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Interventions and Management

1. Phys Occup Ther Pediatr. 2014 Nov 6. [Epub ahead of print]

Bimanual Fine Motor Function (BFMF) Classification in Children with Cerebral Palsy: Aspects of Construct and Content Validity.

Elvrum AK1, Andersen GL, Himmelmann K, Beckung E, Ohrvall AM, Lydersen S, Vik T.

The Bimanual Fine Motor Function (BFMF) is currently the principal classification of hand function recorded by the Surveillance of Cerebral Palsy in Europe (SCPE) register. The BFMF is used in a number of epidemiological studies, but has not yet been validated. Aims: To examine aspects of construct and content validity of the BFMF. Methods and Results: Construct validity of the BFMF was assessed by comparison with the Manual Ability Classification System (MACS) using register-based data from 539 children born 1999-2003 (304 boys; 4-12 years). The high correlation with the MACS (Spearman's rho = 0.89, CI: 0.86-0.91, p<.001) supports construct validity of the BFMF. The content of the BFMF was appraised through literature review, and by using the ICF-CY as a framework to compare the BFMF and MACS. The items hold, grasp and manipulate were found to be relevant to describe increasingly advanced fine motor abilities in children with CP, but the description of the BFMF does not state whether it is a classification of fine motor capacity or performance. Conclusion: Our results suggest that the BFMF may provide complementary information to the MACS regarding fine motor function and actual use of the hands, particularly if used as a classification of fine motor capacity.

[PMID: 25374154](https://pubmed.ncbi.nlm.nih.gov/25374154/) [PubMed - as supplied by publisher]

2. Neural Regen Res. 2012 Nov 25;7(33):2632-9. doi: 10.3969/j.issn.1673-5374.2012.33.009.

Therapies for children with cerebral palsy: A Web of Science-based literature analysis.

Mu Y, Li N, Guan L, Wang C, Shang S, Wang Y.

OBJECTIVE: To identify global research trends in three therapies for children with cerebral palsy. **DATA RETRIEVAL:** We performed a bibliometric analysis of studies on therapies for children with cerebral palsy from 2002 to 2011 retrieved from Web of Science. **SELECTION CRITERIA:** **INCLUSION CRITERIA:** (a) peer-reviewed published articles on botulinum toxin, constraint-induced movement therapy, or acupuncture for children with cerebral palsy indexed in Web of Science; (b) original research articles, reviews, meeting s, proceedings papers, book chapters, editorial material, and news items; and (c) publication between 2002 and 2011. **EXCLUSION CRITERIA:** (a) articles that required manual searching or telephone access; (b) documents that were not

published in the public domain; and (c) a number of corrected papers from the total number of articles. **MAIN OUTCOME MEASURES:** (1) Number of publications on the three therapies; (2) annual publication output, distribution by journals, distribution by institution, and top-cited articles on botulinum toxin; (3) annual publication output, distribution by journal, distribution by institution, and top-cited articles on constraint-induced movement therapy; (4) annual publication, distribution by journal, distribution by institution, and top-cited articles on acupuncture. **RESULTS:** This analysis, based on Web of Science articles, identified several research trends in studies published over the past 10 years of three therapies for children with cerebral palsy. More articles on botulinum toxin for treating children with cerebral palsy were published than the articles regarding constraint-induced movement therapy or acupuncture. The numbers of publications increased over the 10-year study period. Most papers appeared in journals with a focus on neurology, such as *Developmental Medicine and Child Neurology* and *Journal of Child Neurology*. Research institutes publishing on botulinum toxin treatments for this population are mostly in the Netherlands, the United States of America, and Australia; those publishing on constraint-induced movement therapy are mostly in Australia and the United States of America; and those publishing on acupuncture are mostly in China, Sweden and the United States of America. **CONCLUSION:** Analysis of literature and research trends indicated that there was no one specific therapy to cure cerebral palsy. Further studies are still necessary.

[PMID: 25368640](#) [PubMed] [PMCID: PMC4200731](#) Free PMC Article

3. *Braz J Phys Ther.* 2014 Oct;**18(5):419-27**. Epub 2014 Oct 10.

