This case showed the decreased amplitude of soleus H-reflex after the 15-minute vibration therapy, suggesting that  $\alpha$ -motor neuron excitability was suppressed. Vibration therapy using a hand-held vibration massager may offer safe and effective treatment for lower-limb spasticity in patients with chronic neurological disorders.

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PMID: 27082608 [PubMed - in process]

## **Orthèses**

### **Comparison of 2 Orthotic Approaches in Children With Cerebral Palsy.**

Wren TA, Dryden JW, Mueske NM, Dennis SW, Healy BS, Rethlefsen SA.

*Pediatr Phys Ther.* 2015 Fall;27(3):218-26. doi: 10.1097/PEP.0000000000000153.

*Comment in Pediatr Phys Ther.* 2015 Fall;27(3):226.

**PURPOSE:** To compare dynamic ankle-foot orthoses (DAFOs) and adjustable dynamic response (ADR) ankle-foot orthoses (AFOs) in children with cerebral palsy.

**METHODS:** A total of 10 children with cerebral palsy (4-12 years; 6 at Gross Motor Function Classification System level I, 4 at Gross Motor Function Classification System level III) and crouch and/or equinus gait wore DAFOs and ADR-AFOs, each for 4 weeks, in randomized order. Laboratory-based gait analysis, walking activity monitor, and parent-reported questionnaire outcomes were compared among braces and barefoot conditions.

**RESULTS:** Children demonstrated better stride length (11-12 cm), hip extension (2°-4°), and swing-phase dorsiflexion (9°-17°) in both braces versus barefoot. Push-off power (0.3 W/kg) and knee extension (5°) were better in ADR-AFOs than in DAFOs. Parent satisfaction and walking activity (742 steps per day, 43 minutes per day) were higher for DAFOs.

**CONCLUSIONS:** ADR-AFOs produce better knee extension and push-off power; DAFOs produce more normal ankle motion, greater parent satisfaction, and walking activity. Both braces provide improvements over barefoot.

PMID: 26035652 [PubMed - indexed for MEDLINE]

### **Effects of different seating equipment on postural control and upper extremity function in children with cerebral palsy.**

Sahinoğlu D, Coskun G, Bek N.

*Prosthet Orthot Int.* 2016 Mar 29. pii: 0309364616637490. [Epub ahead of print]

Science Infos Paralysie Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 51 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

**BACKGROUND:** Adaptive seating supports for cerebral palsy are recommended to develop and maintain optimum posture, and functional use of upper extremities.

**OBJECTIVES:** To compare the effectiveness of different seating adaptations regarding postural alignment and related functions and to investigate the effects of these seating adaptations on different motor levels.

**STUDY DESIGN:** Prospective study.

**METHODS:** A total of 20 children with spastic cerebral palsy (Gross Motor Function Classification System 3-5) were included. Postural control and function (Seated Postural Control Measure, Sitting Assessment Scale) were measured in three different systems: standard chair, adjustable seating system and custom-made orthosis.

**RESULTS:** In results of all participants ungrouped, there was a significant difference in most parameters of both measurement tools in favor of custom-made orthosis and adjustable seating system when compared to standard chair ( $p < 0.0017$ ). There was a difference among interventions in most of the Seated Postural Control Measure results in Level 4 when subjects were grouped according to Gross Motor Function Classification System levels. A difference was observed between standard chair and adjustable seating system in foot control, arm control, and total Sitting Assessment Scale scores; and between standard chair and custom-made orthosis in trunk control, arm control, and total Sitting Assessment Scale score in Level 4. There was no difference in adjustable seating system and custom-made orthosis in Sitting Assessment Scale in this group of children ( $p < 0.017$ ).

**CONCLUSION:** Although custom-made orthosis fabrication is time consuming, it is still recommended since it is custom made, easy to use, and low-cost. On the other hand, the adjustable seating system can be modified according to a patient's height and weight.

**CLINICAL RELEVANCE:** It was found that Gross Motor Function Classification System Level 4 children benefitted most from the seating support systems. It was presented that standard chair is sufficient in providing postural alignment. Both custom-made orthosis and adjustable seating system have pros and cons and the best solution for each will be dependent on a number of factors.

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PMID: 27025243 [PubMed - as supplied by publisher]

### **Effect of Knee Orthoses on Hamstring Contracture in Children With Cerebral Palsy: Multiple Single-Subject Study.**

*Pediatr Phys Ther.* 2016 Mar 29. [Epub ahead of print]

Laessker-Alkema K, Eek MN.

**PURPOSE:** To examine the effect of knee orthoses on extensibility of the hamstrings in children with spastic cerebral palsy (CP).

**METHODS:** The short-term effects of knee orthoses on passive range of motion (ROM), spasticity, and gross motor function of the hamstrings. Ten children with spastic CP, aged 5 to 14 years, at Gross Motor Function Classification System levels I to V, were followed. The orthoses were worn for a minimum of 30 minutes day, 5 days per week, during the intervention period of 8 weeks.

**RESULTS:** Visual analysis using the Two Standard Deviation Band Method supported improvements in passive ROM for all 20 hamstring muscles and in 12 of 14 knee extension measurements. Analyses with the Wilcoxon signed rank test confirm the individual results and support a significant increase in hamstring muscles ( $P = .005$ ) and knee extension (right:  $P = .028$ ; left:  $P = .018$ ) compared with baseline.

**CONCLUSIONS:** In children with spastic CP, 8 weeks of treatment with knee orthoses can improve extensibility of the hamstrings.

PMID: 27027243 [PubMed - as supplied by publisher]

## **Stimulation cérébrale - Stimulation neurosensorielle**

### **Brain stimulation and constraint for perinatal stroke hemiparesis: The PLASTIC CHAMPS Trial.**

Kirton A, Andersen J, Herrero M, Nettel-Aguirre A, Carsolio L, Damji O, Keess J, Mineyko A, Hodge J, Hill MD  
*Neurology.* 2016 Mar 30. pii: 10.1212/WNL.0000000000002646. [Epub ahead of print]

**OBJECTIVE:** To determine whether the addition of repetitive transcranial magnetic stimulation (rTMS) and/or constraint-induced movement therapy (CIMT) to intensive therapy increases motor function in children with perinatal stroke and hemiparesis.

**METHODS:** A factorial-design, blinded, randomized controlled trial ([clinicaltrials.gov/NCT01189058](http://clinicaltrials.gov/NCT01189058)) assessed rTMS and CIMT effects in hemiparetic children (aged 6-19 years) with MRI-confirmed perinatal stroke. All completed a 2-week, goal-directed, peer-supported motor learning camp randomized to daily rTMS, CIMT, both, or neither. Primary outcomes were the Assisting Hand Assessment and the Canadian Occupational Performance Measure at baseline, and 1 week, 2 and 6 months postintervention. Outcome assessors were blinded to treatment. Interim safety analyses occurred after 12 and 24 participants. Intention-to-treat analysis examined treatment effects over time (linear mixed effects model).

**RESULTS:** All 45 participants completed the trial. Addition of rTMS, CIMT, or both doubled the chances of clinically significant improvement. Assisting Hand Assessment gains at 6 months were additive and largest with rTMS + CIMT ( $\beta$  coefficient = 5.54 [2.57-8.51],  $p = 0.0004$ ). The camp alone produced large improvements in Canadian Occupational Performance Measure scores, maximal at 6 months (Cohen  $d = 1.6$ ,  $p = 0.002$ ). Quality-of-life scores improved. Interventions were well tolerated and safe with no decrease in function of either hand.

**CONCLUSIONS:** Hemiparetic children participating in intensive, psychosocial rehabilitation programs can achieve sustained functional gains. Addition of CIMT and rTMS increases the chances of improvement.

**CLASSIFICATION OF EVIDENCE:** This study provides Class II evidence that combined rTMS and CIMT enhance therapy-induced functional motor gains in children with stroke-induced hemiparetic cerebral palsy.

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PMID: 27029628 [PubMed - as supplied by publisher]

### **Effects of neuromuscular electrical stimulation on the wrist and finger flexor spasticity and hand functions in cerebral palsy.**

Yıldızgören MT, Nakipoğlu Yüzer GF, Ekiz T, Özgirgin N.

*Pediatr Neurol.* 2014 Sep;51(3):360-4. doi: 10.1016/j.pediatrneurol.2014.05.009. Epub 2014 May 21.

**PURPOSE:** To evaluate the effects of neuromuscular electrical stimulation on wrist range of motion, wrist and finger flexor spasticity, and hand functions in patients with unilateral cerebral palsy.

**METHOD:** Twenty-four children with unilateral spastic cerebral palsy (14 boys and 10 girls) between the ages of 5 and 14 years were randomized into neuromuscular electrical stimulation and control groups. Conventional exercises were applied, and static volar wrist-hand orthosis was administered to all patients 5 days a week for 6 weeks. Additionally, 30-minute neuromuscular electrical stimulation sessions were applied to the wrist extensor muscles in the neuromuscular electrical stimulation group. Patients were evaluated by Zancolli Classification System, Manual Ability Classification System, and Abilhand-Kids Test.

**RESULTS:** Compared with baseline, a significant increase was evident in active wrist extension angle at the fourth and sixth weeks in both groups (all  $P < 0.001$ ), more prominent in the neuromuscular electrical stimulation group at the fourth and sixth weeks ( $P = 0.015$  and  $P = 0.006$ , respectively). A decrease was observed in the spasticity values in the neuromuscular electrical stimulation group at the fourth and sixth weeks ( $P = 0.002$  and  $P = 0.001$ , respectively) and in the control group only at the sixth week ( $P = 0.008$ ). Abilhand-Kids values improved only in the neuromuscular electrical stimulation group ( $P < 0.001$ ).

**CONCLUSION:** Neuromuscular electrical stimulation application in addition to conventional treatments is effective in improving active wrist range of motion, spasticity, and hand functions in cerebral palsy.

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PMID: 25011433 [PubMed - indexed for MEDLINE]

### **Extracorporeal shockwave therapy (ESWT) benefits in spastic children with cerebral palsy (CP).**

Mirea A, Onose G, Padure L, Rosulescu E.

