

Monday 16 January 2017

**Cerebral Palsy Alliance** is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at [research.cerebralpalsy.org.au](http://research.cerebralpalsy.org.au)

**Professor Nadia Badawi AM**

Macquarie Group Foundation Chair of Cerebral Palsy

[Subscribe to CP Research News](#)

*Please note: This research bulletin represents only the search results for cerebral palsy and related neurological research as provided by the PubCrawler service. The articles listed below do not represent the views of Cerebral Palsy Alliance.*

## Interventions and Management

### 1. Intramuscular nerve distribution patterns of anterior forearm muscles in children: a guide for botulinum toxin injection.

Yang F, Zhang X, Xie X, Yang S, Xu Y, Xie P.

Am J Transl Res. 2016 Dec 15;8(12):5485-5493. eCollection 2016.

Botulinum toxin (BoNT) can relieve muscle spasticity by blocking axon terminals acetylcholine release at the motor endplate (MEP) and is the safest and most effective agent for the treatment of muscle spasticity in children with cerebral palsy. In order to achieve maximum effect with minimum effective dose of BoNT, one needs to choose an injection site as near to the MEP zone as possible. This requires a detailed understanding about the nerve terminal distributions within the muscles targeted for BoNT injection. This study focuses on BoNT treatment in children with muscle spasms caused by cerebral palsy. Considering the differences between children and adults in anatomy, we used child cadavers and measured both the nerve entry points and nerve terminal sense zones in three deep muscles of the anterior forearm: flexor digitorum profundus (FDP), flexor pollicis longus (FPL), and pronator quadratus (PQ). We measured the nerve entry points by using the forearm midline as a reference and demonstrated intramuscular nerve terminal dense zones by using a modified Sihler's nerve staining technique. The locations of the nerve entry points and that of the nerve terminal dense zones in the muscles were compared. We found that all nerve entry points are away from the corresponding intramuscular nerve terminal dense zones. Simply selecting nerve entry points as the sites for BoNT injection may not be an optimal choice for best effects in blocking muscle spasm. We propose that the location of the nerve terminal dense zones in each individual muscle should be used as the optimal target sites for BoNT injection when treating muscle spasms in children with cerebral palsy.

[PMID: 28078019](#)

### 2. Reliability and sources of variation of the ABILHAND-Kids questionnaire in children with cerebral palsy.

de Jong LD, van Meeteren A, Emmelot CH, Land NE, Dijkstra PU.

Disabil Rehabil. 2017 Jan 9:1-6. doi: 10.1080/09638288.2016.1272139. [Epub ahead of print]

**PURPOSE:** To determine reliability of the ABILHAND-Kids, explore sources of variation associated with these measurement results, and generate repeatability coefficients. **METHOD:** A reliability study with a repeated measures design was performed in an ambulatory rehabilitation care department from a rehabilitation center, and a center for special education. A physician, an occupational therapist, and parents of 27 children with spastic cerebral palsy independently rated the children's manual capacity when performing 21 standardized tasks of the ABILHAND-Kids from video recordings twice with a three week time interval (27 first-, and 25 second video recordings available). Parents additionally rated their children's performance based on their own perception of their child's ability to perform manual activities in everyday life, resulting in eight ratings per child. **RESULTS:** ABILHAND-Kids ratings were systematically different between observers, sessions, and rating method.

Participant × observer interaction (66%) and residual variance (20%) contributed the most to error variance (9%). Test-retest reliability was 0.92. Repeatability coefficients (between 0.81 and 1.82 logit points) were largest for the parents' performance-based ratings. CONCLUSION: ABILHAND-Kids scores can be reliably used as a performance- and capacity-based rating method across different raters. Parents' performance-based ratings are less reliable than their capacity-based ratings. Resulting repeatability coefficients can be used to interpret ABILHAND-Kids ratings with more confidence. Implications for Rehabilitation The ABILHAND-Kids is a valuable tool to assess a child's unimanual and bimanual upper limb activities. The reliability of the ABILHANDS-Kids is good across different observers as a performance- and capacity-based rating method. Parents' performance-based ratings are less reliable than their capacity-based ones. This study has generated repeatability coefficients for clinical decision making.

[PMID: 28068864](#)

### **3. Can parents provide hand function training for their child with cerebral palsy?**

Eliasson AC.

Dev Med Child Neurol. 2017 Jan 13. doi: 10.1111/dmcn.13389. [Epub ahead of print]

[This commentary is on the original article by Ferre et al.]

[PMID: 28083905](#)

### **4. PLAY HANDS PROTECTIVE GLOVES: TECHNICAL NOTE ON DESIGN AND CONCEPT.**

Houston-Hicks M, Lura DJ, Highsmith MJ.

Technol Innov. 2016 Sep;18(2-3):207-210. doi: 10.21300/18.2-3.2016.207.

Cerebral Palsy (CP) is the leading cause of childhood motor disability, with a global incidence of 1.6 to 2.5/1,000 live births. Approximately 23% of children with CP are dependent upon assistive technologies. Some children with developmental disabilities have self-injurious behaviors such as finger biting but also have therapeutic needs. The purpose of this technical note is to describe design considerations for a protective glove and finger covering that maintains finger dexterity for children who exhibit finger and hand chewing (dermatophagia) and require therapeutic range of motion and may benefit from sensory stimulation resulting from constant contact between glove and skin. Protecting Little and Adolescent Youth (PLAY) Hands are protective gloves for children with developmental disorders such as CP who injure themselves by biting their hands due to pain or sensory issues. PLAY Hands will be cosmetically appealing gloves that provide therapeutic warmth, tactile sensory feedback, range of motion for donning/ doffing, and protection to maximize function and quality of life for families of children with developmental disorders. The technology is either a per-finger protective orthosis or an entire glove solution designed from durable 3D-printed biodegradable/bioabsorbable materials such as thermoplastics. PLAY Hands represent a series of protective hand wear interventions in the areas of self-mutilating behavior, kinematics, and sensation. They will be made available in a range of protective iterations from single- or multi-digit finger orthoses to a basic glove design to a more structurally robust and protective iteration. To improve the quality of life for patients and caregivers, they are conceptualized to be cosmetically appealing, protective, and therapeutic.

