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Interventions and Management

1. Dev Neurorehabil. 2013 Jul 17. [Epub ahead of print]

Training of goal directed arm movements with motion interactive video games in children with cerebral palsy - A kinematic evaluation.

Sandlund M, Domellöf E, Grip H, Rönnqvist L, Häger CK.

Department of Community Medicine and Rehabilitation, Umeå University , Umeå , Sweden and.

Objective: The main aim of this study was to evaluate the quality of goal-directed arm movements in 15 children with cerebral palsy (CP) following four weeks of home-based training with motion interactive video games. A further aim was to investigate the applicability and characteristics of kinematic parameters in a virtual context in comparison to a physical context. Method: Kinematics and kinetics were captured while the children performed arm movements directed towards both virtual and physical targets. Results: The children's movement precision improved, their centre of pressure paths decreased, as did the variability in maximal shoulder angles when reaching for virtual objects. Transfer to a situation with physical targets was mainly indicated by increased movement smoothness. Conclusion: Training with motion interactive games seems to improve arm motor control in children with CP. The results highlight the importance of considering both the context and the task itself when investigating kinematic parameters.

[PMID: 23863100](#) [PubMed - as supplied by publisher]

2. Dev Med Child Neurol. 2013 Jul 15. doi: 10.1111/dmcn.12205. [Epub ahead of print]

Effectiveness of hand splints in children with cerebral palsy: a systematic review with meta-analysis.

Jackman M, Novak I, Lannin N.

School of Medicine, University of Notre Dame, Sydney, NSW, Australia.

AIM: The aim of this review was to determine the effectiveness of hand splinting for improving hand function in children with cerebral palsy (CP) and brain injury. METHOD: A systematic review with meta-analyses was conducted. Only randomized and quasi-randomized controlled trials in which all participants were children aged 0 to 18 years with CP or brain injury and a hand splint (cast, brace, or orthosis) were included. RESULTS: Six studies met the inclusion criteria. No study included participants with a brain injury; therefore, the results relate

only to CP. Five studies investigated 'non-functional hand splints' and one investigated a 'functional hand splint'. Moderate-quality evidence indicated a small benefit of non-functional hand splints plus therapy on upper limb skills over therapy alone (standard mean difference [SMD]=0.81, 95% confidence interval [CI]=0.03-1.58), although benefits were diminished 2 to 3 months after splint wearing stopped (SMD=0.35, CI -0.06 to 0.77).

INTERPRETATION: In children with CP, hand splints may have a small benefit for upper limb skills. However, results are diminished after splint wearing stops. Given the costs - potential negative cosmesis and discomfort for the child - clinicians must consider whether hand splinting is clinically worthwhile. Further methodologically sound research regarding hand splinting combined with evidence-based therapy is needed to investigate whether the small clinical effect is meaningful.

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3. Phys Occup Ther Pediatr. 2013 Jul 12. [Epub ahead of print]

Pilot Study of the Efficacy of Constraint-Induced Movement Therapy for Infants and Toddlers with Cerebral Palsy.

Lowes LP, Mayhan M, Orr T, Batterson N, Tonneman JA, Meyer A, Alfano L, Wang W, Whalen CN, Nelin MA, Lo WD, Case-Smith J.

Nationwide Children's Hospital, Columbus, Ohio, USA.

The evidence for Constraint-Induced Movement Therapy (CIMT) effectiveness for infants and toddlers with unilateral cerebral palsy is minimal. We performed a pilot study of CIMT using one-month usual care, one-month intervention, and one-month maintenance (return to usual care) phases on five infants (7- to 18-month old). For the CIMT phase, the infants received 2 hr of occupational therapy and 1 hr of parent-implemented home program for five days/week. The infants were casted for the first 23 days, and bimanual therapy was provided for the last three days. Fine motor skills for the more affected arm and gross motor skills improved significantly during the CIMT; these gains were maintained at one-month follow-up. Individual infant data show mixed effects. This pilot study provides initial evidence that CIMT is feasible for infants with unilateral cerebral palsy, and presents preliminary data for CIMT on fine and gross motor performance.

