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## Interventions and Management

**1. Am J Occup Ther. 2014 Mar-Apr;68(2):159-66. doi: 10.5014/ajot.2014.009860.**

**Potential predictors of functional outcomes after home-based constraint-induced therapy for children with cerebral palsy.**

Chen CL1, Lin KC2, Kang LJ3, Wu CY4, Chen HC5, Hsieh YW6.

**OBJECTIVE.** Our objective was to identify predictors for treatment outcomes after home-based constraint-induced therapy (CIT) in children with cerebral palsy (CP). **METHOD.** Forty-three children (aged 4-12 yr) with CP were treated with individualized CIT at home for 4 wk. Potential predictors were age, sex, affected hand, and upper-extremity motor capacity measured by the Peabody Developmental Motor Scale, 2nd edition (PDMS-2). Outcomes were the Pediatric Motor Activity Log (PMAL) Amount of Hand Use and Quality of Hand Use subscales and the Functional Independence Measure for Children (WeeFIM). **RESULTS.** A higher PDMS-2 Visual-Motor Integration subscale score predicted a better WeeFIM score after home-based CIT (adjusted  $R^2 = .35$ ). Younger age predicted better performance on the PMAL Amount of Hand Use and Quality of Hand Use subscales (adjusted  $R^2 = .06-.08$ ) after home-based CIT. **CONCLUSION.** The potential predictors may allow occupational therapy practitioners to target those children who will benefit most after home-based constraint-induced therapy.

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**2. Disabil Rehabil. 2014 Mar 3. [Epub ahead of print]**

**Walking activity of children with cerebral palsy and children developing typically: a comparison between the Netherlands and the United States.**

Van Wely L1, Dallmeijer AJ, Balemans AC, Zhou C, Becher JG, Bjornson KF.

**Purpose:** To compare walking activity of children with and without cerebral palsy (CP) between the Netherlands and the United States. **Methods:** A cross-sectional analysis on walking activity data from an international retrospective comparison study including a convenience sample of 134 walking children aged 7-12 years with spastic CP, classified as Gross Motor Function Classification System (GMFCS) level I (N = 64), II (N = 49) or III (N = 21), and 223 typically developing children (TDC) from the Netherlands and the United States. Walking activity

was assessed during a one-week period using a StepWatch™ activity monitor. Outcomes were the daily number of strides, daily time being inactive and spent at low (0-15 strides/min), moderate (16-30 strides/min) and high stride rate (31-60 strides/min). Walking activity was compared between countries using multiple linear regression analyses. Results: Walking activity of TDC was not significantly different between countries. Compared to their American counterparts, Dutch children in GMFCS level I and II showed less walking activity ( $p < 0.05$ ), whereas Dutch children in GMFCS level III showed more walking activity ( $p < 0.05$ ). Conclusion: The absence of differences in walking activity between Dutch and American TDC, and the presence of differences in walking activity between Dutch and American children with CP suggest that between-country differences affect walking activity differently in children with CP. Implications for Rehabilitation Physical activity of children with CP should be promoted in both the United States and the Netherlands. The between-country differences in walking activity illustrate that apart from the severity of the CP walking activity seems to be influenced by environmental aspects. In the promotion of physical activity, practitioners should pay attention to environmental barriers that families may experience for increasing physical activity.

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### **3. Funct Neurol. 2014 Oct-Dec;28(4):253-8. doi: 10.11138/FNeur/2013.28.4.253.**

#### **Use of botulinum toxin type A in the management of patients with neurological disorders: a national survey.**

Smania N, Colosimo C, Bentivoglio AR, Sandrini G, Picelli A.

The aim of this survey was to provide an overview of important issues relating to therapeutic strategies based on botulinum toxin type A injection for the treatment of patients with neurological disorders. Two hundred and ten physicians from neurology and neurorehabilitation units in Italian hospitals answered a questionnaire exploring some clinical aspects of the use of botulinum toxin type A in patients with spasticity/dystonia. 66% of the physicians treated patients with dystonia, 80% treated adults with spasticity, and 35% treated children with cerebral palsy. Palpation with no instrumental guidance was the injection technique most commonly used for treating patients with dystonia, spasticity and cerebral palsy; 57% of the physicians evaluated patients instrumentally before toxin injection, while 45% assessed postinjection improvements by instrumental means; 78% of the physicians prescribed (when appropriate) rehabilitation procedures after toxin injection. Our results seem to show that the routine use of botulinum toxin in clinics is far from standardized.