*J Med Life.* 2014;7 Spec No. 3:127-32.

**INTRODUCTION:** ESWT refers to the use of Shock Waves in medical practice. It was used as an important tool in spasticity management of children with CP. The aim of our study was to evaluate the effect of a 3 session of ESWT on spastic upper and lower limbs muscles in children with CP.

**METHODS:** Sixty-three children (37 boys and 26 girls), mean age  $99.57 \pm 53.74$  months, were included in the study. We used focused ESWT, applied in 3 sessions during the admission of each child, on the mainly affected muscles, using the same parameters on all patients (energy - 0.15 mJ/mm<sup>2</sup>, shot dose - 500 shocks/ session, frequency - 10 Hz). All patients were assessed two times: once, in admission (before any physical or ESWT appliance) and second, at discharge (after receiving the entire prescribed treatment), following: Modified Ashworth Scale (MAS), Gross Motor Function Science Infos Paralyse Cérébrale, avril 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 53 1 45 54 03 03 contact: Christine Doumergue \[cdoumergue@lafondationmotrice.org\]\(mailto:cdoumergue@lafondationmotrice.org\)](http://www.fondationmotrice.org)

Classification System (GMFCS), Gross Motor Function Measure 66 (GMFM-66) and also a Questionnaire on Pain caused by spasticity (QPS).

RESULTS: We found a better and significant decrease of MAS level in the ESWT treated group, thus leading to a concomitant decrease of QPS score and also increase of GMFM-66 score.

CONCLUSION: ESWT, applied in 3 sessions, with 0.15 mJ/ mm<sup>2</sup>, using 500 shocks/ min and 10 Hz as frequency may decrease children spasticity level and pain caused by it and improve the gross motor function.

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PMCID: PMC4391398

PMID: 25870710 [PubMed - indexed for MEDLINE]

### **Transcranial direct current stimulation during treadmill training in children with cerebral palsy: a randomized controlled double-blind clinical trial.**

Grecco LA, de Almeida Carvalho Duarte n, Mendonça ME, Cimolin V, Galli M, Fregni F, Santos Oliveira C. *Res Dev Disabil.* 2014 Nov;35(11):2840-8. doi: 10.1016/j.ridd.2014.07.030. Epub 2014 Aug 6.

Impaired gait constitutes an important functional limitation in children with cerebral palsy (CP). Treadmill training has achieved encouraging results regarding improvements in the gait pattern of this population. Moreover, transcranial direct current stimulation (tDCS) is believed to potentiate the results achieved during the motor rehabilitation process. The aim of the present study was to determine the effect of the administration of tDCS during treadmill training on the gait pattern of children with spastic diparetic CP. A double-blind randomized controlled trial was carried out involving 24 children with CP allocated to either an experimental group (active anodal tDCS [1mA] over the primary motor cortex of the dominant hemisphere) or control group (placebo tDCS) during ten 20-min sessions of treadmill training. The experimental group exhibited improvements in temporal functional mobility, gait variables (spatiotemporal and kinematics variables). The results were maintained one month after the end of the intervention. There was a significant change in corticospinal excitability as compared to control group. In the present study, the administration of tDCS during treadmill training potentiated the effects of motor training in children with spastic diparetic CP.

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PMID: 25105567 [PubMed - indexed for MEDLINE]

### **Réalité virtuelle - Jeux video**

#### **A Virtual Environment to Improve the Detection of Oral-Facial Malfunction in Children with Cerebral Palsy.**

**Martín-Ruiz ML, Máximo-Bocanegra N, Luna-Oliva L**

*Sensors (Basel).* 2016 Mar 26;16(4). pii: E444. doi: 10.3390/s16040444.

The importance of an early rehabilitation process in children with cerebral palsy (CP) is widely recognized. On the one hand, new and useful treatment tools such as rehabilitation systems based on interactive technologies have appeared for rehabilitation of gross motor movements. On the other hand, from the therapeutic point of view, performing rehabilitation exercises with the facial muscles can improve the swallowing process, the facial expression through the management of muscles in the face, and even the speech of children with cerebral palsy. However, it is difficult to find interactive games to improve the detection and evaluation of oral-facial musculature dysfunctions in children with CP. This paper describes a framework based on strategies developed for interactive serious games that is created both for typically developed children and children with disabilities. Four interactive games are the core of a Virtual Environment called SONRIE. This paper demonstrates the benefits of SONRIE to monitor children's oral-facial difficulties. The next steps will focus on the validation of SONRIE to carry out the rehabilitation process of oral-facial musculature in children with cerebral palsy.

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PMID: 27023561 [PubMed - in process]

#### **Navigation of a Virtual Exercise Environment with Microsoft Kinect by People Post-stroke or with Cerebral Palsy.**

Pool SM, Hoyle JM, Malone LA, Cooper L, Bickel CS, McGwin G, Rimmer JH, Eberhardt AW.

*Assist Technol.* 2016 Apr 8. [Epub ahead of print]

One approach to encourage and facilitate exercise is through interaction with virtual environments. The present study assessed the utility of Microsoft Kinect as an interface for choosing between multiple routes within a virtual environment through body gestures and voice commands. The approach was successfully tested on 12 individuals post-stroke and 15 individuals with CP. Participants rated their perception of difficulty in completing each gesture using a 5-point Likert scale questionnaire. The "most viable" gestures were defined as those with average success rates of 90% or higher and perception of difficulty ranging between easy to very easy. For those with CP, hand raises, hand extensions, and head nod gestures were found to be most viable. For those post-stroke, the most viable gestures were torso twists, head nods, as well as hand raises and hand extensions using the less impaired hand. Voice commands containing two syllables were viable (>85% successful) for those post-stroke; however, participants with CP were unable to complete any voice commands with a high success rate. This study demonstrated that Kinect may be useful for persons with mobility impairments to interface with virtual exercise environments, but the effectiveness of the various gestures depends upon the disability of the user.

PMID: 27057790 [PubMed - as supplied by publisher]

## **Thérapie cellulaire Médecine régénérative**

### **Stem cell therapy for cerebral palsy.**

Dan B.

*Dev Med Child Neurol.* 2016 May;58(5):424. doi: 10.1111/dmcn.13121.

[Free Article](#)

PMID: 27103186 [PubMed - in process]

### **Human allogeneic AB0/Rh-identical umbilical cord blood cells in the treatment of juvenile patients with cerebral palsy.**

Romanov YA, Tarakanov OP Radaev SM, Dugina TN, Ryaskina SS, Darevskaya AN, Morozova YV, Khachatryan W, Lebedev KE, Zotova NS, Burkova AS, Sukhikh GT, Smirnov VN.

*Cytotherapy.* 2015 Jul;17(7):969-78. doi: 10.1016/j.jcyt.2015.02.010. Epub 2015 Mar 17.

**BACKGROUND AIMS:** The term "cerebral palsy" (CP) encompasses many syndromes that emerge from brain damage at early stages of ontogenesis and manifest as the inability to retain a normal body position or perform controlled movements. Existing methods of CP treatment, including various rehabilitation strategies and surgical and pharmacological interventions, are mostly palliative, and there is no specific therapy focused on restoring injured brain function.

**METHODS:** During a post-registration clinical investigation, the safety and efficacy of intravenous infusion of allogeneic human leukocyte antigen (HLA)-unmatched umbilical cord blood (UCB) cells were studied in 80 pediatric patients with cerebral palsy and associated neurological complications. Patients received up to 6 intravenous infusions of AB0/Rh-identical, red blood cell-depleted UCB cells at an average dose of  $250 \times 10^6$  viable cells per infusion.

**RESULTS:** Patients were followed for 3-36 months, and multiple cell infusions did not cause any adverse effects. In contrast, in most patients who received four or more UCB cell infusions, positive dynamics related to significant improvements in neurological status and/or cognitive functions were observed.

**CONCLUSIONS:** The results confirm that multiple intravenous infusions of allogeneic AB0/Rh-identical UCB cells may be a safe and effective procedure and could be included in treatment and rehabilitation programs for juvenile patients with cerebral palsy.

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PMID: 25791070 [PubMed - indexed for MEDLINE]

## **Exosquelette**

### **A Trunk Support System to Identify Posture Control Mechanisms in Populations Lacking Independent Sitting.**

Goodworth AD, Wu YH, Felmlee D, Dunklebarger E, Saavedra S.

*IEEE Trans Neural Syst Rehabil Eng.* 2016 Mar 24. [Epub ahead of print]

Populations with moderate-to-severe motor control impairments often exhibit degraded trunk control and/or lack the ability to sit unassisted. These populations need more research, yet their underdeveloped trunk control complicates

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identification of neural mechanisms behind their movements. The purpose of this study was to overcome this barrier by developing the first multi-articulated trunk support system to identify visual, vestibular, and proprioception contributions to posture in populations lacking independent sitting. The system provided external stability at a user-specific level on the trunk, so that body segments above the level of support required active posture control. The system included a tilting surface (controlled via servomotor) as a stimulus to investigate sensory contributions to postural responses. Frequency response and coherence functions between the surface tilt and trunk support were used to characterize system dynamics and indicated that surface tilts were accurately transmitted up to 5Hz. Feasibility of collecting kinematic data in participants lacking independent sitting was demonstrated in two populations: two typically developing infants, ~2-8 months, in a longitudinal study (8 sessions each) and four children with moderate-to-severe cerebral palsy (GMFCS III-V). Adaptability in the system was assessed by testing 16 adults (ages 18-63). Kinematic responses to continuous pseudorandom surface tilts were evaluated across 0.046-2Hz and qualitative feedback indicated that the trunk support and stimulus were comfortable for all subjects. Concepts underlying the system enable both research for, and rehabilitation in, populations lacking independent sitting.  
PMID: 27046877 [PubMed - as supplied by publisher]

### **Autres methodes**

#### **Efficacy and safety of acupuncture in children: an overview of systematic reviews.**

Yang C, Hao Z, Zhang LL, Guo Q.

*Pediatr Res.* 2015 Aug;78(2):112-9. doi: 10.1038/pr.2015.91. Epub 2015 May 7.

