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Interventions and Management

1. Learning to cope with mirror movements in unilateral spastic cerebral palsy: a brief report.

Adler C, Hessenauer M, Lipp J, Kunze S, Geigenberger C, Hörning A, Schaudeck M, Berweck S, Staudt M.

Dev Neurorehabil. 2018 May 22;1-6. doi: 10.1080/17518423.2018.1474501. [Epub ahead of print]

PURPOSE: Mirror movements (MM) in unilateral spastic cerebral palsy (USCP) interfere with many bimanual activities of daily living. **METHODS:** Here, we developed a specific bimanual therapeutic regimen, focusing on asymmetric simultaneous movements of the two hands. Twelve children (6-17 years old; complete data available in ten children) with USCP and MM were included. **RESULTS:** After three weeks of inpatient rehabilitation, we observed significant improvements for two self-defined bimanual goal activities (Goal Attainment Scaling, Canadian Occupational Performance Measure) and for bimanual performance in general (Assisting Hand Assessment). These improvements were still present 6 months later. In contrast, even immediately after therapy, the severity of MM had not changed. **CONCLUSIONS:** Hence, targeted bimanual therapy improved bimanual performance, but did not lead to a reduction of MM. The results of this pilot study might suggest that children with MM benefit more from acquiring strategies to cope with MM than by an active training which aimed to reduce MM.

PMID: [29787338](#)

2. Effect of Wii training on hand function in children with hemiplegic cerebral palsy.

El-Shamy SM PhD, PT, El-Banna MF PhD, PT.

Physiother Theory Pract. 2018 May 24;1-7. doi: 10.1080/09593985.2018.1479810. [Epub ahead of print]

OBJECTIVE: The purpose of this study was to investigate the effect of Wii training on hand function in children with hemiplegic cerebral palsy. **METHODS:** A randomized controlled trial was conducted in 40 children with hemiplegic cerebral palsy (8-12 years). The experimental group received Wii training involving four games for 40 minutes a day, three times a week for 12 weeks plus usual care. The control group received usual care alone. Outcomes were spasticity measured using the modified Ashworth scale, grip strength measured using dynamometry, and hand function measured using the Peabody developmental motor scale (2nd ed.). Outcomes were measured at baseline and after 12 weeks of intervention. **RESULTS:** Spasticity in the experimental group decreased by 0.4 out of 4.0 (95% CI 0.1 to 0.8) more than the control group by 12 weeks. Power grip strength increased by 1.6 kg (95% CI 0.7 to 2.5) and pinch grip strength by 1.2 kg (95% CI 0.8 to 1.6) more than the control group by 12 weeks. Hand function increased by 6 out of 52 (95% CI 5 to 7) more than the control group by 12 weeks. **CONCLUSION:** Wii training plus usual care decreases spasticity and increases grip strength and hand function in children with hemiplegic cerebral palsy.

PMID: [29792556](#)

3. Development of postural control in infancy in cerebral palsy and cystic periventricular leukomalacia.

Boxum AG, Dijkstra LJ, la Bastide-van Gemert S, Hamer EG, Hielkema T, Reinders-Messelink HA, Hadders-Algra M.

Res Dev Disabil. 2018 May 19;78:66-77. doi: 10.1016/j.ridd.2018.05.005. [Epub ahead of print]

BACKGROUND: Development of postural problems in Cerebral Palsy (CP) is largely unknown. Postural muscle activity is organized into two levels: 1) direction-specificity; 2) fine-tuning of direction-specific activity. **AIM:** To study development of postural control until 21 months corrected age in subgroups of infants at very high-risk (VHR) of CP: a) with and without CP at 21 months; b) with and without cystic periventricular leukomalacia (cPVL), the brain lesion with highest risk of CP. **METHODS AND PROCEDURES:** Longitudinal electromyography recordings of postural muscles during reaching were made in 38 VHR-infants (severe brain lesion or clear neurological signs) between 4.7 and 22.6 months (18 CP, of which 8 with cPVL). Developmental trajectories were calculated using linear mixed effect models. **OUTCOMES AND RESULTS:** VHR-infants with and without CP showed virtually similar postural development throughout infancy. The subgroup of VHR-infants with cPVL improved performance in direction-specificity with increasing age, while they performed throughout infancy worse in fine-tuning of postural adjustments than infants without cPVL. **CONCLUSIONS AND IMPLICATIONS:** VHR-infants with and without CP have a similar postural development that differs from published trajectories of typically developing infants. Infants with cPVL present from early age onwards dysfunctions in fine-tuning of postural adjustments; they focus on direction-specificity.