[PMID: 28066530](#)

### **5. Comparative study of therapeutic response to baclofen vs tolperisone in spasticity.**

Agarwal S, Patel T, Shah N, Patel BM.

Biomed Pharmacother. 2017 Jan 10;87:628-635. doi: 10.1016/j.biopha.2017.01.005. [Epub ahead of print]

BACKGROUND: Spasticity from the upper motor neuron syndrome can result from a variety of conditions affecting the cortex or spinal cord. Some of the more common conditions associated with spasticity include spinal cord injury, cerebral palsy, and post-stroke syndrome. In this study we compared the efficacy and safety of baclofen vs tolperisone in spasticity. One hundred fifty patients with cerebral palsy or post stroke or spinal cord injury associated spasticity were enrolled in present study. Group

I comprised of Seventy-five patients receiving baclofen and group II comprised of 75 patients receiving tolperisone. For efficacy measurement 4 evaluation methods were used, 1) Modified Ashworth Scale for muscle tone, 2) Medical research council scale for muscle strength and 3) Barthel Index for functional outcome 4) Coefficient of efficacy. In efficacy evaluation, both groups showed significant improvement in muscle tone, muscle strength and functional outcome at week 6 (Group I,  $1.55\pm 0.053$ ,  $2.79\pm 0.032$ ,  $59.31\pm 1.32$ ; Group II,  $1.57\pm 0.053$ ,  $3.04\pm 0.032$ ,  $73\pm 1.32$  respectively). In between the group analysis, there was no significant difference in muscle tone improvement in both the groups after 6 weeks (Group I,  $1.055\pm 0.053$  vs Group II,  $1.57\pm 0.053$ ,  $p>0.05$ ). Group II showed non-significant but greater improvement in muscle strength (Week 6; Group I,  $2.79\pm 0.032$  vs Group II,  $3.04\pm 0.032$ ,  $p>0.07$ ). Improvement in functional outcomes was greater in group II as compared to group I (Group I,  $59.31\pm 1.32$  vs Group II,  $73\pm 1.32$ ,  $p<0.05$ ). Overall efficacy coefficient was greater for group II (3.6) as compared to group I (2.3). Baclofen showed more side effects compared to tolperisone in, asthenia being the most frequent. Tolperisone offers greater improvement in activities of daily living compared to baclofen. Tolperisone is more tolerable drug as compared to baclofen.

[PMID: 28086137](#)

## **6. Stability of the Gross Motor Function Classification System in children and adolescents with cerebral palsy: a retrospective cohort registry study.**

Alriksson-Schmidt A, Nordmark E, Czuba T, Westbom L.

Dev Med Child Neurol. 2017 Jan 13. doi: 10.1111/dmcn.13385. [Epub ahead of print]

AIM: To investigate the stability and to determine factors that affect change in the Gross Motor Function Classification System (GMFCS) in a sample from the total population with cerebral palsy (CP) in two regions of Sweden. METHOD: Retrospective cohort registry study based on the follow-up programme for CP. Children with CP and a minimum of two GMFCS ratings were included. Subtype, sex, ages at GMFCS ratings, time between ratings, number of ratings, assessor change, and birth cohort were analysed in relation to initial GMFCS levels, with descriptive statistics and logistic regression models. RESULTS: Ninety-three per cent ( $n=736$ ) of children with CP born between 1990 and 2007 were included, resulting in 7922 assessments between 1995 and 2014. Fifty-six per cent of the children received the same GMFCS rating at all assessments, with a median of 11 individual GMFCS ratings (range 2-21) and a median of three different assessors (range 1-10). Changes were often transient; downward change (higher performance) was more likely in GMFCS levels II and III than in the other levels. The probability of upward change (lower performance) was lowest in unilateral spastic CP. INTERPRETATION: The results support the stability of the GMFCS shown previously and add new information on the properties of the classification.

[PMID: 28083887](#)

## **7. Effect of cerebrolysin on gross motor function of children with cerebral palsy: a clinical trial.**

Nasiri J, Safavifar F.

Acta Neurol Belg. 2017 Jan 10. doi: 10.1007/s13760-016-0743-x. [Epub ahead of print]

Gross motor dysfunction is considered as the most challenging problem in cerebral palsy (CP). It is proven that improvement of gross motor function could reduce CP-related disabilities and provide better quality of life in this group of patients. Therefore, the aim of this trial is to evaluate the effectiveness of cerebrolysin (CBL) on gross motor function of children with CP who are undergoing treatment. In this clinical trial study, paediatric patients aged 18-75 months with spastic diplegic or quadriplegic cerebral palsy, who were under rehabilitation therapy, were selected and randomly allocated in control and CBL groups. Patients in CBL group underwent treatment with standard rehabilitation therapy plus CBL. The latter was administered intramuscularly as a single daily dose of 0.1 cc/kg for 10 days and then continued weekly for 4 months. Gross motor function of participants in the two studied groups, before and after trial, was evaluated and compared using the validated Persian version of gross motor function classification system-expanded and revised (GMFCS-E&R). During this trial, 108 patients with CP were evaluated for eligibility. From these, 50 patients were enrolled and randomly allocated in the CBL and control groups. Four months after trial, the mean level of GMFCS decreased significantly in the two groups ( $P < 0.05$ ). However, it was significantly lower in the CBL group than in the control group (2.1 vs. 3.16,  $P < 0.05$ ). The results of this trial indicated that CBL could improve gross motor function in patients with CP. This finding is consistent with neurotrophic and neuroprotective effects of CBL, which have been reported in various clinical trials in other neurological disorders. Further studies are recommended to establish the value of continued neuroprotection and to determine the pharmacokinetics/dynamics of CBL in this group of patients.