[PMID: 23848499](#) [PubMed - as supplied by publisher]

4. Dev Med Child Neurol. 2013 Jul 16. doi: 10.1111/dmcn.12231. [Epub ahead of print]

Atrophy and hypertrophy following injections of botulinum toxin in children with cerebral palsy.

Hastings-Ison T, Graham HK.

Murdoch Childrens Research Institute, Parkville, Vic., Australia.

[PMID: 23859067](#) [PubMed - as supplied by publisher]

5. Lakartidningen. 2013 Apr 10-16;110(15):762-4.

Treatment of spasticity can improve everyday life [Article in Swedish]

Tedroff K.

Astrid Lindgrens barnsjukhus, Stockholm kristina.tedroff@ki.se

[PMID: 23662537](#) [PubMed - indexed for MEDLINE]

6. NeuroRehabilitation. 2013 Jan 1;32(4):977. doi: 10.3233/NRE-130983.**Effects of functional movement strength training on strength, muscle size, kinematics, and motor function in cerebral palsy: A 3-month follow-up.**

[No authors listed]

[PMID: 23863336](#) [PubMed - in process]**7. Lakartidningen. 2013 Apr 10-16;110(15):765-6.****Positive development with follow up program for children with cerebral palsy [Article in Swedish]**

Hägglund G.

Skånes universitetssjukhus, Lund. gunnar.hagglund@med.lu.se[PMID: 23662538](#) [PubMed - indexed for MEDLINE]**8. Annu Rev Biomed Eng. 2013 Jul 11;15:383-405. doi: 10.1146/annurev-bioeng-071910-124640.****Sensors and decoding for intracortical brain computer interfaces.**

Homer ML, Nurmikko AV, Donoghue JP, Hochberg LR.

Biomedical Engineering.

Intracortical brain computer interfaces (iBCIs) are being developed to enable people to drive an output device, such as a computer cursor, directly from their neural activity. One goal of the technology is to help people with severe paralysis or limb loss. Key elements of an iBCI are the implanted sensor that records the neural signals and the software that decodes the user's intended movement from those signals. Here, we focus on recent advances in these two areas, placing special attention on contributions that are or may soon be adopted by the iBCI research community. We discuss how these innovations increase the technology's capability, accuracy, and longevity, all important steps that are expanding the range of possible future clinical applications.

[PMID: 23862678](#) [PubMed - in process]**9. Arq Neuropsiquiatr. 2013 Jul;71(7). pii: S0004-282X2013000700453. doi: 10.1590/0004-282X20130061.****Effects of early spasticity treatment on children with hemiplegic cerebral palsy: a preliminary study.**

Zonta MB, Bruck I, Puppi M, Muzzolon S, Neto Ade C, Santos LH.

Neuropediatrics Center, Clinics Hospital, Universidade Federal do Paraná, CuritibaPR, Brazil.

Objective To compare motor and functional performance of two groups of children with hemiplegic cerebral palsy (HCP). Only the study group (SG) received early treatment of spasticity with botulinum neurotoxin type A (BXT-A). **Methods** Gross Motor Function Measure (GMFM), functional performance (Pediatric Evaluation of Disability Inventory - PEDI), range of movement, gait pattern (Physician Rating Scale - PRS) and the speed of hand movements were considered. **Results** The SG, composed of 11 HCP (45.64±6.3 months), was assessed in relation to the comparison group, composed of 13 HCP (45.92±6.4 months). SG showed higher scores in four of the five GMFM dimensions, which included scores that were statistically significant for dimension B, and higher scores in five of the six areas evaluated in the PEDI. Active wrist extension, the speed of hand movements and PRS score were higher in the SG. **Conclusion** Children who received early BXT-A treatment for spasticity showed higher scores in motor and functional performance.