PMID: [29787891](#)

4. Cerebellar peduncle injury predicts motor impairments in preterm infants: A quantitative tractography study at term-equivalent age.

Hasegawa T, Yamada K, Tozawa T, Chiyonobu T, Tokuda S, Nishimura A, Hosoi H, Morimoto M.

Brain Dev. 2018 May 15. pii: S0387-7604(18)30192-X. doi: 10.1016/j.braindev.2018.04.013. [Epub ahead of print]

PURPOSE: Cerebellar injury is well established as an important finding in preterm infants with cerebral palsy (CP). In this study, we investigated associations between injury to the cerebellar peduncles and motor impairments in preterm infants using quantitative tractography at term-equivalent age, which represents an early phase before the onset of motor impairments. **METHODS:** We studied 64 preterm infants who were born at <33 weeks gestational age. These infants were divided into three groups: CP, Non-CP (defined as infants with periventricular leukomalacia but having normal motor function), and a Normal group. Diffusion tensor imaging was performed at term-equivalent age and motor function was assessed no earlier than a corrected age of 2 years. Using tractography, we measured fractional anisotropy (FA) and apparent diffusion coefficient (ADC) of the superior cerebellar peduncles (SCP) and middle cerebellar peduncles (MCP), as well as the motor/sensory tracts. **RESULTS:** The infants in the CP group had significantly lower FA of the SCP and sensory tract than those in the other groups. There was no significant difference in FA and ADC of the motor tract among the three groups. Severity of CP had a significant correlation with FA of the MCP, but not with the FA of other white matter tracts. **CONCLUSION:** Our results suggested that the infants with CP had injuries of the ascending tracts (e.g. the SCP and sensory tract), and that additional MCP injury might increase the severity of CP. Quantitative tractography assessment at term-equivalent age may be useful for screening preterm infants for prediction of future motor impairments.

PMID: [29776704](#)

5. Low bone mineral density in ambulatory persons with cerebral palsy? A systematic review.

Mus-Peters CTR, Huisstede BMA, Noten S, Hitters MWMGC, van der Slot WMA, van den Berg-Emons RJG.

Disabil Rehabil. 2018 May 22:1-11. doi: 10.1080/09638288.2018.1470261. [Epub ahead of print]

PURPOSE: Non-ambulatory persons with cerebral palsy are prone to low bone mineral density. In ambulatory persons with cerebral palsy, bone mineral density deficits are expected to be small or absent, but a consensus conclusion is lacking. In this systematic review bone mineral density in ambulatory persons with cerebral palsy (Gross Motor Function Classification Scales I-III) was studied. **MATERIALS AND METHODS:** Medline, Embase, and Web of Science were searched. According to international guidelines, low bone mineral density was defined as Z-score ≤ -2.0 . In addition, we focused on Z-score ≤ -1.0 because this may indicate a tendency towards low bone mineral density. **RESULTS:** We included 16 studies, comprising 465 patients aged 1-65 years. Moderate and conflicting evidence for low bone mineral density (Z-score ≤ -2.0) was found for several body parts (total proximal femur, total body, distal femur, lumbar spine) in children with Gross Motor Function Classification Scales II and III. We found no evidence for low bone mineral density in children with Gross Motor Function Classification Scale I or adults, although there was a tendency towards low bone mineral density (Z-score ≤ -1.0) for several body parts. **CONCLUSIONS:** Although more high-quality research is needed, results indicate that deficits in bone mineral density are not restricted to non-ambulatory people with cerebral palsy. Implications for Rehabilitation Although more high-quality research is needed, including adults and fracture risk assessment, the current study indicates that deficits in bone mineral density are not restricted to non-ambulatory people with CP. Health care professionals should be aware that optimal nutrition, supplements on indication, and an active lifestyle, preferably with weight-bearing activities, are important in ambulatory people with CP, also from a bone quality point-of-view. If indicated, medication and fall prevention training should be prescribed.