[PMID: 28074392](#)

## 8. Statistical Parametric Mapping to Identify Differences between Consensus-Based Joint Patterns during Gait in Children with Cerebral Palsy.

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

PLoS One. 2017 Jan 12;12(1):e0169834. doi: 10.1371/journal.pone.0169834. eCollection 2017.

Experts recently identified 49 joint motion patterns in children with cerebral palsy during a Delphi consensus study. Pattern definitions were therefore the result of subjective expert opinion. The present study aims to provide objective, quantitative data supporting the identification of these consensus-based patterns. To do so, statistical parametric mapping was used to compare the mean kinematic waveforms of 154 trials of typically developing children ( $n = 56$ ) to the mean kinematic waveforms of 1719 trials of children with cerebral palsy ( $n = 356$ ), which were classified following the classification rules of the Delphi study. Three hypotheses stated that: (a) joint motion patterns with 'no or minor gait deviations' ( $n = 11$  patterns) do not differ significantly from the gait pattern of typically developing children; (b) all other pathological joint motion patterns ( $n = 38$  patterns) differ from typically developing gait and the locations of difference within the gait cycle, highlighted by statistical parametric mapping, concur with the consensus-based classification rules. (c) all joint motion patterns at the level of each joint ( $n = 49$  patterns) differ from each other during at least one phase of the gait cycle. Results showed that: (a) ten patterns with 'no or minor gait deviations' differed somewhat unexpectedly from typically developing gait, but these differences were generally small ( $\leq 3^\circ$ ); (b) all other joint motion patterns ( $n = 38$ ) differed from typically developing gait and the significant locations within the gait cycle that were indicated by the statistical analyses, coincided well with the classification rules; (c) joint motion patterns at the level of each joint significantly differed from each other, apart from two sagittal plane pelvic patterns. In addition to these results, for several joints, statistical analyses indicated other significant areas during the gait cycle that were not included in the pattern definitions of the consensus study. Based on these findings, suggestions to improve pattern definitions were made.

[PMID: 28081229](#)

## 9. Standing activity intervention and motor function in a young child with cerebral palsy: A case report.

Audu O, Daly C.

Physiother Theory Pract. 2017 Jan 10;1-11. doi: 10.1080/09593985.2016.1265621. [Epub ahead of print]

**PURPOSE:** There is limited evidence to fully justify the use of standing interventions for children with cerebral palsy (CP). This case report describes the impact of an 8-week standing program on motor function in a child with severe CP living in western Africa. **METHODS:** The subject was diagnosed with ischemic - hypoxic encephalopathy shortly after birth and with CP at 12 months of age. Gross Motor Function Classification of CP was level IV. Early attempts at physical therapy were interrupted by limited access to medical services. At 18 months, a standing program using a locally constructed standing frame was initiated. The standing intervention was completed at home 5 times a week for 8 weeks. Motor skills were assessed at baseline and post-intervention using the Gross Motor Function Measure (GMFM-66). **RESULTS:** Scores on the GMFM-66 increased from 28 at baseline to 37.4 in 8 weeks. Improvements in motor function included improved head control, improved upper extremity function, and increased sitting ability. **CONCLUSIONS:** Implementation of a home-based standing program may have contributed to improved motor skills for this child. Further research is needed to determine the effect of standing interventions on functional motor development for children with severe CP.

[PMID: 28071965](#)

## 10. The Edinburgh visual gait score - The minimal clinically important difference.

Robinson LW, Clement ND, Herman J, Gaston MS.

Gait Posture. 2017 Jan 3;53:25-28. doi: 10.1016/j.gaitpost.2016.12.030. [Epub ahead of print]

**OBJECTIVE:** The primary aim was to define the minimal clinically important difference (MCID) of the Edinburgh Visual Gait Score (EVGS) using correlations with the Gross Motor Function Classification System (GMFCS) and the Functional Assessment Questionnaire (FAQ). The secondary aim was to confirm the numerical value of the MCID in the Gait Profile Score (GPS). **METHOD:** The EVGS and GPS scores for 151 patients with diplegic cerebral palsy (GMFCS Levels I-III) were retrospectively identified from a database held at the study centre. One-hundred and forty-one patients had FAQ data available.

**RESULTS:** The EVGS and GPS correlated with increasing GMFCS level ( $p < 0.001$ ) and FAQ score ( $p < 0.001$ ). A gradient of 3.8 (2.9-4.7) for the EVGS and 2.9 (2.1-3.7) for the GPS corresponded to a one-level change in GMFCS level. A gradient of 1.9 (1.3-2.4) for EVGS and 1.5 (1.1-2.0) for GPS corresponded to a one-point change in FAQ. **CONCLUSIONS:** The authors propose an MCID value of 2.4 for the EVGS; representing the improvement in gait score after surgery that is likely to reflect a clinical improvement in function. This MCID is closely related to other studies defining post-operative improvements in kinematic data (GPS) and may offer guidance to post-surgical changes that might reasonably be expected to either improve or prevent deteriorating function.

[PMID: 28073083](#)

### **11. AbobotulinumtoxinA (Dysport®) Improves Function According to Goal Attainment in Children With Dynamic Equinus Due to Cerebral Palsy.**

Tilton A, Russman B, Aydin R, Dincer U, Escobar RG, Kutlay S, Lipczyk Z, Velez JC, Grandoulier AS, Tse A, Picaut P, Delgado MR.

