Cerebral Palsy Alliance

NEWS
Cerebral Palsy Research

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## Interventions and Management

**1. Dev Med Child Neurol. 2014 Oct 15. doi: 10.1111/dmcn.12596. [Epub ahead of print]**

**Constraint therapy, the panacea for unilateral cerebral palsy?**

Hoare B.

PMID: 25315321 [PubMed - as supplied by publisher]

**2. Phys Occup Ther Pediatr. 2014 Oct 15. [Epub ahead of print]**

**Home Program Intervention Effectiveness Evidence.**

Novak I1, Berry J.

PMID: 25317927 [PubMed - as supplied by publisher]

**3. J Biomech. 2014 Oct 10. pii: S0021-9290(14)00477-1. doi: 10.1016/j.jbiomech.2014.09.011. [Epub ahead of print]**

**Ground reaction forces and lower-limb joint kinetics of turning gait in typically developing children.**

Dixon PC1, Stebbins J2, Theologis T3, Zavatsky AB1.

Turning is a common locomotor task essential to daily activity; however, very little is known about the forces and moments responsible for the kinematic adaptations occurring relative to straight-line gait in typically developing children. Thus, the aims of this study were to analyse ground reaction forces (GRFs), ground reaction free vertical torque (TZ), and the lower-limb joint kinetics of 90° outside (step) and inside (spin) limb turns. Step, spin, and straight walking trials from fifty-four typically developing children were analysed. All children were fit with the Plug-in Gait and Oxford Foot Model marker sets while walking over force plates embedded in the walkway. Net internal joint moments and power were computed via a standard inverse dynamics approach. All dependent variables were statistically analysed over the entire curves using the mean difference 95% bootstrap confidence band approach. GRFs were directed medially for step turns and laterally for spin turns during the turning phase. Directions were reversed and magnitudes decreased during the approach phase. Step turns showed reduced ankle power generation, while spin turns showed large TZ. Both strategies required large knee and hip coronal and transverse

plane moments during swing. These kinetic differences highlight adaptations required to maintain stability and reorient the body towards the new walking direction during turning. From a clinical perspective, turning gait may better reveal weaknesses and motor control deficits than straight walking in pathological populations, such as children with cerebral palsy, and could potentially be implemented in standard gait analysis sessions.



PMID: 25311452 [PubMed - as supplied by publisher]

**4. Braz J Phys Ther. 2014 Oct 10;0:0. [Epub ahead of print]**

**Effect of a single session of transcranial direct-current stimulation on balance and spatiotemporal gait variables in children with cerebral palsy: A randomized sham-controlled study.**

Grecco LA1, Duarte NA1, Zanon N2, Galli M3, Fregni F4, Oliveira CS1.

Background: Transcranial direct-current stimulation (tDCS) has been widely studied with the aim of enhancing local synaptic efficacy and modulating the electrical activity of the cortex in patients with neurological disorders. Objective: The purpose of the present study was to determine the effect of a single session of tDCS regarding immediate changes in spatiotemporal gait and oscillations of the center of pressure (30 seconds) in children with cerebral palsy (CP). Method: A randomized controlled trial with a blinded evaluator was conducted involving 20 children with CP between six and ten years of age. Gait and balance were evaluated three times: Evaluation 1 (before the stimulation), Evaluation 2 (immediately after stimulation), and Evaluation 3 (20 minutes after the stimulation). The protocol consisted of a 20-minute session of tDCS applied to the primary motor cortex at an intensity of 1 mA. The participants were randomly allocated to two groups: experimental group - anodal stimulation of the primary motor cortex; and control group - placebo transcranial stimulation. Results: Significant reductions were found in the experimental group regarding oscillations during standing in the anteroposterior and mediolateral directions with eyes open and eyes closed in comparison with the control group ($p<0.05$). In the intra-group analysis, the experimental group exhibited significant improvements in gait velocity, cadence, and oscillation in the center of pressure during standing ($p<0.05$). No significant differences were found in the control group among the different evaluations. Conclusion: A single session of tDCS applied to the primary motor cortex promotes positive changes in static balance and gait velocity in children with cerebral palsy.