[PMID: 24598392](#) [PubMed - in process]

### **4. J Child Orthop. 2014 Mar 5. [Epub ahead of print]**

#### **Hip displacement in relation to age and gross motor function in children with cerebral palsy.**

Larnert P1, Risto O, Hägglund G, Wagner P.

**PURPOSE:** Hip dislocation in cerebral palsy (CP) is a serious complication. By radiographic screening and prophylactic surgery of children at risk most dislocations can be prevented. CPUP, the Swedish CP registry and follow-up program, includes annual radiographic examinations of children at Gross Motor Function Classification System (GMFCS) levels III-V. Data from CPUP were analysed to assess the risk of hip displacement in relation to GMFCS levels and age. **METHODS:** All children at GMFCS levels III-V (N = 353) whose first radiographic screening occurred before 3 years of age were followed between the ages 2-7 years. Migration percentages (MPs) were recorded annually (1,664 pelvic radiographs) and analysed using discrete time survival analysis. **RESULTS:** The risk of hip displacement between 2 years and 7 years of age was significantly ( $p < 0.05$ ) higher for children at GMFCS level V during the entire study period. The risk was highest at 2-3 years of age and decreased significantly ( $p < 0.001$ ) with each year of age (OR = 0.71, 95 % CI 0.60-0.83). The cumulative risk at age 7 years for those at GMFCS V for MP  $\geq 40$  % was 47 % (95 % CI 37-58). The corresponding risk at GMFCS IV was 24 % (16-34) and at GMFCS III 23 % (12-42). **CONCLUSIONS:** Children at GMFCS V have a significantly higher risk of hip displacement compared with children at GMFCS III-IV. The risk is highest at 2-3 years of age. The results support a surveillance program including radiographic hip examinations as soon as the diagnosis of severe CP is suspected.

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**5. J Pediatr Orthop. 2014 Apr-May;34(3):295-9. doi: 10.1097/BPO.000000000000146.**

**Proximal femoral resection for the painful dislocated hip in cerebral palsy: does indomethacin prevent heterotopic ossification?**

Dartnell J1, H Paterson JM, Magill N, Norman-Taylor F.

**BACKGROUND:** Painful hip displacement is difficult to treat in severe cerebral palsy. Proximal femoral resection (PFR) is an excellent procedure for pain relief but has a high rate of heterotopic ossification (HO). Indomethacin is the gold standard therapy used for prevention in hip and acetabular surgery. There is no evidence of its benefit in this complex patient group. **METHODS:** Forty-one consecutive patients with severe cerebral palsy underwent 52 primary PFRs for severe pain in 2 pediatric orthopaedic units in London, UK. Twenty-one patients received a prophylactic postoperative dose of indomethacin for the prevention of HO. Notes and radiographs were reviewed independently by 2 orthopaedic trainees. **RESULTS:** The mean age of patients was 14.3 and 14.8 years in the group administered with and administered without indomethacin, respectively, and mean follow-up was 4.5 and 4.3 years. Five patients in each group developed HO. One patient in the indomethacin group was offered reexcision for HO but declined. Two in the nonindomethacin group were offered reexcision and one accepted and made a good recovery. There was no difference in pain relief between the groups and no correlation between the degree of HO and level of postoperative pain. **CONCLUSIONS:** This study does not support the use of prophylactic indomethacin in severe cerebral palsy patients undergoing PFR. We also question the importance of HO in the outcome of this procedure.

LEVEL OF EVIDENCE: Level III.

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**6. Neurosurg Focus. 2014 Mar;36(3):E5. doi: 10.3171/2014.1.FOCUS13514.**

**The use of intraoperative navigation for complex upper cervical spine surgery.**

Guppy KH1, Chakrabarti I, Banerjee A.