J Child Neurol. 2017 Jan 1;883073816686910. doi: 10.1177/0883073816686910. [Epub ahead of print]

This secondary analysis of a large ( $n = 241$ ), randomized, double-blind study evaluated the efficacy of 2 doses of abobotulinumtoxinA + standard of care (SOC) versus placebo + SOC in enabling children with dynamic equinus due to cerebral palsy to achieve their functional goals using Goal Attainment Scaling. Most parents/caregivers selected goals targeting aspects of gait improvement as most relevant. Mean (95% confidence interval) Goal Attainment Scaling T scores at week 4 were higher for both abobotulinumtoxinA groups versus placebo (treatment difference vs placebo: 10 U/kg/leg: 5.32 [2.31, 8.32],  $P = .0006$ , and 15 U/kg/leg 4.65 [1.59, 7.71],  $P = .0031$ ). Superiority of both abobotulinumtoxinA doses versus placebo was maintained at week 12. Best goal attainment T scores were higher in the abobotulinumtoxinA groups versus placebo for the common goals of improved walking pattern, decreased falling, decreased tripping, and improved endurance. These findings demonstrate that single injections of abobotulinumtoxinA (10 and 15 U/kg/leg) significantly improved the ability of pediatric cerebral palsy patients to achieve their functional goals.

[PMID: 28068857](#)

### **12. The effect of deep cross friction massage on spasticity of children with cerebral palsy: A double-blind randomised controlled trial.**

Rasool F, Memon AR, Kiyani MM, Sajjad AG.

J Pak Med Assoc. 2017 Jan;67(1):87-91.

**OBJECTIVE:** To find out the effect of deep cross-friction massage on spasticity in children with cerebral palsy. **METHODS:** This double-blind randomised controlled trial was conducted at the National Institute of Rehabilitation Medicine, Islamabad, Pakistan, from January to July 2013, and comprised paediatric patients with spastic diplegic cerebral palsy. The participants were equally divided into control and treatment groups by a staff member unaware of the treatment (allocation ratio 1:1). The control group received routine physiotherapy, while the experimental group was additionally given deep cross-friction massage for 30 minutes, 5 times a week lasting 6 weeks. The outcome was measured using Modified Ashworth Scale and functional level scale before the treatment and 6 weeks later. Baseline information and characteristics of the patients were also recorded. SPSS 20 was used for data analysis. **RESULTS:** Of the 60 patients, there were 30(50%) in each group. The control group consisted of 14(46.7%) males and 16(53.3%) females compared to 16(53.3%) males and 14(46.7%) females in the experimental group ( $p=0.72$ ). The overall mean age was  $6.03 \pm 1.73$  years. All patients (100%) were followed up for a period of 6 weeks and there was not a significant ( $p=0.26$ ) improvement in experimental group compared to control group evident on Modified Ashworth Scale. The experimental group, however, had significant improvement after 6 weeks compared to the baseline values ( $p < 0.001$ ). However, functional level did not improve ( $p=0.55$ ) by the end of study. **CONCLUSIONS:** Deep cross-friction massage is an efficacious treatment option for the management of spasticity in children with cerebral palsy.

[PMID: 28065961](#)

### 13. Results and complications of percutaneous pelvic osteotomy and intertrochanteric varus shortening osteotomy in 54 consecutively operated GMFCS level IV and V cerebral palsy patients.

Canavese F, Marengo L, de Coulon G.

Eur J Orthop Surg Traumatol. 2017 Jan 12. doi: 10.1007/s00590-017-1902-3. [Epub ahead of print]

**PURPOSE:** This retrospective study evaluated mid-to-long-term outcome of a minimally invasive percutaneous pelvic osteotomy (PPO) approach combined with varus derotational shortening osteotomy (VDRSO) and soft tissue release in children with severe CP. **METHODS:** A retrospective review was performed of all patients presenting with a diagnosis of CP with hip subluxation or dislocation treated surgically by simultaneous soft tissue release, VDRSO, and PPO between 2002 and 2015. Eligible patients included those with a diagnosis of spastic quadriplegia or CP GMFCS level IV or V with unilateral or bilateral hip subluxation or dislocation and surgical treatment of the deformity by simultaneous soft tissue release, VDRSO and PPO. All anterior-posterior (AP) radiographs of the pelvis were reviewed and Reimers migration percentage (MP) and acetabular angle (AA) were measured. **RESULTS:** In total, 54 children and adolescents (34 boys, 20 girls) with CP GMFCS level IV and V were treated during study period: 38 (70.4%) classified GMFCS level IV and 16 (29.6%) classified GMFCS level V. A total of 64 consecutive hips underwent simultaneous PPO associated with VDRSO. Overall, at the time of chart and radiograph review, mean age was  $9.1 \pm 3.3$  years (range 4-16.5) and mean follow-up was  $43.9 \pm 19.5$  months (range 3-72). Mean migration percentage improved from  $66.8 \pm 19.8\%$  (range 33-100) preoperatively to  $8.1 \pm 16.5\%$  (range 0-70) at last follow-up. Mean acetabular angle improved from  $32.7^\circ \pm 7.1^\circ$  (range 20-50) preoperatively to  $14^\circ \pm 6.7^\circ$  (range 0-27) at last follow-up. Only one case of bone graft dislodgment was observed. We did not observe any cases of avascular necrosis of the femoral head. All operated hips were pain free at the time of last follow-up. **CONCLUSION:** PPO through a less invasive surgical approach offers a valuable alternative to standard techniques as it gives similar outcome but with less muscle stripping and less time in surgery.

[PMID: 28083677](#)

### 14. Distal femoral extension and shortening osteotomy as a part of multilevel surgery in children with cerebral palsy.