PMID: 25317766 [PubMed - as supplied by publisher] Free full text

**5. NeuroRehabilitation. 2014 Oct 15. [Epub ahead of print]**

**Gait training reduces ankle joint stiffness and facilitates heel strike in children with Cerebral Palsy.**

Willerslev-Olsen M1, Lorentzen J1, Nielsen JB2.

BACKGROUND: Foot drop and toe walking are frequent concerns in children with cerebral palsy (CP). Increased stiffness of the ankle joint muscles may contribute to these problems. OBJECTIVE: Does four weeks of daily home based treadmill training with incline reduce ankle joint stiffness and facilitate heel strike in children with CP? METHODS: Seventeen children with CP (4-14 years) were recruited. Muscle stiffness and gait ability were measured twice before and twice after training with an interval of one month. Passive and reflex-mediated stiffness were measured by a dynamometer which applied stretches below and above reflex threshold. Gait kinematics were recorded by 3-D video-analysis during treadmill walking. Foot pressure was measured by force-sensitive foot soles during treadmill and over-ground walking. RESULTS: Children with increased passive stiffness showed a significant reduction in stiffness following training ($P = 0.01$). Toe lift in the swing phase ($P = 0.014$) and heel impact ($P = 0.003$) increased significantly following the training during both treadmill and over-ground walking. CONCLUSIONS: Daily intensive gait training may influence the elastic properties of ankle joint muscles and facilitate toe lift and heel strike in children with CP. Intensive gait training may be beneficial in preventing contractures and maintain gait ability in children with CP.

PMID: 25318785 [PubMed - as supplied by publisher]

**6. NeuroRehabilitation. 2014 Oct 15. [Epub ahead of print]**

**Gait cycle and plantar pressure distribution in children with cerebral palsy: Clinically useful outcome measures for a management and rehabilitation.**

Nsenga Leunkeu A1, Lelard T1, Shephard RJ2, Doutrellot PL3, Ahmaidi S1.

BACKGROUND: Information on altered foot pressures during ambulation would clarify how far limb deformities modify walking patterns in cerebral palsy (CP), and whether such data can inform prognosis and guide rehabilitation. OBJECTIVE: To compare the extent of plantar pressures during walking between children with CP and their able-bodied (AB) peers. METHODS: Twenty-five children/adolescents (10 with hemiplegia, 5 with diplegia, and 10 AB, respective ages 13.0 ± 1.9, 13.0 ± 0.6 and 14.0 ± 0.7 years) walked a 12 m line at a self-selected speed. Spatio-temporal parameters and peak in-shoe plantar pressures were recorded for both feet, using the Parotec analysis system. RESULTS: Walking speeds (m·-1) differed significantly between groups (0.65 ± 0.13, hemiplegia, 0.93 ± 0.22 diplegia and 1.26 ± 0.05 AB), with shorter stride lengths in CP. Contact time, double support time and step duration were also shorter in hemiplegia. Plantar pressures differed substantially and consistently between AB and CP, with increased medial heel pressures in hemiplegia, and reduced hallux and lateral heel pressures but increased lateral, medial mid-foot and first metatarsal pressures in diplegia. CONCLUSIONS: Substantial alterations in spatio-temporal parameters (greater in hemiplegia than in diplegia) and plantar pressure distribution reflect attempts to compensate for poor stability of posture in CP. Further study of these adaptive changes holds clinical promise in providing data relevant to the design of orthotics, determinations of prognosis and the planning of neurorehabilitation.

PMID: 25318772 [PubMed - as supplied by publisher]

**7. Dev Med Child Neurol. 2014 Oct 16. doi: 10.1111/dmcn.12608. [Epub ahead of print]**

**Heavy going but making progress: challenges for increasing physical activity in young people with cerebral palsy.**

Maher C.

PMID: 25318862 [PubMed - as supplied by publisher]

**8. Bone. 2014 Oct 11. pii: S8756-3282(14)00368-8. doi: 10.1016/j.bone.2014.10.003. [Epub ahead of print]**

**Adults with spastic cerebral palsy have lower bone mass than those with dyskinetic cerebral palsy.**

Kim W1, Lee SJ1, Yoon YK2, Shin YK3, Cho SR4, Rhee Y5.