Imaging guidance using intraoperative CT (O-arm surgical imaging system) combined with a navigation system has been shown to increase accuracy in the placement of spinal instrumentation. The authors describe 4 complex upper cervical spine cases in which the O-arm combined with the StealthStation surgical navigation system was used to accurately place occipital screws, C-1 screws anteriorly and posteriorly, C-2 lateral mass screws, and pedicle screws in C-6. This combination was also used to navigate through complex bony anatomy altered by tumor growth and bony overgrowth. The 4 cases presented are: 1) a developmental deformity case in which the C-1 lateral mass was in the center of the cervical canal causing cord compression; 2) a case of odontoid compression of the spinal cord requiring an odontoidectomy in a patient with cerebral palsy; 3) a case of an en bloc resection of a C2-3 chordoma with instrumentation from the occiput to C-6 and placement of C-1 lateral mass screws anteriorly and posteriorly; and 4) a case of repeat surgery for a non-union at C1-2 with distortion of the anatomy and overgrowth of the bony structure at C-2.

[PMID: 24580006](#) [PubMed - in process]

**7. Ther Clin Risk Manag. 2014 Feb 17;10:113-20. doi: 10.2147/TCRM.S58186. eCollection 2014.**

**Postural pattern recognition in children with unilateral cerebral palsy.**

Domagalska-Szopa M, Szopa A.

**BACKGROUND:** Several different strategies for maintaining upright standing posture in children with cerebral palsy (CP) were observed. **PURPOSE:** The purpose of the present study was to define two different postural patterns in children with unilateral CP, using moiré topography (MT) parameters. Additionally, another focus of this article was

to outline some implications for managing physiotherapy in children with hemiplegia. **PATIENTS AND METHODS:** The study included 45 outpatients with unilateral CP. MT examinations were performed using a CQ Elektronik System device. In addition, a weight distribution analysis on the base of support between unaffected and affected body sides was performed simultaneously. A force plate pressure distribution measurement system (PDM-S) with Foot Print software was used for these measurements. **RESULTS:** THE CLUSTER ANALYSIS REVEALED FOUR GROUPS: cluster 1 (n=19; 42.22%); cluster 2 (n=7; 15.56%); cluster 3 (n=9; 20.00%); and cluster 4 (n=10; 22.22%). **CONCLUSION:** BASED ON THE MT PARAMETERS (EXTRACTED USING A DATA REDUCTION TECHNIQUE), TWO POSTURAL PATTERNS WERE DESCRIBED: 1) the pro-gravitational postural pattern; and 2) the anti-gravitational pattern.

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#### **8. Case Rep Orthop. 2014;2014:186973. doi: 10.1155/2014/186973. Epub 2014 Jan 29.**

##### **Agensis of the Corpus Callosum and Skeletal Deformities in Two Unrelated Patients: Analysis via MRI and Radiography.**

Al Kaissi A1, Kurz H2, Bock W3, Pärtan G4, Klaushofer K5, Ganger R6, Grill F6.

**Purpose.** Mental retardation, mild to severe epilepsy and cerebral palsy often of hemiplegic type are common accompaniments in patients with agensis/hypoplasia of the corpus callosum. Skeletal deformities of bilateral radiohumeral synostosis, brachydactyly, bilateral elbow dislocation, talipes equinovarus, and juxtacalcaneal accessory bones have been encountered in two unrelated children with agensis of the corpus callosum. **Methods.** We report on two unrelated children who presented with the full clinical criteria of agensis of the corpus callosum. Strikingly, both presented with variable upper and lower limb deformities. The clinical features, radiographic and MRI findings in our current patients, have been compared with previously reported cases identified through a PubMed literature review. **Results.** Bilateral radiohumeral synostosis associated with pyruvate dehydrogenase deficiency has been encountered in one patient. The other patient manifested bilateral elbow dislocation, coxa valga, talipes equinovarus, and bilateral juxtacalcaneal accessory bones. **Conclusion.** The constellation of malformation complexes in our current patients have the hitherto not been reported and expanding the spectrum of skeletal deformities in connection with agensis of the corpus callosum.