[PMID: 23857615](#) [PubMed - in process]

10. Dev Med Child Neurol. 2013 Jul 15. doi: 10.1111/dmcn.12225. [Epub ahead of print]**A more comprehensive overview of executive dysfunction in children with cerebral palsy: theoretical perspectives and clinical implications.**

Roy A.

Psychology Laboratory, LUNAM, Angers University, Angers, France; Neurofibromatosis Clinic and Pediatric Unit for Learning Disabilities, Nantes University Hospital, Nantes, France.

[PMID: 23855453](#) [PubMed - as supplied by publisher]

11. Pediatrics. 2013 Jul 15. [Epub ahead of print]**Characteristics of Pain in Children and Youth With Cerebral Palsy.**

Penner M, Xie WY, Binopal N, Switzer L, Fehlings D.

Department of Paediatrics, University of Toronto, Toronto, Ontario, Canada; and.

OBJECTIVES: Pain in children with cerebral palsy (CP) is underrecognized, undertreated, and negatively affects quality of life. Communication challenges and multiple pain etiologies complicate diagnosis and treatment. The primary objectives of this study were to determine the impact of pain on activities and to identify the common physician-identified causes of pain in children and youth ages 3 to 19 years across all levels of severity of CP. **METHODS:** The study design was cross-sectional, whereby children/youth aged 3 to 19 years and their families were consecutively recruited. The primary caregivers were asked to complete a one-time questionnaire, including the Health Utilities Index 3 pain subset, about the presence and characteristics of pain. The treating physician was asked to identify the presence of pain and provide a clinical diagnosis for the pain, if applicable. **RESULTS:** The response rate was 92%. Of 252 participants, 54.8% reported some pain on the Health Utilities Index 3, with 24.4% of the caregivers reporting that their child experienced pain that affected some level of activities in the preceding 2 weeks. Physicians reported pain in 38.7% and identified hip dislocation/subluxation, dystonia, and constipation as the most frequent causes of pain. **CONCLUSIONS:** One-quarter of our sample experienced pain that limited activities and participation. Clinicians should be aware that hip subluxation/dislocation and dystonia were the most common causes of pain in children/youth with CP in this study. Potential causes of pain should be identified and addressed early to mitigate the negative impact of pain on quality of life.

[PMID: 23858420](#) [PubMed - as supplied by publisher]

12. Saudi Med J. 2013 Jul;34(7):695-700.**Percutaneous endoscopic gastrostomy tube placement in children with neurodevelopmental disabilities. Parents' perspectives.**

Alsaggaf AH, Jan MM, Saadah OI, Alsaggaf HM.

Department of Pediatrics, Faculty of Medicine, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.

OBJECTIVE: To study the attitudes of parents toward percutaneous endoscopic gastrostomy (PEG) tube placement and identify contributing factors to their negative attitudes. **METHODS:** Thirty consecutive parents were included retrospectively through a single endoscopy unit at the King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia from January to July 2012. A structured 25-item questionnaire was designed to examine their demographics, attitudes, and experience with the PEG procedure. **RESULTS:** Patients' ages were 3-19 years (mean: 10.2), mostly with severe cerebral palsy (77%). Their PEG tubes were inserted 2-144 months (mean: 39) prior to the encounter. Only 43% of the parents felt informed and most (73%) had negative attitudes toward the procedure, which was associated with significant delays ($p=0.016$). After the procedure, most parents (67%) reported a better-than-expected experience, which was associated with their information levels ($p=0.03$). Most parents (80%) regretted not having the PEG tube placed earlier. This depended on their information level, as those who were not informed were more likely to have strong regrets when compared to those informed (82% versus

42%, $p=0.008$). **CONCLUSION:** Most parents are not well-informed regarding the PEG procedure, which affects their expectations and experiences. Most parents found the experience better than what they expected and regretted not having carried it out earlier.

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Prevention and Cure

13. Early Hum Dev. 2013 Jul 12. pii: S0378-3782(13)00142-4. doi: 10.1016/j.earlhumdev.2013.06.004. [Epub ahead of print]

Early prediction of cerebral palsy after neonatal intensive care using motor development trajectories in infancy.