In recent years, acupuncture has increasingly being integrated into pediatric health care. It was used on ~150,000 children (0.2%). We aim to update the evidence for the efficacy and safety of acupuncture for children and evaluate the methodological qualities of these studies to improve future research in this area. We included 24 systematic reviews, comprising 142 randomized controlled trials (RCTs) with 12,787 participants. Only 25% (6/24) reviews were considered to be high quality ( $10.00 \pm 0.63$ ). High-quality systematic reviews and Cochrane systematic reviews tend to yield neutral or negative results ( $P = 0.052, 0.009$  respectively). The efficacy of acupuncture for five diseases (Cerebral Palsy (CP), nocturnal enuresis, tic disorders, amblyopia, and pain reduction) is promising. It was unclear for hypoxic ischemic encephalopathy, attention deficit hyperactivity disorder, mumps, autism spectrum disorder (ASD), asthma, nausea/vomiting, and myopia. Acupuncture is not effective for epilepsy. Only six reviews reported adverse events (AEs) and no fatal side effects were reported. The efficacy of acupuncture for some diseases is promising and there have been no fatal side effects reported. Further high-quality studies are justified, with five diseases in particular as research priorities.

PMID: 25950453 [PubMed - indexed for MEDLINE]

#### **fMRI assessment of neuroplasticity in youths with neurodevelopmental-associated motor disorders after piano training.**

Alves-Pinto A, Turova V, Blumenstein T, Thienel A, Wohlschläger A, Lampe R.

*Eur J Paediatr Neurol.* 2015 Jan;19(1):15-28. doi: 10.1016/j.ejpn.2014.09.002. Epub 2014 Sep 18.

**BACKGROUND:** Damage to the developing brain may lead to lifelong motor impairments namely of the hand function. Playing an instrument combines the execution of gross and fine motor movements with direct auditory feedback of performance and with emotional value. This motor-associated sensory information may work as a self-control of motor performance in therapeutic settings.

**AIMS:** The current study examined the occurrence of neuronal changes associated to piano training in youths with neurodevelopmental-associated hand motor deficits.

**METHODS:** Functional magnetic resonance imaging responses evoked during a finger tapping task in a group of ten youths with neuromotor impairments that received individualized piano lessons for eighteen months were analyzed. Functional imaging data obtained before and after the piano training was compared to that obtained from a similar group of six youths who received no training during the same period of time.

**RESULTS:** Dynamic causal modeling of functional data indicated an increase in positive connectivity from the left primary motor cortical area to the right cerebellum from before to after the piano training.

**CONCLUSIONS:** A wide variability across patients was observed and further studies remain necessary to clarify the neurophysiological basis of the effects of piano training in hand motor function of patients with neurodevelopmental motor disorders.

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## Langage -parole-communication

### **Communication changes experienced by adults with cerebral palsy as they age.**

Dark LJ, Clemson L, Balandin S.

*Int J Speech Lang Pathol.* 2016 Apr 4:1-12. [Epub ahead of print]

**PURPOSE:** Adults with cerebral palsy (CP) experience multiple, functional changes as they age, including changes to communication modes and methods that enable development and maintenance of relationships, communicative participation and quality-of-life. Little is known about the nature of communication changes experienced by this group. The aim of this study was to better understand how adults with CP experience changes in their communication abilities as they age and the subsequent psychosocial impact.

**METHOD:** Twenty adults with cerebral palsy aged 40-72 years with complex communication needs (CCN) participated in a series of in-depth interviews, framing their experiences of loss and grief throughout their lives. The impact of changing communication abilities emerged as an important area of focus. Data were analysed using constructivist grounded theory methodology.

**RESULT:** Themes arising from the participants' perceptions of their communication included experiencing communication change as a loss with subsequent impact on self-concept; and how communication is integral to the process of managing losses associated with older age.

**CONCLUSION:** Implications for speech-language pathologists working with older people with cerebral palsy and CCN include the need to understand the psychosocial impact of communication changes on social interaction, relationships and communicative participation. It is important to promote positive and meaningful communication options that maintain a coherent sense of self in addition to promoting functional communication skills and communicative participation.

PMID: 27063695 [PubMed - as supplied by publisher]

### **Development and reliability of the Functional Communication Classification System for children with cerebral palsy.**

Barty E, Caynes K, Johnston LM.

*Dev Med Child Neurol.* 2016 Apr 17. doi: 10.1111/dmcn.13124. [Epub ahead of print]

**AIM:** This paper describes the development, validation, and reliability of the Functional Communication Classification System (FCCS), designed to classify expressive communication skills of children with cerebral palsy (CP) aged 4 years and 5 years (between their fourth and sixth birthdays).

**METHOD:** The Functional Communication Classification System (FCCS) was developed in 2006 using a literature review, client file audit, and expert consultative committee process in order to devise scale content, structure, and check clinical validity and utility. Interrater reliability was examined between speech-language pathologists (SLPs), other allied health professionals (AHPs), and parents of 48 children with CP. The scale was revised and a clinical reasoning prompt sheet added, then trialled again for 42 children. The result was a five-level system with descriptors and decision-making guides for classification of functional expressive communication for children with CP.

**RESULTS:** Overall interrater reliability was excellent for the final FCCS, intraclass correlation coefficient=0.97 (95% confidence interval 0.95 to 0.98). Kappa values were 0.94 between SLPs and AHPs, 0.59 between SLPs and parents, and 0.60 between AHPs and parents.

**INTERPRETATION:** The FCCS is a reliable tool for describing functional communication in young children with CP, appropriate for use by SLPs, other AHPs, and parents of children with CP.

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PMID: 27087436 [PubMed - as supplied by publisher]

### **Dysarthria in Adults With Cerebral Palsy: Clinical Presentation and Impacts on Communication.**

Schölderle T, Staiger A, Lampe R, Strecker K, Ziegler W.

*J Speech Lang Hear Res.* 2016 Apr 8:1-14. doi: 10.1044/2015\_JSLHR-S-15-0086. [Epub ahead of print]

**Purpose:** Although dysarthria affects the large majority of individuals with cerebral palsy (CP) and can substantially complicate everyday communication, previous research has provided an incomplete picture of its clinical features. We aimed to comprehensively describe characteristics of dysarthria in adults with CP and to elucidate the impact of dysarthric symptoms on parameters relevant for communication.

**Method:** Forty-two adults with CP underwent speech assessment by means of standardized auditory rating scales. Listening experiments were conducted to obtain communication-related parameters-that is, intelligibility and naturalness-as well as age and gender estimates.

**Results:** The majority of adults with CP showed moderate to severe dysarthria with symptoms on all dimensions of speech, most prominently voice quality, respiration, and prosody. Regression analyses revealed that articulatory, respiratory, and prosodic features were the strongest predictors of intelligibility and naturalness of speech. Listeners' estimates of the speakers' age and gender were predominantly determined by voice parameters.

**Conclusion:** This study provides an overview on the clinical presentation of dysarthria in a convenience sample of adults with CP. The complexity of the functional impairment described and the consequences on the individuals'communication call for a stronger consideration of dysarthria in CP both in clinical care and in research.

PMID: 27057824 [PubMed - as supplied by publisher]

### **Social media experiences of adolescents and young adults with cerebral palsy who use augmentative and alternative communication.**

Caron JG, Light J

*Int J Speech Lang Pathol.* 2016 Apr 6:1-13. [Epub ahead of print]

**PURPOSE:** This pilot study aimed to expand the current understanding of how adolescents and young adults with cerebral palsy (CP) and complex communication needs use social media.

**METHOD:** An online focus group was used to investigate the social media experiences of seven individuals with CP who used Augmentative and Alternative Communication (AAC). Questions posed to the group related to social media: (a) advantages; (b) disadvantages; (c) barriers; (d) supports; and (e) recommendations.

**RESULT:** Adolescents with CP who use AAC used a range of communication media to participate in daily interactions, including social media. An analysis of the focus group interaction revealed that the participants used social media to: bypass the constraints of face-to-face interactions; communicate for a number of reasons (e.g. maintain relationships, share experiences); and support independent leisure (e.g. playing games, looking at pictures/videos). Despite the advantages, the participants discussed barriers including limitations related to AAC technologies, social media sites and literacy skills.

**CONCLUSION:** The results suggest that service providers should implement interventions to support social media use, including enhancement of linguistic, operational and strategic competence. Technology manufacturers should focus on improving the designs of AAC apps and social media sites to facilitate access by individuals who require AAC.

PMID: 27063698 [PubMed - as supplied by publisher]

### **Spoken language comprehension of phrases, simple and compound-active sentences in non-speaking children with severe cerebral palsy.**

Geytenbeek JJ, Heim M, Knol D, Vermeulen RJ, Oostrom KJ.

*Int J Lang Commun Disord.* 2015 Jul;50(4):499-515. doi: 10.1111/1460-6984.12151. Epub 2015 Feb 19.

**BACKGROUND:** Children with severe cerebral palsy (CP) (i.e. 'non-speaking children with severely limited mobility') are restricted in many domains that are important to the acquisition of language.

**AIMS:** To investigate comprehension of spoken language on sentence type level in non-speaking children with severe CP.

**METHODS & PROCEDURES:** From an original sample of 87 non-speaking children with severe CP, 68 passed the pre-test (i.e. they matched at least five spoken words to the corresponding objects) of a specifically developed computer-based instrument for low motor language testing (C-BiLLT), admitting them to the actual C-BiLLT computer test. As a result, the present study included 68 children with severe CP (35 boys, 33 girls; mean age 6;11 years, SD 3;0 years; age range 1;9-11;11 years) who were investigated with the C-BiLLT for comprehension of different sentence types: phrases, simple active sentences (with one or two arguments) and compound sentences. The C-BiLLT provides norm data of typically developing (TD) children (1;6-6;6 years). Binomial logistic regression analyses were used to compare the percentage correct of each sentence type in children with severe CP with that in TD children (subdivided into age groups) and to compare percentage correct within the CP subtypes.