Adults with cerebral palsy (CP) are known to have low bone mass with an increased risk of fragility fracture. CP is classified into two major types: spastic (pyramidal) and dyskinetic (extrapyramidal). Spastic CP is the most common and is characterized by muscle hypertonicity and impaired neuromuscular control. By contrast, dyskinetic CP is characterized by mixed muscle tone with involuntary movements. The aim of this study was to elucidate the relationship between bone metabolism and subtype of CP. Fifty-eight adults with CP (aged 18 to 49years, mean age 33.2years; 32 men, 26 women) were included in this cross-sectional analysis. Lumbar spine and femoral bone mineral density (BMD) Z-scores were measured. Bone markers, including C-telopeptide of type I collagen (CTx) and osteocalcin (OCN), were also analyzed. Among these participants, 30 had spastic CP and 28 had dyskinetic CP. The Z-scores of lumbar spine BMD did not differ between the two types. However, the Z-scores of femur trochanteric BMD were significantly lower in participants with spastic CP than in those with dyskinetic CP (-1.6±1.2 vs. -0.9±1.1, $p<0.05$). Seventy-four percent of participants with either type of CP had abnormally elevated CTx, while about 90% of participants showed normal OCN levels. When participants were subclassified into nonambulatory and ambulatory groups, the nonambulatory group had significantly lower BMD in the femur, including the trochanteric and total regions, whether they were spastic or dyskinetic ($p<0.05$). Because the type of CP affects bone mass, nonambulatory spastic CP participants showed the lowest total hip region BMD among the four groups. These results reveal that reduced weight bearing and immobility related to CP causes a negative bone balance because of increased bone resorption, which leads to a lower bone mass. In addition, hypertonicity of the affected limbs in participants with spastic CP resulted in lower bone mass than in those with dyskinetic CP. Type of

CP and degree of ambulatory function in adults with CP should be regarded as important factors affecting bone metabolism.



PMID: 25316282 [PubMed - as supplied by publisher]

**9. Eur Neurol. 2014 Oct 14;72(5-6):340-348. [Epub ahead of print]**

**Young Adults with Dyskinetic Cerebral Palsy Improve Subjectively on Pallidal Stimulation, but not in Formal Dystonia, Gait, Speech and Swallowing Testing.**

Koy A1, Pauls KA, Flossdorf P, Becker J, Schönau E, Maarouf M, Liebig T, Fricke O, Fink GR, Timmermann L.

Background: Pharmacological treatment of dyskinetic cerebral palsy (CP) is often ineffective. Data about outcome of deep brain stimulation (DBS) in these patients remains scarce. Methods: Eight patients with dyskinetic CP and DBS of the Globus Pallidus internus were investigated. Using pre- and postoperative videos the severity of dystonia and changes thereof during standardized settings ('on') and after the stimulator had been switched off ('off') were assessed using the Burke-Fahn-Marsden Dystonia Rating Scale (BFMDRS). Furthermore, subjective impression (SI) of the extent of postoperative change as well as gait (Leonardo Mechanograph® Gangway), speech (Frenchay Dysarthria) and swallowing performances (fiberoptic laryngoscopy) were assessed during 'on' and 'off'. Results: When comparing pre- and postoperative as well as 'on' and 'off', the BFMDRS and most of the gait, speech, and swallowing parameters did not differ significantly. In contrast, patients reported significant improvement of their SI postoperatively (3.1 on a 10-point-scale). Conclusion: Data show that our CP-patients did not benefit from GPi-DBS when tested formally for dystonia, gait, speech and swallowing. In stark contrast, these patients reported significant subjective improvement. Taken together, and in light of current unsatisfactory medical treatment options, our data suggest that further assessment of the effects of GPi-DBS in dyskinetic CP is warranted. © 2014 S. Karger AG, Basel.

PMID: 25322688 [PubMed - as supplied by publisher]

**10. J Neurosurg Pediatr. 2014 Oct 17:1-9. [Epub ahead of print]**

**Deep brain stimulation for the treatment of childhood dystonic cerebral palsy.**

Keen JR1, Przekop A, Olaya JE, Zouros A, Hsu FP.