PMID: [29783868](#)

6. Participation in Daily Life: Influence on Quality of Life in Ambulatory Children with Cerebral Palsy.

Omura J, Fuentes M, Bjornson K.

PM R. 2018 May 18. pii: S1934-1482(18)30244-2. doi: 10.1016/j.pmrj.2018.05.010. [Epub ahead of print]

BACKGROUND: Cerebral palsy is a chronic condition which affects children and has an impact on social and physical activity, as well as participation in daily life. Participation and quality of life are two important measures of successful rehabilitation that have not been well studied in children with cerebral palsy. **OBJECTIVE:** To report levels of participation and examine the relationship of participation to quality of life (QOL) in ambulatory children with cerebral palsy (CP) **DESIGN:** Secondary analysis, cross-sectional cohort study **SETTING:** Regional pediatric specialty care center **PARTICIPANTS:** A cohort of 128 ambulatory children with CP, Gross Motor Function Classification System (GMFCS) levels I-III, age 2-9 years **INTERVENTIONS:** Not Applicable **MAIN OUTCOME MEASURES:** Pediatric Quality of Life Inventory (PedsQL); Assessment of Life Habits (LIFE-H); Children's Assessment of Participation and Enjoyment and Assessment of Preschool Children's Participation (CAPE/APCP). **RESULTS:** Participation is negatively associated with increasing GMFCS, but not age. Level of participation was associated with psychosocial QOL (2.97, $p = .001$) and total QOL (54.70, $p = .03$), but not physical QOL. There was a positive relationship between physical activity performance (0.63, $p = .001$), walking performance (0.002, $p = .01$) and communication level (7.23, $p = .05$) with physical QOL. Increasing age and decreased frequency of participation were negatively associated with all QOL domains. **CONCLUSIONS:** The results suggest that participation in daily life is negatively influenced by physical impairment and that levels of participation are positively associated with psychosocial and total QOL among ambulatory children with CP. This suggests that participation influences QOL and further studies are needed to determine the aspects of participation directly impacting QOL in ambulatory children with CP.

PMID: [29783065](#)

7. Longitudinal growth of receptive language in children with cerebral palsy between 18 months and 54 months of age.

Hustad KC, Sakash A, Broman AT, Rathouz PJ.

Dev Med Child Neurol. 2018 May 22. doi: 10.1111/dmcn.13904. [Epub ahead of print]

AIM: We examined receptive language developmental trajectories between 18 months and 54 months for three clinical speech-language profile groups of children with cerebral palsy (those with speech motor involvement, without speech motor involvement, and with anarthria) and quantified differences from age-level expectations. We identified latent classes of comprehension development, related these classes to clinical profile groups, and examined how well early receptive language predicted outcomes. **METHOD:** We used a prospective longitudinal design. Eighty-five children with cerebral palsy (43 females, 42 males) were followed longitudinally from 18 to 54 months of age. Children were seen two to eight times (322 data points). Children were classified into clinical profile groups. Language comprehension age-equivalent scores were the primary measures of interest. **RESULTS:** Children with anarthria had significant language delays, limited developmental change over time, and comprised their own latent class. Children with speech motor impairment had slight receptive language delays over time. Children with no speech motor impairment had age-appropriate receptive language over time. Early language comprehension scores were highly predictive of later latent profile group membership. **INTERPRETATION:** Early language comprehension abilities are highly predictive of language comprehension growth trajectory and suggest that children with early language delay, particularly those who are non-speaking, should receive language intervention to support development. **WHAT THIS PAPER ADDS:** There are two growth trajectories for language comprehension among children with cerebral palsy. Children with speech motor impairment had a constant 6-month receptive language delay. Children without speech motor impairment had age-appropriate receptive language. Non-speaking children had significant receptive language delay. Early language comprehension change was highly predictive of later trajectory group.