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**OUTCOMES & RESULTS:** Sentence comprehension in non-speaking children with severe CP followed the developmental trajectory of TD children, but at a much slower rate; nevertheless, they were still developing up to at least age 12 years. Delays in sentence type comprehension increased with sentence complexity and showed a large variability between individual children and between subtypes of CP. Comprehension of simple and syntactically more complex sentences were significantly better in children with dyskinetic CP than in children with spastic CP. Of the children with dyskinetic CP, 10-13% showed comprehension of simple and compound sentences within the percentage correct of TD children, as opposed to none of the children with spastic CP.

**CONCLUSION & IMPLICATIONS:** In non-speaking children with severe CP sentence comprehension is delayed rather than deviant. Results indicate the importance of following comprehension skills across all age groups, even beyond age 12 years. Moreover, the subtype of CP should be considered when establishing an educational programme for sentence comprehension, and augmentative and alternative communication support. In addition, educational programmes for children with severe CP should take into account the linguistic hierarchy of sentence comprehension when focusing on the input and understanding of spoken language comprehension.

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PMID: 25703269 [PubMed - indexed for MEDLINE]

## Autres Troubles /troubles concomitants

### **A combined surveillance program and quality register improves management of childhood disability.**

Alriksson-Schmidt AI, Arner M, Westbom L, Krumlind-Sundholm L, Nordmark E, Rodby-Bousquet E, Hägglund G  
*Disabil Rehabil.* 2016 Apr 4:1-7. [Epub ahead of print]

**PURPOSE:** To describe a concept for prevention of secondary conditions in individuals with chronic neuromuscular disabilities by using two Swedish developed follow-up-programmes for cerebral palsy (CP; CPUP) and myelomeningocele (MMC; MMCUP) respectively as examples.

**METHOD:** This paper describes and outlines the rationale, development and implementation of CPUP and MMCUP.

**RESULTS:** Both programmes are multidisciplinary longitudinal follow-up programmes that simultaneously serve as national registries. The programmes are population-based and set in Swedish habilitation clinics. Most children (95%) born 2000 or later with CP are enrolled in CPUP and the recruitment of adults is underway. CPUP has also been implemented in Norway, Denmark, Iceland, Scotland and parts of Australia. In MMCUP, almost all children with MMC born 2007 or later participate and individuals of all ages are now invited. The registries provide epidemiological profiles associated with CP and MMC and platforms for population-based research and quality of care improvement.

**CONCLUSIONS:** Through multidisciplinary follow-up and early detection of emerging complications individuals with CP or MMC can receive less complex and more effective interventions than if treatment is implemented at a later stage. Possibilities and challenges to design, implement and continuously run multidisciplinary secondary prevention follow-up programmes and quality registries for individuals with CP or MMC are described and discussed. Implications for rehabilitation Individuals with disabilities such as cerebral palsy or myelomeningocele are at risk of developing secondary conditions. Multidisciplinary population-based longitudinal follow-up programmes seem effective in preventing certain types of secondary conditions.

PMID: 27044661 [PubMed - as supplied by publisher]

## Troubles de la croissance

### **Growth characteristics in cerebral palsy subtypes: a comparative assessment.**

Stanek JL, Emerson JA, Murdock FA, Petroski GF.

*Dev Med Child Neurol.* 2016 Apr 5. doi: 10.1111/dmcn.13116. [Epub ahead of print]

**AIM:** Children with quadriplegic cerebral palsy (CP) have been found to have growth rates that differ from those of children with typical development. Little research has been performed to distinguish whether growth patterns in hemiplegic, diplegic, and quadriplegic CP differ from one another. The purpose of this study was to compare growth of children with quadriplegic, hemiplegic, and diplegic CP.

**METHOD:** Retrospective data were collected from the electronic medical record of patients with CP at an outpatient center. Linear mixed models were used to examine growth by diagnosis, using International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes 343.0 (diplegia), 343.1 (hemiplegia), and 343.2 (quadriplegia).

**RESULTS:** Heights and weights of children with quadriplegic CP were consistently lower than those with hemiplegic or diplegic CP. Children with hemiplegic CP had greater heights and weights than other CP subtypes. There were statistically significant differences in weight gain curves among the three diagnoses for males ( $p < 0.05$ ).

**INTERPRETATION:** Our study reveals differences in growth rates between hemiplegic, diplegic, and quadriplegic CP subtypes.

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## Troubles respiratoires

### **Community-Acquired Pneumonia Hospitalization among Children with Neurologic Disorders.**

Millman AJ, Finelli L, Bramley AM, Peacock G, Williams DJ, Arnold SR, Grijalva CG, Anderson EJ, McCullers JA, Ampofo K, Pavia AT, Edwards KM, Jain S.

*J Pediatr.* 2016 Mar 17. pii: S0022-3476(16)00271-7. doi: 10.1016/j.jpeds.2016.02.049. [Epub ahead of print]

**OBJECTIVE:** To describe and compare the clinical characteristics, outcomes, and etiology of pneumonia among children hospitalized with community-acquired pneumonia (CAP) with neurologic disorders, non-neurologic underlying conditions, and no underlying conditions.

**STUDY DESIGN:** Children <18 years old hospitalized with clinical and radiographic CAP were enrolled at 3 US children's hospitals. Neurologic disorders included cerebral palsy, developmental delay, Down syndrome, epilepsy, non-Down syndrome chromosomal abnormalities, and spinal cord abnormalities. We compared the epidemiology, etiology, and clinical outcomes of CAP in children with neurologic disorders with those with non-neurologic underlying conditions, and those with no underlying conditions using bivariate, age-stratified, and multivariate logistic regression analyses.

**RESULTS:** From January 2010-June 2012, 2358 children with radiographically confirmed CAP were enrolled; 280 (11.9%) had a neurologic disorder (52.1% of these individuals also had non-neurologic underlying conditions), 934 (39.6%) had non-neurologic underlying conditions only, and 1144 (48.5%) had no underlying conditions. Children with neurologic disorders were older and more likely to require intensive care unit (ICU) admission than children with non-neurologic underlying conditions and children with no underlying conditions; similar proportions were mechanically ventilated. In age-stratified analysis, children with neurologic disorders were less likely to have a pathogen detected than children with non-neurologic underlying conditions. In multivariate analysis, having a neurologic disorder was associated with ICU admission for children  $\geq 2$  years of age.

**CONCLUSIONS:** Children with neurologic disorders hospitalized with CAP were less likely to have a pathogen detected and more likely to be admitted to the ICU than children without neurologic disorders.

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PMID: 27017483 [PubMed - as supplied by publisher]

## Troubles cardiovasculaires

### **Associations of sedentary behaviour, physical activity, blood pressure and anthropometric measures with cardiorespiratory fitness in children with cerebral palsy.**

Ryan JM, Hensey O, McLoughlin B, Lyons A, Gormley J.

*PLoS One.* 2015 Apr 2;10(4):e0123267. doi: 10.1371/journal.pone.0123267. eCollection 2015.

**BACKGROUND:** Children with cerebral palsy (CP) have poor cardiorespiratory fitness in comparison to their peers with typical development, which may be due to low levels of physical activity. Poor cardiorespiratory fitness may contribute to increased cardiometabolic risk.

**PURPOSE:** The aim of this study was to determine the association between sedentary behaviour, physical activity and cardiorespiratory fitness in children with CP. An objective was to determine the association between cardiorespiratory fitness, anthropometric measures and blood pressure in children with CP.

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**METHODS:** This study included 55 ambulatory children with CP [mean (SD) age 11.3 (0.2) yr, range 6-17 yr; Gross Motor Function Classification System (GMFCS) levels I and II]. Anthropometric measures (BMI, waist circumference and waist-height ratio) and blood pressure were taken. Cardiorespiratory fitness was measured using a 10 m shuttle run test. Children were classified as low, middle and high fitness according to level achieved on the test using reference curves. Physical activity was measured by accelerometry over 7 days. In addition to total activity, time in sedentary behaviour and light, moderate, vigorous, and sustained moderate-to-vigorous activity ( $\geq 10$  min bouts) were calculated.

**RESULTS:** Multiple regression analyses revealed that vigorous activity ( $\beta = 0.339$ ,  $p < 0.01$ ), sustained moderate-to-vigorous activity ( $\beta = 0.250$ ,  $p < 0.05$ ) and total activity ( $\beta = 0.238$ ,  $p < 0.05$ ) were associated with level achieved on the shuttle run test after adjustment for age, sex and GMFCS level. Children with high fitness spent more time in vigorous activity than children with middle fitness ( $p < 0.05$ ). Shuttle run test level was negatively associated with BMI ( $r^2 = -0.451$ ,  $p < 0.01$ ), waist circumference ( $r^2 = -0.560$ ,  $p < 0.001$ ), waist-height ratio ( $r^2 = -0.560$ ,  $p < 0.001$ ) and systolic blood pressure ( $r^2 = -0.306$ ,  $p < 0.05$ ) after adjustment for age, sex and GMFCS level.

**CONCLUSIONS:** Participation in physical activity, particularly at a vigorous intensity, is associated with high cardiorespiratory fitness in children with CP. Low cardiorespiratory fitness is associated with increased cardiometabolic risk.

PMCID: PMC4383550

PMID: 25835955 [PubMed - indexed for MEDLINE]

## Nutrition – Troubles nutritionnels

### **Aspiration Pneumonia in Children with Cerebral Palsy after Videofluoroscopic Swallowing Study.**

Lagos-Guimarães HN, Teive HA, Celli A, Santos RS, Abdulmassih EM, Hirata GC, Gallinea LF.

*Int Arch Otorhinolaryngol.* 2016 Apr;20(2):132-7. doi: 10.1055/s-0035-1566093. Epub 2015 Oct 20.

**Introduction** Dysphagia is a common symptom in children with cerebral palsy, either in oral or pharyngeal phases. Children who face such difficulties tend to show health problems such as food aspiration, malnutrition and respiratory infections. Videofluoroscopic swallowing study is the most recommended for these cases, as it reveals the real situation during swallowing. **Objective** The study aimed to verify the occurrence of aspiration pneumonia in children with cerebral palsy after videofluoroscopy.