Object Deep brain stimulation (DBS) for dystonic cerebral palsy (CP) has rarely been reported, and its efficacy, though modest when compared with that for primary dystonia, remains unclear, especially in the pediatric population. The authors present a small series of children with dystonic CP who underwent bilateral pallidal DBS, to evaluate the treatment's efficacy and safety in the pediatric dystonic CP population. Methods The authors conducted a retrospective review of patients (under the age of 18 years) with dystonic CP who had undergone DBS of the bilateral globus pallidus internus between 2010 and 2012. Two of the authors independently assessed outcomes using the Barry-Albright Dystonia Scale (BADS) and the Burke-Fahn-Marsden Dystonia Rating Scale-movement (BFMDRS-M). Results Five children were diagnosed with dystonic CP due to insults occurring before the age of 1 year. Mean age at surgery was 11 years (range 8-17 years), and the mean follow-up was 26.6 months (range 2-42 months). The mean target position was 20.6 mm lateral to the midcommissural point. The mean preoperative and postoperative BADS scores were 23.8 ± 4.9 (range 18.5-29.0) and 20.0 ± 5.5 (range 14.5-28.0), respectively, with a mean overall percent improvement of 16.0% (p = 0.14). The mean preoperative and postoperative BFMDRS-M scores were 73.3 ± 26.6 (range 38.5-102.0) and 52.4 ± 21.5 (range 34.0-80.0), respectively, with a mean overall percent improvement of 28.5% (p = 0.10). Those stimulated at least 23 months (4 patients) improved 18.3% (p = 0.14) on the BADS and 30.5% (p = 0.07) on the BFMDRS-M. The percentage improvement per body region yielded conflicting results between rating scales; however, BFMDRS-M scores for speech showed some of the greatest improvements. Two patients required hardware removal (1 complete system, 1 unilateral electrode) within 4 months after implantation because of infections that resolved with antibiotics. Conclusions All postoperative dystonia rating scale scores improved with pallidal stimulation, and the greatest improvements occurred in those stimulated the longest. The results were modest but comparable to findings in other similar series. Deep brain stimulation remains a viable treatment option for childhood dystonic CP, although

young children may have an increased risk of infection. Of particular note, improvements in the BFMDRS-M subscores for speech were comparable to those for other muscle groups, a finding not previously reported.

PMID: 25325412 [PubMed - as supplied by publisher]

**11. Vopr Kurortol Fizioter Lech Fiz Kult. 2014 Jul-Aug;(4):43-6.**

**The comparative effectiveness of the application of various methods for electrical muscle stimulation in the patients presenting with juvenile cerebral palsy [Article in Russian]**

[No authors listed]

We studied the clinical effectiveness of rehabilitation of 168 patients presenting with juvenile cerebral palsy in the form of spastic diplegia who received the comprehensive rehabilitative treatment including therapeutic physical exercises, paraffin applications, general hydromassage baths, manual massage and electrical stimulation of weakened muscles with the use of the following devices: <SCENAR 97> for group 1 of the patients (n=38), <Mioneyroton-bike> for group 2 (n=43), <ACORD-Multimiostim> for group 3 (n=45), and <Amplipuls-5> for group 4 (n=38). The study yielded the significantly higher scores in the <disequilibrium> test for groups 1,2, and 3 compared with group 4 ($p<0.05$). In all the groups, with the exception of group 4, a significant ($p<0.05$) increase in the range of ankle joint motions was observed in conjunction with the lowering of the spastic calf muscle tone. After a course of rehabilitation, the overall clinical effectiveness did not differ significantly between the groups, viz. it was documented in 36 (94.7%) patients of group 1, in 39 (92.8%) patients of group 2, in 43 (95.6%) patients of group 3, and in 38 (88.3%) patients of group 4. However, the estimates of <improvements were as follows: 21 (55.3%) patients in group 1, 33 (78.5%) patients in group 2, 37 (82.2%) in group 3, and 13 (30.2%) patients in group 4. These findings give evidence of high clinical effectiveness of functional electrical stimulation with the use of <Mioneyroton-bikes and ,<ACORD-Multimiostim> devices for the combined rehabilitation of the patients suffering from juvenile cerebral palsy in the form of spastic diplegia.