[PMID: 24592343](#) [PubMed] [PMCID: PMC3926397](#) Free PMC Article

#### **9. Muscles Ligaments Tendons J. 2014 Feb 24;3(4):356-7. eCollection 2013.**

##### **Insight in spastic musculoskeletal structures in cerebral palsy: impaired or compensatory structural changes?**

Di Lorenzo L1, Forte AM2, Forte F2.

[PMID: 24596702](#) [PubMed] [PMCID: PMC3940512](#) Free PMC Article

#### **10. J Clin Exp Dent. 2014 Feb 1;6(1):e1-6. doi: 10.4317/jced.51129. eCollection 2014.**

##### **Resting position of the head and malocclusion in a group of patients with cerebral palsy.**

Martinez-Mihi V1, Silvestre FJ2, Orellana LM3, Silvestre-Rangil J1.

Cerebral palsy are found as a result of these disorders, along with associated neuromuscular functional alterations that affect the resting position of the head. In this context, the resting position of the head could be responsible for several skeletal and dental occlusal disorders among patients with cerebral palsy. **OBJECTIVE:** To assess the presence of malocclusions in patients with cerebral palsy, define the most frequent types of malocclusions, and evaluate how the resting position of the head may be implicated in the development of such malocclusions. **STUDY DESIGN:** Forty-four patients aged between 12-55 years (18 males and 26 females) were studied. Occlusal conditions, the Dental Aesthetic Index (DAI), changes in the resting position of the head, and breathing and swallowing functions were assessed. **RESULTS:** Orthodontic treatment was required by 70.8% of the patients, the

most frequent malocclusions being molar class II, open bite and high overjet. These individuals showed altered breathing and swallowing functions, as well as habit and postural disorders. The resting position of the head, especially the hyperextended presentation, was significantly correlated to high DAI scores. **CONCLUSIONS:** The results obtained suggest that patients with cerebral palsy are more susceptible to present malocclusions, particularly molar class II malocclusion, increased open bite, and high overjet. Such alterations in turn are more common in patients with a hyperextended position of the head. **Key words:** Cerebral palsy, malocclusion, head position, disabled patients.

[PMID: 24596627](#) [PubMed] [PMCID: PMC3935897](#) Free PMC Article

**11. Spec Care Dentist. 2014 Mar;34(2):56-63. doi: 10.1111/scd.12028. Epub 2013 Jun 4.**

**Impact of oral diseases and disorders on oral-health-related quality of life of children with cerebral palsy.**

Abanto J1, Ortega AO, Raggio DP, Bönecker M, Mendes FM, Ciamponi AL.

The aim of this study was to investigate the impact of oral diseases and disorders on the oral-health-related quality of life (OHRQoL) of children with CP, adjusting this impact by socioeconomic factors. Data were collected from 60 pairs of parents-children with CP. Parents answered the child oral health quality of life questionnaire (parental-caregivers perception questionnaire and family impact scale) and a socioeconomic questionnaire. Dental caries experience, traumatic dental injuries, malocclusions, bruxism, and dental fluorosis were also evaluated. The multivariate adjusted model showed that dental caries experience ( $p < 0.001$ ) and the presence of bruxism had a negative impact ( $p = 0.046$ ) on the OHRQoL. A greater family income had a positive impact on it ( $p < 0.001$ ). Dental caries experience and bruxism are conditions strongly associated with a negative impact on OHRQoL of children with CP and their parents, but a higher family income can improve this negative impact.

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**12. PLoS One. 2014 Feb 26;9(2):e89186. doi: 10.1371/journal.pone.0089186. eCollection 2014.**

**Risk Factors for Hospital Admission with RSV Bronchiolitis in England: A Population-Based Birth Cohort Study.**

Murray J1, Bottle A1, Sharland M2, Modi N3, Aylin P1, Majeed A1, Saxena S1; Medicines for Neonates Investigator Group.