**Methods** The population for this prospective cross-sectional study involved 103 children with cerebral palsy, referred for videofluoroscopic who had returned for medical examination after a week to search for signs and symptoms of pneumonia. **Results** The study involved 46 girls (44.66%) and 57 boys (55.34%), aged between 0 and 14 years of age. Of the total, 84 (81.5%) had dysphagia, of which 24 (23.3%) were severe, 8 (7.7%) were moderate and 52 (50.4%) were mild dysphagia. None of the children presented aspiration pneumonia or infectious complications during the course of videofluoroscopy or after the procedure.

**Conclusion** In the population studied, the authors found no cases of aspiration pneumonia, even with tracheal aspiration present in 32 (31.07%) cases.

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PMCID: PMC4835321

PMID: 27096017 [PubMed]

### **Association between gross motor function and nutritional status in children with cerebral palsy: a cross-sectional study from Colombia.**

Herrera-Anaya E, Angarita-Fonseca A, Herrera-Galindo VM, Martínez-Marín RD, Rodríguez-Bayona CN.

*Dev Med Child Neurol.* 2016 Mar 31. doi: 10.1111/dmcn.13108. [Epub ahead of print]

**AIM:** To determine the association between gross motor function and nutritional status in children with cerebral palsy (CP) residing in an urban area in a developing country.

**METHOD:** We conducted a cross-sectional study in 177 children (ages 2-12y, 59.3% male) with a diagnosis of CP who were attending rehabilitation centres in Bucaramanga, Colombia (2012-2013). A physiotherapist evaluated patients using the Gross Motor Function Classification System (GMFCS, levels I to V). Nutritional status was evaluated by nutritionists and classified according to the World Health Organization growth charts. We used linear and multinomial logistic regression methods to determine the associations.

RESULTS: There were 39.5%, 6.8%, 5.6%, 16.4%, and 31.6% patients classified in levels I to V respectively. The mean adjusted differences for weight-for-age, height-for-age, BMI-for-age, and height-for-weight z-scores were significantly larger for children classified in levels II to V compared with those in level I. The children classified in levels IV and V were more likely to have malnutrition (adjusted odds ratio [OR] 5.64; 95% confidence interval [CI] 2.27-14.0) and stunting (OR 8.42; 95% CI 2.90-24.4) than those classified in GMFCS levels I to III.

INTERPRETATION: Stunting and malnutrition are prevalent conditions among paediatric patients with CP, and both are directly associated with higher levels of gross motor dysfunction.

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PMID: 27038060 [PubMed - as supplied by publisher]

### **The nutritional state of children and adolescents with cerebral palsy is associated with oral motor dysfunction and social conditions: a cross sectional study.**

Pinto VV, Alves LA, Mendes FM, Ciamponi AL.

*BMC Neurol.* 2016 Apr 26;16(1):55. doi: 10.1186/s12883-016-0573-8.

BACKGROUND: Cerebral palsy (CP) is the main cause of severe physical impairment during childhood and has commonly shown oral motor association. It has been considered as the main cause of the high prevalence of problems in children's nutrition. Respiration, chewing, swallowing, speaking and facial expression are part of the orofacial motor functions and when affected they can interfere in children's well-being. The aim of this study was to correlate two methods of orofacial motor evaluation, analyze the influence of orofacial motor functional impairment on the nutritional status of children and adolescents with CP, and the association between socioeconomic factors.

METHODS: Seventy children and adolescents with CP were selected, age range 6-16 years and following the exclusion criteria previously determined; 129 normoreactive children (control group), sex and age-matched to patients with CP. For the orofacial motor analysis two evaluation instruments were applied, the "Oral Motor Assessment Scale" (OMAS) and "Nordic Orofacial Test-Screening" (NOT-S). The anthropometric evaluation was based on the World Health Organization (WHO) and followed the criteria recommended by the Brazilian Ministry of Health.

RESULTS: There was statistically significant correlation between the oral motor methods of evaluation ( $r = -0.439$ ,  $p < 0.0001$ ). Concerning the nutritional status evaluation, being overweight was associated with dystonic and mixed CP forms variables ( $p = 0.034$ ), mother with no partnership ( $p = 0.045$ ) and mild oral motor impairment ( $p = 0.028$ ).

CONCLUSION: It could be concluded that, the weight's gain by children and adolescents might be favored by a better functional oral motor performance and social factors.

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PMCID: PMC4847222

PMID: 27117791 [PubMed - in process]

## Troubles gastrologiques

### **Duodenal Emphysema Complicated with Superior Mesenteric Artery Syndrome in a Patient with Cerebral Paralysis: A Case Report.**

Ichikawa T, Yamamuro H, Koizumi J, Joishi D, Ohnuki Y, Yutani S, Imai Y.

*Tokai J Exp Clin Med.* 2015 Jun 20;40(2):40-3.

Superior mesenteric artery syndrome (SMAS) is characterized by an arteriomesenteric duodenal compression commonly resulting from significant weight loss. Vomiting is the most frequent symptom. SMAS can be complicated by massive gastric dilatation. Patients with cerebral palsy have various factors that can predispose them to SMAS. In this paper, we report a rare case of SMAS complicated by duodenal, peritoneal and retroperitoneal emphysema in a patient with cerebral paralysis, referring to the relevant literature. In this case, severe vomiting associated with epilepsy and weight loss may have contributed to the development of duodenal emphysema.

[Free Article](#)

PMID: 26150182 [PubMed - indexed for MEDLINE]

## Sphère bucco-dentaire

### **Development of a new instrument for determining the level of chewing function in children.**

Serel Arslan S, Demir N, Barak Dolgun A, Karaduman AA.

*J Oral Rehabil.* 2016 Apr 4. doi: 10.1111/joor.12399. [Epub ahead of print]

This study aimed to develop a chewing performance scale that classifies chewing from normal to severely impaired and to investigate its validity and reliability. The study included the developmental phase and reported the content, structural, criterion validity, interobserver and intra-observer reliability of the chewing performance scale, which was called the Karaduman Chewing Performance Scale (KCPS). A dysphagia literature review, other questionnaires and clinical experiences were used in the developmental phase. Seven experts assessed the steps for content validity over two Delphi rounds. To test structural, criterion validity, interobserver and intra-observer reliability, two swallowing therapists evaluated chewing videos of 144 children (Group I: 61 healthy children without chewing disorders, mean age of 42.38 ± 9.36 months; Group II: 83 children with cerebral palsy who have chewing disorders, mean age of 39.09 ± 22.95 months) using KCPS. The Behavioral Pediatrics Feeding Assessment Scale (BPFAS) was used for criterion validity. The KCPS steps arranged between 0-4 were found to be necessary. The content validity index was 0.885. The KCPS levels were found to be different between groups I and II ( $\chi^2 = 123.286$ ,  $P < 0.001$ ). A moderately strong positive correlation was found between the KCPS and the subscales of the BPFAS ( $r = 0.444-0.773$ ,  $P < 0.001$ ). An excellent positive correlation was detected between two swallowing therapists and between two examinations of one swallowing therapist ( $r = 0.962$ ,  $P < 0.001$ ;  $r = 0.990$ ,  $P < 0.001$ , respectively). The KCPS is a valid, reliable, quick and clinically easy-to-use functional instrument for determining the level of chewing function in children.

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PMID: 27043312 [PubMed - as supplied by publisher]

### **Impact of oral diseases and disorders on oral-health-related quality of life of children with cerebral palsy.**

Abanto J, Ortega AO, Raggio DP, Bönecker M, Mendes FM, Ciamponi AL.

*Spec Care Dentist.* 2014 Mar-Apr;34(2):56-63. doi: 10.1111/scd.12028. Epub 2013 Jun 4.

The aim of this study was to investigate the impact of oral diseases and disorders on the oral-health-related quality of life (OHRQoL) of children with CP, adjusting this impact by socioeconomic factors. Data were collected from 60 pairs of parents-children with CP. Parents answered the child oral health quality of life questionnaire (parental-caregivers perception questionnaire and family impact scale) and a socioeconomic questionnaire. Dental caries experience, traumatic dental injuries, malocclusions, bruxism, and dental fluorosis were also evaluated. The multivariate adjusted model showed that dental caries experience ( $p < 0.001$ ) and the presence of bruxism had a negative impact ( $p = 0.046$ ) on the OHRQoL. A greater family income had a positive impact on it ( $p < 0.001$ ). Dental caries experience and bruxism are conditions strongly associated with a negative impact on OHRQoL of children with CP and their parents, but a higher family income can improve this negative impact.

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PMID: 24588489 [PubMed - indexed for MEDLINE]

### **Orthodontic management of a patient with cerebral palsy: six years follow-up.**

Sabuncuoglu FA, Özcan E.

*J Contemp Dent Pract.* 2014 Jul 1;15(4):491-5.

**AIM:** Cerebral palsy (CP) is a disorder that affects muscle tone, movement and motor skills. CP can also lead to other health issues, including vision, hearing and speech problems, as well as learning disabilities and dental problems. A case report describing the successful orthodontic treatment of a 10-year-old boy with the dyskinesia type of CP and severe malocclusion is presented.

**MATERIALS AND METHODS:** A 10-year and 2-month old boy was presented by his parents for orthodontic treatment, complaining of his unsatisfactory occlusion and poor chewing efficacy. An extraoral examination showed a convex profile. An intraoral examination showed the patient to be in mixed dentition with a class II molar relationship, 10 mm overjet and 4 mm overbite. In addition, his maxillary and mandibular arches were severely crowded. Cephalometric analysis indicated a severe skeletal class II discrepancy, which was confirmed by an ANB of 12°. The first phase of treatment involved the use of twin blocks with a headgear tube to attempt some growth modification and reduce the overjet. Once it was clear that the appliance was being well tolerated and the oral hygiene was satisfactory, the fixed appliance was used.

RESULTS: Because of the good participation of the patient and his parents, orthodontic treatment was successful in the patient, achieving a normal overjet in combination with successful orofacial therapy.

CONCLUSION: As demonstrated in our case report, the success of the treatment was dependent on the cooperation of the patient and his parents. Furthermore, this case illustrates the importance of the treatment by a dental team in patients with CP.

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PMID: 25576118 [PubMed - indexed for MEDLINE]

### **Submandibular Duct Re-routing for Drooling in Neurologically Impaired Children.**

Sagar P, Handa KK, Gulati S, Kumar R.