Klotz MC, Hirsch K, Heitzmann D, Maier MW, Hagmann S, Dreher T.

World J Pediatr. 2016 Dec 23. doi: 10.1007/s12519-016-0086-y. [Epub ahead of print]

**BACKGROUND:** There are several reports describing an increase in anterior pelvic tilt after hamstring lengthening in children with cerebral palsy (CP). Distal femoral extension and shortening osteotomy (DFESO) is an alternative treatment for correction of fl exed knee gait, but investigations analyzing outcome and influence on adjacent joint are few in the literature. The purpose of this study was to analyze the influence of DFESO on knee and pelvis in children with CP. Furthermore, it was of interest if an additional patellar tendon advancement (PA) influences outcome. **METHODS:** In this retrospective study, 31 limbs of 22 children (GMFCS I-III; mean age:  $12.1 \pm 3.1$  years), who received DFESO were included and kinematic parameters (knee, pelvis) measured by 3-D-gait analysis were compared before and at least 1 year after surgery (mean follow-up period: 15.6 months). **RESULTS:** After surgery, during stance phase minimum knee flexion improved significantly by  $20.5^\circ$  ( $P < 0.001$ ) and mean anterior pelvic tilt increased by 4.0 degrees ( $P = 0.045$ ). In 16 limbs, the postoperative increase in maximum anterior pelvic tilt was more than  $5^\circ$ . Limbs who received an additional PA showed the biggest increase in anterior pelvic tilt. **CONCLUSIONS:** DFESO is an effective method for correction of fl exed knee gait in children with CP. Furthermore, the results of this study indicate that DFESO may lead to an increase in anterior pelvic tilt, which may lead to a recurrence of fl exed knee gait. In this context, PA seemed to aggravate the effect on the pelvis.

[PMID: 28074440](#)

### 15. Changes in Cardiorespiratory Responses and Kinematics With Hippotherapy in Youth With and Without Cerebral Palsy.

Rigby BR, Gloeckner AR, Sessums S, Lanning BA, Grandjean PW.

Res Q Exerc Sport. 2017 Jan 11:1-10. doi: 10.1080/02701367.2016.1266458. [Epub ahead of print]

**PURPOSE:** The purpose of this study was to characterize pelvic displacement and cardiorespiratory responses to simulated horseback riding and walking in youth with cerebral palsy and to compare responses to youth without cerebral palsy before and after 8 weeks of hippotherapy. **METHOD:** Eight youth with cerebral palsy (Mage =  $10 \pm 4$  years; Mheight =  $137 \pm 24$  cm;

Mweight = 32 ± 16 kg) and 8 youth without cerebral palsy (Mage = 11 ± 2 years; Mheight = 149 ± 14 cm; Mweight = 48 ± 15 kg) underwent a hippotherapy intervention. Participants completed simulated horseback riding at an intensity approximating a fast walk (0.65 Hz) and walked on a treadmill (1 mph, 0% grade) before and after hippotherapy. Pelvic displacement along the anterior-posterior, vertical, and medial-lateral axes, heart rate, oxygen consumption, ventilation, and blood pressure were measured at rest and during steady-state exercise in both exercise modes. RESULTS: Kinematics and cardiorespiratory responses were similar between the 2 groups during simulated horseback riding ( $p > .05$  for all) before the intervention. Significantly greater cardiorespiratory responses were observed in the youth with cerebral palsy compared with the group without cerebral palsy while walking before and after the intervention ( $p < .05$ , effect sizes 26% to 237% greater). Eight weeks of hippotherapy did not alter responses, but anecdotal improvements in gait, balance, posture, and range of motion were observed in those with cerebral palsy. CONCLUSION: These results contribute to our understanding regarding the efficacy of hippotherapy as an intervention to improve functional abilities in those with cerebral palsy.

[PMID: 28075704](#)

### 16. Body composition, diet, and physical activity: a longitudinal cohort study in preschoolers with cerebral palsy.

Oftedal S, Davies PS, Boyd RN, Stevenson RD, Ware RS, Keawutan P, Benfer KA, Bell KL.

Am J Clin Nutr. 2017 Jan 11. pii: ajcn137810. doi: 10.3945/ajcn.116.137810. [Epub ahead of print]

BACKGROUND: Altered body composition in children with cerebral palsy (CP) could be due to differences in energy intake, habitual physical activity (HPA), and sedentary time. OBJECTIVE: We investigated the longitudinal relation between the weight-for-age z score (WZ), fat-free mass (FFM), percentage of body fat (%BF), and modifiable lifestyle factors for all Gross Motor Function Classification System (GMFCS) levels (I-V). DESIGN: The study was a longitudinal population-based cohort study of children with CP who were aged 18-60 mo (364 assessments in 161 children; boys: 61%; mean ± SD recruitment age: 2.8 ± 0.9 y; GMFCS: I, 48%; II, 11%; III, 15%; IV, 11%; and V, 15%). A deuterium dilution technique or bioelectrical impedance analysis was used to estimate FFM, and the %BF was calculated. Energy intake, HPA, and sedentary time were measured with the use of a 3-d weighed food diary and accelerometer wear. Data were analyzed with the use of a mixed-model analysis. RESULTS: Children in GMFCS group I did not differ from age- and sex-specific reference children with typical development for weight. Children in GMFCS group IV were lighter-for-age, and children in GMFCS group V had a lower FFM-for-height than those in GMFCS group I. Children in GMFCS groups II-V had a higher %BF than that of children in GMFCS group I, with the exception of orally fed children in GMFCS group V. The mean %BF of children with CP classified them as overfat or obese. There was a positive association between energy intake and FFM and also between HPA level and FFM for children in GMFCS group I. CONCLUSIONS: Altered body composition was evident in preschool-age children with CP across functional capacities. Gross motor function, feeding method, energy intake, and HPA level in GMFCS I individuals are the strongest predictors of body composition in children with CP between the ages of 18 and 60 mo.