PMID: [29786137](#)

8. Early receptive language comprehension ability in children with cerebral palsy.

Nordberg A.

Dev Med Child Neurol. 2018 May 22. doi: 10.1111/dmcn.13901. [Epub ahead of print] No abstract available.

PMID: [29786134](#)

9. Speech and language pathologists' perceptions and practises of communication partner training to support children's communication with high-tech speech generating devices.

Tegler H, Pless M, Blom Johansson M, Sonnander K.

Disabil Rehabil Assist Technol. 2018 May 23;1-9. doi: 10.1080/17483107.2018.1475515. [Epub ahead of print]

PURPOSE: This study examined speech and language pathologists' (SLPs') perceptions and practices of communication partner training with high-tech speech generating devices (SGDs). **METHOD:** Fifteen SLPs were recruited throughout Sweden. The SLPs answered a study-specific questionnaire on communication partner training in relation to communication partners to children with severe cerebral palsy and intellectual disability. The results were analysed with descriptive statistics (closed-ended questions, responses on Likert scales) and content analysis (open-ended question) using ICF-CY. **RESULTS:** Twelve SLPs completed the survey. Half had no or one training session with communication partners in the last year. One-third never used documents for goal-setting. Half seldom or never taught communication partner strategies. Three quarters only used verbal instructions. The main obstacles were environmental factors. **CONCLUSIONS:** This study contributes valuable knowledge about high-tech SGD interventions targeting communication partners. The high-tech SGD intervention may benefit from goal-setting, extended number of training sessions and a range of instructional approaches. Implications for Rehabilitation Speech and language pathologist (SLPs) reported that children with severe cerebral palsy and intellectual disability (SSPI) can benefit from speech generating device (SGD) communication. Communication partner strategies and goal-setting supports the development of communication with SGD. SLPs seldom taught stakeholder communication partner strategies and instruments for goal-setting. Because stakeholders may vary in their way of learning SLPs need to use a variety of instructional approaches. SLPs used few instructional approaches, typically verbal information.

PMID: [29790394](#)

10. Resting energy expenditure in children with cerebral palsy: Accuracy of available prediction formulae and development of a population-specific formula.

Penagini F, Borsani B, Bosetti A, Mameli C, Dilillo D, Ramponi G, Motta F, Bedogni G, Zuccotti GV.

Clin Nutr ESPEN. 2018 Jun;25:44-49. doi: 10.1016/j.clnesp.2018.04.006. Epub 2018 Apr 19.

BACKGROUND AND AIMS: Energy requirements are difficult to estimate in children with cerebral palsy (CP). Resting energy expenditure (REE), necessary for personalized nutritional intervention, is most commonly estimated using prediction formulae because the reference method, i.e. indirect calorimetry (IC), is not available in all Nutrition Units. The main aim of the present study was to evaluate the accuracy of the most commonly used REE prediction formulae in children with CP. The secondary aim was to develop a new population-specific formula for the estimation of REE in children with CP. **METHODS:** REE was measured by IC in 54 children and adolescents with spastic quadriplegic cerebral palsy (SQCP) and estimated from the five most commonly used prediction formulae, i.e. the World Health Organization (WHO), Harris-Benedict, Schofield weight, Schofield weight & height, and Oxford formulae. **RESULTS:** The mean (standard deviation, SD) difference between the estimated and measured REE was 64 (238) kcal/day for the WHO formula, 79 (226) kcal/day for the Schofield weight formula, 79 (223) kcal/day for the Schofield weight and height formula, 55 (226) kcal/day for the Oxford formula, 37 (224) kcal/day for the Harris-Benedict formula and 0 (213) kcal/day for the purposely developed population-specific formula. Owing to the large SD of the bias, none of these formulae can be reliably applied at the individual level to estimate REE. **CONCLUSIONS:** The most commonly used REE prediction formulas are inaccurate at both the population and individual level in children with SQCP. A purposely developed population-specific formula, despite being accurate at the population level, does not perform better than the most commonly used REE formulae at the individual level.