*Indian J Otolaryngol Head Neck Surg.* 2016 Mar;68(1):75-9. doi: 10.1007/s12070-015-0926-4. Epub 2015 Dec 12.

Drooling is a challenging situation to manage especially in neurologically impaired pediatric population. Numerous surgical procedures have been described in literature but none of them is standardized. We evaluate the effectiveness of bilateral submandibular duct rerouting and sublingual gland excision in drooling paediatric patients. Prospective interventional study was conducted from November 2007 to September 2009 in twenty-eight pediatric patients with drooling who had failed conservative treatment modalities. Patients underwent bilateral submandibular duct transposition and sublingual gland excision. Patients were assessed pre-operatively, at 7, 30 and 90 days after surgery for drooling severity, frequency as per Thomas-Stonell and Greenberg classification and also number of bibs changed per day. Result was categorized using Wilkie and Brody criteria for assessing effectiveness of the surgery. Twenty-eight patients were successfully operated. All patients were followed-up for a duration of at least 3 months. The success rate achieved in term of control of drooling was 95.2 % at 3 months follow up. Statistically significant difference ( $p < 0.001$ ) was noted in pre-operative and postoperative mean values for severity and frequency of drooling and also bibs/day. Transient, minor complications ( $n = 5/28$ , 17.8 %) were encountered following this surgical procedure. Bilateral submandibular duct rerouting and sublingual gland excision in drooling paediatric patients is a simple and effective surgery with minor operative morbidity. Concomitant sublingual gland excision bilaterally helps in reducing the incidence of ranula formation significantly.

PMCID: PMC4809808 [Available on 2017-03-01]

PMID: 27066416 [PubMed]

### **The Comparison of Malocclusion Prevalence Between Children with Cerebral Palsy and Healthy Children.**

Bakarić D, Lajnert V, Marčić BM, Jokić NI, Vrancić ZR, Grzić R, Prpić I.

*Coll Antropol.* 2015 Sep;39(3):663-6.

This study sets out to examine the prevalence of malocclusion and habits in a group of children with cerebral palsy and to compare it with a control group of healthy children. The presence of an anterior open bite was statistically significantly higher in the cerebral palsied group. The presence of a posterior crossbite was not significantly different between the examined groups, as was the case for a lingual crossbite. The occurrence of visceral swallowing, incompetent lips and oral respiration was significantly higher in the cerebral palsied group. The current study cannot satisfactorily sustain the issue of a higher prevalence of posterior and lingual crossbite in children with cerebral palsy because of no significant differences between groups, but it certainly can for an anterior openbite. The present study also adds to the evidence that there is an increased prevalence of oral breathing, visceral swallowing and lip incompetence in children with cerebral palsy.

PMID: 26898063 [PubMed - indexed for MEDLINE]

## **Troubles de la vision**

### **Measurement of visual ability in children with cerebral palsy: a systematic review.**

Deramore Denver B, Froude E, Rosenbaum P, Wilkes-Gillan S, Imms C.

*Dev Med Child Neurol.* 2016 Apr 21. doi: 10.1111/dmcn.13139. [Epub ahead of print]

AIM: To identify and evaluate measures of visual ability used with children with cerebral palsy (CP).



**METHOD:** Eight databases were searched for measures of visual ability. Key selection criteria for measures were: use with children with CP; focus of visual ability measurement at the Activities and Participation domain of the International Classification of Functioning, Disability and Health (ICF). The Consensus-based Standards for the Selection of Measurement Instruments (COSMIN) Checklist was used to assess psychometric properties.

**RESULTS:** From 6763 papers retrieved, 25 were relevant and 19 measures of visual ability were identified. Only 10 measures were supported with evidence of validity or reliability. No discriminative measure analogous to existing CP functional classification systems was found. No outcome measure valid for evaluation of visual abilities of children with CP was found.

**INTERPRETATION:** Vision impairment is recognized as relevant to the functioning of children with CP; however, measurement of vision is most often focused at 'Body Function' levels, for example visual acuity. Measuring visual abilities in the Activities and Participation domain is important in considering how a child with CP functions in vision-related activities. The lack of psychometrically strong measures for visual ability is a gap in current clinical practices and research.

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PMID: 27098366 [PubMed - as supplied by publisher]

## Troubles du sommeil

### **Sleep positioning systems for children with cerebral palsy.**

Blake SF, Logan S, Humphreys G, Matthews J, Rogers M, Thompson-Coon J, Wyatt K, Morris C.

*Cochrane Database Syst Rev.* 2015;11:CD009257. doi: 10.1002/14651858.CD009257.pub2. Epub 2015 Nov 2.

**BACKGROUND:** Sleep positioning systems can be prescribed for children with cerebral palsy to help reduce or prevent hip migration, provide comfort to ease pain and/or improve sleep. As sleep disturbance is common in children with developmental disabilities, with impact on their carers' sleep, and as sleep positioning systems can be expensive, guidance is needed to support decisions as to their use.

**OBJECTIVES:** To determine whether commercially-available sleep positioning systems, compared with usual care, reduce or prevent hip migration in children with cerebral palsy. Any negative effect of sleep positioning systems on hip migration will be considered within this objective. Secondary objectives were to determine the effect of sleep positioning systems on: (1) number or frequency of hip problems; (2) sleep patterns and quality; (3) quality of life of the child and family; (4) pain; and (5) physical functioning. We also sought to identify any adverse effects from using sleep positioning systems.

**SEARCH METHODS:** In December 2014, we searched CENTRAL, Ovid MEDLINE, Embase, and 13 other databases. We also searched two trials registers. We applied no restrictions on date of publication, language, publication status or study design. We checked references and contacted manufacturers and authors for potentially relevant literature, and searched the internet using Google.

**SELECTION CRITERIA:** We included all randomised controlled trials (RCTs) evaluating whole body sleep positioning systems for children and adolescents (up to 18 years of age) with cerebral palsy.

**DATA COLLECTION AND ANALYSIS:** Two review authors independently screened reports retrieved from the search against pre-determined inclusion criteria and assessed the quality of eligible studies. Members of the public (parent carers of children with neurodisability) contributed to this review by suggesting the topic, refining the research objectives, interpreting the findings, and reviewing the plain language summary.

**MAIN RESULTS:** We did not identify any randomised controlled trials that evaluated the effectiveness of sleep positioning systems on hip migration. We did find two randomised cross-over trials that met the inclusion criteria in respect of secondary objectives relating to sleep quality and pain. Neither study reported any important difference between sleeping in sleep positioning systems and not for sleep patterns or sleep quality (two studies, 21 children, very low quality evidence) and pain (one study, 11 children, very low quality evidence). These were small studies with established users of sleep positioning systems and were judged to have high risk of bias. We found no eligible trials that explored the other secondary objectives (number or frequency of hip problems, quality of life of the child and family, physical functioning, and adverse effects).

**AUTHORS' CONCLUSIONS:** We found no randomised trials that evaluated the effectiveness of sleep positioning systems to reduce or prevent hip migration in children with cerebral palsy. Nor did we find any randomised trials that evaluated the effect of sleep positioning systems on the number or frequency of hip problems, quality of life of the child and family or on physical functioning. Limited data from two randomised trials, which evaluated the effectiveness

Science Infos Paralyse Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 65 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

of sleep positioning systems on sleep quality and pain for children with cerebral palsy, showed no significant differences in these aspects of health when children were using and not using a sleep positioning system. In order to inform clinical decision-making and the prescription of sleep positioning systems, more rigorous research is needed to determine effectiveness, cost-effectiveness, and the likelihood of adverse effects.

PMID: 26524348 [PubMed - indexed for MEDLINE]

## Qualité de vie et rapport au monde

### **Social Attitudes toward Cerebral Palsy and Potential Uses in Medical Education Based on the Analysis of Motion Pictures.**

Jóźwiak M, Chen BP, Musielak B, Fabiszak J, Grzegorzewski A.

*Behav Neurol.* 2015;2015:341023. doi: 10.1155/2015/341023. Epub 2015 Jul 14.

This study presents how motion pictures illustrate a person with cerebral palsy (CP), the social impact from the media, and the possibility of cerebral palsy education by using motion pictures. 937 motion pictures were reviewed in this study. With the criteria of nondocumentary movies, possibility of disability classification, and availability, the total number of motion pictures about CP was reduced to 34. The geographical distribution of movie number ever produced is as follows: North America 12, Europe 11, India 2, East Asia 6, and Australia 3. The CP incidences of different motor types in real world and in movies, respectively, are 78-86%, 65% (Spastic); 1.5-6%, 9% (Dyskinetic); 6.5-9%, 26% (Mixed); 3%, 0% (Ataxic); 3-4%, 0% (Hypotonic). The CP incidences of different Gross Motor Function Classification System (GMFCS) levels in real world and in movies, respectively, are 40-51%, 47% (Level I + II); 14-19%, 12% (Level III); 34-41%, 41% (Level IV + V). Comparisons of incidence between the real world and the movies are surprisingly matching. Motion pictures honestly reflect the general public's point of view to CP patients in our real world. With precise selection and medical professional explanations, motion pictures can play the suitable role making CP understood more clearly.

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PMCID: PMC4516815

PMID: 26257472 [PubMed - indexed for MEDLINE]

## **Qualité de vie**

### **Caregiver-reported health-related quality of life of children with cerebral palsy and their families and its association with gross motor function: A South Indian study.**

Surender S, Gowda VK, Sanjay KS, Basavaraja GV, Benakappa N, Benakappa A.

*J Neurosci Rural Pract.* 2016 Apr-Jun;7(2):223-7. doi: 10.4103/0976-3147.178657.

**INTRODUCTION:** In children, health-related quality of life (HRQOL) includes parental impact and family functioning along with concepts of illness, functional status, mental health, and comfort. We are focusing on the impact of cerebral palsy (CP) on children's HRQOL and their families, and its relationship with gross motor dysfunction.

**SUBJECTS AND METHODS:** CP children aged 3-10 years under regular neurology follow-up were enrolled. The HRQOL and motor severity were prospectively assessed using lifestyle assessment questionnaire-CP and gross motor function classification systems, respectively.