**OBJECTIVE:** To examine the timing and duration of RSV bronchiolitis hospital admission among term and preterm infants in England and to identify risk factors for bronchiolitis admission. **DESIGN:** A population-based birth cohort with follow-up to age 1 year, using the Hospital Episode Statistics database. **SETTING:** 71 hospitals across England. **PARTICIPANTS:** We identified 296618 individual birth records from 2007/08 and linked to subsequent hospital admission records during the first year of life. **RESULTS:** In our cohort there were 7189 hospital admissions with a diagnosis of bronchiolitis, 24.2 admissions per 1000 infants under 1 year (95%CI 23.7-24.8), of which 15% (1050/7189) were born preterm (47.3 bronchiolitis admissions per 1000 preterm infants (95% CI 44.4-50.2)). The peak age group for bronchiolitis admissions was infants aged 1 month and the median was age 120 days (IQR=61-209 days). The median length of stay was 1 day (IQR=0-3). The relative risk (RR) of a bronchiolitis admission was higher among infants with known risk factors for severe RSV infection, including those born preterm (RR=1.9, 95% CI 1.8-2.0) compared with infants born at term. Other conditions also significantly increased risk of bronchiolitis admission, including Down's syndrome (RR=2.5, 95% CI 1.7-3.7) and cerebral palsy (RR=2.4, 95% CI 1.5-4.0). **CONCLUSIONS:** Most (85%) of the infants who are admitted to hospital with bronchiolitis in England are born at term, with no known predisposing risk factors for severe RSV infection, although risk of admission is higher in known risk groups. The early age of bronchiolitis admissions has important implications for the potential impact and timing of future active and passive immunisations. More research is needed to explain why babies born with Down's syndrome and cerebral palsy are also at higher risk of hospital admission with RSV bronchiolitis.

[PMID: 24586581](#) [PubMed - in process] [PMCID: PMC3935842](#) Free PMC Article

**13. Aten Primaria. 2014 Feb 26. pii: S0212-6567(14)00009-2. doi: 10.1016/j.aprim.2013.12.005. [Epub ahead of print]**

**Impact of a psychosocial intervention in caregiver burden of children with cerebral palsy [Article in Spanish]**

Martínez Lazcano F1, Avilés Cura M2, Ramírez Aranda JM1, Riquelme Heras H1, Garza Elizondo T1, Barrón Garza F3.

**OBJECTIVE:** To demonstrate that problem-solving therapy is effective in reducing the burden on caregivers of children with cerebral palsy. **DESIGN:** Randomized clinical trial. **LOCATION:** Check primary care within a private nonprofit association. **PARTICIPANTS:** 140 caregivers divided into control group (CG) and experimental group (EG). **INTERVENTIONS:** We performed in both groups a psychosocial intervention with a frequency of one session per week for three weeks to complete 120 minutes. In the EG performed a shortened form of problem-solving therapy with a focus on caregiver burden and the CG performed an educational intervention focusing on respiratory diseases. **MAIN MEASURES:** The response variable corresponds to the score obtained by Zarit questionnaire. The independent variable accounted for psychosocial intervention. **RESULTS:** In the EG according to Zarit questionnaire score was obtained by averaging 45.0 points pre intervention against 45.3 points in the CP after intervention Zarit was obtained by averaging 29.8 points in the EG and 44.3 points in the CG ( $P < .0001$ ). The catalog groups according to their score Zarit in charge: none, mild, moderate and severe impact differences were found in the different intervention categories (Wilcoxon test  $Z = 6.281$ ,  $P < .00001$ ). **CONCLUSIONS:** Problem solving therapy is effective in reducing the burden on caregivers of children with cerebral palsy.

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**14. J Neurol Neurosurg Psychiatry. 2014 Mar 3. doi: 10.1136/jnnp-2013-307041. [Epub ahead of print]**

**The impact and prognosis for dystonia in childhood including dystonic cerebral palsy: a clinical and demographic tertiary cohort study.**

Lin JP1, Lumsden DE, Gimeno H, Kaminska M.