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: 25372004](#) [PubMed - in process] Free full text

4. *Dev Neurorehabil.* 2014 Dec;**17(6):414-9**. doi: 10.3109/17518423.2014.938834.

The influence of physical therapy and anti-botulinum toxin antibody on the efficacy of botulinum toxin-A injections in children with spastic cerebral palsy.

Jang DH1, Sung IY.

Objective: To identify factors associated with the efficacy of botulinum toxin-A (BoNT-A) injections. **METHODS:** Thirty-eight children with spastic cerebral palsy (CP) received BoNT-A injections into the gastrocnemius. The baseline anti-botulinum antibodies were checked. The Static dorsiflexion range of motion (ROM), Modified Tardieu Scale (MTS) and Physician Rating Scale (PRS) were assessed at pre-injection as well as 4- and 12-week post-injection. **RESULTS:** No samples contained anti-botulinum antibodies. Greater baseline MTS dynamic range was associated with greater changes in MTS dynamic ranges at 4-week post-injection. More frequent physical therapy was associated with greater changes in static dorsiflexion ROM at 4-week post-injection and greater changes in

PRS at 4- and 12-week post-injection. **CONCLUSION:** The improvement in PRS at 12-week post-injection was associated with the frequency of physical therapy. Therefore, intensive physical therapy programs may be necessary to maintain the beneficial effects of BoNT-A injections in children with CP.

[PMID: 25372070](#) [PubMed - in process]

5. Neural Regen Res. 2014 Sep 1;9(17):1628-34. doi: 10.4103/1673-5374.141795.

Virtual reality training improves balance function.

Mao Y, Chen P, Li L, Huang D.

Virtual reality is a new technology that simulates a three-dimensional virtual world on a computer and enables the generation of visual, audio, and haptic feedback for the full immersion of users. Users can interact with and observe objects in three-dimensional visual space without limitation. At present, virtual reality training has been widely used in rehabilitation therapy for balance dysfunction. This paper summarizes related articles and other articles suggesting that virtual reality training can improve balance dysfunction in patients after neurological diseases. When patients perform virtual reality training, the prefrontal, parietal cortical areas and other motor cortical networks are activated. These activations may be involved in the reconstruction of neurons in the cerebral cortex. Growing evidence from clinical studies reveals that virtual reality training improves the neurological function of patients with spinal cord injury, cerebral palsy and other neurological impairments. These findings suggest that virtual reality training can activate the cerebral cortex and improve the spatial orientation capacity of patients, thus facilitating the cortex to control balance and increase motion function.

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6. Bone Joint J. 2014 Nov;96-B(11 Supple A):27-31.

The neuromuscularly challenged patient: total hip replacement is now an option.

Kraay MJ, Bigach SD.

Degenerative problems of the hip in patients with childhood and adult onset neuromuscular disorders can be challenging to treat. Many orthopaedic surgeons are reluctant to recommend total hip replacement (THR) for patients with underlying neuromuscular disorders due to the perceived increased risks of dislocation, implant loosening, and lack of information about the functional outcomes and potential benefits of these procedures in these patients. Modular femoral components and alternative bearings which facilitate the use of large femoral heads, constrained acetabular components and perhaps more importantly, a better understanding about the complications and outcomes of THR in the patient with neuromuscular disorders, make this option viable. This paper will review the current literature and our experience with THR in the more frequently encountered neuromuscular disorders. Cite this article: Bone Joint J 2014;96-B(11 Suppl A):27-31.

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7. Bone Joint J. 2014 Nov;96-B(11):1546-52. doi: 10.1302/0301-620X.96B11.34385.

Prevention of dislocation of the hip in children with cerebral palsy: 20-year results of a population-based prevention programme.

Hägglund G1, Alriksson-Schmidt A1, Lauge-Pedersen H1, Rodby-Bousquet E2, Wagner P2, Westbom L1.