PMID: [29779817](#)

11. Subjective Global Nutritional Assessment: A Reliable Screening Tool for Nutritional Assessment in Cerebral Palsy Children - Correspondence.

Kumar J, Singh A.

Indian J Pediatr. 2018 May 18. doi: 10.1007/s12098-018-2694-0. [Epub ahead of print] No abstract available.

PMID: [29777466](#)

12. Peripheral Blood Mononuclear Cells and Growth Factor Therapy for Cerebral Palsy.

Cho KH, Kim M.

J Korean Med Sci. 2018 May 16;33(21):e176. doi: 10.3346/jkms.2018.33.e176. eCollection 2018 May 21.

PMID: [29780298](#)

13. [Selective dorsal rhizotomy: a review of the literature on this technique for the treatment of spasticity in infantile cerebral palsy].

Garriz-Luis M, Sanchez-Carpintero R, Alegre M, Tejada S.

Rev Neurol. 2018 Jun 1;66(11):387-394. Review. Spanish.

INTRODUCTION: Infantile cerebral palsy is a well-known condition, the prevalence of which has varied only slightly over the years. The most common subtype is spastic diplegia, and spasticity is the most disabling symptom. Its treatment involves a multidisciplinary intervention that includes rehabilitation, the use of drugs, and orthopaedic and nervous system surgery, where selective dorsal rhizotomy is a prominent procedure. **AIM:** To present a thorough review of the use, indication and long-term consequences of selective dorsal rhizotomy. **DEVELOPMENT:** It is a minimally invasive procedure aimed at reducing spasticity in the lower extremities in order to improve the ability to walk, lessen pain, facilitate care in everyday life and diminish the need for orthopaedic surgery. The literature contains a wide range of criteria for its use, and the main indication is spastic diplegia with the absence of dystonia. It is routinely performed in several countries, while we have no evidence of its application in ours. **CONCLUSIONS:** Following the literature review, we believe there is enough experience to state that selective dorsal rhizotomy is a safe and simple technique from which many patients with spasticity of the lower limbs secondary to infantile cerebral palsy can benefit in both the short and the long term.

PMID: [29790572](#)

14. Serial Changes of Cytokines in Children with Cerebral Palsy Who Received Intravenous Granulocyte-colony Stimulating Factor Followed by Autologous Mobilized Peripheral Blood Mononuclear Cells.

Koh H, Rah WJ, Kim YJ, Moon JH, Kim MJ, Lee YH.

J Korean Med Sci. 2018 Mar 6;33(21):e102. doi: 10.3346/jkms.2018.33.e102. eCollection 2018 May 21.

BACKGROUND: This study was performed to assess serial cytokine changes and their clinical impact in children with cerebral palsy (CP) who received granulocyte-colony stimulating factor (G-CSF) followed by infusion of autologous mobilized peripheral blood mononuclear cells (mPBMCs). **METHODS:** Peripheral blood (PB) samples were collected from 16 CP children at enrollment, and 1 month and 7 months after G-CSF infusion as well as at the end of the study. Cytokine levels were measured by enzyme-linked immunosorbent assays with plasma samples. **RESULTS:** There were no significant differences in cytokine levels between the mPBMC and placebo groups over 6 months. However, when clinical responders and non-responders were compared, interleukin (IL)-6 ($P = 0.050$) as well as G-CSF ($P = 0.010$) were higher in the responders than the non-responders at 1 month, while brain-derived neurotrophic factor (BDNF) ($P = 0.030$) and insulin-like growth factor (IGF)-1 ($P = 0.001$) were lower. In addition, BDNF was higher at baseline in the responders than the non-responders ($P = 0.030$). **CONCLUSION:** The changes of G-CSF itself, as well as G-CSF-induced cytokines such as IL-6, may be associated with the clinical improvement of neurologic functions. The G-CSF-induced changes of IL-6, BDNF and IGF-1, and BDNF levels before treatment, could be used as prognostic factors in G-CSF trials in CP children.