**RESULTS:** One hundred children participated in this study. Thirty-three percent of children had good, 22% had mildly affected, whereas 45% had moderately to severely affected HRQOL. A significant association is present between gross motor function classification system and HRQOL.

**CONCLUSION:** HRQOL in CP and their caregivers is highly impaired. The degree of impairment is associated with physical independence, mobility, clinical burden, and social integration dimensions. Therapies targeting these dimensions and associated comorbidities will improve the HRQOL. Gross motor function classification system is a good indicator of HRQOL.

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PMCID: PMC4821929

PMID: 27114652 [PubMed]

**A grounded theory of Internet and social media use by young people who use augmentative and alternative communication (AAC).**

Hynan A, Goldbart J, Murray J.

*Disabil Rehabil.* 2015;37(17):1559-75. doi: 10.3109/09638288.2015.1056387. Epub 2015 Jun 19.

**PURPOSE:** This paper presents a conceptual grounded theory for how young people with a diagnosis of cerebral palsy who use augmentative and alternative communication (AAC), perceive using the Internet and social media. The aims of the research were to understand and contextualise their perceptions of access and use and explore implications for self-representation and social participation; to date literature on this topic is limited.

**METHOD:** A constructivist grounded theory research approach concurrently collected and analysed interview data from 25 participants (aged 14-24 years) who use AAC and additional sources.

**RESULTS:** A conceptual grounded theory was developed around an emergent core category that showed young people who use AAC have a clear desire to use the Internet and social media. This was underpinned by eight supporting categories: reported use, described support, online challenges, access technology, speech generating device (SGD) issues, self-determination, self-representation and online social ties.

**CONCLUSION:** The conceptual grounded theory supports understanding of facilitators and challenges to use of the Internet and social media by young people with a diagnosis of cerebral palsy who use AAC. The grounded theory illustrates how the desire to use the Internet and social media is based upon perceived benefits for enriching social relationships and enhancing opportunities for self-representation and self-determination that are synonymous with identified antecedents for community-based social inclusion. Some of the participants are engaging with the Internet and social media through collaborative practice and the implications for how this phenomenon may impact on orthographic literacy and the personal care workforce are raised.

PMID: 26087813 [PubMed - indexed for MEDLINE]

 **Activité physique - Sport**

**Barriers and facilitators of sports in children with physical disabilities: a mixed-method study.**

Jaarsma EA, Dijkstra PU, de Blécourt AC, Geertzen JH, Dekker R.

*Disabil Rehabil.* 2015;37(18):1617-23; quiz 1624-5. doi:10.3109/09638288.2014.972587. Epub 2014 Oct 27.

**PURPOSE:** This study explored barriers and facilitators of sports participation of children with physical disabilities from the perspective of the children, their parents and their health professionals.

**METHOD:** Thirty children and 38 parents completed a questionnaire, and 17 professionals were interviewed in a semi-structured way. Data from the three groups were combined in a mixed-method design, after which the results were triangulated.

**RESULTS:** Mean age (SD) of the children was 14.1 (2.9) years old, 58% were boys. Sixty-seven percent of the children had cerebral palsy and 77% participated in sports after school. Most commonly practiced sports were swimming, cycling and football. Children specifically experienced dependency on others as a barrier, parents did not have enough information about sports facilities, and professionals observed that the family's attitude had influence on the child's sports participation. Facilitators were health benefits, fun and social contacts.

**CONCLUSION:** Sports participation of children with physical disabilities is a complex phenomenon because children, their parents and professionals reported different barriers. Sports participation is more physically challenging for children with severe physical disabilities, as their daily activities already require much energy. However, the psychosocial benefits of sports are applicable to all children with physical disabilities.

**IMPLICATION FOR REHABILITATION:** Perceived barriers seemed to differ for children, parents and health professionals, suggesting that sports participation is a complex phenomenon. Sports might be more physically challenging for children with severe physical disabilities, as their daily activities already take much energy. The psychosocial benefits of sports should be emphasized by rehabilitation professionals when advising children with physical disabilities about sports.

PMID: 25347764 [PubMed - indexed for MEDLINE]

## **Evaluation of a Physical Activity Intervention for Adults With Brain Impairment: A Controlled Clinical Trial.**

Clanchy KM(1), Tweedy SM(2), Trost SG(3).

*Neurorehabil Neural Repair.* 2016 Mar 29. pii: 1545968316632059. [Epub ahead of print]

**BACKGROUND:** Individuals with brain impairment (BI) are less active than the general population and have increased risk of chronic disease.

**OBJECTIVE:** This controlled trial evaluated the efficacy of a physical activity (PA) intervention for community-dwelling adults with BI.

**METHODS:** A total of 43 adults with BI (27 male, 16 female; age  $38.1 \pm 11.9$  years; stage of change 1-3) who walked as their primary means of locomotion were allocated to an intervention ( $n = 23$ ) or control ( $n = 20$ ) condition. The intervention comprised 10 face-to-face home visits over 12 weeks, including a tailored combination of stage-matched behavior change activities, exercise prescription, community access facilitation, and relapse prevention strategies. The control group received 10 face-to-face visits over 12 weeks to promote sun safety, healthy sleep, and oral health. Primary outcomes were daily activity counts and minutes of moderate-to-vigorous-intensity PA (MVPA) measured with the ActiGraph GT1M at baseline (0 weeks), postintervention (12 weeks) and follow-up (24 weeks). Between-group differences were evaluated for statistical significance using repeated-measures ANOVA.

**RESULTS:** MVPA for the intervention group increased significantly from baseline to 12 weeks ( $20.8 \pm 3.1$  to  $31.2 \pm 3.1$  min/d;  $P = .01$ ), but differences between baseline and 24 weeks were nonsignificant ( $20.8 \pm 3.1$  to  $25.3 \pm 3.2$  min/d;  $P = .28$ ). MVPA changes for the control group were negligible and nonsignificant. Between-group differences for change in MVPA were significant at 12 weeks ( $P = .03$ ) but not at 24 weeks ( $P = .49$ ).

**CONCLUSION:** The 12-week intervention effectively increased adoption of PA in a sample of community-dwelling adults with BI immediately after the intervention but not at follow-up. Future studies should explore strategies to foster maintenance of PA participation.

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PMID: 27026691 [PubMed - as supplied by publisher]

## **Quantification of Physical Activity and Sedentary Time in Adults with Cerebral Palsy.**

Claridge EA, McPhee PG, Timmons BW, Martin Ginis KA, Macdonald MJ, Gorter JW.

*Med Sci Sports Exerc.* 2015 Aug;47(8):1719-26. doi: 10.1249/MSS.0000000000000589.

**PURPOSE:** The purpose of this study was to determine objective and subjective quantification of habitual physical activity (HPA) and sedentary time in ambulatory and nonambulatory adults with cerebral palsy (CP).

**METHODS:** We recruited a clinical sample of adults with CP ( $N = 42$ ; 21 women; mean (SD) age, 33.5 (12.3) yr; Gross Motor Function Classification System (GMFCS) distribution: level I ( $n = 5$ ), level II ( $n = 9$ ), level III ( $n = 10$ ), level IV ( $n = 11$ ), and level V ( $n = 7$ ). Objective measures of HPA and sedentary time were obtained by using ActiGraph GT3X accelerometers at both hip and wrist sites. Three previously established cut-point values distinguishing light physical activity (LPA) and moderate-to-vigorous physical activity (MVPA) were evaluated across GMFCS levels. The concurrent validity of the self-report Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) was assessed for LPA and MVPA intensities in GMFCS levels II-V.

**RESULTS:** Participants showed little reluctance to wearing accelerometers; one participant reported discomfort. Nonambulatory adults (GMFCS levels IV-V) differed from ambulatory adults (GMFCS levels I-III) for recorded activity counts (hip and wrist sites), minutes of MVPA with each cut-point value, and breaks from sedentary time (all  $P < 0.05$ ). For the same measures, adults in GMFCS level III also differed from GMFCS level I (all  $P < 0.05$ ). The PARA-SCI correlated significantly with accelerometer-derived minutes of MVPA per day ( $r = 0.396$ ;  $P = 0.014$ ) and per hour of monitoring time ( $r = 0.356$ ;  $P = 0.027$ ).

**CONCLUSIONS:** Our findings support the use of accelerometers to objectively measure HPA and sedentary behavior in adults with CP across the severity spectrum, regardless of cut-point implementation. The PARA-SCI is a valid tool to capture subjectively reported patterns of MVPA in adults with CP who are GMFCS levels II-V.

PMID: 25423446 [PubMed - indexed for MEDLINE]

## **Prise en charge et Accompagnement**

### **Fatigue in the mothers of children with cerebral palsy.**

Science Infos Paralyse Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 68 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

Garip Y, Ozel S Tuncer OB, Kilinc G, Seckin F, Arasil T.  
*Disabil Rehabil.* 2016 Mar 25:1-6. [Epub ahead of print]

**PURPOSE:** To evaluate fatigue in the mothers of children with cerebral palsy (CP), and to determine its associations with clinical parameters of CP, depression and quality of life (QoL).

**METHOD:** Ninety children (50 girls and 40 boys) with spastic CP and their mothers were included. Control group comprised mothers of healthy children. Gross motor function classification system (GMFCS) was used for determining functional status. Spasticity was evaluated by using modified Ashworth scale. Fatigue symptom inventory (FSI) was used for assessing maternal fatigue, Nottingham health profile (NHP) for maternal QoL, and Beck Depression Scale (BDS) for maternal depression.

**RESULTS:** Mothers of children with CP scored significantly higher in all FSI subgroups (intensity of fatigue, duration of fatigue and interference with QoL), all NHP subgroups and BDS ( $p < 0.05$ ) when compared with controls. FSI was found to be correlated with BDS and all subgroups of NHP ( $p < 0.01$ ). No association was found between FSI and clinical parameters of children with CP including age, gender, type of CP, tonus and functional impairment ( $p > 0.05$ ).