In 1994 a cerebral palsy (CP) register and healthcare programme was established in southern Sweden with the primary aim of preventing dislocation of the hip in these children. The results from the first ten years were published in 2005 and showed a decrease in the incidence of dislocation of the hip, from 8% in a historical control group of 103 children born between 1990 and 1991 to 0.5% in a group of 258 children born between 1992 and 1997. These

two cohorts have now been re-evaluated and an additional group of 431 children born between 1998 and 2007 has been added. By 1 January 2014, nine children in the control group, two in the first study group and none in the second study group had developed a dislocated hip ($p < 0.001$). The two children in the first study group who developed a dislocated hip were too unwell to undergo preventive surgery. Every child with a dislocated hip reported severe pain, at least periodically, and four underwent salvage surgery. Of the 689 children in the study groups, 91 (13%) underwent preventive surgery. A population-based hip surveillance programme enables the early identification and preventive treatment, which can result in a significantly lower incidence of dislocation of the hip in children with CP. Cite this article: *Bone Joint J* 2014; 96-B:1546-52.

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8. Paediatr Anaesth. 2014 Nov 5. doi: 10.1111/pan.12561. [Epub ahead of print]

Perioperative respiratory complications following awake and deep extubation in children undergoing adenotonsillectomy.

Baijal RG1, Bidani SA, Minard CG, Watcha MF.

BACKGROUND: Perioperative respiratory complications after adenotonsillectomy (T&A) are common and have been described to occur more frequently in children below 3 years of age, those with cranio-facial abnormalities, Down syndrome, obstructive sleep apnea, morbid obesity, and failure to thrive. **AIMS:** To investigate the association between awake vs deep tracheal extubation and perioperative respiratory conditions. **RESULTS:** The primary outcome was any perioperative respiratory complication. Major complications included the need for airway reinstrumentation, continuous or bi-level positive airway pressure (CPAP or BiPAP) and ventilation, or pharmacologic intervention for managing airway obstruction. Minor respiratory complications included persistent hypoxemia defined as oxygen saturation (SpO_2) $< 92\%$ for ≥ 30 s or postoperative oxygen dependence for hypoxemia for ≥ 15 min. There was no statistically significant difference in the incidence of any perioperative respiratory complication in children undergoing an awake vs deep extubation (18.5% and 18.9% for awake and deep extubation, respectively ($P = 0.93$)). Only low weight (≤ 14 kg) was associated with increased perioperative respiratory complications ($P = 0.005$). In this study, factors found not to be statistically significant with perioperative respiratory complications included age; presence of Down syndrome, cranio-facial abnormality, or cerebral palsy; obstructive sleep apnea confirmed by polysomnography; diagnosis of obstructive sleep apnea by clinical history; presence of an upper respiratory tract infection (URI) within 2 weeks of presentation; history of reactive airway disease; status at extubation; endtidal sevoflurane and carbon dioxide concentrations at extubation; total intraoperative opioids administered in morphine equivalents ($mg \cdot kg^{-1}$); administration of propofol at extubation; and intraoperative administration of an anticholinergic drug. **CONCLUSIONS:** There was no difference in the incidence of perioperative respiratory complications in children undergoing a T&A following an awake vs deep extubation. Only weight ≤ 14 kg was associated with increased perioperative respiratory complications.

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9. J Med Speech Lang Pathol. 2013;20(4):88-94.

Kinematic Characteristics of Speaking Rate in Individuals with Cerebral Palsy: A Preliminary Study.

Nip IS.

Many individuals with cerebral palsy (CP) have a slower speaking rate compared with their typically developing peers. Previous studies examining age-related changes in speaking rate in typical development suggest that (1) cognitive and linguistic processing increases account for most of these changes, and (2) changes to linguistic task demands affect the articulatory strategies used to produce the target stimuli (e.g., truncating movements for tasks with fewer linguistic demands). The purpose of this study was to determine the relations between linguistic and physiologic factors in individuals with CP to better understand how the pathophysiology of CP affects speech production in these individuals. Four participants with CP and 38 age-matched peers were asked to complete a

diadochokinetic (DDK) task, a vowel-consonant-vowel syllable repetition task, and a sentence repetition task. Speaking rate for the tasks and lower lip maximum movement speed, range of movement, and duration of the closing and opening gestures common to each task were measured. In general, participants with CP have reduced speaking rates compared with their typically developing peers despite increased movement speeds. In both groups, linguistic task effects were observed; higher linguistic demands resulted in slower speaking rates and higher movement speeds. Range of movement was greater for participants with CP than their typically developing peers and may have contributed to the observed decreased speaking rates in individuals with CP.