[PMID: 28077375](#)

### 17. Multimorbidity in Middle-Aged Adults with Cerebral Palsy.

Cremer N, Hurvitz EA, Peterson MD.

Am J Med. 2017 Jan 5. pii: S0002-9343(16)31304-3. doi: 10.1016/j.amjmed.2016.11.044. [Epub ahead of print]

BACKGROUND: Individuals with cerebral palsy have less lean body mass, greater relative adiposity, and lower fitness and physical activity participation; and yet, the prevalence of age-related multimorbidity in this population has yet to be established. PURPOSE: To examine the prevalence of lifestyle-related chronic conditions and multimorbidity in a sample of middle-aged adults with cerebral palsy. METHODS: A clinic-based sample of middle-aged adults with cerebral palsy was examined using Electronic Medical Records Search Engine (EMERSE) software. Our cohort included  $n = 435$  individuals aged 40-60 years old, with an ICD-9/10-CM Diagnosis Code for cerebral palsy. Prevalence of 12 chronic conditions were evaluated, including existing diagnoses or historical record of: osteopenia/osteoporosis, myocardial infarction, stroke, coronary artery disease, impaired glucose tolerance/type 2 diabetes, other cardiovascular conditions, rheumatoid arthritis, osteoarthritis, asthma, emphysema, pre-hypertension/hypertension, and hyperlipidemia. Multivariate logistic models were used to estimate adjusted multimorbidity (i.e.,  $\geq 2$  chronic conditions), adjusting for age, sex, smoking status, obesity, and Gross Motor Function Classification System (GMFCS). RESULTS: There were 137 unique multimorbidity combinations. Multimorbidity was

significantly more prevalent among obese versus non-obese individuals for both GMFCS I-III (75.8% vs. 53.6%) and GMFCS IV-V (79.0% vs 64.2%), but was also significantly higher in non-obese individuals with GMFCS IV-V (64.2%) compared to individuals with non-obese individuals with GMFCS I-III (53.6%). Both obesity status (OR: 2.20; 95% CI 1.32-2.79) and the GMFCS IV-V category (OR: 1.81; 95% CI 1.32-3.68) were independently associated with multimorbidity. **CONCLUSION:** Middle-aged adults with cerebral palsy have high estimates of multimorbidity, and both obesity and higher GMFCS levels are independently associated with greater risk.

[PMID: 28065772](#)

### **18. Hyperbaric oxygen therapy is safe and effective for the treatment of sleep disorders in children with cerebral palsy.**

Long Y, Tan J, Nie Y, Lu Y, Mei X, Tu C.

Neurol Res. 2017 Jan 12:1-9. doi: 10.1080/01616412.2016.1275454. [Epub ahead of print]

**OBJECTIVE:** To observe the effects of hyperbaric oxygen (HBO2) therapy on the treatment of sleep disorders and its safety in children with cerebral palsy (CP). **METHODS:** A total of 71 recruited children were divided into two groups based on age: group 1, aged between 2 and 4 years; and group 2, aged between 4 and 6 years. The effects of HBO2 therapy on sleep quality were observed. **RESULTS:** The total sleep items (TSIs) were significantly different in the two groups between pre-HBO2, post 10 HBO2 sessions, and post 20 HBO2 sessions ( $p < 0.01$ ). A total of 15/38 (39.5%) participants in group 1 and 8/21 (38.0%) in group 2 presented difficulty in falling asleep; 17/38 (44.7%) in group 1 and 4/21 (19.0%) in group 2 had a short duration of sleep during the night; and 20/38 (52.6%) in group 1 and 11/21 (52.4%) in group 2 woke up easily in the night. No significant difference in the average TSIs in 59 participants was found after 10 HBO2 sessions. Eight participants had insomnia after the first 5 sessions, and three in group 2 had nocturnal hyperkinesia after 15 sessions. A seizure during decompression was observed in 2/59 participants (2/419 sessions). **DISCUSSION:** These results indicate that HBO2 therapy is beneficial to improve sleep and is safe for children with CP; however, further studies are necessary to explore the mechanisms of HBO2 on sleep.

[PMID: 28079475](#)

### **19. Transdermal Scopolamine Withdrawal Syndrome Case Report in the Pediatric Cerebral Palsy Population.**

Chowdhury NA, Sewatsky ML, Kim H.

Am J Phys Med Rehabil. 2017 Jan 9. doi: 10.1097/PHM.0000000000000665. [Epub ahead of print]

Sialorrhea in children with cerebral palsy (CP) results in aspiration, decreased social integration, and poor quality of life. Management options include transdermal anticholinergics such as the scopolamine patch. A controlled clinical trial has proven botulinum toxin (BTX) injections into the salivary glands are an effective alternative to transdermal anticholinergics with a safer side effect profile. Multiple studies of the injections in diverse populations demonstrate reduction in saliva production with improvement in quality of life and decrease in hospitalization-associated costs. The authors describe a 15-year-old boy with spastic quadriplegic CP who developed emesis, nausea, and lethargy 1 day after the first injection of botulinum toxin A (BTX-A) to his salivary glands for sialorrhea management. The authors ascribed his symptoms to scopolamine withdrawal. Given the lack of exposure in the medical literature, there is minimal awareness of the withdrawal syndrome from transdermal scopolamine in children with or without CP, resulting in delayed diagnosis and potential complications. Treatment of the withdrawal syndrome has been successful with meclizine though safety and efficacy has not been established in children younger than 12 despite frequent clinical and over-the-counter use. Prompt diagnosis of the transdermal scopolamine withdrawal syndrome can result in quicker treatment and a shorter hospital stay.