**INTRODUCTION AND METHODS:** The impact of dystonia in childhood is poorly understood. We report our experience of referrals between 2005 and 2012. **RESULTS:** Of 294/315 assessable children, 15/294 had pure spasticity, leaving 279/294 with dystonia classified as primary (30/279: 10.7%); primary-plus (19/279: 6.8%) and secondary (230/279: 82.4%) dystonia, including heredodegenerative dystonia (29/279: 10.3%); 150/279 (53.7%) with cerebral palsy and 51/279 (18.2%) acquired brain injury. Definitive diagnoses were available in 222/294 (79.6%), but lower in primary/primary-plus compared with secondary groups (11/49 vs 211/230: Fisher's exact test  $p < 0.0001$ ). Spasticity comorbidity was present in 79/230 (34.3%) children. Median age (interquartile years) at referral was 9.75 (6.58-13), not significantly differing by aetiology (Kruskal-Wallis test  $p > 0.05$ ); dystonia-onset age was 3 (0.5-7.0) for primary/primary-plus and 0.25 (0.08-0.8) in the secondary/CP groups. Dystonia duration at referral was 4.75 years (3.0-10.33) for primary/primary-plus groups and 7.83 (5.4-11) in the secondary group. The mean (interquartile range) proportion of life lived with dystonia, derived as dystonia duration normalised to age was 0.68 (0.31-0.96); 0.59 (0.35-0.8); 0.75 (0.62-0.95) and 0.9 (0.92-0.99) for primary, primary-plus, heredodegenerative and secondary-static dystonias respectively. Only 91/279 (32.6%) experienced a period of normal motor development. Carers perceived dystonia deterioration in 168/279 (60.2%), stabilisation in 88/279 (31.5%) and improvement in 23/279 (8.2%). Dystonia occurred in 26/225 (11.6%) siblings: 14/26 secondary and 5/26 heredodegenerative dystonia. Comorbidities were identified in 176/279 (63.1%) cases. Gross Motor Function Classification System (GMFCS) levels I-III were commoner in primary/primary-plus (37/49: 75%) compared with secondary/CP (29/230: 13%) cases,  $\chi^2 p < 0.0001$ . **DISCUSSION:** In this selective cohort, childhood dystonia is severe, presenting early before worsening without remission. Secondary dystonias spend a higher proportion of life living with dystonia and lower functional capacity. Despite referral bias, services offering neurosurgical interventions and health service planning agencies should understand the context and predicament of life with childhood dystonia.

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## Prevention and Cure

15. Med Hypotheses. 2014 Feb 12. pii: S0306-9877(14)00049-8. doi: 10.1016/j.mehy.2014.02.003. [Epub ahead of print]

### Prevention of cerebral palsy, autism spectrum disorder, and attention deficit - Hyperactivity disorder.

Strickland AD.

This hypothesis states that cerebral palsy (CP), autism spectrum disorder (ASD), and attention-deficit/hyperactivity disorder (ADHD) are all caused by an exaggerated central nervous system inflammatory response to a prenatal insult. This prenatal insult may be one or more episodes of ischemia-reperfusion, an infectious disease of the mother or the fetus, or other causes of maternal inflammation such as allergy or autoimmune disease. The resultant fetal inflammatory hyper-response injures susceptible neurons in the developing white matter of the brain in specific areas at specific gestational ages. The exaggerated neuroinflammatory response is theorized to occur between about 19 and 34 post-conception weeks for CP, about 32 and 40 weeks for ADHD, and about 36 and 48 weeks (i.e. 2 months after delivery) for ASD. The exaggerated inflammatory response is hypothesized to occur because present diets limit intake of effective antioxidants and omega-3 polyunsaturated fatty acids while increasing intake of omega-6 polyunsaturated fatty acids. Oxidation products of the omega-3 fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) limit neuroinflammation while oxidation products of the omega-6 fatty acid arachidonic acid exacerbate inflammation. Preventative treatment should begin in all pregnant women during the first trimester and should include both DHA and an effective antioxidant for prevention of neuroinflammation. The suggested antioxidant would be N-acetylcysteine, though melatonin could be chosen instead. Combined DHA and NAC therapy is theorized to decrease the incidence of the three disorders by more than 75%.

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