**CONCLUSIONS:** Our findings indicate that fatigue levels of mothers with CP children are higher than those with healthy children and associated with depression and deterioration in QoL in terms of physical, social and emotional functioning. This should be considered while designing a family centred rehabilitation programme for children with CP. Implications for Rehabilitation Caring for a child with cerebral palsy has psychological, social and financial impacts on families and is associated with increased levels of fatigue among mothers. The capacity of current programs and services needs to be strengthened to accommodate the needs of children with CP and their mothers in order to reduce fatigue of mothers. New programs need to be developed to provide psychosocial support for the mothers and to reduce their fatigue as they continue to care for their children. Provision of assistive technology devices (particularly suitable wheelchairs) will be useful in reduction of fatigue levels of mothers.

PMID: 27015263 [PubMed - as supplied by publisher]

#### **Improving allied health professionals' research implementation behaviours for children with cerebral palsy: protocol for a before-after study.**

Imms C, Novak I, Kerr C, Shields N, Randall M, Harvey A, Graham HK, Reddihough D.

*Implement Sci.* 2015 Feb 6;10:16. doi: 10.1186/s13012-014-0202-0.

**BACKGROUND:** Cerebral palsy is a permanent disorder of posture and movement caused by disturbances in the developing brain. It affects approximately 1 in every 500 children in developed countries and is the most common form of childhood physical disability. People with cerebral palsy may also have problems with speech, vision and hearing, intellectual difficulties and epilepsy. Health and therapy services are frequently required throughout life, and this care should be effective and evidence informed; however, accessing and adopting new research findings into day-to-day clinical practice is often delayed.

**METHODS/DESIGN:** This 3-year study employs a before and after design to evaluate if a multi-strategy intervention can improve research implementation among allied health professionals (AHPs) who work with children and young people with cerebral palsy and to establish if children's health outcomes can be improved by routine clinical assessment. The intervention comprises (1) knowledge brokering with AHPs, (2) access to an online research evidence library, (3) provision of negotiated evidence-based training and education, and (4) routine use of evidence-based measures with children and young people aged 3-18 years with cerebral palsy. The study is being implemented in four organisations, with a fifth organisation acting as a comparison site, across four Australian states. Effectiveness will be assessed using questionnaires completed by AHPs at baseline, 6, 12 and 24 months, and by monitoring the extent of use of evidence-based measures. Children's health outcomes will be evaluated by longitudinal analyses.

**DISCUSSION:** Government, policy makers and service providers all seek evidence-based information to support decision-making about how to distribute scarce resources, and families are seeking information to support intervention choices. This study will provide knowledge about what constitutes an efficient, evidence-informed service and which allied health interventions are implemented for children with cerebral palsy.

**TRIAL REGISTRATION:** Trial is not a controlled healthcare intervention and is not registered.

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PMCID: PMC4328993

PMID: 25889110 [PubMed - indexed for MEDLINE]

#### **Medical service use in children with cerebral palsy: The role of child and family factors characteristics.**

Science Infos Paralyisie Cérébrale , avril 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 69 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

Meehan EM, Reid SM, Williams KJ, Freed G, Sewell JR, Reddihough DS.  
*J Paediatr Child Health*. 2016 Apr 18. doi: 10.1111/jpc.13163. [Epub ahead of print]

**AIM:** The aim of the study was to investigate the patterns of medical service use in children with cerebral palsy (CP), taking into account child and family characteristics.

**METHODS:** Nine hundred and one parents and carers of children registered with the Victorian CP Register were invited to complete a survey. Participants were asked about their child's appointments with general practitioners and public and private paediatric medical specialists over the preceding 12 months. Information on family characteristics and finances was also collected. Data on CP severity and complexity were extracted from the CP Register.

**RESULTS:** Three hundred and fifty parents and carers (39%) participated. Of these, 83% reported that their child had  $\geq 1$  appointment with a general practitioner over the preceding 12 months, while 84% had  $\geq 1$  appointment with a public or private paediatric medical specialist. Overall, 58% of children saw 2-5 different paediatric medical specialists, while 9% had appointments with  $\geq 6$  clinicians. Children with severe and complex CP were more likely to have had  $\geq 1$  appointment with a publically funded paediatric medical specialist and had seen a greater number of different clinicians over the study period. Family characteristics were not associated with service use.

**CONCLUSIONS:** Children with CP are managed by a number of paediatric medical specialists, and they continue to see a range of specialists throughout adolescence. In Victoria, differences in service use are not based on family characteristics; instead the highest service users are those with severe and complex CP. For this group, care co-ordination and information sharing between treating clinicians are important, if gaps in care are to be avoided.

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PMID: 27088437 [PubMed - as supplied by publisher]

### **Parents' perceptions of the services provided to children with cerebral palsy in the transition from preschool rehabilitation to school-based services.**

Alsem MW, Verhoef M, Gorter JW, Langezaal LC, Visser-Meily JM, Ketelaar M.

*Child Care Health Dev*. 2016 Apr 26. doi: 10.1111/cch.12341. [Epub ahead of print]

**AIM:** To describe the course of parents' perceptions of the family centredness of rehabilitation services provided to their children with cerebral palsy (CP) before and after the transition from preschool to school-based services.

**BACKGROUND:** Parents of 59 children with CP aged 2.5 to 4.5 years filled in the 56-item Measure of Processes of Care (MPOC-56) on three occasions pre (2) and post (1) transition to school-based services. Friedman tests were used to describe changes in parents' perceptions over time. Mann-Whitney U tests were used to describe differences in course of parents' perceptions between regular school and special school or day care.

**RESULTS:** Parents' perceptions of preschool services were stable between the ages of 2.5 and 3.5 years, with a decline after transition on four of the five domains of the MPOC ( $P < 0.05$ ). The domain providing general information was scored lowest (median at baseline 3.56, IQR 2.39) compared with the four other MPOC domains, but remained stable over time. No differences in course of parental perceptions were found for school type.

**CONCLUSION:** The transition from preschool to school-based services for children with CP is associated with a decrease in parents' perception of family centredness independent of the type of school. The transition in services has a negative impact on perceived family-centred practices.

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## Domotique - Nouvelles technologies – Matériel médical

### **A comparative study: use of a Brain-computer Interface (BCI) device by people with cerebral palsy in interaction with computers.**

Heidrich RO, Jensen E, Rebelo F, Oliveira T.

*An Acad Bras Cienc*. 2015 Oct-Dec;87(4):1929-37. doi: 10.1590/0001-3765201520130413. Epub 2015 Oct 30.

This article presents a comparative study among people with cerebral palsy and healthy controls, of various ages, using a Brain-computer Interface (BCI) device. The research is qualitative in its approach. Researchers worked with Observational Case Studies. People with cerebral palsy and healthy controls were evaluated in Portugal and in Brazil.

Science Infos Paralyisie Cérébrale , avril 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 70 1 45 54 03 03 contact: Christine Doumergue [cdoumergue@lafondationmotrice.org](mailto:cdoumergue@lafondationmotrice.org)

The study aimed to develop a study for product evaluation in order to perceive whether people with cerebral palsy could interact with the computer and compare whether their performance is similar to that of healthy controls when using the Brain-computer Interface. Ultimately, it was found that there are no significant differences between people with cerebral palsy in the two countries, as well as between populations without cerebral palsy (healthy controls).

**Free Article**

PMID: 26536851 [PubMed - indexed for MEDLINE]

**Lessons learned from studying the functional impact of adaptive seating interventions for children with cerebral palsy.**

Ryan SE.

*Dev Med Child Neurol.* 2016 Mar;58 Suppl 4:78-82. doi: 10.1111/dmnc.13046.

Little empirical evidence exists about the effectiveness of assistive technology interventions for children with cerebral palsy (CP) to inform clinical practice. This article reviews what we know about the functional impact of adaptive seating interventions - a common assistive technology type recommended for children with CP. A contemporary assistive technology outcomes framework is considered as a way to model the temporality and measure the effects of seating interventions and moderating cofactors. Three research studies are profiled to illustrate different research methods, measurement approaches, and follow-up periods to learn about adaptive seating outcomes. Recommendations for future research include the adoption of common measurement indicators, consideration of quality assessment criteria, and the use of varied methodologies to generate new knowledge about functional outcomes. It is suggested that the proposed strategies will lead to new understandings, clinical applications, and ultimately improvements in the everyday lives of children with CP and their families.

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**Two Seating Systems' Effects on an Adolescent With Cerebral Palsy and Severe Scoliosis.**

Lephart K, Kaplan SL.

*Pediatr Phys Ther.* 2015 Fall;27(3):258-66. doi: 10.1097/PEP.000000000000163.

*Comment in Pediatr Phys Ther.* 2015 Fall;27(3):266. *Pediatr Phys Ther.* 2015 Fall;27(3):217.

**BACKGROUND AND PURPOSE:** To compare physiological functioning, communication switch activation, and response accuracy in a 19-year-old young man with quadriplegic cerebral palsy and neurological scoliosis using 2 seating systems within the school setting.

**METHODS:** Prospective single-subject alternating treatment design with 2 conditions: baseline phase with standard planar inserts (A1), custom-molded back with original seat (B), and return to baseline (A2). Measures included oxygen saturation (SaO<sub>2</sub>), heart rate (HR), respiration rate (RR), body temperature (BT), processing time to activate switches, and response accuracy.

**RESULTS:** SaO<sub>2</sub> levels increased from "distressed" to "normal"; variability decreased. HR, RR, and BT fluctuations decreased with the custom-molded back. Processing time decreased with increased variability, affected by subject's motivation; accuracy improved slightly. Reported social approachability and student-initiated communication increased.

**CONCLUSIONS:** SaO<sub>2</sub> increased and HR, RR, and BT fluctuations decreased with a custom-molded back. Graphing data may help determine seating effect with complex clients.

PMID: 26102166 [PubMed - indexed for MEDLINE]



**LA FONDATION MOTRICE , Fondation de recherche sur la Paralyse cérébrale**

**67 rue Vergniaud 75013 Paris**

**Tel.: + 33 1 45 54 063 03**

**[secretariat@lafondationmotrice.org](mailto:secretariat@lafondationmotrice.org)**

**[www.lafondationmotrice.org](http://www.lafondationmotrice.org)**