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Neonatal intensive care unit (NICU) patients are at high risk for developmental disabilities such as cerebral palsy (CP). Early identification of CP is essential to effective rehabilitation, but diagnosis is often delayed, especially in preterm infants. We hypothesized that through the longitudinal evaluation of motor trajectories in the NICU follow-up clinic, we could distinguish infants who develop CP by 3 years of age. **STUDY DESIGN AND SUBJECTS:** This was a retrospective study of 606 patients in the NICU Follow-up Clinic at Vanderbilt University with birth weight <1500g or a diagnosis of hypoxic ischemic encephalopathy. **OUTCOMES MEASURES:** Assessments included neurologic exams, the Developmental Assessment of Young Children (DAYC), the Bayley Scales of Infant Development (BSID) and the Gross Motor Function Classification Scale. **RESULTS:** A decrease in DAYC scores between 6 and 12 months was present in preterm and term infants later diagnosed with CP, but not in children without CP (-23 vs. +1.5, $p<0.001$). DAYC score decreases in infancy were highly predictive of later CP ($p<0.001$). BSID scores quantified severe motor delays but did not add to prediction of CP diagnosis. **CONCLUSION:** Standardized assessments of motor milestones quantitatively predict the risk of CP in former NICU patients by 12 months, allowing for timely diagnosis, counseling and therapy in high-risk infants.

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14. Arch Dis Child Fetal Neonatal Ed. 2013 Jul 17. [Epub ahead of print]

Do very preterm twins and singletons differ in their neurodevelopment at 5 years of age?

Bodeau-Livinec F, Zeitlin J, Blondel B, Arnaud C, Fresson J, Burguet A, Subtil D, Marret S, Rozé JC, Marchand-Martin L, Ancel PY, Kaminski M; On behalf of the EPIPAGE group.

Epidemiology and Biostatistics, EHESP Rennes, Sorbonne Paris Cité, , Rennes, France.

OBJECTIVE: Twins have inconsistently shown poorer outcomes than singletons. Although a high proportion of twins are born very preterm, data are sparse on the long-term outcomes in very preterm twins. The objective of this study was to compare mortality and neurodevelopmental outcomes of very preterm singletons and twins and to study outcomes in relation to factors specific to twins. **DESIGN:** Birth cohort study Etude Epidémiologique sur les Petits Ages Gestationnels (EPIPAGE). **SETTING:** Nine regions in France. **PATIENTS:** All very preterm live births occurring from 22 to 32 weeks of gestation in all maternity wards of nine French regions in 1997 ($n=2773$). **MAIN OUTCOMES MEASURES:** Neurodevelopmental status, including cerebral palsy, and a cognitive assessment with the Kaufman Assessment Battery for Children, with scores on the Mental Processing Composite (MPC) scale, was available for 1732 and 1473 children at 5 years of age, respectively. **RESULTS:** Among live births, twins had higher

hospital mortality than singletons (adjusted (a)OR: 1.4 (95% CI 1.1 to 1.9)). Among survivors, there was no crude difference at 5 years between twins and singletons in the prevalence of cerebral palsy (8.0% vs 9.1%, respectively), MPC <70 (9.5% vs 11.1%) and mean MPC (94.6 vs 94.4). However, after adjustment for sex, gestational age, intrauterine growth restriction and social factors, twins were more likely to have lower MPC scores (mean difference: -2.4 (95% CI -4.8 to 0.01)). Live born twins had a higher risk of mortality when birth weight discordance was present (aOR:2.9 (95% CI 1.7 to 4.8)), but there were no differences in long-term outcomes. **CONCLUSIONS:** Compared with very preterm singletons, twins had higher mortality, no difference with respect to severe deficiencies, but slightly lower MPC scores at 5 years.

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15. *Pediatr Neurol.* 2013 Aug;49(2):119-23. doi: 10.1016/j.pediatrneurol.2013.04.026.