[PMID: 28081025](#)

## 20. Oral health evaluation in special needs individuals.

[Article in English, Portuguese]

Pini DM, Fröhlich PC, Rigo L.

Einstein (Sao Paulo). 2016 Oct-Dec;14(4):501-507. doi: 10.1590/S1679-45082016AO3712.

**OBJECTIVE:** To identify the prevalence of the main oral problems present in special needs children and to relate the underlying conditions with the clinical and demographic variables. **METHODS:** The study was based on the physical examination of 47 students from the Associação de Pais e Amigos dos Excepcionais diagnosed as Down syndrome, cerebral palsy and intellectual deficit. For data collection, we used a self-administered questionnaire that included indices of dental caries and oral hygiene, Angle classification, malposition of dental groups and oral hygiene habits. **RESULTS:** The predominant age group was 12-25 years (46.8%) and most patients were male (55.3%). Regarding daily brushing, 63.8% reported brushing their teeth three times a day, and 85.1% did it by themselves. A total of 48.9% were rated as Angle class I, and 25.5% had no type of malocclusion. A high dental carries index (decayed, missing, filled >10) was observed in 44.7%, and 53.2% had inadequate oral hygiene (zero to 1.16). There was a statistically significant difference between cerebral palsy and the act of the participants brushing their teeth by themselves. **CONCLUSION:** There was a high decayed-missing-filled teeth index and malocclusion class I, as well as inadequate oral hygiene. The type of underlying condition of the participants influenced the act of brushing teeth by themselves.

[PMID: 28076597](#)

## 21. Focusing on Participation: A Commentary on "Current Rehabilitation Practices for Children with Cerebral Palsy: Focus and Gaps".

Pritchard-Wiart L.

Phys Occup Ther Pediatr. 2017 Jan 12:1-3. doi: 10.1080/01942638.2017.1259379. [Epub ahead of print]

[No abstract available]

[PMID: 28080172](#)

## 22. Burnout of Formal Caregivers of Children with Cerebral Palsy.

Vicentic S, Sapic R, Damjanovic A, Vekic B, Loncar Z, Dimitrijevic I, Ilankovic A, Jovanovic AA.

Isr J Psychiatry Relat Sci. 2016;53(2):10-15.

**BACKGROUND:** Burnout syndrome is under-researched within caregivers (CGs) of children with cerebral palsy. The primary aim was to determine the burnout level of formal CGs of children with cerebral palsy (G1) and to compare it with a control group (G2) of professional pediatric nurses, and second, to correlate the level of depression and anxiety with the burnout level. **METHOD:** In a total sample of 60 CGs, the Maslach Burnout Inventory Human Services Survey (MBI-HSS), consisting of three structural units - emotional exhaustion (MBIEE) subscale, depersonalization (MBI-DP) subscale and personal accomplishment (MBI-PA) subscale - was used to measure burnout. The Beck Anxiety Inventory (BAI) was used for the assessment of anxiety, and the Beck Depression Inventory (BDI) for depression. **RESULTS:** A significant difference was shown on the MBI-EE subscale and on the BDI test ( $p < 0.05$ ), in both cases higher scores were obtained by G1. High burnout was observed in all subscales, on the MBI-EE subscale registered 50% of CGs in G1, and 17% in control G2. Correlation of the MBI-EE subscale with BDI and BAI tests was highly significant ( $p < 0.01$ ). **CONCLUSIONS:** These findings indicate the need for future research aimed at formulating preventive strategies for caregivers' mental health. Better care for caregivers would provide them with better professional satisfaction, and consequently would lead to better care for patients.

[PMID: 28079032](#)

### **23. An exploratory study investigating the multidimensional factors impacting the health and well-being of young adults with cerebral palsy.**

Sienko SE.

Disabil Rehabil. 2017 Jan 9:1-10. doi: 10.1080/09638288.2016.1274340. [Epub ahead of print]

**BACKGROUND:** For young adults with cerebral palsy, changes in psychological and social development, in conjunction with the progression of musculoskeletal deformities and the onset of secondary conditions, make the transition to adulthood a difficult developmental phase. Preliminary evidence shows that many of the physical impairments reported in adults with cerebral palsy begin during late adolescence; however, there is little information about prevalence of impairments and the combined role impairments, psychological and social factors have on the health and well-being of young adults with cerebral palsy. **METHODS:** A cross-sectional, multidimensional survey approach was used to examine the ambulatory decline, pain, pain interference, depression, fatigue, locus of control, emotional support, overall health status and satisfaction with life of young adults with cerebral palsy, age 18-30 years. **RESULTS:** Ninety-seven surveys (57 self-report and 40 proxy report) were completed across all gross motor function classification system levels. No significant differences were found amongst functional levels for pain, pain interference, fatigue or depression. Only pain interference significantly contributed to the variance in health status, while emotional support significantly contributed to the variance in satisfaction with life. **CONCLUSIONS:** The large percentage of young adults in this study reporting pain, fatigue and depression indicates that the onset of these impairments may begin at an earlier age. This study found that emotional support from family facilitates improved health status and enhanced satisfaction with life in young adults with cerebral palsy. Similar to physical impairments, social and psychological factors also contribute to the health and well-being of young adults with cerebral palsy, a holistic approach to care that includes preventative strategies to address both mental and physical health outcomes should begin well in advance to their transition into young adulthood in order to mitigate the impact these factors have on health and well-being during this critical developmental time. Implications for Rehabilitation Pain, fatigue and depression were reported for all levels of GMFCS and should be assessed and addressed with appropriate treatment early in order to determine whether there are surgical, pharmacological, rehabilitative or counseling services that could be implemented at a younger age to improve outcomes in young adulthood. For young adults with CP, emotional support plays a significant role in the health status and satisfaction with life and strategies to enhancing support beyond the family could enhance health status and satisfaction with life.