PMID: 25314769 [PubMed - in process]

**12. Yonsei Med J. 2014 Nov 1;55(6):1736-42. doi: 10.3349/ymj.2014.55.6.1736.**

**Effects of hippotherapy on gross motor function and functional performance of children with cerebral palsy.**

Park ES1, Rha DW1, Shin JS2, Kim S3, Jung S4.

PURPOSE: The purpose of our study was to investigate the effects of hippotherapy on gross motor function and functional performance in children with spastic cerebral palsy (CP). MATERIALS AND METHODS: We recruited 34 children (M:F=15:19, age: 3-12 years) with spastic CP who underwent hippotherapy for 45 minutes twice a week for 8 weeks. Twenty-one children with spastic CP were recruited for control group. The distribution of gross motor function classification system level and mean age were not significantly different between the two groups. Outcome measures, including the Gross Motor Function Measure (GMFM)-66, GMFM-88 and the Pediatric Evaluation of Disability Inventory: Functional Skills Scale (PEDI-FSS), were assessed before therapy and after the 8-weeks intervention as outcome measures. RESULTS: There were no significant differences between intervention and control groups in mean baseline total scores of GMFM-66, GMFM-88 or PEDI-FSS. After the 8-weeks intervention, mean GMFM-66 and GMFM-88 scores were significantly improved in both groups. However, the hippotherapy group had significantly greater improvement in dimension E and GMFM-66 total score than the control group. The total PEDI-FSS score and the sub-scores of its 3 domains were significantly improved in the hippotherapy group, but not in the control group. CONCLUSION: The results of our study demonstrate the beneficial effects of hippotherapy on gross motor function and functional performance in children with CP compared to control group. The significant improvement in PEDI-FSS scores suggests that hippotherapy may be useful to maximize the functional performance of children with CP.

PMID: 25323914 [PubMed - in process] Free full text

**13. Am Orthopt J. 2014;64(1):17-20. doi: 10.3368/aoj.64.1.17.**

**Strabismus in cerebral palsy: when and why to**

Collins ML.

Cerebral palsy (CP) is the most common physical disability in children. Orthoptists and ophthalmologists who care for children with CP know that strabismus is a common feature. This paper reviews the literature on strabismus in patients with CP, and then provides summary data and recommendations for management of these patients. The incidence of strabismus in patients with CP, especially in patients with spastic diplegia, is much higher than in neurologically normal children. Esotropia is the most common ocular misalignment. CP patients with strabismus benefit from nonsurgical treatment and should be treated promptly. Strabismus surgery should be considered in CP patients for psychosocial reasons as well as for potential successful ocular realignment and restoration of binocular vision. The literature is lacking in a long-term natural history study, prospective strabismus surgery studies, and long-term outcome studies of strabismus management in patients with CP.



PMID: 25313106 [PubMed - in process]

**14. Disabil Health J. 2014 Sep 16. pii: S1936-6574(14)00142-3. doi: 10.1016/j.dhjo.2014.09.002. [Epub ahead of print]**

**Functional difficulties and school limitations of children with epilepsy: Findings from the 2009-2010 National Survey of Children with Special Health Care Needs.**

Pastor PN1, Reuben CA2, Kobau R3, Helmers SL4, Lukacs S2.

BACKGROUND: Epilepsy is a common serious neurologic disorder in children. However, most studies of children's functional difficulties and school limitations have used samples from tertiary care or other clinical settings. OBJECTIVE: To compare functional difficulties and school limitations of a national sample of US children with special health care needs (CSHCN) with and without epilepsy. METHODS: Data from the 2009-2010 National Survey of CSHCN for 31,897 children aged 6-17 years with and without epilepsy were analyzed for CSHCN in two groups: 1) CSHCN with selected comorbid conditions (intellectual disability, cerebral palsy, autism, or traumatic brain injury) and 2) CSHCN without these conditions. Functional difficulties and school limitations, adjusted for the effect of sociodemographic characteristics, were examined by epilepsy and comorbid conditions. RESULTS: Three percent of CSHCN had epilepsy. Among CSHCN with epilepsy 53% had comorbid conditions. Overall CSHCN with epilepsy, both with and without comorbid conditions, had more functional difficulties than CSHCN without epilepsy. For example, after adjustment for sociodemographic characteristics a higher percentage of children with epilepsy, compared to children without epilepsy, had difficulty with communication (with conditions: 53% vs. 37%, without conditions: 13% vs. 5%). Results for school limitations were similar. After adjustment, a higher percentage of children with epilepsy, compared to children without epilepsy, missed 11 + school days in the past year (with conditions: 36% vs. 18%, without conditions: 21% vs. 15%). CONCLUSION: CSHCN with epilepsy, compared to CSHCN without epilepsy, were more likely to have functional difficulties and limitations in school attendance regardless of comorbid conditions.