Five Novel Mutations in ARG1 Gene in Chinese Patients of Argininemia.

Wu TF, Liu YP, Li XY, Wang Q, Ding Y, Ma YY, Song JQ, Yang YL.

Department of Pediatrics, Peking University First Hospital, Beijing, China.

BACKGROUND: Argininemia is an autosomal recessive genetic disorder caused by hepatocyte arginase deficiency. It could be detected by blood amino acids analysis (high arginine) and confirmed by molecular diagnosis. The clinical manifestations in patients are similar to cerebral palsy so the diagnosis is usually much delayed. Reports of argininemia from mainland China are few, and genetic analyses have not been reported. **PATIENTS AND METHODS:** Five Chinese patients with argininemia were investigated. They had progressive spastic tetraplegia, poor physical growth from 1 month to 4 years. When argininemia was found at the ages of 4 to 12 years, four of patients had mental retardation, and three had seizures. **RESULTS:** Elevated blood arginine and significantly decreased erythrocyte arginase activity in five patients confirmed the diagnosis of arginase deficiency. Liver dysfunction was found in four patients, two of whom had mildly elevated blood ammonia levels. Cranial magnetic resonance imaging showed progressive cerebral atrophy in three patients. Six mutations in the ARG1 gene were identified, of which only one (c.703 G>A, p.G235R) in exon 7 has been reported before; c.34 G>T (p.G12X) in exon 1, c.67delG (p.G23fsX31) in exon 2, c.539G>C (p.R180 T) in exon 5, c.374C>T (p.A125 V) in exon 4, and c.646-649del CTCA (p.T215fsX219) in exon 6 were novel mutations. **CONCLUSIONS:** Argininemia is one of the few treatable causes of pediatric spastic paraparesis. Early metabolic investigation is very important to reach a diagnosis and better outcome. Five Chinese patients with late-diagnosed argininemia were reported. The mutation spectrum of ARG1 gene should be different from other populations.

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16. *Early Hum Dev.* 2013 Jul 11. pii: S0378-3782(13)00145-X. doi: 10.1016/j.earlhumdev.2013.06.007. [Epub ahead of print]

Assessment of motor behaviour in high-risk-infants at 3months predicts motor and cognitive outcomes in 10years old children.

Fjørtoft T, Grunewaldt KH, Løhaugen GC, Mørkved S, Skranes J, Evensen KA.

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BACKGROUND: The general movement assessment has mainly been used to identify children with cerebral palsy (CP). A detailed assessment of quality of infant motor repertoire using parts of the "Assessment of Motor Repertoire - 3 to 5Months" which is based on Prechtl's general movement assessment can possibly identify later motor and cognitive problems in children without CP. **AIMS:** This study aims to determine whether analysis of quality of infant motor repertoire has predictive value for motor and cognitive outcomes at age 10 in children at risk for later neurological impairment. **STUDY DESIGN:** A longitudinal study design was used. **SUBJECTS:** Video-recordings of

40 "neurologically high-risk" infants at 14weeks post-term age were analysed with respect to motor repertoire. OUTCOME MEASURES: Fidgety movements were classified as present or absent. Quality of concurrent motor repertoire was classified as normal if smooth and fluent and abnormal if jerky, monotonous or stiff. Poor motor outcome was defined as a score =5th centile on the Movement-Assessment-Battery-2, while poor cognitive outcome as total IQ <85 on Wechsler Intelligence Scale-III. RESULTS: Among the high-risk children with presence of fidgety movements, poor motor and/or cognitive outcome at 10years was identified by abnormal concurrent motor repertoire at 14weeks post-term age in 86% (95% CI: 0.60-0.96) of the children. On the other hand, 71% (95% CI: 0.47-0.87) of those with normal motor and cognitive outcomes were identified by presence of fidgety movements and normal motor repertoire. CONCLUSIONS: Assessment of quality of infant motor repertoire may be a valuable early clinical marker for later impaired motor and cognitive outcomes in high-risk children who do not develop CP.

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