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10. Phys Occup Ther Pediatr. 2014 Nov 3. [Epub ahead of print]

Complementary, Alternative, and Mainstream Service use Among Families with Young Children with Multiple Disabilities: Family Costs to Access Choices.

Bourke-Taylor H1, Cotter C, Stephan R.

Families raising a young child with multiple disabilities are charged with significant responsibilities such as learning about their child's condition and navigating mainstream and alternative services. Aim: Describe service choices, costs, out of pocket expenses, and the impact on families. Methods: Survey design using a custom questionnaire was used to collect extensive retrospective and current data. Purposive sampling (N = 29) occurred from one early intervention facility specialized in servicing children with cerebral palsy (CP) and, or multiple disabilities in Australia. Descriptive statistics were used for analysis of data. Results: Twenty-three (79%) families reported caring for a child with CP. Twenty-three families reported using at least one complementary/alternative intervention. Out-of-pocket amounts were reported including: chiropractic services (10 families); naturopathy (9 families); point percussion therapy (7 families), and Chinese medicine (6 families). Expenses resulted in families reporting forgoing clothing items, family entertainment, recreation/hobbies for parents (55%); family holidays (59%); time for parents alone (66%); and health services for parents (38%). Conclusions: Families of young children with multiple disabilities select a wide range of services for their child, with consequential out of pocket expenses. Early intervention professionals can be an important resource for families as they evaluate their choices and select interventions for their child.

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11. Clin Rehabil. 2014 Oct;28(10):938. doi: 10.1177/0269215514550566. Epub 2014 Sep 16.

Children with cerebral palsy. Introductory paragraph.

[No authors listed]

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Prevention and Cure

12. *Glia*. 2014 Nov 6. doi: 10.1002/glia.22764. [Epub ahead of print]

Transplanted glial restricted precursor cells improve neurobehavioral and neuropathological outcomes in a mouse model of neonatal white matter injury despite limited cell survival.

Porambo M1, W Phillips A, Marx J, Ternes K, Arauz E, Pletnikov M, Wilson MA, Rothstein JD, Johnston MV, Fatemi A.

OBJECTIVE: Neonatal white matter injury (NWMI) is the leading cause of cerebral palsy and other neurocognitive deficits in prematurely-born children, and no restorative therapies exist. Our objective was to determine the fate and effect of glial restricted precursor cell (GRP) transplantation in an ischemic mouse model of NWMI. **METHODS:** Neonatal CD-1 mice underwent unilateral carotid artery ligation on postnatal-Day 5 (P5). At P22, intracallosal injections of either enhanced green fluorescent protein (eGFP) + GRPs or saline were performed in control and ligated mice. Neurobehavioral and postmortem studies were performed at 4 and 8 weeks post-transplantation. **RESULTS:** GRP survival was comparable at 1 month but significantly lower at 2 months post-transplantation in NWMI mice compared with unligated controls. Surviving cells showed better migration capability in controls; however, the differentiation capacity of transplanted cells was similar in control and NWMI. Saline-treated NWMI mice showed significantly altered response in startle amplitude and prepulse inhibition (PPI) paradigms compared with unligated controls, while these behavioral tests were completely normal in GRP-transplanted animals. Similarly, there was significant increase in hemispheric myelin basic protein density, along with significant decrease in pathologic axonal staining in cell-treated NWMI mice compared with saline-treated NWMI animals. **INTERPRETATION:** The reduced long-term survival and migration of transplanted GRPs in an ischemia-induced NWMI model suggests that neonatal ischemia leads to long-lasting detrimental effects on oligodendroglia even months after the initial insult. Despite limited GRP-survival, behavioral, and neuropathological outcomes were improved after GRP-transplantation. Our results suggest that exogenous GRPs improve myelination through trophic effects in addition to differentiation into mature oligodendrocytes. *GLIA* 2014.

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