PMID: 25312691 [PubMed - as supplied by publisher]

**15. Front Neurol. 2014 Oct 1;5:197. doi: 10.3389/fneur.2014.00197. eCollection 2014.**

**Technology-aided assessment of sensorimotor function in early infancy.**

Allievi AG1, Arichi T2, Gordon AL3, Burdet E1.

There is a pressing need for new techniques capable of providing accurate information about sensorimotor function during the first 2years of childhood. Here, we review current clinical methods and challenges for assessing motor

function in early infancy, and discuss the potential benefits of applying technology-assisted methods. We also describe how the use of these tools with neuroimaging, and in particular functional magnetic resonance imaging (fMRI), can shed new light on the intra-cerebral processes underlying neurodevelopmental impairment. This knowledge is of particular relevance in the early infant brain, which has an increased capacity for compensatory neural plasticity. Such tools could bring a wealth of knowledge about the underlying pathophysiological processes of diseases such as cerebral palsy; act as biomarkers to monitor the effects of possible therapeutic interventions; and provide clinicians with much needed early diagnostic information.

PMID: 25324827 [PubMed] PMCID: PMC4181230 Free PMC Article

# Prevention and Cure

**16. J Pediatr. 2014 Aug;165(2):398-400.e3. doi: 10.1016/j.jpeds.2014.04.007. Epub 2014 May 14.**

**School-age outcomes following a randomized controlled trial of magnesium sulfate for neuroprotection of preterm infants.**

Chollat C1, Enser M2, Houivet E3, Provost D2, Bénichou J3, Marpeau L4, Marret S5.

In a French randomized trial, children at school-age demonstrated no evidence of harm from fetal exposure to MgSO4 before very preterm birth. Motor dysfunction/death, qualitative behavioral disorders, cognitive difficulties, school grade repetition, and education services were decreased in the children exposed to MgSO4, although the differences were not significant.



PMID: 24837863 [PubMed - indexed for MEDLINE]

**17. Nat Rev Neurol. 2014 Oct 14. doi: 10.1038/nrneurol.2014.187. [Epub ahead of print]**

**Maternal immune activation and abnormal brain development across CNS disorders.**

Knuesel I1, Chicha L2, Britschgi M1, Schobel SA1, Bodmer M3, Hellings JA4, Toovey S5, Prinssen EP1.

Epidemiological studies have shown a clear association between maternal infection and schizophrenia or autism in the progeny. Animal models have revealed maternal immune activation (mIA) to be a profound risk factor for neurochemical and behavioural abnormalities in the offspring. Microglial priming has been proposed as a major consequence of mIA, and represents a critical link in a causal chain that leads to the wide spectrum of neuronal dysfunctions and behavioural phenotypes observed in the juvenile, adult or aged offspring. Such diversity of phenotypic outcomes in the mIA model are mirrored by recent clinical evidence suggesting that infectious exposure during pregnancy is also associated with epilepsy and, to a lesser extent, cerebral palsy in children. Preclinical research also suggests that mIA might precipitate the development of Alzheimer and Parkinson diseases. Here, we summarize and critically review the emerging evidence that mIA is a shared environmental risk factor across CNS disorders that varies as a function of interactions between genetic and additional environmental factors. We also review ongoing clinical trials targeting immune pathways affected by mIA that may play a part in disease manifestation. In addition, future directions and outstanding questions are discussed, including potential symptomatic, disease-modifying and preventive treatment strategies.

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