PMID: [29780293](#)

15. Standardized outcome measures for cerebral palsy among physiotherapists in southwestern Nigeria: awareness, use, barriers, and facilitators.

Obembe AO, Dada O, Balogun AO, Ojo OW, Johnson OE.

Physiother Theory Pract. 2018 May 22:1-8. doi: 10.1080/09593985.2018.1474983. [Epub ahead of print]

The use of outcome measures for assessing progress in the management and treatment of cerebral palsy (CP) is widely recommended. This study was, therefore, carried out to determine awareness and use of standardized outcome measures among physiotherapists managing CP in Nigeria. Barriers to and facilitators for the use of outcome measures were also investigated. This was a descriptive study involving 138 physiotherapists from selected hospitals in southwestern Nigeria. A self-administered questionnaire was used to obtain relevant information on socio-demographics, awareness, use, barriers to, and facilitators for the use of seven standardized outcome measures. The Gross Motor Function Measure was the most recognized (78.9%) and commonly used (58%) outcome measure, while the Paediatric Outcomes Data Collection Instrument (23.2%) and the Paediatric Evaluation of Disability Inventory (10.9%) were the least recognized and least used, respectively. The greatest perceived facilitators were familiarity (87.7%), positive attitude (87.7%), and that outcome measures allow for a balanced clinical assessment (89.1%). The greatest perceived barriers identified were the need for extra accommodation to apply outcome measures (63%) and time consumption on the part of patients (44.2%). Many physiotherapists in this study identified the standardized outcome measures, but fewer used them irrespective of educational status and years of work experience. Generally, there was a positive attitude toward the use of outcome measures. The use of outcome measures should be promoted among physiotherapists in Nigeria, through training programs and translation into the native languages, to effectively assess, manage, and monitor the progress of patients with CP, putting into consideration barriers and facilitators.

PMID: [29787341](#)

16. Decreasing prevalence and severity of cerebral palsy in Norway among children born 1999 to 2010 concomitant with improvements in perinatal health.

Hollung SJ, Vik T, Lydersen S, Bakken IJ, Andersen GL.

Eur J Paediatr Neurol. 2018 May 8. pii: S1090-3798(18)30025-4. doi: 10.1016/j.ejpn.2018.05.001. [Epub ahead of print]

BACKGROUND: The aim of our study was to explore if the prevalence and clinical characteristics of cerebral palsy (CP), concomitant with perinatal health indicators in the general population, remained unchanged for children born in Norway between 1999 and 2010. **METHODS:** This national multi-register cohort study included 711 174 children recorded in the Medical Birth Registry of Norway. Among these, 707 916 were born alive, and 1664 had a validated diagnosis of CP recorded in the Cerebral Palsy Registry of Norway and/or the Norwegian Patient Registry. Prevalence per 1000 live births as a function of birth year was analyzed using logistic regression with fractional polynomials to allow for non-linear trends. Chi-square statistics were used to estimate trends in proportions of clinical characteristics. **RESULTS:** The prevalence of CP in Norway decreased from 2.62 per 1000 live births in 1999 to 1.89 in 2010. The reduction was most evident among children with bilateral CP, in particular those with diplegia. During the study period, the proportions of children with severe motor impairments, epilepsy, intellectual impairment and reduced speech also decreased. At the same time, perinatal mortality has decreased in Norway, along with the proportion of women with preeclampsia, children born preterm or as a multiple. **CONCLUSION:** We observed a significant decrease in the prevalence and severity of CP subtypes and associated impairments among children with CP in Norway. This coincided with improvements in perinatal health indicators in the general population. These improvements are most likely explained by advancements in obstetric and neonatal care.

PMID: [29779984](#)