[PMID: 28068863](#)

### **24. Addressing heterogeneous needs using cerebral palsy registers.**

Zwicker J, Oskoui M.

Dev Med Child Neurol. 2017 Jan 10. doi: 10.1111/dmcn.13375. [Epub ahead of print]

[This commentary is on the original article by Meehan et al.]

[PMID: 28070888](#)

## **Prevention and Cure**

### **25. The neuroprotective compound P7C3-A20 promotes neurogenesis and improves cognitive function after ischemic stroke.**

Loris ZB, Pieper AA, Dalton Dietrich W.

Exp Neurol. 2017 Jan 8. pii: S0014-4886(17)30005-5. doi: 10.1016/j.expneurol.2017.01.006. [Epub ahead of print]

Ischemic stroke is a devastating condition with few therapeutic interventions available. The neuroprotective compound P7C3-A20 inhibits mature neuronal cell death while also increasing the net magnitude of postnatal neurogenesis in models of neurodegeneration and acute injury. P7C3 compounds enhance flux of nicotinamide adenine dinucleotide (NAD) in

mammalian cells, a proposed therapeutic approach to treating cerebral ischemia. The effectiveness of P7C3-A20 treatment on chronic histopathological and behavioral outcomes and neurogenesis after ischemic stroke has not previously been established. Here, a transient middle cerebral artery occlusion in rats was followed by twice daily injection of P7C3-A20 or vehicle for 7 days. P7C3-A20-treated rats performed significantly better than vehicle-treated controls in sensorimotor cylinder and grid-walk tasks, and in a chronic test of spatial learning and memory. These behavioral improvements with P7C3-A20 treatment were correlated with significantly decreased cortical and hippocampal atrophy, and associated with increased neurogenesis in the subventricular zone and hippocampal dentate gyrus subgranular zone. Furthermore, cerebral ischemia significantly reduced NAD in the cortex but P7C3-A20 treatment restored NAD to sham levels. Thus, P7C3-A20 treatment mitigates neurodegeneration and augments repair in the brain after focal ischemia, which translates into chronic behavioral improvement. This suggests a new therapeutic approach of using P7C3 compounds to safely augment NAD and thereby promote two independent processes critical to protecting the brain from ischemic stroke: mature neuron survival and postnatal hippocampal neurogenesis throughout the post-ischemic brain.

[PMID: 28077334](#)

## **26. [Predictive value of cerebellar growth and general movements assessments for neurodevelopment of very preterm infants at 18-24 months' corrected age].**

[Article in Spanish]

Cunha M, Correa F, Cadete A, Oliveira A, Figueiredo H, Valerio P, Barroso R, Carreiro H.

Rev Neurol. 2017 Jan 16;64(2):63-69.

**INTRODUCTION:** Fidgety movements assessments is very sensitive predicting long-term outcome or cerebral palsy of preterm, disrupted cerebellar growth has been reported in these patients. **AIM:** To compare the predictive value of cerebellar ultrasound growth and fidgety movements assessments, for neurodevelopment outcome of very preterm at 18-24 month's corrected age (CA). **SUBJECTS AND METHODS:** Prospective study of 88 infants cohort ( $\leq 32$  weeks' gestation), transverse cerebellar diameter was obtained by ultrasound via mastoid fontanel, in a weekly basis, until 40 weeks CA. Fidgety movements were assessed at 3 months CA. Neurodevelopment outcome at 18-24 month's CA was evaluated in 68 using Schedule of Growing Skills II Scale (SGS-II) and Amiel-Tison Neurologic Assessment (ATNA). **RESULTS:** At term age, cerebellar growth was under 3rd percentile in 11 (10.3%). Fidgety movements were normal in 42 (61.8%) and abnormal or absent in 7 (10.3%). At 18-24 months CA, 54 (79.4%) were normal by the SGS-II and in 6 (8.8%) ATNA classified as cerebral palsy. Cerebellar diameter under 3rd percentile at term was associated with abnormal motor outcome and normal fidgety movements correlated with normal neurodevelopment. **CONCLUSION:** Ultrasound cerebellar measurements and functional examinations (fidgety movements) have important complementary roles in predicting neurodevelopment of very preterm.

[PMID: 28074999](#)

## **27. Recognizing the Common Origins of Dystonia and the Development of Human Movement: A Manifesto of Unmet Needs in Isolated Childhood Dystonias.**

Lin JP, Nardocci N.

Front Neurol. 2016 Dec 19;7:226. doi: 10.3389/fneur.2016.00226. eCollection 2016.

Dystonia in childhood may be severely disabling and often unremitting and unrecognized. Considered a rare disorder, dystonic symptoms in childhood are pervasive in many conditions including disorders of developmental delay, cerebral palsy (CP), autism, neurometabolic, neuroinflammatory, and neurogenetic disorders. Collectively, there is a need to recognize the role of early postures and movements which characterize phases of normal fetal, infant, and child development as a backdrop to the many facets of dystonia in early childhood neurological disorders and to be aware of the developmental context of dystonic symptoms. The role of cocontraction is explored throughout infancy, childhood, young adulthood, and in the elderly. Under-recognition of pervasive dystonic disorders of childhood, including within CP is reviewed. Original descriptions of CP by Gowers are reviewed and contemporary physiological demonstrations are used to illustrate support for an interpretation of the tonic labyrinthine response as a manifestation of dystonia. Early recognition and molecular diagnosis of childhood dystonia where possible are desirable for appropriate clinical stratification and future precision medicine and functional neurosurgery where appropriate. A developmental neurobiological perspective could also be useful in exploring new clinical strategies for adult-onset dystonia disorders focusing on environmental and molecular interactions and systems behaviors.

[PMID: 28066314](#)